

Nikiforos, Michalis; Carvalho, Laura; Schoder, Christian

**Working Paper**

## "Twin deficits" in Greece: In search of causality

IMK Working Paper, No. 143

**Provided in Cooperation with:**

Macroeconomic Policy Institute (IMK) at the Hans Boeckler Foundation

*Suggested Citation:* Nikiforos, Michalis; Carvalho, Laura; Schoder, Christian (2014) : "Twin deficits" in Greece: In search of causality, IMK Working Paper, No. 143, Hans-Böckler-Stiftung, Institut für Makroökonomie und Konjunkturforschung (IMK), Düsseldorf, <https://nbn-resolving.de/urn:nbn:de:101:1-2015032510680>

This Version is available at:

<https://hdl.handle.net/10419/110392>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Working Paper

Michalis Nikiforos<sup>1</sup>, Laura Carvalho<sup>2</sup>,  
Christian Schoder<sup>3</sup>

## “Twin deficits” in Greece: in search of causality

May 2, 2014

### Abstract

The paper discusses the trajectories of the Greek public deficit and sovereign debt between 1980 and 2010 and its connection to the political and economic environment of the same period. We pay special attention to the causality between the public and the external deficit in the period after 1995, the post-Maastricht treaty period. We argue that, due to the European monetary unification process and the adoption of the common currency, causality ran from the external deficit to the public deficit. This hypothesis is tested econometrically using both Granger Causality and Cointegration analyses. We find empirical support for this hypothesis.

**Keywords:** Greece, crisis, public debt, twin deficits, imbalances

**JEL Classification:** E62, F21, F34, F41

<sup>1</sup> corresponding author, Levy Economics Institute, New York, USA, email address: mnikifor@levy.org.

<sup>2</sup> São Paulo School of Economics - FGV, São Paulo, Brazil.

<sup>3</sup> Macroeconomic Policy Institute (IMK), Düsseldorf, Germany.

# “Twin deficits” in Greece: in search of causality.\*

Michalis Nikiforos<sup>†</sup>

Laura Carvalho<sup>‡</sup>

Christian Schoder<sup>§</sup>

May 2, 2014

## Abstract

The paper discusses the trajectories of the Greek public deficit and sovereign debt between 1980 and 2010 and its connection to the political and economic environment of the same period. We pay special attention to the causality between the public and the external deficit in the period after 1995, the post-Maastricht treaty period. We argue that, due to the European monetary unification process and the adoption of the common currency, causality ran from the external deficit to the public deficit. This hypothesis is tested econometrically using both Granger Causality and Cointegration analyses. We find empirical support for this hypothesis.

**Keywords:** Greece, crisis, public debt, twin deficits, imbalances

**JEL Classification:** E62, F21, F34, F41

---

\* An earlier version of this paper appeared in the Levy Economics Institute Working Paper Collection, WP No. 771. For valuable comments and suggestions, we would like to thank Lance Taylor, Sebastian Gechert and Gennaro Zezza as well as the participants of the 39th Eastern Economic Association Annual Conference in New York. The usual disclaimer applies.

<sup>†</sup> corresponding author, Levy Economics Institute, New York, USA, email address: [mnikifor@levy.org](mailto:mnikifor@levy.org)

<sup>‡</sup> São Paulo School of Economics - FGV, São Paulo, Brazil

<sup>§</sup> Macroeconomic Policy Institute (IMK), Düsseldorf, Germany

# 1 Introduction

The Greek crisis of the last four years has occupied a central role in the public international debate. This is surprising for a country whose GDP is only a tiny fraction of world—or European—output. The antithesis between the small relative size of the Greek economy and its vast repercussions highlights the fragile and unstable state of the European and global economies.

A central feature of the Greek economic crisis is the coexistence for a long period of time of fiscal and foreign deficits, which led to the accumulation of a large stock of public and external debt. Greece entered the crisis of 2008 with the highest public debt to GDP ratio among the economies of the European Monetary Union (EMU). Moreover, the level of Greek net external debt rose considerably after the mid-1990s due to persistent current account deficits. This pattern may have further impeded the country's access to international capital markets, since investors may be even more likely to doubt the solvency of external debt accumulation (see Schoder et al., 2013).

It is natural to ask how this persistence of public and external deficits can be explained. The conventional narrative emphasizes the high degree of tax evasion and the profligacy of the Greek state as the main factors causing the accumulation of public debt. Indeed—besides the highest debt to GDP ratio—Greece has, together with Italy, the highest level of tax evasion and the largest shadow economy within the EMU (Schneider, 2011). This evidence has been used to support the “twin deficit hypothesis” for the Greek case. In that sense the country's accumulation of current account deficits are attributed to such “exogenous” public deficits. From this point of view fiscal austerity would help solve both the fiscal and the external imbalances in Greece.

A different approach maintains that the main source of the problem is to be found in the structural characteristics of the EMU and the global economic recession of the last five years. This argument gained prominence after other countries such as Portugal, Ireland and Cyprus had to be bailed out, and Spanish and Italian bond yields increased to unsustainable levels. According to this explanation, the countries of the EMU with high productivity have gained a permanent competitive advantage over countries with low productivity, which is translated into “quasi-structural” foreign deficits for European periphery countries. The problem was further exacerbated by divergent paths in the cost of labor and inflation across member states. In this context, the accumulation of Greek government debt could be seen as the result rather than

the cause of these imbalances. The adjusting role of the public deficit could be working through automatic stabilizers, or to active expansionary policies that helped prevent a fall in GDP in the midst of a deterioration in the trade balance. If this is the case, the solution to the Greek crisis would require further financial, fiscal and political integration in Europe, with the objective of correcting such external imbalances (or a complete disintegration and exit from the euro).

In the present paper we seek to examine the causal relationship between the Greek public and external deficits in the post-Maastricht period. After a brief review of the related literature, Section 3 discusses the evolution of the Greek public deficit and sovereign debt and its relationship to the political and economic environment of the same period. Understanding the accumulation of public debt requires a broader examination of the Greek economy, its position in the international economic system, as well as the goals and the actions of policymakers during the period in question. The examination of the Greek economy in the last three decades leads us—in section 4—to the formulation of the hypothesis that since 1995, because of the European monetary unification process, the adoption of the so-called hard-drachma policy and, subsequently, the adoption of the common currency, causality has been running from the foreign to the public deficit. In Section 5, we test this hypothesis with a series of econometric techniques. We first conduct Granger Causality tests to obtain preliminary results. Then causality is studied by means of Cointegrated Vector Autoregression analysis. The results support our hypothesis.

## **2 The Relationship between public and external deficits**

### **2.1 Accounting relations**

Accounting implies that the current account balance,  $CAB$ , as defined by the sum of the trade balance,  $X - M$ , net income,  $NY$ , and current transfers from abroad,  $NCT$ , is identical to the difference between gross domestic saving  $S$  and investment  $I$ . Hence,

$$CAB = X - M + NY + NCT = S - I. \quad (1)$$

Alternatively, as formulated by Godley and Cripps (1983) and Steindl (1990), the sum of net borrowing flows, as defined by the difference between expenditure and gross disposable income of the private sector,

the government and the foreign sector, must be equal to zero, so that the current account deficit (or net lending to the rest of the world) can be expressed as the sum of private and public net borrowing, denoted as  $NB_P$  and  $NB_G$ , respectively:

$$-CAB = NB_P + NB_G \quad (2)$$

Different *closures* have been applied to such accounting relationships in economic literature, each of them implying in a set of causal channels and adjustment mechanisms involving the variables in question.<sup>1</sup>

## 2.2 Public deficits causing external deficits

The conventional answer to the question of causality among the macroeconomic variables of equation (2) is the so-called twin-deficits hypothesis, according to which the causality runs from the fiscal deficit towards the foreign deficit (Volcker, 1984; Abell, 1990). There are two main transmission mechanisms. The first one is based on the loanable funds theory of the interest rate. An increase in the fiscal deficit means that the gross domestic investment exceeds gross domestic saving (see equation 1) or that the demand for loanable funds is higher than the supply. This situation will lead to an increase in the interest rate (the equilibrating variable in the loanable funds market), which will lead to an inflow of foreign capital and thus an appreciation of the exchange rate, causing a deterioration of the trade balance. In addition to responses of the interest rate in the loanable funds market and the increase in net capital flows, the adjustment of the foreign to the public deficit can happen through changes in relative prices. According to this transmission channel, a fiscal expansion would increase domestic demand relative to output, with a positive effect on domestic prices. The consequent real appreciation of domestic goods relative to foreign goods would crowd out net exports.<sup>2</sup>

The most common criticism against the twin deficits hypothesis comes from the Ricardian equivalence principle (Barro, 1974). In the Ricardian view of consumption infinite-horizon optimizing households know that they will have to pay for the government deficit in the future; as a result they respond to any permanent

---

<sup>1</sup>The terminology of *closures* has been popularized by Taylor and Lysy (1979) to denote the set of variables that are considered endogenous and exogenous and the different causalities that can be placed in a set of restrictions or simple economic relations.

