



THE DIVERSITY OF DEBT CRISES IN EUROPE

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The external debts of the European countries are at the core of the current crises. Generally, the crises are attributed to government budget deficits in excess of the values stated in the Stability and Growth Pact (SGP), and the Maastricht Treaty. Proposals for reform involve increasing the powers of the European Union to monitor fiscal policies of the national governments and increasing bank regulation. I explain the inter-country differences in the debt crisis in Europe. The SGP and the EU focused upon rules concerning government debt ratios and deficit ratios. They ignored the causes of external debt ratios in the entire economy that led to a crisis in the financial markets.

My basic questions in the European context are: how were 'excessive/non sustainable' external debt ratios produced in the various countries? Were the crises due to government budget deficits/government dissaving or to the private investment less private saving? What is the mechanism whereby the actions of the public and private sectors lead to an unsustainable debt burden, defined as an unsustainable ratio of debt service/GDP? The answers determine to a large extent how one should evaluate proposals for economic reform, to avert future crises.

The external debt ratio is not a control variable, but is an endogenous variable that is determined by 'fundamentals' in a dynamic manner. The fundamentals are determined by the actions of both the public and the private sectors. I explain this by drawing upon the Natural Real Exchange Rate NATREX model of the equilibrium real exchange rate and external debt – the endogenous variables.

* Brown University, Providence RI. This article is based upon chapter 8 of my forthcoming book, *Stochastic Optimal Control and US Financial Crisis* (Springer Science, 2012). I thank Peter Clark, Serge Rey, Karlhans Sauernheimer, Christoph Fischer and Carl D'Adda for advice.

I start by presenting some relevant basic statistics. They strongly suggest the inter-country differences that caused the debt crisis. The government sector was the main cause in Greece and Portugal. The private sector was the main cause in Ireland and Spain.¹

Basic statistics related to the origins of the crises

Table 1 presents the 'government structural balance' as a percentage of potential GDP (SBGDP). It refers to the general government cyclically adjusted balance adjusted for nonstructural elements beyond the economic cycle. The last row contains the mean and standard deviation in the pre-crisis period 1998–2007. In Greece and Portugal the SBGDP have been on average twice as high as in the euro area, whereas in Spain the SBGDP have been significantly lower and in Ireland they have been similar to the euro area. A difference between Spain and Ireland is that, from 2001–2007, the structural budget deficits in Ireland increased significantly, but were relatively stable in Spain.

Current account/GDP, origins of the external debt ratio

The relevant debt is the external debt, and a crisis occurs when the debt service payments/GDP are unsustainable. The sources of the external debt are current account deficits. Country experiences were different concerning the causes of the current account deficits.

Table 2 describes the current account/GDP in the euro area and in Greece, Ireland, Italy, Portugal and Spain. The net external debt is the sum of current account deficits. The steady trend in government deficits in Greece, Portugal, Italy and Ireland led to a steady trend of current account deficits and external debt. In Ireland and Spain, the rise in the demand for housing/non-tradables since 2004 discussed below were additional factors that appreciat-

¹ Sources for country studies are the reports of the central banks and EEAG (2011).

Table 1

Government structural balance as % GDP (SBGDP)

	Eurozone	Spain	Ireland	Portugal	Greece	Italy
1998	-2.03	-1.736	1.219	-3.4	-2.86	-3.1
1999	-1.6	-1.02	0.269	-3.38	-1.89	-1.8
2000	-1.969	-1.22	1.673	-4.7	-2.68	-0.9
2001	-2.676	-1.757	-1.8	-5.5	-3.647	-3.1
2002	-2.86	-1.1	-2.757	-4.9	-4.1	-3.0
2003	-3.1	-0.976	-3.167	-4.89	-6.03	-3.5
2004	-2.98	-0.978	-2.75	-5.2	-8.638	-3.6
2005	-2.67	-1.598	-3.756	-5.7	-6.01	-4.4
2006	-2.07	-1.275	-4.0	-3.9	-4.9	-3.3
2007	-1.83	-1.132	-7.3	-3.4	-6.795	-1.5
2008	-2.58	-4.9	-11.26	-4.02	-11.47	-2.7
1998–2007 Mean (standard deviation)	-2.38 (0.54)	-1.28 (0.31)	-2.24 (2.71)	-4.5 (0.09)	-4.76 (2.11)	-2.81 (1.02)

Sources: EconStats, IMF World Economic Outlook; Italy, Federal Reserve St. Louis, International Economic Trends, Government budget balance/GDP.

