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Sophocles N. Brissimis
George Hondroyiannis
Christos Papazoglou
Nicholas T. Tsaveas
Melina A. Vasardani

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CURRENT ACCOUNT DETERMINANTS AND EXTERNAL SUSTAINABILITY IN PERIODS OF STRUCTURAL CHANGE

Sophocles N. Brissimis
Bank of Greece and University of Piraeus

George Hondroyiannis
Bank of Greece and Harokopeio University

Christos Papazoglou
Bank of Greece and Panteion University

Nicholas T. Tsaveas
Bank of Greece

Melina A. Vasardani
Bank of Greece and European Central Bank

ABSTRACT

The aim of this paper is to study the main macroeconomic, financial and structural characteristics that affected current account developments in Greece over the period 1960-2007 and link these to the issue of external sustainability. Concerns over Greece's external sustainability have emerged since 1999 when the current account deficit widened substantially and exhibited high persistence. The empirical model used, which theoretically rests on the intertemporal approach, treats the current account as the gap between domestic saving and investment. We examine the behaviour of the current account in the long run and the short run using co-integration analysis and a variety of econometric tests to account for the effect of significant structural changes in the period under review. We find that a stable equilibrium current account model can be derived if the ratio of private sector financing to GDP, as a proxy for financial liberalization, is included in the specification. Policy options to restore the country's external sustainability are explored by performing a simulation exercise based on the estimated equilibrium model.

Correspondence:
Sophocles N. Brissimis
Bank of Greece
21, E. Venizelos Ave.,
102 50 Athens, Greece
tel. + 30 210 3202388
Email: sbrissimis@bankofgreece.gr

1. Introduction

Large and persistent current account deficits constitute a cause for concern, particularly when sustainability issues are raised and thus the economic prospects of a country are put at risk. In the case of small open economies that heavily rely on external financing, an adverse change in foreign investors' behaviour may trigger a process of sharp and disorderly adjustment of external imbalances with serious consequences for the economy. This is highly relevant in the recent global financial and economic crisis, which seems to have exacerbated these risks in the long term, as the correction of the current account imbalances that took place in the aftermath of the crisis is considered to be mostly cyclical and short-lived.

Against this background, identifying the determinants of the current account is an issue of utmost importance, as also shown from the development of a number of theoretical intertemporal models in the literature over the last decade. Several empirical applications of these models have drawn on the national accounting identity, which treats the current account balance as the difference between national saving and investment and have suggested a number of "fundamental" factors as determinants of current account positions.

This paper, which theoretically rests on the intertemporal model to the current account, attempts to ascertain empirically the determinants of the current account balance in Greece. The analysis extends over a period of almost 50 years (1960- 2007) and aims at revealing the main macroeconomic, financial and structural characteristics that affected net national saving and thus shaped the course of current account developments. Given the exceptional and crisis-related circumstances that characterized global economic developments in 2008 and 2009, the analysis does not cover the most recent years. During most of the period under consideration, Greece experienced medium to small current account deficits, which were the result of diverse conditions in different sub-periods. The last sub-period 1999-2007, however, appears of particular interest as it is characterized by a substantial widening of the current account deficit that raises the issue of external sustainability. The paper suggests that the financial liberalization that took place in the 1990s and the process of monetary integration that led to the adoption of the

euro in 2001 resulted in considerable credit expansion and fall in the private saving ratio that contributed to much larger current account deficits, making the economy more vulnerable to external shocks.

The purpose of this paper is twofold. First, it attempts to empirically determine the main variables that influence the current account in Greece both in the long run and the short run using co-integration analysis. In this respect we find that a stable equilibrium current account model can be derived if the ratio of private sector financing to GDP, as a proxy for financial liberalization, is included in the long-run specification. Secondly, on the basis of the empirical results, it addresses the sustainability question, particularly for the period since 1999. A novelty of the paper is that it relates the policy measures needed to restore sustainability to the equilibrium model of the current account that is developed. A further contribution of the paper is the use of a variety of econometric tests for the long-run analysis and the short-run dynamics in order to account for shifts in behaviour during times of significant structural change. This is particularly true in the case of Greece, which in the period under review went through a process of financial liberalization and policy regime changes that substantially altered the country's macroeconomic conditions. The paper concludes by exploring possible policy options for reverting to external sustainability, using the estimated equilibrium model to perform a simulation exercise.

The rest of the paper is organized as follows. Section 2 presents the stylized facts concerning current account developments and sectoral saving-investment gaps in Greece. A description of the empirical model and the determinants of the current account appear in Section 3. Section 4 examines the methodological issues and presents the sources of the data used. The empirical results of our analysis are discussed in Section 5, while the policy implications are addressed in Section 6. Finally, Section 7 concludes.

2. Stylised facts

Historically, Greece's current account balance has been characterized by medium to small deficits (1.7 percent of GDP in the period 1960-1973 and 2.2 percent of GDP in the period 1982-1998) or small surpluses (0.9 percent of GDP in the period 1974-1981). Since 1999, however, a dramatic deterioration of the Greek current account balance has been observed, with the external deficit reaching on average 11.2 percent of GDP.

The sectoral breakdown of the national saving-investment gap between private sector and general government provides some insights into the possible origins of Greece's current account problems (see Figure 1). In the earlier period of 1960-1973, current account deficits were the result of rising private investment, in excess of also rising private saving, which overall offset moderate fiscal surpluses. This was a period of high output growth at an average rate of 8.6 percent. Given the stable long-run financial inflows, particularly foreign direct investment including investment in real estate, the current account deficit of that period was generally considered as being sustainable.

In the post-1974 period, a number of changes occurred in the saving and investment behaviour of both the private and the public sector that seem to relate to the gradual worsening of the current account position. First, private investment steadily weakened, broadly in line with the stages of economic development, where higher capital stock building is required in the earlier phases of the catching-up process.[1] Having said that, its muted evolution since, might also indicate a certain degree of misallocation of the increased inflows of EU cohesion funds towards consumption rather than investment in the 1980s and the 1990s. As a result, the net private saving-investment gap was positive until mid- to late-1990s, when a strong decrease in private saving turned it back into negative. The large deterioration of private saving coincided with the years of financial liberalization in Greece, the completion of the Single Market and the process of monetary integration in the EU. Second, significant fiscal expansion took place, mostly

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[1] See Debelle and Faruqee (1996), Faruqee and Debelle (1998) and Chinn and Prasad (2003). A less developed country has a larger deficit as the marked need for investment is accompanied by relatively low domestic saving. At an early stage of development, the external financing requirement initially rises with the increasing development of a country but then goes down when a higher level of development has been achieved.

as a result of increased government consumption rather than government investment; the latter remained relatively stable throughout the respective period, with a slight pick-up due to public infrastructure projects in the late 1980s and the 1990s (cohesion policy packages) and in 2004 (Olympic Games). Fiscal consolidation appeared to be the case only in the sub-period 1995-1999, in the context of the convergence efforts undertaken by the Greek authorities to meet the euro area entry criteria. Finally, in the most recent sub-period since 1999, the negative net saving positions of both the public and the private sector further widened, again largely as a result of falling saving rather than booming investment.