<sup>2</sup>The seminal study in support of twin deficits hypothesis for the United States in the 1980s is by Abell (1990) who shows by means of a VAR model that increases in the fiscal deficit led to an appreciation of the currency and thus to a deterioration of the trade deficit. Recent studies have also found empirical evidence against the twin deficits hypothesis. Erceg et al. (2005) find that the fiscal deficit has a relatively small effect on the trade balance in the United States. Baharumshah et al. (2006) find a two-way causality relationship for the vast majority of countries in their sample.

increase in government spending by reducing consumption by the exact same amount. Unless the increase in government spending is taken to be transitory, no external impact of a higher fiscal deficit would be observed in this case. In terms of equation (2) an increase in  $NB_G$  will be met by an exact decrease decrease of  $NB_P$  leaving  $CAB$  intact.

### 2.3 External deficits causing public deficits

Another possibility—which is less common in the literature and the public debates—is that the causality runs from the foreign deficit towards the government deficit. There are various reasons that would justify this direction of causality. In what seems more relevant in the Greek case, the foreign position of the country might deteriorate for reasons exogenous to the fiscal stance of the government . The fiscal deficit responds to this deterioration and adjusts in order to stabilize the economy (Darrat, 1988). This adjustment can come either through automatic stabilizers or active policy decisions of the government. A necessary condition for this to happen is a sufficient inflow of foreign capital and ability of the government to borrow at a relatively low interest rate. Stiglitz (2010) explains the foreign and fiscal deficits in the US along these lines. He argues that the status of the US dollar as a global reserve currency increases the demand for US T-bills and US dollars and leads to an increase in the US trade deficit; this weakens America’s aggregate demand. “*To offset this [weak aggregate demand], the government runs a fiscal deficit*” (p.233, emphasis added).

This direction of causality can be also justified with other mechanisms. In the absorption approach used in the so-called “gap models”, the adjustment in equation (2) depends on which of three gaps—foreign exchange, savings and fiscal—is binding.<sup>3</sup> In this context, it is often considered that in small open economies, it is national income that adjusts to keep domestic absorption and the current account in balance, or at a level which can be financed by an exogenously determined amount of net capital flows available. In this case, it is clear that the abundance of capital inflows could allow for higher domestic—particularly, government—spending and, thus, for a higher GDP level. This argument is further developed in the literature based on balance of payments constraints on growth (see for instance Thirlwall and Hussain (1982)).

Moreover, as highlighted by Summers (1988), governments in some countries have used the budget policy for external adjustment in what the author calls *current account targeting*. In this case the fiscal stance

---

<sup>3</sup>For a review of gap models, see Taylor (1994).

of the government responds to the conditions in the foreign sector. Finally, even if it starts from a loanable funds theoretical framework, the Balance of Payments Manual published by the IMF (1999) states that if foreign savings are more than sufficient to compensate for an initial current account deficit at home, there would be overall excess savings (domestic and foreign) relative to investment, driving down the interest rate and increasing interest-sensitive components of domestic spending, as well as the space for expansionary fiscal policy, which, as above-mentioned could be used for stabilization purposes.

## **2.4 The literature on Greece (and EMU)**

In the case of Greece there is a limited literature that explicitly examines the causality between foreign and public deficits. The study by Vamvoukas (1999) examines trivariate causality tests for the trade balance, the fiscal deficit and either real output or the inflation rate in Greece from 1948 to 1994, and concludes that there was a predominantly unidirectional causality running from the budget deficit to the trade deficit in both the long- and short-run during that period. More recently Kollintzas et al. (2012) explain the Greek crisis within an “insiders-outsiders” analytical framework. They argue that one of the consequences of the “insiders-outsiders society” is the creation of the twin deficits (p.29-33).

There is a wider body of literature that examines the current account imbalances that have emerged in the Eurozone (and thus in Greece) since the mid-1990’s. Although this literature does not address the specific question of the causality between the current account and fiscal balances, it can provide some intuition for our discussion.

From our point of view, we could distinguish two different approaches to the emergence of the current account imbalances in the Eurozone. According to the first approach the current account imbalances are the result of changes in domestic saving. This is in line with the twin deficit hypothesis—although the domestic private sector also played a big role in this process. A central piece of this literature is the paper by Blanchard and Giavazzi (2002). They argue that the decrease in net domestic saving, and thus an increase in the current account deficit, in the poorer countries (and the the reverse process in the richer countries) is the natural outcome of the financial and economic integration of the countries in the Eurozone and the convergence process between the poorer and richer economies. A similar argument is put forward by Ahearne et al. (2009).

This tolerant attitude against large external imbalances changed after the crisis started and a different variant of this argument emerged. The “good imbalances” driven by convergence turned out to be “bad imbalances” driven by domestic distortions (for example Jaumotte and Sodsriwiboon, 2010). However, the direction of causality remains from the domestic towards the foreign sector. As a result, the number one policy tool against high current account deficits is “fiscal consolidation to increase government saving” (p. 4 and p. 17-20). Decressin and Stavrev (2009) argue along the same lines and underplay the importance of other factors such as the real exchange rates.

Eichengreen (2010) points to a different direction and stresses the role of “real exchange rate appreciation and real overvaluation in the euro-area periphery.” The importance of the real exchange rates in the creation of the current account imbalances in the Euro-area (independently of the real income growth) was first stressed by Arghyrou and Chortareas (2008). Belke and Dreger (2011) ask if the current account within the EMU are due to “catching up or competitiveness”; they answer that it is the latter. The role of real exchange rate and competitiveness was also highlighted by Gibson et al. (2012), although the causal story in their case is less clear. Finally, Stockhammer and Sotiropoulos (2012) and Flassbeck and Lapavitsas (2013) stress the structural deficiencies of the Eurozone and in particular the role of the real exchange rates for the creation of the imbalances in the Eurozone. To the extent that the real exchange rate is not determined by the fiscal stance of the government, this approach implies that the causality runs from the real exchange rate towards the foreign balance and then the fiscal balance.

### 3 The Greek public debt in historical perspective

#### 3.1 Decomposing the debt-GDP ratio

It is easy to show that the trajectory of public debt as a percentage of Gross Domestic Product can be described by the following equation<sup>4</sup>:

$$\Delta(D/PY)_t = \left[ d_t^p + (j_t - g_t - \pi_t - \pi_t g_t) D_{t-1} \right] / P_t Y_t \quad (3)$$

---

<sup>4</sup>The first to use this equation to analyze the dynamics of government debt was Evsey Domar (1944).

where  $\Delta$  is the difference operator,  $D$  stands for government debt,  $Y$  for the real GDP,  $P$  for the price level,  $d^p$  for the primary deficit,  $j$  for the interest rate,  $g$  for the growth rate of the real GDP,  $\pi$  for the inflation rate and the subscript  $t$  for the time period each variable refers to.

Equation (3) shows that—*ceteris paribus*—an increase in the primary deficit and the interest rate and a *decrease* in the growth rate and the inflation rate will tend to increase the debt-GDP ratio. Therefore, understanding the accumulation of public debt relative to GDP requires analyzing the trajectory of the primary deficit, the interest rate, and the growth and inflation rates. We take up this task next.

### 3.1.1 Debt and Growth

#### Figure 1 around here

Figure 1 presents the trajectory of the Greek debt for the period 1960-2010. In 1960 the debt-GDP ratio was around 10%. This ratio fluctuates around 20% until the mid-1970's, and starts accelerating until the early 1990's. The rate of increase slows down in 1992 and the debt-GDP ratio stabilizes in 1996 at around 107%. A slight increase in 2008 is followed by the explosion in 2009 and 2010.

#### Figure 2 around here

Figure 2 presents the real GDP growth rate for the same period. It shows that the Greek economy follows the growth pattern of most economies in the world. The first decade, until the late 1960s is marked by high rates of growth. This pattern is interrupted in the early 1970s. In the late 1970s there are again some years of high growth. The years between 1980 and 1994 are characterized by a significantly lower average growth rate as compared to the preceding two decades. In the last half of the 1990s and the first seven years of the 2000s, the Greek economy grows at an average rate of around 4%. This rate slows down in 2008 and becomes negative in 2009 and 2010 (-2.04% and -4.5% respectively).

### 3.1.2 Government Deficit and its decomposition

Figure 3 presents the government deficit and its decomposition into primary balance and interest payments for the period 1970-2010. In the 1970s the deficit hovered around 2.3%. During this period, there is a steady increase of net interest payments, which reach 1.7% in 1980. The deficit jumps in 1981, an election year.

The total deficit increases to 7.8% that year, a 5.5 % jump as compared to the year before. The primary deficit is responsible for almost 5% of that increase. The primary deficit continues to hover around 4.5% for the rest of the decade. However, the burden of net interest payments is increasingly heavy and as a result the total deficit is increasing. The 1990s is a decade of fiscal consolidation. 1994 is the first year with a primary surplus after more than two decades. The primary balance remains positive until 2002, even if fiscal deficits still occur due to the burden of interest payments, which kept increasing until 1995. When interest payments start falling, mainly due to the fall of interest rates, there is also a deterioration of the primary balance. 2003 is the first year after ten years with primary deficit, which further increases in 2004—the year of the Olympic games of Athens. After a small decrease in 2005 and 2006 the deficit explodes after 2007 and reaches 15.7% in 2009.

### **Figure 3 around here**

An interesting characteristic of the behavior of the primary and total deficit is that in the period prior the mid-1990s it increases at the election years, namely 1981, 1985, 1989 and 1990 and 1993. The elections of 1993 were followed by two elections (1996 and 2000) without a visible increase in the deficit. An increase of the deficit during an election year can be observed again in 2004 (although it is not clear to what extent this increase is due to the outlays for the Olympic games of that year) and the period after that.