Table 2

Current account/GDP

Year	Eurozone	Greece	Ireland	Spain	Italy	Portugal
1998		-2.8	0.8	-1.2	1.6	-6.8
1999	-0.59	-5.6	0.3	-2.9	0.7	-8.8
2000	-1.35	-7.8	-0.4	-4.0	-0.5	-10.4
2001	-1.06	-7.3	-0.6	-3.9	-0.1	-10.3
2002	0.66	-6.8	-1.0	-3.3	-0.8	-8.23
2003	-0.08	-6.5	0.0	-3.5	-1.3	-6.4
2004	0.78	-5.8	-0.6	-5.3	-0.9	-8.3
2005	0.02	-7.6	-3.5	-7.4	-1.7	-10.3
2006	-0.56	-11.3	-3.6	-9.0	-2.6	-10.7
2007	0.13	-14.5	-5.3	-10.0	-2.4	-10.4
2008	-1.83	-14.7	-5.6	-9.7	-2.9	-12.6
2009	-1.24	-11.4	-3.0	-5.5	-2.1	-10.2
2010	-0.81	-10.5	-0.3	-5.5	-3.5	

Sources: Federal Reserve Bank of St. Louis, International Economic Trends; Portugal, World Bank.

Table 3

External debt position, end of 2009

Country	Net external debt/GDP (in %)	General government net external debt/GDP (in %)
Portugal	88.6	74.4
Greece	82.5	78.9
Spain	80.6	47.3
Ireland	75.1	70.6
Italy	37.3	42.9
Germany	-21.7	48.5

Source: Cabral (2010). Negative value is creditor.

ed the real exchange rate and generated the current account deficits.

Table 3 describes the net external debt/GDP and the general government external debt/GDP, as of the end of 2009. The *net* external debt/GDP in column 1 is the key to understanding the crises in Europe. It is

equal to total public and private liabilities to foreigners and public and private claims on foreigners. Column 2 is the general government net external debt/GDP.

Looking at Germany one sees the difference between the two measures. Germany is a net *creditor* concern-

ing the net external debt, whereas it has a general government net debt/GDP similar to Spain and higher than Italy. For Portugal, Greece and Ireland, most of the external debt is accounted for by government debt. However, for Spain the gap between the two is large. Therefore, the exclusive focus upon the government sector is misleading. Italy does not have a high net external debt/GDP.

The low world rates of interest and high domestic economic growth led to a rise in housing prices. In the period 1991–2000 the growth rates in Ireland and Spain were very high, and generated a boom in housing prices. Thus the demand for non-tradables rose, appreciating the real exchange rate – the ratio of domestic/foreign prices – inducing a current account deficit financed by capital inflows and the external debt burden rose.

The capital market assumed that, since these countries are in the euro area, there is neither an exchange rate risk nor a default risk. The capital market treated these countries alike insofar as interest rates were concerned, and did not charge countries a risk premium relative to the rest of the euro area during the period 2000–2008.

Repercussions in financial markets

It is difficult to separate bank debt from government debt when the governments have bailed out banks. The government/taxpayer takes over the role of the debtor. There is reason to combine the two debtors. Table 4 displays the debts of the banks and governments. Debtor is listed in row and creditor in column. The major debtors were Italy, Spain and Ireland. Spain owed 220 billion US dollars to the French and 238 billion US dollars to the Germans. The major

creditors were the French, German and British banks. The major creditors for Ireland were Britain and Germany. Last column is total debt to all countries in addition to those in the table.