The impact of these developments on the current account seems to partly depend on the interaction between the private and the public sector. In the earlier sub-period 1974-1995, private saving fully or largely counteracted the high and sometimes double-digit fiscal deficits, keeping thus current account imbalances under control. This Ricardian effect however has become less evident since 1996 and was consequently reversed after 1999, suggesting that fiscal policy started to affect, at least in part, current account developments (twin-deficit hypothesis).

However, it was the private sector's behaviour that seems to have played a far more crucial role in the widening of Greece's current account imbalances in the post-1999 period. Table 1 shows that the fall in private saving accounted for essentially all (and more) of the deterioration in the external balance, with the other items having a small and mostly countervailing impact. As noted, the fall in the saving ratio predated Greece's euro area entry in 2001. The saving ratio fell from 25 percent or higher in the pre-1995 period to slightly above 10 percent in the period after 2001. One can thus venture the hypothesis that *prima facie* financial liberalization and the process to EMU accession, with falling inflation and interest rates among other factors, were responsible for the sharp fall in the national saving ratio[2] and the subsequent large deterioration of Greece's current account balance. The experience of other peripheral EU countries, which liberalized their financial systems around the same time as Greece, was similar;

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[2] About one fifth of the decline of the ratio of private saving to GDP can be attributed to the fall in the disposable income to GDP ratio, reflecting increased taxation of the private sector.

some widening of the current account deficit was to be expected, but not necessarily of that magnitude and speed.

3. Determinants of the current account

The two most commonly used approaches to explain the current account balance are the *elasticities approach*, which emphasizes international price competitiveness and relative demand, as determining factors of exports and imports, and the *intertemporal approach to the current account*, which views the current account as the outcome of macroeconomic, financial and structural factors that influence the national saving-investment balance. As these factors are typically different from the explanatory variables of standard trade-equation models used to generate estimates of the current account position, the implications for economic policy and exchange rate adjustments can vary considerably, depending on the approach adopted.

The economic theory underpinning this paper stems from the *intertemporal approach to the current account*, which was initially proposed by Sachs (1981) and Buiter (1981) and later extended by Obstfeld and Rogoff (1995). The intertemporal model of current account determination constitutes an extension of the rational expectations permanent income hypothesis model of private consumption to an open economy setting. The model treats the current account balance of a country as the outcome of forward-looking consumption and investment decisions (see Gandolfo, 2001), formed on the basis of expectations regarding future developments of macroeconomic variables. The standard intertemporal model features a small open economy with an infinitely-lived representative agent, who optimally allocates consumption over time by freely lending or borrowing abroad in order to maximize his welfare (i.e. aggregate utility function). The model assumes that the current account will absorb temporary or transitory shocks to net national cash flow (i.e. output minus investment and government spending), primarily reflected in national saving, so that consumption is fully smoothed over time under the assumption of free capital movements. The economy will decrease (increase)

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national saving by running a current account deficit (surplus) whenever it expects a temporary decrease (increase) in net national cash flow in the future.[3]

Empirical applications of the model have followed two directions (see Bussière *et al*., 2004; Ca' Zorzi and Rubaszek, 2008). On the one hand, several studies have tried to establish evidence in favour of the baseline model using different testing strategies (e.g. see Sheffrin and Woo, 1990; Bergin and Sheffrin, 2000; Nason and Rogers, 2006). On the other hand, a number of papers have examined the long- run relationship between the current account and its fundamental macroeconomic determinants by applying standard econometric techniques (e.g. see Debelle and Faruquee, 1996; Blanchard and Giavazzi, 2002; Chinn and Prasad, 2003; Bussière *et al*., 2005). The present paper adopts the second line of research and attempts to empirically test some of the implications for the current account as suggested by the intertemporal model.

The starting point of the empirical model is the accounting identity of the current account (*CA*) being equal to the difference between domestic saving (*S*) and investment (*I*), which is further decomposed into net private saving $(S_P - I_P)$ and general government fiscal balance $(S_G - I_G)$:

$$S - I = (S_P - I_P) + (S_G - I_G)$$ (1)

For normalisation purposes, all variables are expressed as ratios of GDP. The left hand side variable is the current account balance. A negative value of this variable represents a current account deficit:

$$\frac{CA}{Y} = \frac{S_P}{Y} - \frac{I_P}{Y} + \frac{S_G - I_G}{Y}$$ (2)

As *prima facie* evidence suggests that private saving plays an important role in explaining current account developments in Greece, we are particularly interested in investigating the determining factors of private saving. We specify the private saving to GDP ratio (S_P / Y) as a function of different economic variables, including domestic real GDP per capita (Y / N) relative to the real GDP per capita of a reference country or

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[3] On the other hand, an anticipated permanent change in national cash flow, say due to an increase in output, will cause a one-for-one change in consumption leaving the current account unaltered (Makrydakis, 1999).

group of countries (Y^*/N^*), the real effective exchange rate *(REER)*, the ratio of the general government fiscal balance to GDP $((S_G - I_G)/Y)$ and the ratio of private investment to GDP (I_P/Y). It is obvious that domestic investment plans by private agents will affect private saving ratios to the extent that these are financed domestically. Our basic private saving specification is the following:

$$\frac{S_P}{Y} = f\left(\frac{Y}{N}/\frac{Y^*}{N^*}, REER, \frac{S_G - I_G}{Y}, \frac{I_P}{Y}\right) \tag{3a}$$

In addition to the basic specification, the following financial and demographic factors are considered to explain the private saving rate: (i) credit to the private sector as a percent of GDP *(CRP)*; (ii) the real interest rate *(RIR)*; and (iii) the dependency ratio (or alternatively the fertility rate) (DEM). Finally, the effect of uncertainty, proxied by inflation volatility *(VOL)*, is taken into account. The extended private saving specification reads as:

$$\frac{S_P}{Y} = f\left(\frac{Y}{N}/\frac{Y^*}{N^*}, REER, \frac{S_G - I_G}{Y}, \frac{I_P}{Y}, CRP, RIR, DEM, VOL\right) \tag{3b}$$

Relative real GDP per capita represents an important factor in explaining current account developments. In line with Debelle and Faruqee (1996), Faruqee and Debelle (1998), Chinn and Prasad (2003) and Freund (2000), we assume that there is a link between the intertemporal approach and the stages of development hypothesis. A small open economy that starts from relatively low domestic income is expected to have low saving, as the optimal consumption levels are high relative to current income. This implies increased external borrowing against future income, which coupled with substantial initial investment needs, would translate into larger current account deficits. In other words, at an early stage of development, the external financing needs initially rise as the country develops, but then go down when a higher level of development has been reached, as a result of the economic catching-up process. Thus, we expect relative real GDP per capita to be positively related to private saving.

An appreciation of the *REER* increases the purchasing power in terms of imported goods of current and future income, as well as the value of the accumulated monetary and property assets of domestic agents. This effect tends to raise consumption and reduce the propensity to save. Thus, an increase in *REER* is expected to decrease private saving.