Another important dimension for understanding the trajectory of the public debt is the cost of its service. Each year the net interest payments of the government are equal to the previous stock of public debt *times* an implicit interest rate, a weighted average of the interest rate on the government bonds of different maturities.

### **Figure 4 around here**

Figure 4 presents this implicit interest rate for the period 1970 to 2010 (calculated with the data we presented above), together with the series for the GDP growth and the Federal Reserve effective interest rate. As we can see the implicit interest rate increases until the early 1990s and after a period of stability in the first half of that decade decreases to slightly below 4% in the 2000s.

An important part of the behavior of this interest rate can be explained by the conditions that prevailed in the global economy and can be considered as exogenous to a small economy like Greece. A detailed analysis of this issue is complicated because of the obvious endogeneity issues and goes beyond the scope

of this paper, however it is obvious that the increase of the implicit interest rate until the late-1980s is related to a large extent to the high interest rates that prevailed at the time due to the policy of the Federal Reserve in the US. For example, although in the years up to 1976 there is no increase in the debt-to-GDP ratio the implicit interest rate almost doubles.

The evolution of the total debt, as presented in figure 1, can thus be understood through the discussion of figures that followed. The change of government debt as a percent of GDP is a function of the primary deficit, the net interest payments and the growth rate. The term  $j_t - g_t$  is the distance between the implicit interest rate and the growth rate lines in figure 4. Besides the increase in the cost of lending the global economy experienced a slowdown of growth after the mid-1970s. To the extent that this slowdown affected the growth rate of the Greek economy, this slowdown played a similar role with the increase of the interest rates.

### **3.1.3 Inflation**

Figure 5 presents the trajectory of inflation. Inflation is below 5% in the first period of our sample. The energy crisis of 1973 sent inflation to 21% that year and 23% the year after. The second energy crisis of 1979 sent again the inflation above 20%. Inflation peaked in 1982 at 27% and then receded slowly for the rest of the 1980s to reach 14.5% in 1989. After a jump in 1990 when it passes 20% , a decade of rapidly decelerating inflation follows. In 1999 inflation reached 3% and remained around that level for the next decade.

#### **Figure 5 around here**

The examination of inflation rate is important because starting with the Maastricht Treaty a stable and low inflation rate becomes the main focus of economic policy in Europe and Greece. The first criterion that an aspiring member of the common currency should meet is “the achievement of a high degree of price stability”. This criterion is then specified as “an average rate of inflation,...that does not exceed by more than 1<sup>1/2</sup> percentage points that of, at most, the three best performing Member States in terms of price stability”. After the Maastricht Treaty the fiscal, the monetary and as we will see below, the exchange rate policy focus

on the maintenance of a low inflation rate.<sup>5</sup>

Figure 5 shows that Greece made a serious effort to meet the inflation criterion, and that by historical (and by almost any other) standards it achieved a very low inflation rate after the late 1990s. Still, this inflation rate, which reflected the trajectory of the nominal wages, was high compared to the inflation of the European core; for example, German inflation in the period 1998-2007 never exceeded 2%, with most of the years being below 1%.

### 3.2 Net Lending

As we explained in section 2 the government deficit has to be matched by net lending flows from the other institutional sectors of the economy.

#### Figure 6 around here

In figure 6 we present the Net Lending-Net Borrowing position of the three main sectors of the Greek economy: the private, the government and the foreign sector; some interesting observations can be made. First, in the period until the late 1990s the private sector was a net lender. It became a net borrower for the first time in 1999. For the period before 1999, 75% of the government deficit is covered with domestic borrowing. The behavior of the private sector changes in the mid-1990s, when it starts a monotonic decrease of its lending which lasts until 2002. After 2002 and until the recent crisis the private sector continued to be a net borrower. In general, the private sector in Greece only very recently started spending more than it earned. This runs contrary to the usual stereotype of widespread profligacy.

The monotonic increase of lending on behalf of the private sector and after 1999 of the public sector is naturally mirrored with an analogous increase of net lending from abroad. For almost a decade and a half—1995 until 2008—there is a constant increase of net lending from abroad, which compensates for the borrowing of the private and the public sector. Note that the discussion until now does not involve the direction of the causality between the foreign and domestic deficit. We discuss this in the next section.

---

<sup>5</sup>The economic rationale behind this focus on low inflation is that in a world with rational expectations, unemployment will always be at its *natural* level and any effort to lower unemployment below that level will only create inflation without any employment gains. This is the famous *rules rather than discretion* argument made by Kydland and Prescott (1977) and Barro and Gordon (1983). The rest of the Maastricht criteria and the institutions of the EMU were built around this target of low inflation. For example, the second criterion of low government deficit (below 3%) or the call for a *conservative central banker* are the textbook policy conclusions of the aforementioned economic models because they create an institutional structure that prohibits discretionary policy.

## 4 In Search of Causality

Several of the previous observations, and in particular, the net borrowing patterns from the three institutional sectors suggest that the mid-1990s were a turning point for the Greek economy. The patterns that had prevailed for (at least) the previous two decades seem to change. This is probably nowhere else as evident as in the patterns of the net-lending we just described.

These changes coincide with the monetary unification process, which started with the signing of the Maastricht Treaty on February 7, 1992, and ended with the circulation of the euro on January 1, 2002. In addition to the general Maastricht criteria for inflation, deficits and interest rates, the unification required the rapid deregulation of the financial system and the removal of restrictions on capital account transactions. The controls on long-term capital movements were lifted in March 1993 and on short-term capital movements in May 1994.

Moreover, as we mentioned above, the main policy target according to the Maastricht Treaty was to contain inflation. In 1995 governor of the Bank of Greece (BoG) announced that the main objective of the BoG would be a further decrease in inflation; the inflation rate had already been halved in the previous 4 years. Towards that goal, the BoG announced for the first time a specific exchange rate target. This was the so-called *hard-drachma policy*. More precisely, the BoG set as an intermediate target to limit the year-on-year depreciation of the drachma against ECU to 3%.<sup>6</sup> As highlighted by Bresser-Pereira (2009), the use of this type of exchange rate policy for inflation control has the side effect of overvaluing the currency.

Three years later, on March 16, 1998, the drachma joined the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS) at a central rate against the ECU, which implied a depreciation of 12.3%. The depreciation reduced the current account deficit momentarily, but did not change the overall trend. Finally, on January 1, 2001, Greece was admitted into the euro area.

Based on the previous discussion, we formulate the following hypothesis:

**Hypothesis:** *In the period after 1995 the causality between the foreign deficits and the public deficits runs from the former to the latter*

---

<sup>6</sup>The hard-drachma policy rationale is explained in a paper written by the deputy director and the research director of the Bank of Greece six years later, after the successful entry in the Eurozone (Garganas and Tavlas, 2001). Their analysis is based on the 1997 World Economic Outlook of the IMF entitled “Exchange Rate Arrangements and Economic Performance in Developing Countries”(International Monetary Fund, 1997).

At the root of this behavior lies the hard drachma policy and subsequently the introduction of the euro, which led to a deterioration of the foreign position of the Greek economy. Due to the loss of competitiveness, the external deficit becomes (quasi-)exogenous and leads to a domestic deficit; public and private.

As we explained in section 2.3 that a necessary condition for the causality between foreign and public deficits to run this way is a sufficient inflow of foreign capital and the ability of the government to borrow at a relatively low interest rate. In the case of Greece the necessary capital inflows could only be sustained for so long, for one and a half decades, because of the general euphoria that predominated in global financial markets at the same time. In turn the inflows of foreign capital were made possible with the deregulation of the capital movements in 1993 and 1994.<sup>7</sup>

### **Figure 7 around here**

We examine the hypothesis in the next section by means of various statistical methods. However, before going to the econometric tests, we will present a series of historical and circumstantial evidence that support our thesis. Figure 7 presents the Real Effective Exchange Rate based on unit labor costs of Greece with the former EU-15 countries, the 24 industrial countries, the 36 industrial countries for the period 1970-2010. It is characteristic that for the period until the mid-1990's the real effective exchange rate fluctuates around a constant mean. After the mid-1990's and until the end of the sample there is an unprecedented appreciation of the real exchange rate. The real effective exchange rate at the last year of our sample is almost 40% higher compared to its local minimum in 1992, the year of the Maastricht treaty. It is important to note that this real appreciation took place despite the rapid decrease in inflation.

In figure (8) we present the real effective exchange rate together with the external financing from figure 6.<sup>8</sup> Sub-figure 8a presents the actual series while the lower figure 8b presents the series filtered with the Hodrick-Prescott (1997) filter. Both figures reveal an extraordinary correlation between the two series. In particular for the period after the mid-1990's the real appreciation is accompanied by similar increase in the current account deficit.

From the point of view of causality it is hard to see how either the fiscal stance of the government or

---

<sup>7</sup>In that sense this process can be viewed (to paraphrase Keynes) as one bubble in the whirlpool of bubbles of this period. It is characteristic that the latest edition of the seminal *Manias, Panics and Crashes* identifies this process in Greece as part of one of "The big ten financial bubbles" (Kindleberger and Aliber, 2011, p. 11).

<sup>8</sup>The exchange rate refers to the left vertical axis while the external finance to the right one.

the foreign deficit could have caused the appreciation of the currency. The most plausible explanation is that the hard-drachma policy and then the adoption of the common currency are the primary reasons for the real appreciation of the currency. In turn, this real appreciation led to the widening current account deficit, which then was mirrored with the increase of the fiscal deficit.