When the crises occurred in Greece, Portugal, Ireland and Spain, whether due to the government or the private sector, defaults occurred or were threatened. If Spain defaulted then assets of the British, French and German banks/government declined in value. If the Irish defaulted, the British and German banks/governments were affected. If Italy defaulted, the French and German banks would be affected.

NATREX model of external debt and real exchange rate²

The crucial variable leading to a debt crisis is the net external debt/GDP. It is the sum of current account deficits. The accounting identity is: current account = (private saving less private investment) + government saving. The first term in parenthesis refers to the private sector and the second to the government sector. The *exclusive* focus of the SGP upon the government debt and deficit is misleading – as the recent crises indicated. The case of each country is different.

The external debt is an endogenous variable that depends upon ‘economic fundamentals’. I present the Natural Real Exchange Rate Model (NATREX) concerning the simultaneous evolution of the endogenous variables: the real exchange rate – the ratio of domestic/foreign prices – and the external debt. The ‘fundamentals’ are: (a) the expenditures on non-tradables that may arise from either the government budget bal-

² The NATREX model is based upon Stein (2006, chapter 4).

Table 4

Banks and governments: debtor and creditor by country (in billion US dollars)

	Greece	Ireland	Italy	Spain	Portugal	Britain	France	Germany	Total debt
Greece	–	8.5	6.9	1.3	9.7	15	75	45	236
Ireland	0.8	–	18	16	22	188	60	184	867
Italy	0.7	46	–	47	5.2	77	511	190	1,400
Spain	0.4	30	31	–	28	114	220	238	1,100
Portugal	0.1	5.4	6.7	86	–	24	45	47	286
Britain									
France									
Germany									
Total	2	89.9	62.6	150.3	64.9	418	911	704	

Source: Fidelity Investments, Strategic Advisers, 2010. Row is debtor and column is creditor.

ance or expenditures by the private sector such as occurred in the house price bubble; and (b) the productivity of the economy that increases the current account, by increasing the output of tradables. In the case (a) the external debt rises from the medium to the long run; and the real exchange rate first appreciates and then depreciates below its initial level. In case (b), the real exchange rate appreciates from the medium to the longer run. The external debt first rises and then declines steadily in the long run to a level below the initial value.

I apply the NATREX model to explain the diversity of debt crises in the European countries. In the empirical part, I explain the relative roles of the different fundamentals in the various European countries.

Equilibrium exchange rates and external debt

The equilibrium real exchange rate and external debt interact in a dynamic manner. NATREX analysis concerns the *equilibrium* real exchange rate and is not the *actual* real exchange rate. The NATREX explains the fundamental determinants of the medium-run equilibrium and the dynamic trajectory of the real exchange rate and the external debt to the long-run equilibrium. In both the medium run and longer run the NATREX equilibrium real exchange rate satisfies equation (1), subject to constraints. The *constraints* are that there is *internal balance*, where the rate of capacity utilization is at its longer-term mean, and *external balance* where the real rates of interest at home and abroad are equal, there are neither changes in reserves, nor speculative capital flows based upon anticipations. The equilibrium real exchange rate is the mean of a distribution, which is based upon real fundamentals. The mean will vary over time due to endogenous changes in capital and external debt, as well as changes in the exogenous real fundamentals. Deviations from this mean are produced by speculative factors involving anticipations, cyclical factors, lags in adjustment, and interest rate differentials. These disequilibrium elements average out to zero. These deviations produce considerable variation but their effects are ephemeral.