The relationship between private saving and current account on one hand and fiscal policy on the other depends on the extent to which consumers react in a Keynesian or Ricardian manner.[4] The Keynesian model assumes that a higher fiscal deficit (or lower fiscal surplus), as a result of lower taxes or higher government spending, increases disposable income and thereby consumption and decreases private saving, leading to a higher current account deficit (or lower current account surplus). The economic reaction of private agents under the Keynesian model supports the twin-deficit hypothesis, according to which wider fiscal deficits should usually be accompanied by wider current account deficits. However, the twin-deficit hypothesis does not necessarily hold when consumers act in a Ricardian manner. If the fiscal situation is perceived by agents as increasingly unsustainable, then tax increases or reduction in government spending (i.e. fiscal consolidation) are expected in the future, which will affect agents' future net wealth. In this case, a higher fiscal deficit (or lower fiscal surplus) in the present decreases consumption and increases precautionary saving, so that agents maintain their long-run rate of consumption, in an environment of reduced future disposable income. This would lead to a lower current account deficit (or higher current account surplus). In the extreme case where changes in public saving are fully offset by changes in private saving (Ricardian equivalence), fiscal policies have no impact on the current account, as it is also assumed by the standard intertemporal model. The empirical literature, however, on the issue of whether private saving offsets government deficits has generally concluded that a full offset (Ricardian equivalence) is rejected by the data, meaning that fiscal policy has important long-term implications for the current account. Given agents' finite time horizon, the heterogeneity of the population and the existence of borrowing constraints, the absorption of government deficits by private saving may be incomplete.[5]

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[4] For a literature review, see Debelle and Faruquee (1996), Bussière *et al.* (2005) and Briotti (2005).
[5] It appears that the level of the government debt to GDP ratio can partly explain the Ricardian or Keynesian behaviour of private agents. The empirical evidence (see Nickel and Vansteenkiste, 2008)

Thus, if private agents do not adjust their saving more than the change in the fiscal balance, the current account will respond positively to the fiscal balance.

A potentially important determinant of saving that has been emphasized in the literature is financial liberalization, usually proxied by credit to the private sector as percent of GDP. The process of deregulation in financial markets should be associated with lower levels of private saving, as the borrowing constraint faced by households is relaxed. Financial liberalization and the integration of capital markets allow banks to lend more freely and at a lower cost to individuals, for instance for purchase of a house or for consumption, and this may lead to a significant decline in saving. Empirical evidence supports this effect in countries that have liberalised access to consumer credit (see Jappelli and Pagano, 1989; Bayoumi, 1993; Lehmussaari, 1990 and Ostry and Levy, 1995).[6] Moreover, private credit as percent of GDP is also likely to capture wealth effects associated with the sharp increase in asset prices, particularly house prices. For example, evidence has shown that the increase in house prices in a number of industrial countries over the last decade has reinforced household mortgage borrowing, while at the same time its positive wealth effect has resulted in a reduction in household saving (see Faulkner-MacDonagh and Mühleisen, 2004). Thus, private credit is expected to influence negatively private saving.

As far as the real interest rate is concerned, its rise increases the rate of return on saving and, thus, the saving ratio.[7] In the same vein, the reduction in interest rate spreads and currency risk, due for example to financial liberalization and nominal convergence in

shows that for countries with debt to GDP ratios up to 90 percent the relationship between the government balance and the current account balance is positive, i.e. an increase in the fiscal deficit leads to a higher current account deficit. For very high debt countries this relationship, however, turns negative but insignificant, implying that a rise in the fiscal deficit does not result in a rise in the current account deficit. Implicitly, this result suggests that households in very high debt countries tend to become Ricardian. The composition of government spending may also be important (see Bayoumi and Masson, 1998). For example, public investment, to the extent that it is viewed as productive, is not expected to require further taxes and should not generate a private saving response. In contrast, investment that does not generate revenues for the government (and is considered equivalent to government consumption) would involve future taxes and might induce a larger private saving offset.

[6] For further evidence from other countries showing that financial liberalization increases consumption, and significantly decreases saving, while it does not substantially increase investment, see Melitz (1990), Englund (1990) and Osugi (1990).

[7] The income effect of interest rate changes on saving is not taken into account as most empirical studies have found a positive, although often insignificant, interest rate elasticity of saving.

the EU, is expected to reduce private saving (as well as increase private investment) for countries like Greece that are net borrowers. Therefore, the real interest rate is expected to be positively related to private saving and the current account.

A demographic variable is added, as represented by the overall dependency ratio or the fertility rate, since the age profile of the population is likely to be a structural determinant of domestic saving. One would expect the size of the dependent population relative to the working-age population to be negatively correlated with aggregate domestic saving. An increase in the dependency ratio or the fertility rate will decrease the saving ratio because, according to the life-cycle hypothesis, the young and the old are net consumers, while the remainder of the population is net savers. However, other factors like the desire of the elderly to leave bequests, the uncertainties about the lifespan after retirement and the financial support that will be required, as well as the public-pension portion of their incomes, may urge them to save rather than spend. Consequently, the effect of the demographic variable on private saving may be positive or negative.

Inflation volatility may affect saving for several reasons. The predominant finding in the literature is that agents in economies that are characterized by more volatile inflation tend to save more for precautionary reasons in order to smooth their consumption streams in the face of volatile future income flows. However, there is some empirical evidence that high inflation volatility might lead to less saving, as it advances expenditure in time by creating a climate of insecurity that works in the opposite direction, that is favouring present (relative to future) consumption.[8] As a result, the sign of the volatility of inflation variable is inconclusive and can only be determined empirically.

Substituting equation (3b) into equation (2) yields:

$$\frac{CA}{Y} = f\left(\frac{Y}{N} / \frac{Y^*}{N^*}, REER, \frac{S_G - I_G}{Y}, \frac{I_P}{Y}, CRP, RIR, DEM, VOL \right) + \frac{S_G - I_G}{Y} - \frac{I_P}{Y} \qquad (4)$$

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[8] See for example, Dayal-Gulati and Thimann (1997) and recent work by Nocetti and Smith (2010).

Private investment as a percent of GDP is considered both as a determining factor of private saving, as well as an autonomous variable influencing directly the current account balance. Similarly, the fiscal balance is taken into the equation as the determining factor of S_P and autonomously without any further breakdown, as it is difficult to comprehensibly distinguish the factors that influence public consumption (saving) and public investment, as government decisions do not always follow purely economic considerations.

A linear representation of equation (4) can be written as[9]:

$$\left(\frac{CA}{Y}\right)_t = \beta_0 + \overset{+}{\beta_1}\left(\frac{Y}{N} / \frac{Y^*}{N^*}\right)_t + \overset{-}{\beta_2} REER_t + (1 + \overset{+}{\beta_3})\left(\frac{S_G - I_G}{Y}\right)_t + (\overset{-}{\beta_4} - 1)\left(\frac{I_P}{Y}\right)_t +$$

$$+ \overset{-}{\beta_5} CRP_t + \overset{+}{\beta_6} RIR_t + \overset{+/-}{\beta_7} DEM_t + \overset{+/-}{\beta_8} VOL_t + \varepsilon_t \tag{5}$$

If $(1 + \beta_3) = 0$, the Ricardian equivalence holds. If $(\beta_4 - 1) = 0$, domestic saving fully finances domestic investment (Feldstein-Horioka hypothesis[10]). According to the arguments above, a positive sign is expected for β_1, $(1 + \beta_3)$ and β_6, a negative sign for β_2, $(\beta_4 - 1)$ and β_5, while the signs of β_7 and β_8 cannot be determined a priori.