Second, a closer examination of figure 6 strengthens our hypothesis. As mentioned above, the government deficit picks up in all election years during the first sub-period (1981, 1985, 1989, 1990 and 1993) and only in 2004 and 2009 during the second. Moreover, such spikes in the public deficit were mirrored by an increase in net lending from abroad in the period until 1995. This relationship disappears after the mid-1990's, when the higher deficits came in years of lower external deficits.<sup>9</sup> This points towards a twin-deficit behavior for the pre-1995 period which however vanishes for the period after 1995.

Finally, it is a common conclusion in the literature that 1995 is a switching point for the Greek economy. Bryant et al. (2001), in a volume which celebrates the entrance of Greece in the common currency, point to the regime change of 1995.<sup>10</sup> They write that “the performance of the Greek economy in the second half of the 1990s contrasts starkly with the performance during 1975-1994” (p. 3). Other contributions in the same volume make similar points. Garganas and Tavlas (2001) also identify 1995 as a turning point for the Greek economy. Their focus—as deputy director and the research director of the BoG—is inflation. They argue that two different regimes can be distinguished: one for the period 1975-1990 with high inflation and unsatisfactory macroeconomic performance, and one for the period after 1995 with low inflation and accelerated growth. The period in-between is identified as a transition period. They test their hypothesis with various statistical tests. For example, they test the hypothesis of a regime change in inflation based on Zivot and Andrews (1992) test and find that a regime switch took place in 1994. Bosworth and Kollintzas (2001) approach the macroeconomic performance of the Greek economy from a growth-accounting point of view and reach a similar conclusion.

In the literature of the time it becomes clear that the economists and the policymakers of the time were aware of the pressure on the current account of Greece as a result of this regime switch. However, they believed in the merits of low inflation, the ability of the market to self-regulate itself, the use of capital

---

<sup>9</sup>An exception to this pattern in the first period is 1981. This is probably due to the recording of the capital transfers related to the entry of Greece in the European Economic Community the year before. Data from other sources, such as the World Economic Outlook of the International Monetary Fund (2012) show an increase in the current account deficit for that year.

<sup>10</sup>The volume is the product of collaboration between the Bank of Greece and the Brookings Institution.

inflows for productive purposes and the ability of “prudential supervision” and “surveillance” on behalf of the policy makers. The mantra of the day was that “this rate of growth [of the period 1995-2001] should be sustainable in future years” and that “one might hope that the Greek experience would more closely follow that of Ireland”(Bosworth and Kollintzas, 2001, p. 177-178). More generally, as we explained in section (2.4), the economists of the time had recognized the growing current account imbalances that emerged after the mid-1990s, but argued that they are a natural and welcome outcome of of the financial and economic integration the convergence process between the poorer and richer economies (Blanchard and Giavazzi, 2002).

## **5 Econometric analysis**

In this section we examine our hypothesis econometrically for the period 1995 until the beginning of the Greek crisis in 2010. We first do that with a simple Granger-causality test and then we employ a Vector-Error-Correction Model. For reasons of comparison we run the tests also for the fifteen-year period that preceded, 1980-1994. Our results confirm that the causality in the period after 1995 was running from the external to the public deficit. The test do not provide a clear answer for the previous period.

### **5.1 Data**

One of the biggest challenges of an econometric analysis of the Greek economy is data availability and reliability. This challenge becomes even more important for quarterly data. Hence, we briefly discuss the data set used for the econometric analysis and how it was generated.

Due to data availability issues we use the real trade balance ( $n_t$ )—and not net lending—as the variable that describes the behavior of the foreign sector. We attempt to identify its relation to the primary deficit ( $d_t$ ) of the government. The primary deficit—as opposed to total deficit—expresses better the spending decisions of the government. We use quarterly data for the period 1980Q1 to 2010Q4.

The real trade balance has been computed using data provided by the IMF Balance of Payments database and the GDP deflator obtained implicitly based on the Real and Nominal GDP series provided in the OECD Economic Outlook Database. It has been seasonally adjusted.

The real primary deficit has been more difficult to generate. Again the GDP deflator has been used to

deflate the primary deficit, which was obtained from two different sources. Until 1998Q4 we employ data provided by the OECD Economic Outlook Database (which has been discontinued in 2005). For the period thereafter, we use Eurostat data which have been seasonally adjusted.

## 5.2 Granger Causality

To gain some preliminary insights into the causality between the trade surplus and the primary deficit, we apply the Granger Causality test (Granger, 1969). The augmented Dickey-Fuller test suggests  $d_t$  to follow an  $I(1)$  process in both periods, and  $n_t$  to follow a stationary process in the first period and  $I(1)$  process in the second period.<sup>11</sup> Since our variables seem to be non-stationary, we perform the Toda and Yamamoto (1995) version of the Granger causality test. We check robustness by considering different lag lengths.

### Table 1 around here

Table 1 reports the results for testing Granger Causality between  $n_t$  and  $d_t$  two periods before and after 1995. For the first period 1980Q1-1994Q4, we cannot reject either of the null hypotheses for most of the lag lengths. This suggests that none of the variables seem to have affected each other.

Yet, this picture changes radically in the period 1995Q1-2010Q4. While the null of the primary deficit not Granger-causing the trade balance cannot be rejected, the null of the trade balance not Granger-causing the primary deficit can be rejected at a high level of significance. Hence, it seems that in the second period the trade balance has been driving the primary deficit but not the over way around. This result is robust to the lag length chosen.

## 5.3 Cointegrated Vector-Autoregression Analysis

Granger Causality tests can only provide preliminary insights as the forward-looking behavior of agents allows for an event X to be realized before another event Y even though Y is the true cause of X. Yet, the Granger Causality test will indicate that Y fails to Granger-Cause X, as Y is realized after X in time. To check the robustness of the results above by another method, we analyze the interaction of  $n_t$  and  $d_t$

---

<sup>11</sup>Since the power of the Dickey-Fuller test is weak, especially in small samples, we nevertheless pursue a cointegration analysis below for both periods.

in a Vector-Autoregression (VAR) model as suggested by Johansen (1988); Johansen and Juselius (1990); Juselius (2006).

As the baseline specification, we estimate the following VAR in Vector-Error-Correction Model (VECM) representation:

$$\Delta x_t = \alpha \begin{bmatrix} \beta' & \beta_0 & \beta_1 \end{bmatrix} \begin{bmatrix} x_{t-1} \\ c \\ t \end{bmatrix} + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \Phi D_t + \varepsilon_t, \quad (4)$$

where  $x_t = \begin{bmatrix} n_t & d_t \end{bmatrix}'$ ,  $D_t$  is a matrix of deterministic variables and  $\varepsilon_t \sim IN_p(0, \Omega)$  is a vector of disturbances. We include a constant term as well as a trend, the latter only in the cointegrating space. We chose  $k = 2$  as the optimal lag length according to the H-Q criterion (analyzed in CATS for RATS) applied to the baseline model. No more lags are required since there is generally no problems with serial correlation in the residuals. We stick to the choice of two lags also when considering extensions of the baseline specification in order to be as comparable as possible. Only if autocorrelation problems arise (which is almost never the case) adding additional lags is considered as an option to deal with the problem.

There is an issue with the choice of the deterministic variables such as trends, constants and dummies in the model. Looking at the residuals generally reveals in our study that dummy variables for instance capturing the financial crisis do not seem to be required. This leaves the question of how to correctly restrict trends and constants in the model. Since there is no trend in the data and there is no plausible explanation for expecting one in the cointegrating relation between the trade balance and the primary deficit, a trend should be excluded from the model. Yet, sometimes the trace test will not be able to identify the cointegrating relationship if the trend is excluded. Therefore, it might be necessary to include a trend in all specifications to identify the cointegrating relationship in all of them and make them consistent to each other.<sup>12</sup>

### 5.3.1 Rank test

**Table 2 around here**

Table 2 reports the rank test statistics for the periods before and after 1995 for specifications with or

---

<sup>12</sup>Note that we only present the estimation results of the two-dimensional system comprising net exports and the public deficit, since adding variables such as the real output or the inflation rate as in Vamvoukas (1999) does not change the results substantially.

without the time trend. According to the trace test, we can accept the hypothesis of  $r = 1$  for almost all sub-samples regardless of whether a time trend has been included or not.<sup>13</sup> Note that there seems to be stronger evidence for a cointegration relationship between public deficits and net exports in the second period than in the first period. Hence, the results of the VECM estimation for the first period have to be interpreted with caution. Since we want to highlight differences between the periods before and after the introduction of the Euro, we report the results for both.

### 5.3.2 Testing restrictions on $\alpha$ and $\beta'$

Before discussing the estimation results from fitting the model in (4) to the data, note that we tested for serial correlation in the residuals for each of the periods considered. We cannot reject the hypotheses of no serial correlation of the residuals up to order 3 at any reasonable level of significance. Hence, no issues regarding serial correlation exist in our specifications.

#### Table 3 around here

Table 3 reports the estimates of  $\alpha$  and  $\beta'$  in (4) for the periods before and after 1995. We consider both specifications, including and excluding a time trend. Note that no over-identifying restrictions are imposed. For each sample, the cointegrating vector,  $\beta'$ , has been normalized to  $n$ .