4. Methodological issues and data

As discussed, the purpose of the empirical analysis is to identify the current account determinants in Greece over the period 1960-2007 and relate them to the issue of current account sustainability. At the first stage, a co-integration vector is estimated and tested for stability. At the second stage, two alternative non-linear models of the dynamics of the current account, in addition to the linear model, are selected, a regime-switching model (RS-R) and a threshold model (TA-R), and estimated conditional on the stable co-integration equation obtained at the first stage. These types of models are employed to analyze the short-run behaviour of the current account when the latter is

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[9] See also Herrmann and Jochem (2005).
[10] For a discussion see Coakley *et al.* (1996).

subject to regime shifts or changes above or below a threshold value. Under this assumption, the estimated model can accurately capture nonlinearities and/or asymmetries resulting from regime shifts.

Before estimating the long-run relationship, we test for the order of integration of the variables. Standard tests for the presence of a unit root based on the work of Dickey and Fuller (1979, 1981), Perron (1988), Phillips (1987), Phillips and Perron (1988), Kwiatkowski *et al*. (1992) and Lee and Strazicich (2004) are used to investigate the order of integration of the variables employed in the empirical analysis. In particular, we test for a unit root in the presence of a structural break by using the Lee and Strazicich (2004) minimum LM unit root test that endogenously determines a structural break in intercept and trend. The one-break minimum LM unit root test, unlike the Zivot and Andrews (1992) test, does not exhibit size distortions in the presence of a break under the null.

The order of integration of the ratio of the current account balance to GDP (CA/Y) is important for the additional reason that it is related to the notion of external sustainability (see Trehan and Walsh, 1991). The latter is evaluated on the basis of the ratio of external debt to GDP, which must be a stationary process in the steady state (see discussion in Section 6), implying that the economy satisfies its intertemporal long-run budget constraint (see Taylor, 2002). The external sustainability condition holds if the ratio CA / Y is stationary. However, non-stationarity of the CA / Y ratio does not necessarily indicate external non-sustainability. A more informative way of examining this issue is to look at the following long-run regression equation (see Holmes, 2006):

$$\left(\frac{X}{Y}\right)_t = \beta_0 + \beta_1\left(\frac{M^*}{Y}\right)_t + \varepsilon_t \tag{6}$$

where X is exports of goods and services, M^* is imports of goods and services minus net factor incomes and net unilateral transfers[11] and X-M^*=CA. Given that (X/Y) and (M^*/Y) are non-stationary variables, failure to detect co-integration between them would indicate that the economy fails to satisfy its long-run budget constraint and,

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[11] Net payments of interest and net receipts from shipping largely account for the net factor income component of the Greek current account.

therefore, is expected to default on its external debt (see Hakkio and Rush, 1991). If, however, exports and imports are co-integrated, i.e. ε_t is an I(0) process, and moreover (β_0, β_1) is $(0,1)$, then this would imply debt sustainability, because in this case the current account would be balanced. If exports and imports are co-integrated, but $\beta_1 \langle 1$ or $\beta_0 \neq 0$ and $\beta_1 = 1$, then the external debt as percent of GDP is unsustainable and can grow without bound.[12]

Once the order of integration of the variables has been determined, the long-run relationship, equation (5), which is our final current account specification, is estimated. Co-integration testing is performed using the fully modified OLS (FM-OLS) regression technique of Phillips and Hansen (1990), which modifies least squares to account for the endogeneity in the regressors resulting from the existence of a co-integrating relationship. The fact that since 1999 a considerable worsening of the current account deficit has taken place might conceivably create instability in the estimated long-run relationship towards the end of the sample. As long-run stability implies that the estimated parameters of the co-integrating relationship are invariant over time, to allow for valid inference, we carry out the stability tests taking into account (i) the non-stationarity of the variables and (ii) that a break in the estimated long-run relationship may have occurred towards the end of the sample period. Andrews and Kim (2003) proposed a co-integration breakdown test appropriate for testing the end-of-sample stability of a co-integrating relationship. The co-integration breakdown test is a generalization of the Chow test for stability and can be applied to the FM-OLS procedure. For this purpose, two statistics from Andrews and Kim (2003) are reported, the P_c and R_c statistics, which detect whether the breakdown of the co-integration relationship is due to a shift in the estimated parameters or a change in the distribution of the co-integration residuals, which in that case will no longer be stationary.

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[12] To test for co-integration between the two variables, the Engle-Granger approach is used. Since over longer periods, shifts in industrial structure, productivity, etc may have occurred which altered the long-run relationship, the Gregory and Hansen (1996) co-integration tests that account for an endogenously determined break are applied. This is a two-step procedure (as is also the Engle-Granger procedure), in which dummy variables are included in the co-integrating equation to account for possible shifts.

Finally, an error correction model (ECM) for (CA/Y) is estimated using OLS and, alternatively, RS-R or TA-R. Engle and Granger (1987) show that in the presence of co-integration, there always exists a corresponding error-correction representation, which implies that changes in the dependent variable are a function of the lagged error of the co-integration relationship (error-correction term, ECT), as well as changes in the explanatory variables. However, if there is a structural change in the short-run dynamics of the ECM, the resulting estimate of the coefficient of ECT is not consistent. An underlying assumption of OLS is that the coefficients are constant. In order to capture possible regime shifts, two different methods of estimation of the error correction model (ECM) are employed: the RS-R and the TA-R regression models. In the RS-R model the regime shift is exogenously determined, while in the TA-R model the regime-generating process is not assumed to be exogenous, but directly linked to the endogenous variable. Both models are estimated with two regimes. [13,14]

The empirical analysis was carried out using annual data for the period 1960 to 2007. The current account variable (CA/Y) is the ratio of the current account balance to nominal GDP, the fiscal balance $((S_G - I_G)/Y)$ is equal to general government saving minus investment as percent of GDP and the private investment rate (I_P/Y) is private investment as percent of GDP. The data above, as well as the exports *(X)* and adjusted imports (M^*) as percent of GDP are obtained from the Greek National Accounts. *REER* index is the CPI-deflated real effective exchange rate obtained from Eurostat. An increase in *REER* implies appreciation of the currency. The ratio $(\frac{Y}{N}/\frac{Y^*}{N^*})$ is calculated (in logs) as the difference between real GDP per capita in Greece and Germany. Real GDP and the population of Germany are taken from the IMF's *International Financial Statistics* (IFS), while the source for the population of Greece is the National Statistical Service of Greece. Credit to private sector, *CRP*, is (the log of) the ratio of claims of banks on resident sectors other than the government sector (IFS) to GDP. The source for the

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[13] Following Krolzig (1997) and Krolzig *et al.* (2002), the RS-R and the TA-R models are estimated with shifts in the coefficients (including the constant) and the error variance Σ.
[14] The RS-R and the TA-R models are estimated by means of the EM algorithm proposed by Dempsteir *et al.* (1977), using the MSVAR software developed by Krolzig. For more details, see Krolzig (1997).

demographic variables (dependency ratio and fertility rate) is the OECD Health Database. The real interest rate is the deposit rate or Treasury bill rate (IFS) adjusted for CPI inflation (National Statistical Service of Greece). Finally, VOL, used as a proxy for uncertainty, is the variance of the annual inflation rate based on quarterly CPI data.