Since our previous analysis suggests a break with the preparations for the Maastricht criteria, we are primarily interested in the results for the periods before and after 1995. Comparing the results for the two sub-samples reveals some interesting differences. While the long-run relationship between  $n$  and  $d$  is positive and insignificant before 1995, it is negative and significant thereafter for both specifications. In the first period,  $d$  is weakly exogenous, i.e. it does not respond to a disequilibrium in the cointegrating relation. To be precise, we cannot reject the null hypothesis that the deficit does not respond to a disequilibrium in the cointegrating relation. The adjustment of  $n$  to a disequilibrium is significant but not error-correcting since it has the wrong sign. Due to a weak cointegration relation in the first period, these results have to be interpreted with caution.<sup>14</sup> In the second period, the results are unambiguous. We find a significant, inverse

---

<sup>13</sup>The only exception is the trace test for the specification with time trend for the period from 1980Q1 to 1994Q4, which indicates no cointegration relation.

<sup>14</sup>For the pre-1995 period our data do not contradict the results obtained by Vamvoukas (1999) who also tries to identify the direction of causality between the public and external deficits of the Greek economy using annual data from 1948 to 1994. He

long-run relationship between  $n$  and  $d$ . Further, in contrast to the previous period, the parameter describing the adjustment of  $d$  to a disequilibrium in the long-run relation is significant in both specifications and has the expected sign. Hence, the adjustment of  $d$  to a disequilibrium is significant and error-correcting. At the same time,  $n$  is weakly exogenous, i.e. it does not respond to a disequilibrium between  $n$  and  $d$ . This finding is highly consistent with the results of the Granger-Causality tests. Since 1995 it seems that the trade balance has been driving the primary deficit.

## 6 Concluding remarks

In this paper, we analyze the causal relationship between the Greek public and external deficits. In this context, we examine the trajectories of the Greek debt-to-GDP ratio and its components since the 1980s. We show that the mid-1990s mark the beginning of a sharp deterioration of the external position of the Greek economy, which lasts until 2009. The so-called hard-drachma policy executed for price stabilization purposes and later the introduction of the euro have led to the deterioration of the external balance. In this period, the behavior of the foreign sector obtains an autonomous status. The increasingly high external deficits may be seen as the cause of the deficits in the domestic sector. In fact, the latter only helped avoid a contractionary adjustment of GDP and became possible due to massive capital inflows to Greece and the low borrowing cost.

After this descriptive analysis, we examine this hypothesis econometrically. Our results are confirmative. The Granger causality test indicates that none of the variables affected each other in the period before 1995 and only the external deficit Granger-causes the public deficit in the period after 1995. Similarly, the Cointegration analysis suggests that, in the period after 1995, the external deficit does not respond endogenously to a disequilibrium between the public and external deficit, whereas the adjustment of the public deficit to a disequilibrium is significant and error-correcting.

From a policy point of view, our results suggest that rather than relying on fiscal austerity, a solution to the imbalances in the Greek economy must start from an improvement of the external sector. In that sense, a European “Current Account Compact” would be more appropriate than the recently created Fiscal Compact.

---

employs a trivariate Granger Causality analysis as well as a trivariate Cointegrated Vector Autoregression model including the public deficit, the external deficit and real output or inflation. According to his findings the causality is running from the public to the external deficit. This is consistent with the view that pre-1995 external deficits may have been driven by public deficits.

## References

- Abell, J. D. (1990). Twin deficits during the 1980s: an empirical investigation. *Journal of Macroeconomics*, 12(1):81–96.
- Ahearne, A., Schmitz, B., and von Hagen, J. (2009). Current Account Imbalances and Financial Integration in the Euro Area. CEPR Discussion Papers 7262, C.E.P.R. Discussion Papers.
- Argyrou, M. G. and Chortareas, G. (2008). Current Account Imbalances and Real Exchange Rates in the Euro Area. *Review of International Economics*, 16(4):747–764.
- Baharumshah, A. Z., Lau, E., and Khalid, A. M. (2006). Testing the twin deficits hypothesis using VARs and variance decomposition. *Journal of the Asia Pacific Economy*, 11:331–354.
- Barro, R. J. (1974). Are Government Bonds Net Wealth? *The Journal of Political Economy*, 82(6):pp. 1095–1117.
- Barro, R. J. and Gordon, D. B. (1983). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics*, 12(1):101–121.
- Belke, A. and Dreger, C. (2011). Current Account Imbalances in the Euro Area: Catching up or Competitiveness? Ruhr Economic Papers 0241, Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Ruhr-Universität Bochum, Universität Dortmund, Universität Duisburg-Essen.
- Blanchard, O. and Giavazzi, F. (2002). Current Account Deficits in the Euro Area: The End of the Feldstein Horioka Puzzle? *Brookings Papers on Economic Activity*, 33(2):147–210.
- Bosworth, B. and Kollintzas, T. (2001). Economic Growth in Greece: Past Performance and Future Prospects. In *Greece's Economic Performance and Prospects*. Bank of Greece and The Brookings Institution, Athens, Greece and Washington, D.C.
- Bresser-Pereira, L. C. (2009). The Tendency of the Exchange Rate toward Overvaluation. In Bresser-Pereira, L. C., editor, *Globalization and Competition*, pages 125–147. Cambridge University Press.

- Bryant, R. C., Garganas, N. C., and Tavlas, G. S., editors (2001). *Greece's Economic Performance and Future Prospects*. Bank of Greece and The Brookings Institution, Athens, Greece and Washington, D.C.
- CES-IFO (2011). Net Interest Payments, General Government, as a Percentage of Nominal GDP, 1960 - 2012. <http://www.cesifo-group.de>.
- Darrat, A. F. (1988). Have Large Budget Deficits Caused Rising Trade Deficits? *Southern Economic Journal*, 54(4):879–887.
- Decressin, J. and Stavrev, E. (2009). Current Accounts in a Currency Union. IMF Working Paper No. 09/127.
- DG ECFIN (2011). European Commission, Directorate General for Economic and Financial Affairs, Annual macro-economic database (AMECO). Data retrieved December 5, 2011. [http://ec.europa.eu/economy\\_finance/ameco](http://ec.europa.eu/economy_finance/ameco).
- Domar, E. (1944). The 'burden of debt' and the national income. *American Economic Review*, 34(4):798–827.
- Eichengreen, B. (2010). Imbalances in the Euro Area. University of California, Berkeley manuscript.
- Erceg, C. J., Guerrieri, L., and Gust, C. (2005). Expansionary Fiscal Shocks and the US Trade Deficit\*. *International Finance*, 8(3):363–397.
- Federal Reserve (2013). Board of Governors of the Federal Reserve System, Selected Interest Rates. Data retrieved January 24, 2013. <http://www.federalreserve.gov/releases/h15/>.
- Flassbeck, H. and Lapavistas, C. (2013). The systemic crisis of the euro—true causes and effective therapies. manuscript, Rosa Luxemburg Stiftung.
- Garganas, N. C. and Tavlas, G. S. (2001). Monetary Regimes and Inflation Performance: The Case of Greece. In *Greece's Economic Performance and Prospects*. Bank of Greece and The Brookings Institution, Athens, Greece and Washington, D.C.
- Gibson, H. D., Hall, S. G., and Tavlas, G. S. (2012). The Greek financial crisis: Growing imbalances and sovereign spreads. *Journal of International Money and Finance*, 31(3):498 – 516.

- Godley, W. and Cripps, F. (1983). *Macroeconomics*. Oxford University Press, New York.
- Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica*, 37(3):424–438.
- Hodrick, R. J. and Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking*, 29(1):1–16.
- IMF (1999). Balance of Payments Manual. Statistics department, International Monetary Fund.
- International Monetary Fund (1997). World Economic Outlook (WEO). available online at <http://www.imf.org/external/pubs/ft/weo/weo1097/weocon97.HTM>.
- International Monetary Fund (2012). World Economic Outlook (WEO): Growth Resuming, Dangers Remain. available online at <http://www.imf.org/external/pubs/ft/weo/2012/01/index.htm>.
- Jaumotte, F. and Sodsriwiboon, P. (2010). Current Account Imbalances in the Southern Euro Area. IMF Working Paper No. 10/139.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3):231–54.
- Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration - with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2):169–210.
- Juselius, K. (2006). *The Cointegrated VAR Model : Methodology and Applications*. Oxford University Press, Oxford, UK.
- Kindleberger, C. and Aliber, R. (2011). *Manias, Panics and Crashes: A History of Financial Crises*. Palgrave Macmillan, sixth edition.
- Kollintzas, T., Papageorgiou, D., and Vassilatos, V. (2012). An Explanation of the Greek Crisis: “The Insiders - Outsiders Society”. manuscript, Athens University of Economics and Business.
- Kydland, F. E. and Prescott, E. C. (1977). Rules Rather than Discretion: The Inconsistency of Optimal Plans. *The Journal of Political Economy*, 85(3):pp. 473–492.

- OECD (2011a). Organisation for Economic Co-operation and Development, Economic Outlook Database. Data retrieved December 5, 2011. <http://www.oecd-ilibrary.org/>.
- OECD (2011b). Organisation for Economic Co-operation and Development, OECD.Stat Extracts. Data retrieved December 5, 2011. <http://stats.oecd.org/Index.aspx>.
- Schneider, F. (2011). The Shadow Economy and Shadow Economy Labor Force: What Do We (Not) Know. Discussion Paper No. 576, Institute for the Study of Labor.
- Schoder, C., Proaño, C. R., and Semmler, W. (2013). Are the Current Account Imbalances between EMU countries sustainable? Evidence from parametric and non-parametric tests. *Journal of Applied Econometrics*, forthcoming.
- Steindl, J. (1990). Saving and Debt. In *Economic Papers 1941-88.*, pages 208–215. Macmillan.
- Stiglitz, J. (2010). *Freefall: America, Free Markets, and the Sinking of the World Economy*. W. W. Norton, New York.
- Stockhammer, E. and Sotiropoulos, D. P. (2012). Rebalancing the Euro area: the costs of internal devaluation. Post Keynesian Economics Study Group Working Paper 1206.
- Summers, L. H. (1988). Tax policy and international competitiveness. In Frenkel, J., editor, *International aspects of fiscal policies*, pages 349–375. Chicago University Press, Chicago.
- Taylor, L. (1994). Gap models. *Journal of Development Economics*, 45:17–34.
- Taylor, L. and Lysy, F. J. (1979). Vanishing income redistributions: Keynesian clues about model surprises in the short run. *Journal of Development Economics*, 6(1):11–29.
- Thirlwall, A. P. and Hussain, M. N. (1982). The Balance of Payments Constraint, Capital Flows and Growth Rate Differences between Developing Countries. *Oxford Economic Papers*, 34(3):498–510.
- Toda, H. Y. and Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, 66(1-2):225–250.

Vamvoukas, G. A. (1999). The twin deficits phenomenon: evidence from Greece. *Applied Economics*, 31:1093–1100.

Volcker, P. A. (1984). Facing up to the twin deficits. Challenge 3.

World Bank Group (2011). World development indicators online. Data retrieved December 5, 2011. <http://data.worldbank.org/data-catalog/world-development-indicators>.

Zivot, E. and Andrews, D. W. K. (1992). Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis. *Journal of Business & Economic Statistics*, 10(3):251–270.

Null Hypothesis	1980Q1-1994Q4			1995Q1-2010Q4		
	Obs	$\chi^2$ Statistic	Prob.	Obs	$\chi^2$ Statistic	Prob.
<i>2 lags</i>						
$d_t$ does not Granger Cause $n_t$	57	0.298	0.861	64	2.724	0.256
$n_t$ does not Granger Cause $d_t$		1.170	0.557		11.903	0.002
<i>3 lags</i>						
$d_t$ does not Granger Cause $n_t$	56	0.746	0.862	64	2.678	0.444
$n_t$ does not Granger Cause $d_t$		0.685	0.877		10.819	0.013
<i>4 lags</i>						
$d_t$ does not Granger Cause $n_t$	55	3.597	0.463	64	2.737	0.603
$n_t$ does not Granger Cause $d_t$		3.561	0.469		11.747	0.019

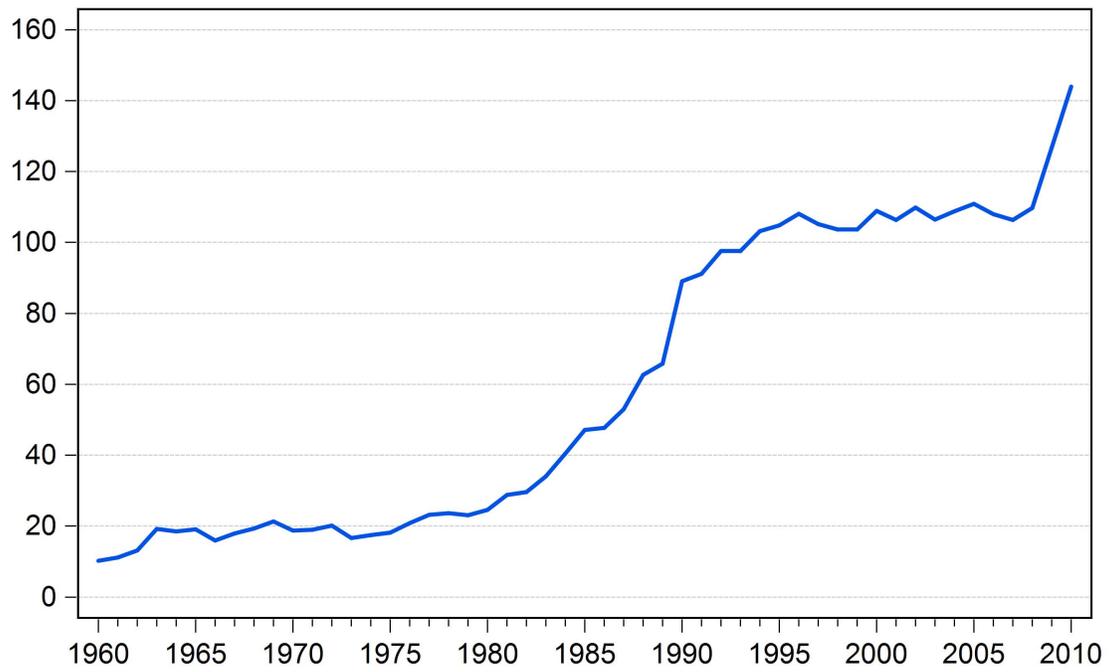
Table 1: Granger Causality tests for different lag lengths and sub-periods

No of CE(s)	1980Q1-1994Q4			1995Q1-2010Q4		
	EV	TS	Prob.	EV	TS	Prob.
<i>With Time Trend</i>						
None*	0.18	19.19	0.269	0.29	30.83	0.011
At most 1	0.12	7.78	0.269	0.12	8.39	0.220
<i>Without Time Trend</i>						
None*	0.17	12.16	0.023	0.29	26.99	0.005
At most 1	0.43	1.34	0.899	0.06	4.58	0.331

Table 2: Trace tests for different sub-periods

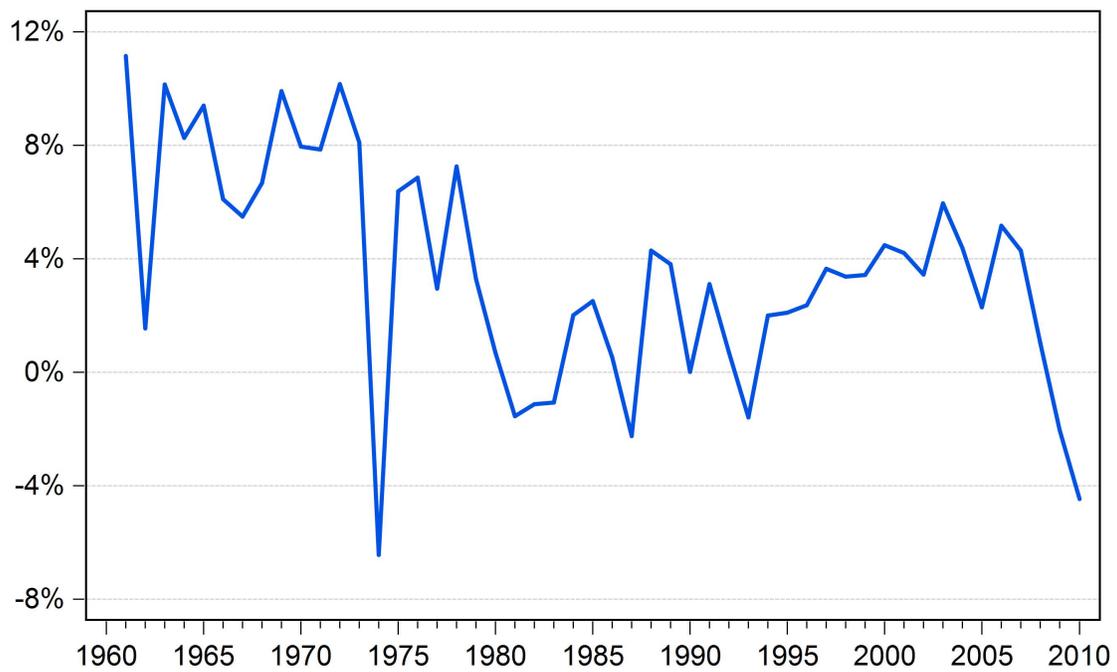
	1980Q1-1994Q4				1995Q1-2010Q4			
	$n$	$d$	$c$	$t$	$n$	$d$	$c$	$t$
The cointegrating relations $\beta$								
$\beta$	1.00	-0.17 [-0.96]	2424.30 [15.42]	8.21 [1.39]	1.00	0.70 [2.65]	2083.68 [16.17]	33.71 [1.54]
The adjustment coefficients $\alpha$								
$\alpha$	-0.51 [-3.05]	0.03 [0.78]			-0.04 [-0.75]	-0.30 [-4.89]		
The cointegrating relations $\beta$								
$\beta$	1.00	-0.34 [-1.91]	2813.66 [15.42]	—	1.00	1.20 [6.33]	4716.16 [16.17]	—
The adjustment coefficients $\alpha$								
$\alpha$	-0.36 [-2.29]	0.07 [1.78]			-0.01 [-0.30]	-0.23 [-4.97]		