We constructed a GARCH measure of volatility as follows:

Mean equation: $\quad\quad \pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_1 \pi_{t-2} + \varepsilon_t$ $\quad\quad\quad\quad\quad\quad\quad$ (7)

Variance equation: $\quad \sigma_t^2 = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \beta_2 \sigma_{t-1}^2 + \beta_3 \pi_{t-1}$ $\quad\quad\quad\quad\quad$ (8)

where π_t is the annual CPI inflation rate and ε_t is a random error. The conditional variance in equation (8) is a function of four terms: (i) the mean, β_0; (ii) news about inflation volatility in the previous period, measured as the lag of the squared residuals from the mean equation, ε_{t-1}^2 (the ARCH term); (iii) last period's error variance, σ_{t-1}^2 (the GARCH term); and (iv) inflation in the previous period.

5. Empirical results

The ADF, PP, KPSS and Lee-Strazicich tests for stationarity were applied to all the variables in levels and first differences.[15] Table 2 presents the results for the ADF and the Lee-Strazicich tests. All variables except for *VOL* were tested for stationarity assuming a shift in the mean. The *VOL* variable was tested assuming a shift in the mean and in the trend. The ADF statistic suggests that all variables are integrated of order one, I(1). The Lee-Strazicich test confirmed the stationarity properties of the first difference for all variables and moreover suggested that *VOL* is I(0).[16] Hence we concluded that the current account ratio was non- stationary and this in turn indicated that some further testing was needed for the external sustainability issue.

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[15] The results do not include variables that were found insignificant in the co-integration analysis (see also footnote 17).

[16] The results of the PP and the KPSS unit root tests are available from the authors upon request.

As a next step, we tested for the existence of co-integration between (X/Y) and (M^*/Y) both of which can be shown to be I(1) series (see Table 2 and Figure 2). The co-integration relationship between these two variables was estimated by employing the Engle-Granger method. The ADF test was applied to test for the stationarity of the residuals of this relationship. This test could not reject the null hypothesis of no co-integration between the two variables at the 5 percent level of significance (ADF= -1.72).[17] Two dummy variables were included in the co-integrating relationship to account for a potential break in 1999, a year in which the current account deficit widened substantially. The first dummy affects the intercept and takes the value 1 for all the years since 1999 and the other one is a slope dummy, which affects (M^*/Y). The co-integrating relationship between (X/Y) and (M^*/Y) was estimated by employing again the Engle-Granger method. The ADF test rejected the null hypothesis of no co-integration among the variables at the 5 percent level of significance (ADF= -3.48). The results indicated that for the period 1960-1998 the estimated coefficient of (M^*/Y) is equal to 0.99, which is not different from one (t= -0.02) and the constant term is not different from zero (t= -0.03), while for the period 1999-2007 the coefficient of (M^*/Y) is equal to 0.19, which is smaller than one (t= -12.27). This implied that Greece's external position seemed to be sustainable in the period 1960-1998, but not in the later period 1999-2007.

Table 3 presents the results of estimating the model for the current account with the basic specification for the private saving rate (equation 3a), using FM-OLS. All the estimated coefficients have the right sign and are statistically significant except for the *REER* (see Table 3, basic specification). The Andrews and Kim (2003) breakdown tests were applied to test for the stability of the parameters of the co-integrating relationship. One break was considered towards the end of the estimation period, that is, in 1999. The results reported in Table 3 (see panel 2) clearly show that the stability of this specification is rejected at 1 percent level of significance, indicating the existence of a

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[17] Since this result might be biased in favour of accepting the null hypothesis of no co-integration due to the existence of structural breaks, the Gregory-Hansen test which accounts endogenously for possible changes in the co-integration vector over the estimation period was applied. The various tests (level shift: -4.02, level shift with trend: -4.25 and regime shift with potential break point: -4.55) suggested that the data support the hypothesis of no co-integration between the two variables.

break. Next, an extended specification was estimated where two more variables, the credit (*CRM*) and the inflation volatility (*VOL*) variables, were included into the model.[18] All the estimated coefficients have the right sign and are statistically significant. Moreover, the stability of the estimated co-integrating equation cannot be rejected.

From the above equation (see Table 3, last column) a number of interesting results emerge. First, the stage of development matters. The positive estimated coefficient of relative real GDP per capita implies that the current account deficit will narrow as real GDP per capita in Greece converges to that of Germany. Thus further real economic convergence is expected to induce lower current account deficits in the future. Second, the negative coefficient of the *REER* indicates that an appreciation of this rate influences adversely the current account not only through worsened international competitiveness and reduced net exports (trade channel) but also through reduced saving due to higher purchasing power in terms of imported goods and increased value of the accumulated financial and real assets. Third, the estimated coefficient of the fiscal balance is greater than zero and less than one. This implies that an increase in the fiscal deficit is only partially offset by an increase in private saving, thus widening the current account deficit. Therefore, evidence points against complete Ricardian equivalence, supporting the twin-deficit hypothesis. Fourth, the estimated coefficient of private investment is statistically significant indicating that domestic saving only partially finances private investment and thus the Feldstein-Horioka hypothesis is rejected. Consequently, a rise in private investment would tend to increase the current account deficit. Fifth, the highly significant negative effect of credit on the current account indicates that the relaxation of the borrowing constraints for the private sector following financial liberalization has led to a sizable deterioration of the current account balance during the last decade, as consumption increased and saving fell. Finally, inflation volatility, which is a proxy for macroeconomic uncertainty, surprisingly affects negatively the current account by reducing saving.

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[18] Preliminary estimations of the model showed that the real interest rate (*RIR*) and the demographic variables (*DEM*) were not significant and therefore these variables were omitted. All the regressions are available from the authors upon request.

At a second stage, the error correction model (ECM) was estimated for the current account initially for the entire period [19] (see Table 4, last column). Only the coefficient of *REER* was statistically significant and had a negative sign, implying that an appreciation of the currency result in a deterioration of the current account position. All the other coefficients including that of the error correction term were not statistically significant. The non-significance of the error correction term indicated that the current account balance was weakly exogenous, implying that the deviations from equilibrium were not corrected in the short run, as there was no tendency for the current account to return to equilibrium. Instead, it was through real exchange rate changes that the current account adjusted during this period.

However, the linear ECM may not be appropriate to capture differences in the short-run dynamics due to regime shifts. For this purpose we employed the RS-R and the TA-R models.[20] In the RS-R model two regimes were selected. Regime 1 is the period before 1991 and regime 2 is the period since 1991. The year 1991 marks the beginning of a period characterized by the transition from high inflation (around 20 percent) to single-digit inflation (see Garganas and Tavlas, 2001). The estimation results shown in Table 4 suggest that during the first regime, i.e. before 1991, all the estimated coefficients except that of *REER* are not statistically significant. The non-significance of the error correction term means that before 1991 the current account was a weakly exogenous variable, responding to exchange rate policy. On the contrary, during the second regime, i.e. after 1991, all the estimated coefficients except for those of *REER* and fiscal balance were statistically significant. This finding suggests that after 1991 credit to the private sector and relative real GDP per capita were the drivers of the short-run current account developments. Also, the current account was a weakly endogenous variable in this period suggesting that it adjusts in the short run to restore equilibrium, as determined by the long-run relationship.