Table 3: Estimation results for different sub-periods



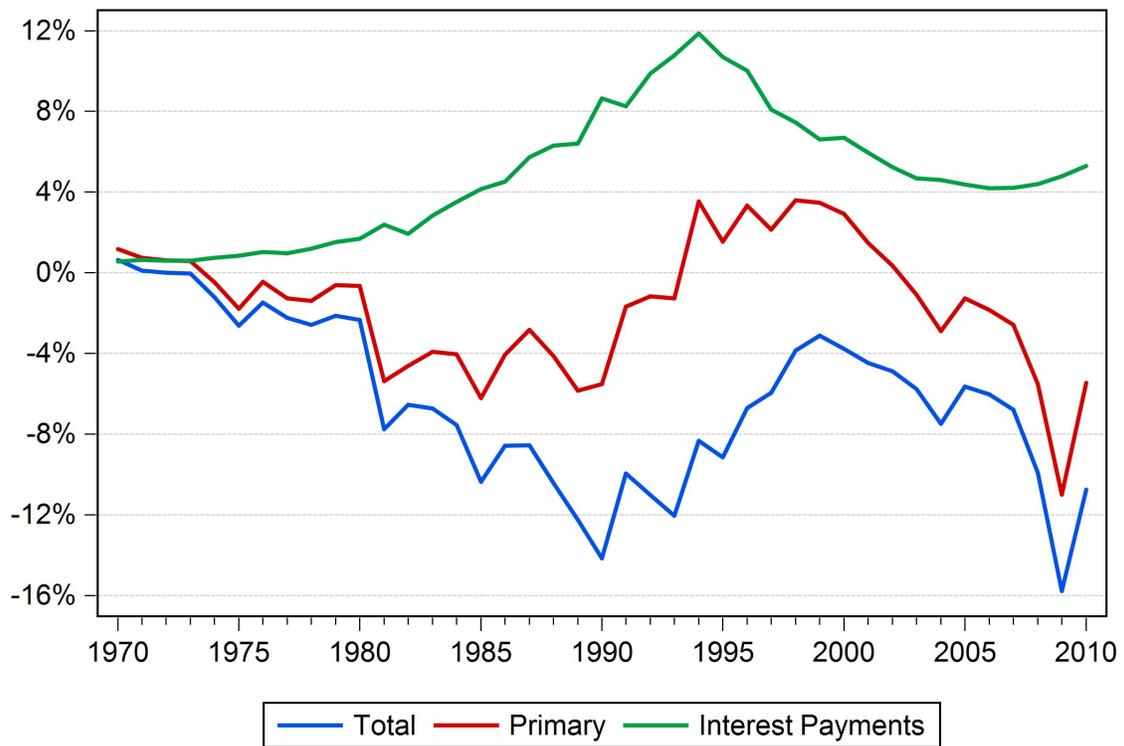
Source: World Development Indicators (World Bank Group, 2011)

Figure 1: Sovereign debt-GDP ratio



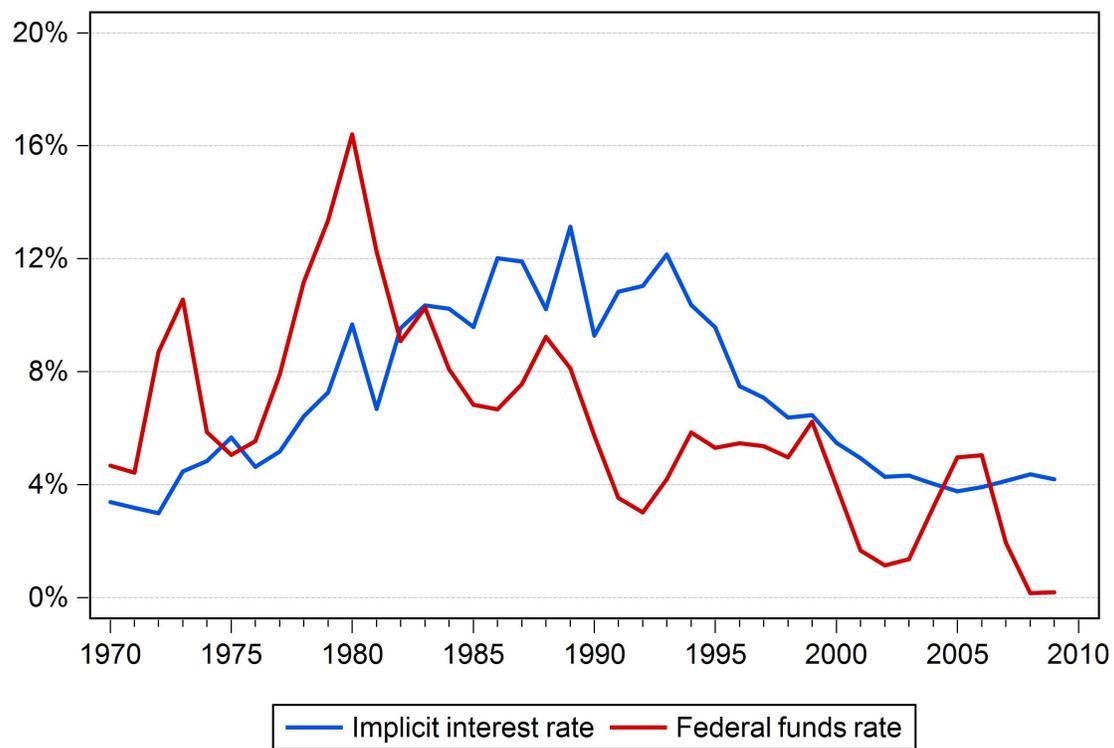
Source: World Development Indicators (World Bank Group, 2011)

Figure 2: Real GDP growth rate



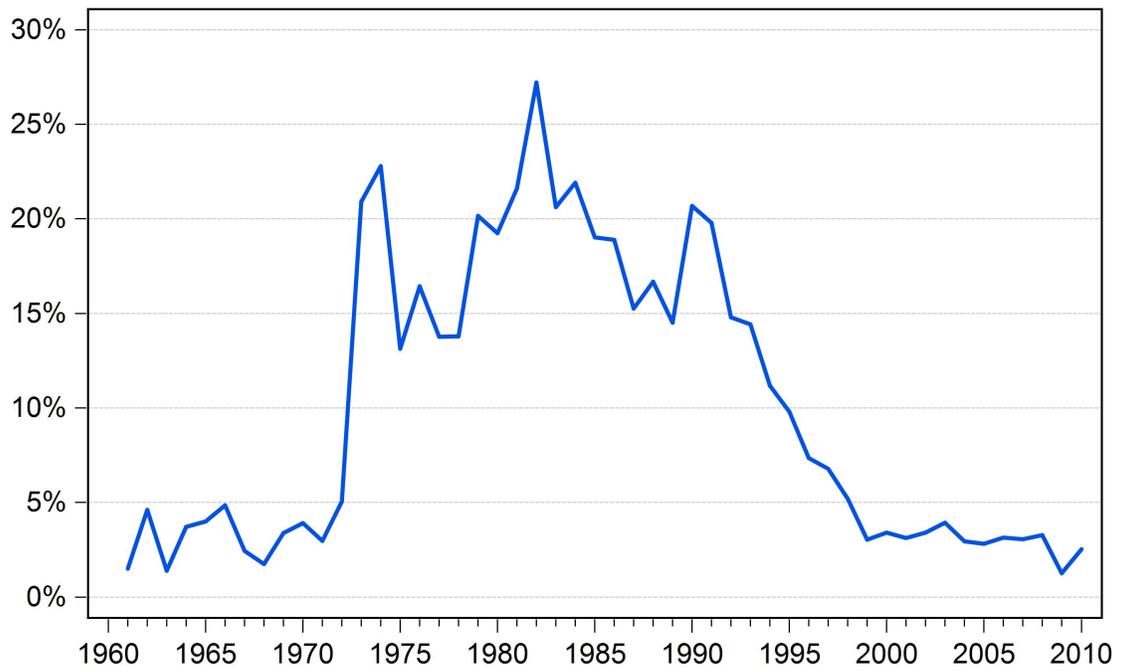
Source: OECD Economic Outlook (OECD, 2011a), AMECO (DG ECFIN, 2011), CES-IFO (2011) and authors' calculations

Figure 3: Decomposition of the government deficit (1970-2010)



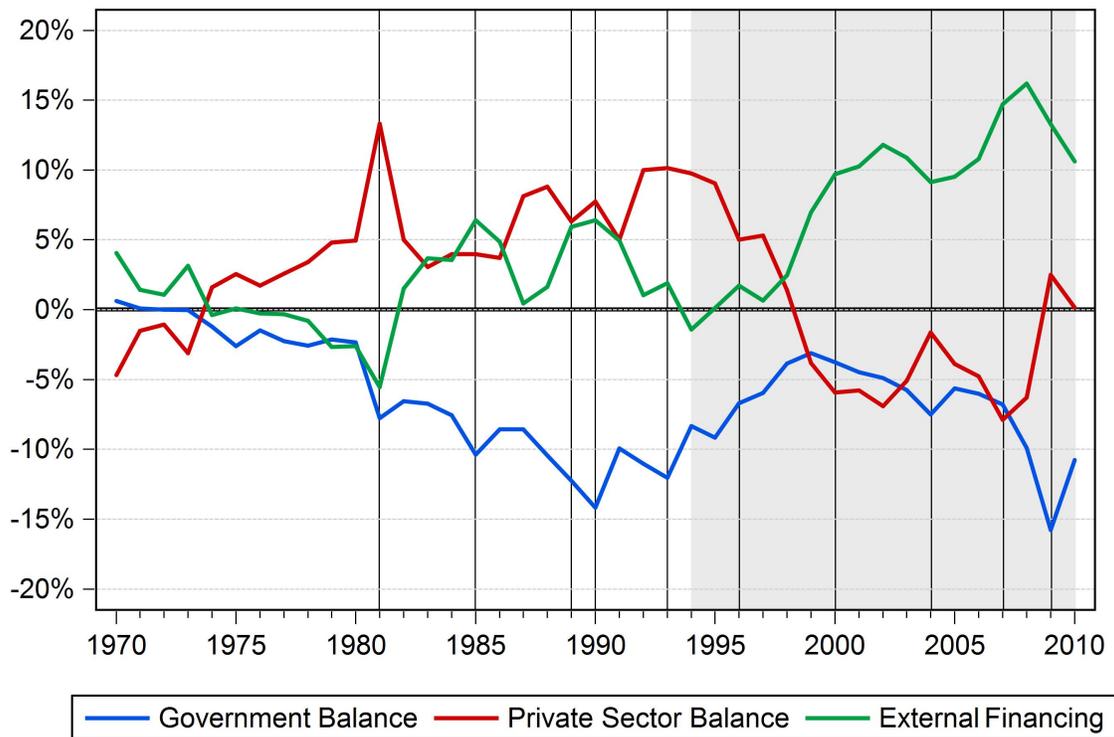
Source: World Development Indicators (World Bank Group, 2011), CES-IFO (2011), Federal Reserve (2013) and authors' calculations

Figure 4: The GDP growth rate, the implicit interest rate and the effective interest rate of the FED (1970-2010)



Source: World Development Indicators (World Bank Group, 2011)

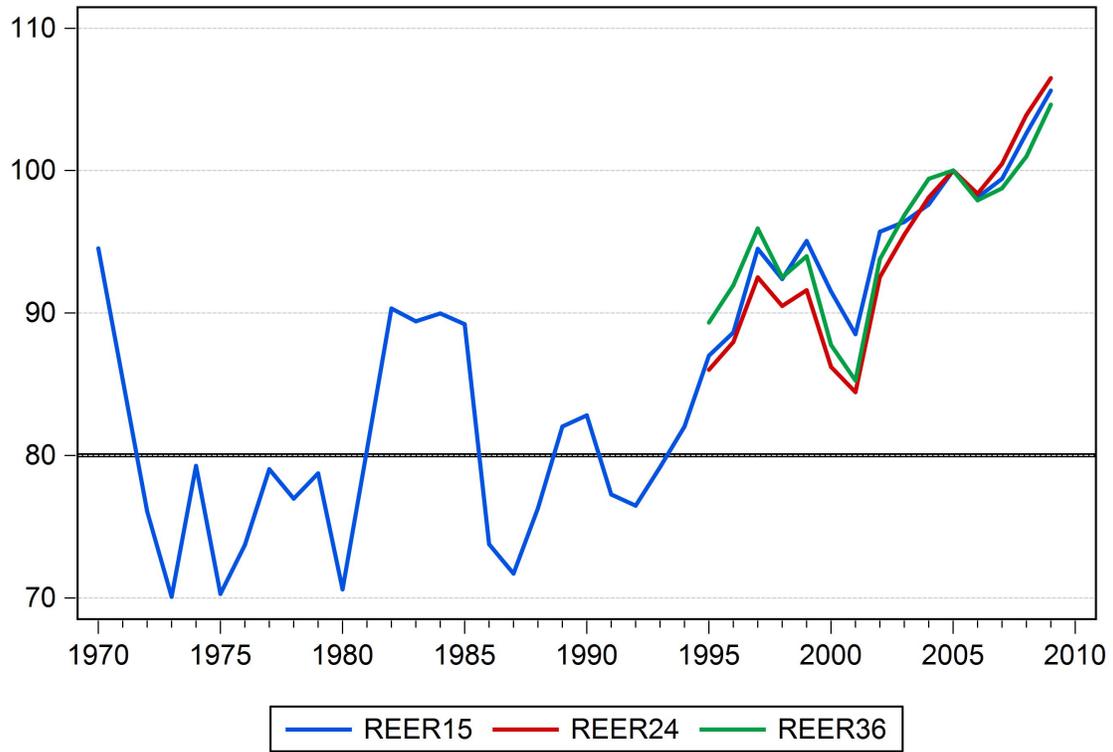
Figure 5: Inflation rate (GDP deflator) for the period 1960-2010



Source:

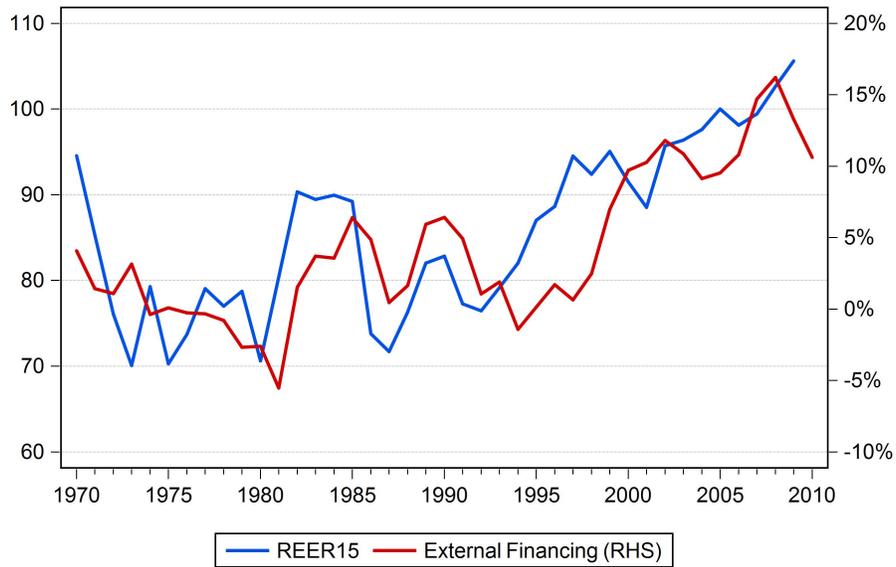
OECD.Stat Extracts database (OECD, 2011b), OECD Economic Outlook (OECD, 2011a), AMECO (DG ECFIN, 2011), and authors' calculations

Figure 6: Resource gap by institutional sector (1970-2010). The dashed lines mark election years.

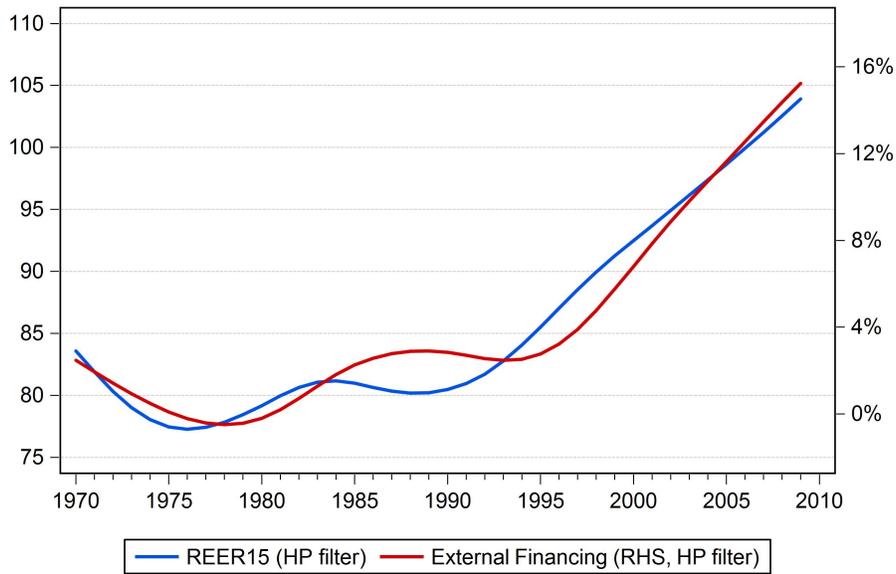


Source: AMECO (DG ECFIN, 2011)

Figure 7: The Real Effective Exchange Rate based on unit labor costs of Greece with the former EU-15 countries, the 24 industrial countries, the 36 industrial countries for the period 1970-2010 (2005=100)



(a) Actual data



(b) Filtered data

Source: OECD.Stat Extracts database (OECD, 2011b), AMECO (DG ECFIN, 2011) and authors' calculations

Figure 8: Real Effective Exchange Rate and Net-Borrowing (1970-2010)

---

**Publisher:** Hans-Böckler-Stiftung, Hans-Böckler-Str. 39, 40476 Düsseldorf, Germany  
**Phone:** +49-211-7778-331, [IMK@boeckler.de](mailto:IMK@boeckler.de), <http://www.imk-boeckler.de>

**IMK Working Paper is an online publication series available at:**  
[http://www.boeckler.de/imk\\_5016.htm](http://www.boeckler.de/imk_5016.htm)

**ISSN:** 1861-2199

The views expressed in this paper do not necessarily reflect those of the IMK or the Hans-Böckler-Foundation.

All rights reserved. Reproduction for educational and non-commercial purposes is permitted provided that the source is acknowledged.

**Hans Böckler  
Stiftung** 

Fakten für eine faire Arbeitswelt.

---