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[19] A one year lag for all the variables of the ECM was adopted.

[20] All the linearity tests strongly reject the null hypothesis of linear relationship for both models (LR= 24.32 and LR= 42.95 respectively). Moreover, the AIC and SC criteria are smaller in value in the case of non-linear models indicating a better fit. In addition, standard errors are different among regimes in both models, but considerably smaller compared with that of the linear model. This last finding suggests that the correlation among the variables is different across regimes

The analysis of the short-run dynamics with the TA-R model also used two regimes and showed similar results. The regimes were determined by the position of the current account as percent of GDP in the previous year. Table 4 presents the relevant estimates. The threshold value of the current account determined endogenously by the model was estimated at -1.3 percent of GDP. The results (see Table 4) suggest that for high current account deficits (greater than 1.3 percent of GDP), credit to the private sector is significant, confirming the importance of financial liberalization for the short-run deterioration of the current account since 1999. In addition, the statistical significance of the error correction term in this regime implies that in periods characterized by high external deficits, the current account reacts to correct deviations from equilibrium. During the second regime, i.e. a current account position in surplus or in deficit smaller than 1.3 percent of GDP, the variables that significantly affected the current account were the *REER*, the fiscal balance and the private investment rate. However, the current account was weakly exogenous, since the coefficient of the ECT was not statistically significant.

6. Policy implications

Our empirical findings strongly indicate that Greece's current account balance until the outbreak of the global crisis was in an unsustainable path and that appropriate structural and macroeconomic policies could facilitate the smooth and orderly correction of the country's current account imbalances.

A general conclusion that can be derived from the analysis in the previous section is that current account developments in Greece are determined by factors such as the fiscal balance, competitiveness, real convergence, private investment and macroecononomic uncertainty, working through the saving-investment channel. A finding, however, that seems to be highly relevant in explaining growing current account imbalances in Greece refers to the role of financial liberalization as proxied by private sector credit in relation to GDP. We found that it is the inclusion of the credit variable in the model that actually produces a stable relationship between the current account and its determinants. Credit to the private sector increased rapidly after financial liberalization.

Private agents, and in particular households, borrowed at an increasing rate in order to reach a higher desired level of indebtedness. In effect, private agents moved from an initial position of very low indebtedness towards the steady state level, defined as the level at which the rate of growth of credit is equal to the nominal GDP growth rate. Faced with a permanent move to a new regime with easy access to funding due to relaxed credit constraints, and low-cost financing due to lower and more stable inflation and interest rates, households opted to adjust their consumption and investment (mainly housing) through increased borrowing and reduced private saving. This contributed to the strong deterioration of the current account balance. In sum, in the period 1999-2007 we have witnessed a significant increase in private indebtedness following the changes of the economic environment brought about by financial liberalization and EMU membership.

As the private sector indebtedness approaches the steady-state, one can expect that the rate of accumulation of private debt will slow down, either because banks will not lend as much as in the past, or because the private sector will avoid an excessive burden of debt that will strain its ability to service it. It is interesting to note that this trend has intensified since the summer of 2007 as a result of the global financial crisis. Thus, in the long run, we can expect that private sector's debt will stabilize as a proportion of GDP.[21] This slowdown in credit growth will imply: (i) reduced consumption capacity and thus lower domestic demand and demand for imports and (ii) increased saving in order for private agents to be able to service in the future the accumulated debt (assuming intertemporal consumption-smoothing behaviour). The above described adjustment path of credit to the private sector towards its steady state, is a market-driven process, which however could be reinforced by strengthened bank lending prudential standards and supervision.

Both, the reduced consumption capacity and the continuous balance sheet restructuring through increased saving on the part of households are likely to contribute to a reduction in the current account deficit to GDP. As credit growth slows down towards nominal GDP growth, the current account ratio will also reach a plateau. Still, a

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[21]A recent study by Brissimis and Vlassopoulos (2009) shows that mortgage loans have a unitary long-run elasticity with respect to GDP.

note of caution is required. The stabilisation of the credit ratio at some higher level (possibly close to the EU average) does not necessarily mean, however, that the country's external position will become sustainable. Additional policy measures, suggested by the findings of this study and discussed below, can help the current account to revert to sustainability.

The necessary condition for external sustainability is that the country's net investment position (*NIP*), expressed as a ratio to GDP, is stable at some level, such that:

$$NIP_t / GDP_t = NIP_{t-1} / GDP_{t-1} = k \tag{9}$$

Since the country's net foreign asset position evolves according to the following rule (ignoring, for simplicity, account valuation effects):

$$NIP_t = NIP_{t-1} + CA_t \tag{10}$$

where *CA* is the current account, the sustainability condition can be written as:

$$CA_t / GDP_t = gk \tag{11}$$

where *g* is the economy's nominal growth rate and *k* is the constant level at which the economy's net external indebtedness is stabilised. For simplicity we can assume that *k* is equal to Greece's current net external position, where net external obligations are close but below to the country's GDP. This implies that we set the target that there will be no further worsening of the country's external position. Let's also assume that the long-run nominal growth rate is about 5 percent, consisting of a 3 percent real growth rate (more or less in line with the potential growth rate of the last fifteen years) and an inflation rate of just below 2 percent (which is consistent with the ECB's inflation target). Under these assumptions, sustainability would require a current account deficit below 5 percent.

In order to shed further light on adjustment, we use the co-integrating relation identified earlier to perform a simulation exercise. More specifically, we assume that private investment remains at its pre-crisis average level of about 20 percent of GDP and the fiscal deficit falls fast and reaches zero by 2012, as assumed in Greece's previous

Stability Programme. At the same time, the *REER* reverts from the pre-crisis level to the levels seen before Greece joined the euro area. The *REER* adjustment could be achieved through a combination of structural and other reforms that would induce price and cost restraint. For example, policies such as the deregulation of closed professions would increase market competition, thus reducing prices and costs and improving external and internal competitiveness. Finally, it is also assumed that the real GDP per capita convergence continues along the pre-crisis trend, supported by structural reforms.

The results show that there is no room for complacency. Based on quite ambitious underlying assumptions and the rather modest target of no further worsening of the country's external position beyond the pre-crisis level, Greece's current account deficit falls to 4.7 percent of GDP in 2015; that is, it reaches a point that may be considered sustainable only after a number of years and only after taking decisive and comprehensive action in the direction of eliminating fiscal deficits, improving competitiveness and implementing structural reforms.

The risks to such an adjustment path are on the downside. The situation may prove to be even more challenging given the recent adoption of a package of austerity measures by the Greek government, in view of the serious economic difficulties the country currently faces. In this respect, a more ambitious target to reduce external debt would be preferable. Furthermore, over the next few years, nominal GDP growth is likely to lag significantly behind the assumed in our simulation 5 percent rate, as the economy goes through a period of fiscal consolidation and subdued domestic, and possibly external, demand. While, the financial crisis is likely to impair the potential growth rates of most economies, including Greece's, the population ageing and a slowdown of immigration can be expected to further reduce potential growth of Greece below its recent performance. Against this background, it seems that a return to external sustainability will take even more time and further multi-level and broad-based policy action. A single policy measure alone will be ineffective in correcting the domestic imbalances that have caused the significant deterioration of the current account balance of Greece since 1999.

In sum, despite the fact that the ongoing financial and economic crisis seems to have speeded up adjustment of current account imbalances in Greece, as it has forced the correction of some underlying domestic imbalances, bold policy measures are needed to restore the economy's external equilibrium.

7. Conclusions

This paper analysed the determinants of the current account in Greece over the period 1960-2007 by focusing on the main macroeconomic, financial and structural characteristics that affected saving and investment patterns. The current account deficit has widened substantially since 1999 showing high persistence and signs of non-sustainability as the relevant tests have shown. The worsened current account deficit was mainly the result of significantly decreasing private saving rates and not exceptionally strong investment activity. From the co-integration analysis of the current account model we specified, we found that credit growth was pivotal in explaining the fall of the private saving rate and concluded that the end of rapid credit expansion will help arrest the recent sizeable deterioration of the current account. On the other hand, there is a clear risk that, even if this rapid credit expansion comes to an end, the current account deficit will be stabilised, but at a level inconsistent with long-term sustainability.

Further policy actions are therefore needed to contain the deficit within limits. We used the estimated co-integration equation to perform a simulation exercise and found that, while a return to a sustainable level is feasible, wide-ranging policy adjustments are needed to ensure sustainability. The policy options that can be considered to restore macroeconomic equilibrium are fiscal consolidation, improvement in external competitiveness and implementation of structural reforms. Action on only one front is not sufficient to restore sustainability within a reasonable time frame.

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Appendix

Table 1 Saving and investment as percent of GDP

	Private sector saving	General government saving	Private sector investment	General government investment	Current external balance
1994	25.6	-6.5	16.2	2.7	0.2
2007	10.5	-2.0	19.6	3.0	-14.0
Δ(2007-1994)	-15.1	4.5	3.4	0.3	-14.3

Sources: National Statistical Service of Greece and authors' calculations.

Table 2 Augmented Dickey-Fuller and Lee-Strazicich unit root tests

Variables	ADF unit root test		Lee-Strazicich unit root test	
	Level	First difference	Level	First difference
CA/Y	-0.359	-6.260***	-2.395	-6.059***
$\dfrac{Y}{N}/\dfrac{Y^*}{N^*}$	-2.599	-1.913	-0.708	-6.060***
$REER$	-1.900	-6.515***	-1.401	-7.889***
$(S_G - I_G)/Y$	-1.393	-6.598***	-1.68	-7.151***
I_p/Y	-2.489	-7.365***	-1.54	-7.420***
CRP	0.051	-5.803***	-1.471	-6.266***
VOL	-2.388	-8.607***	-4.609**	-
X/Y	-2.114	-8.943***	-2.422	-6.178***
M^*/Y	-1.467	-8.671***	-2.115	-4.968***

Notes: The LM Lee-Strazicich unit root test endogenously determines the structural break in intercept for all variables except for *VOL*, and in both intercept and trend for *VOL*. The critical values for the former case are: -4.24, -3.57 and -3.21 at the 1, 5 and 10 percent level of significance and for the later case are -5.11, -4.50 and -4.21 respectively (see Lee and Strazicich, 2004). ** and *** indicate significance at the 5 and 1 percent level.

**Table 3 FM –OLS estimation of the long-run current account specification**

Variables	Basic specification	Extended specification
Constant	0.275 (1.06)	1.667*** (6.66)
$\dfrac{Y}{N}\Big/\dfrac{Y^*}{N^*}$	0.099** (2.04)	0.274*** (4.56)
REER	-0.027 (-0.46)	-0.189*** (-3.60)
$(S_G - I_G)/Y$	0.407** (2.48)	0.467** (2.70)
I_P/Y	-0.394*** (-3.56)	-0.928*** (-6.01)
CRP		-0.119*** (-9.65)
VOL		-0.015** (-2.12)
Co-integration breakdown tests of the long-run specification		
Year of break / test	p-value	p-value
1999 / P_c	0.000	0.74
1999 / R_c	0.000	0.77

Notes: The numbers in parenthesis are the t-statistics. ** and *** indicate significance at the 5 and 1 percent level. P_c and R_c are the co-integration breakdown tests proposed by Andrews and Kim (2003). Reported values are simulated p values.

**Table 4 Estimation of the short-run current account specification**

Variables	RS-R		TA-R		Linear specification
	Regime 1	Regime 2	Regime 1	Regime 2	Model
Constant	-0.002	0.004	-0.007	-0.007**	-0.002
	(-0.53)	(0.77)	(-1.08)	(-3.34)	(-0.65)
$\Delta\left(\dfrac{Y}{N}/\dfrac{Y^*}{N^*}\right)_{t-1}$	-0.096	0.287**			-0.082
	(-1.43)	(1.93)			(-0.89)
$\Delta REER_{t-1}$	-0.168***	0.090	-0.167	-0.117**	-0.167**
	(-2.87)	(0.52)	(-1.64)	(-2.63)	(-2.45)
$\Delta\left(\dfrac{S_G - I_G}{Y}\right)_{t-1}$	0.245	-0.29	-0.288	0.618***	-0.022
	(1.28)	(-1.10)	(-1.39)	(3.97)	(-0.11)
$\Delta\left(\dfrac{I_P}{Y}\right)_{t-1}$			0.100	-0.272***	0.028
			(0.63)	(-4.00)	(0.23)
ΔCRP_{t-1}	-0.008	-0.235***	-0.215***	0.019	-0.037
	(-0.36)	(-5.11)	(-5.66)	(1.24)	(-1.52)
D1991			0.016*	-0.007	0.001
			(1.86)	(-1.29)	(0.22)
ECT_{t-1}	0.020	-0.57**	-0.702**	0.045	-0.080
	(0.15)	(-1.89)	(-2.94)	(0.46)	(-0.50)
Standard error	0.013	0.011	0.012	0.008	0.016
Log Likelihood	137.71		146.68		125.60
AIC	-5.38		-5.64		-5.07
SC	-4.82		-4.96		-4.71
LR linearity test	24.32***		42.95***		

Notes: The numbers in parenthesis are the t-statistics. ** and *** indicate significance at the 5 and 1 percent level.

Figure 1 Greece: Saving –investment gaps and current external balance
(percent of GDP)
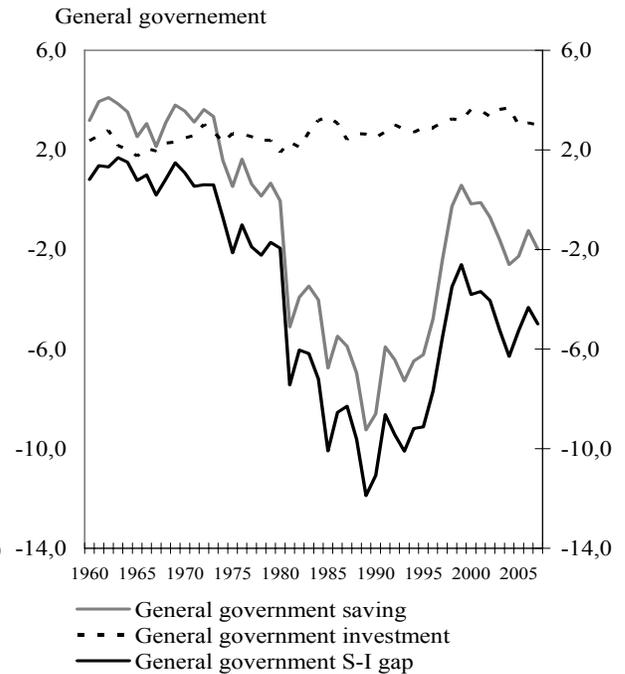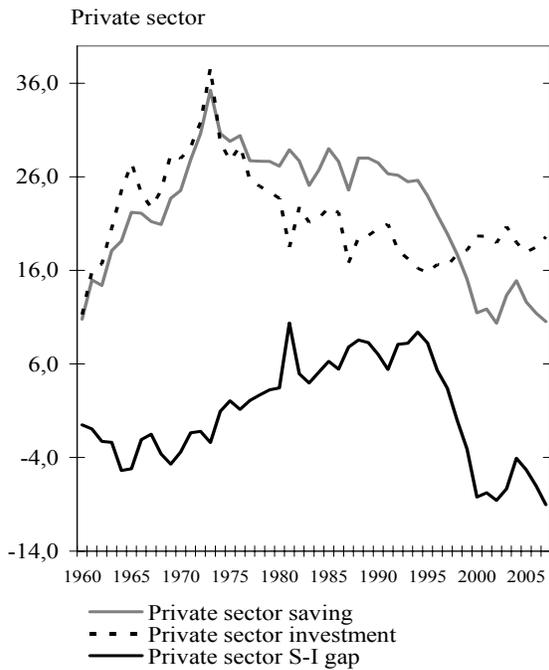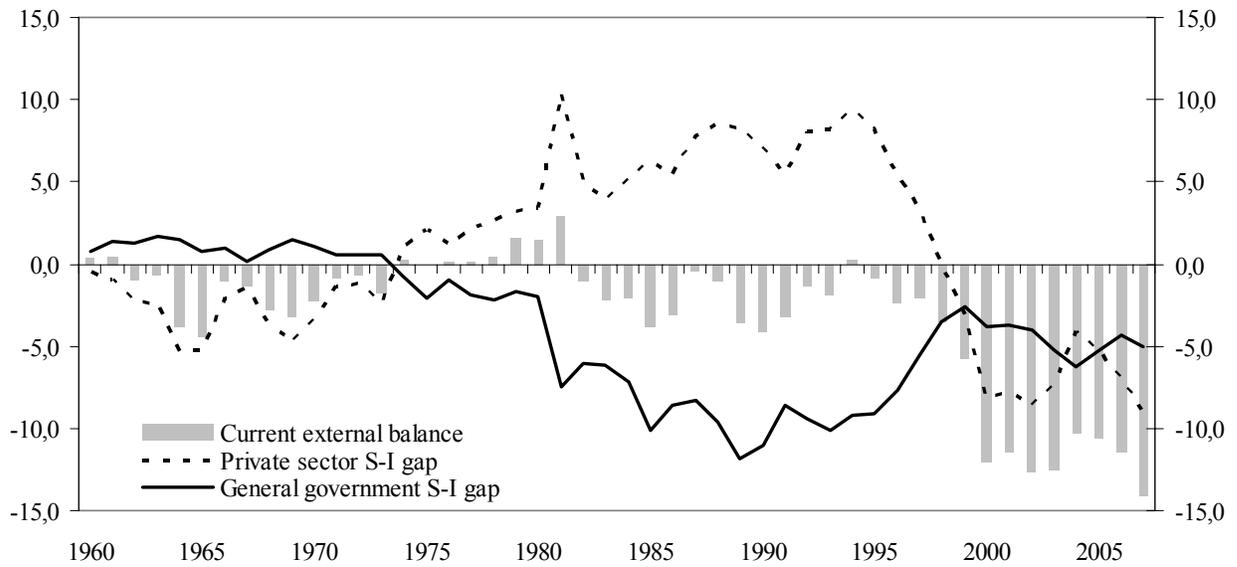
Figure 2 Exports and (adjusted) imports of goods and services
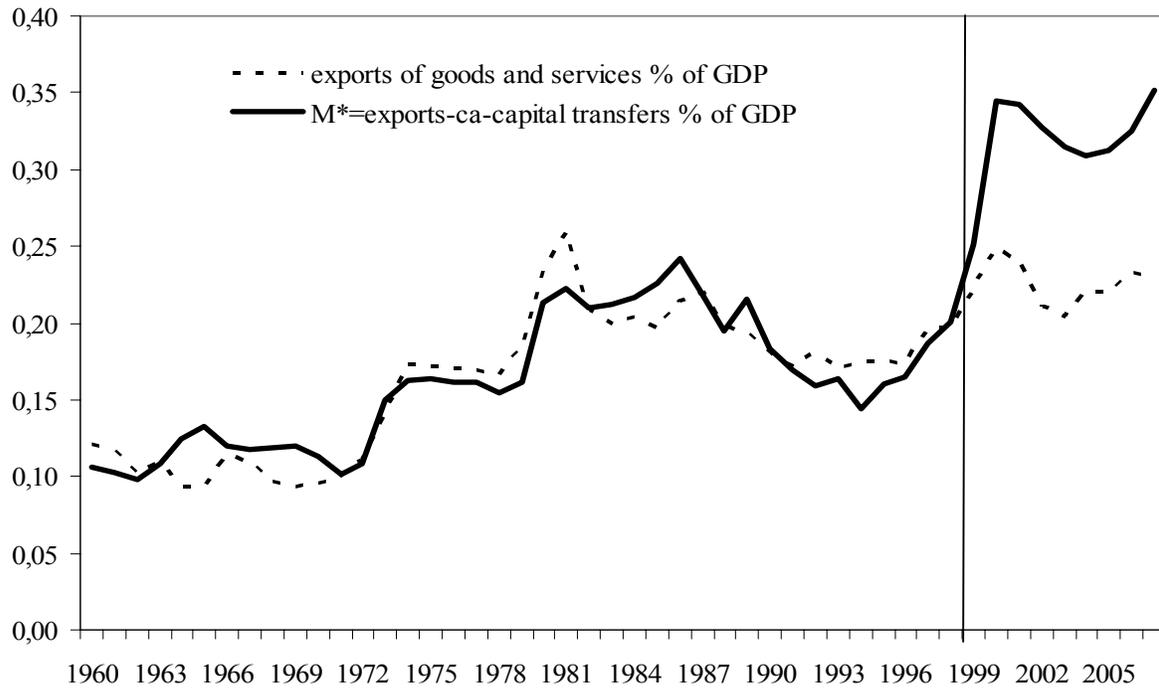
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