The terms in (1) are that investment less saving ($I_t - S_t$) plus the current account is equal to zero. Investment less saving is the non-speculative capital inflow. The current account ($B_t - r_t F_t$) is the trade balance B_t less transfers of interest and dividends $r_t F_t$. The net external debt is F_t and r_t is the 'interest/dividend' rate. The international investment position consists of equity,

portfolio investment and direct investment. The debt F_t is the negative of the net international investment position. Measure investment, saving and the debt as fractions of the GDP.

$$[(I_t - S_t) + (B_t - r_t F_t)] = 0 \quad (1)$$

In the NATREX approach the endogenous current account generates an evolving external debt, which feeds back into the medium-run equation (1). A trajectory to longer-run equilibrium is generated. The dynamics of the debt/GDP ratio F_t is equation (2), where g is the growth rate. The current account deficit is the change in the external debt. The real exchange rate affects the trade balance B in equation (1), and the trade balance affects the evolution of the actual debt ratio in equation (2). There is a dynamic interaction between the endogenous real exchange rate and debt ratio.

$$\begin{aligned} dF_t / dt &= (I_t - S_t) - g_t F_t = (r_t F_t - B_t) - g_t F_t \\ &= (r_t - g_t) F_t - B_t \end{aligned} \quad (2)$$

In the *longer-run equilibrium*, the debt ratio stabilizes at a value that satisfies equation (3). The trade balance B_t is sufficient to finance the interest plus dividend transfer on the debt net of growth $(r_t - g_t)F_t$. A negative debt is net foreign assets.

$$(r_t - g_t) F_t - B_t = 0. \quad (3)$$

The *longer-run equilibrium* real exchange rate R_t^* and debt/GDP ratio F_t^* are endogenous variables that satisfy both equations (1) and (3). They are written as (4) and (5) to indicate that they both depend upon the real fundamentals Z_t .

$$R_t^* = R(Z_t) \quad (4)$$

$$F_t^* = F(Z_t). \quad (5)$$

I call dynamic stock-flow model equations (1) to (3) the NATREX model, which is an acronym for the **N**atural **R**eal **E**xchange **R**ate. This is a model of *positive economics*. The derivation of the underlying equations is in Stein (2006, chapter 4).

Populist and growth scenarios

The NATREX model is a technique of analysis. The purpose of the model is to understand the effects of policies and external disturbances upon the trajectories of the equilibrium real exchange rate R_t and equi-

librium external debt ratio F_t , which depend upon the vector of fundamentals Z_t . Insofar as the fundamentals vary over time, the equilibrium real exchange rate and external debt ratio will vary over time, as indicated in equations (4) and (5). The logic and insights of the NATREX model can be summarized in two scenarios. Each scenario concerns different elements in the vector Z_t of the fundamentals, and has different effects upon the *equilibrium* trajectories of the real exchange rate NATREX and of the external debt. This analysis will help understand the roles of the government budget deficit and the housing price bubble in generating external deficits. Table 5 summarizes the differences between the two scenarios in the medium and the long run.

The first scenario, called the *Populist scenario*, involves a decrease in the ratio of social saving/GDP. This could occur when (i) the government incurs high-employment budget deficits, lowers tax rates that raise consumption, or (ii) there is a rise in the demand for non-tradable goods/housing. For example, there are low interest rate loans for the production of non-tradable goods. These scenarios represent a rise in the consumption ratio/a decline in the saving ratio, a shift in the S function in equations (1) and (2). These Populist expenditures are designed to raise the standards of consumption/quality of life for the present generation.

The second scenario, called the *Growth scenario*, involves policies designed to raise the productivity of capital and increase the competitiveness of the economy, increase the supply of traded goods.

The stories behind the dynamics are as described by Figures 1 and 2, and Table 5. Curve SI (Figure 1) is saving less investment ($S-I$)(t). It is positively relat-

ed to the real exchange rate because a rise in domestic/foreign prices adversely affects investment (see Stein 2006, chapter 4). The curve labeled CA(t) is the current account function ($B_t - r_t F_t$), which is negatively related to the real exchange rate because a rise in domestic/foreign prices adversely affects the trade balance. Initial equilibrium is $R = R(0)$ and $CA = 0$.

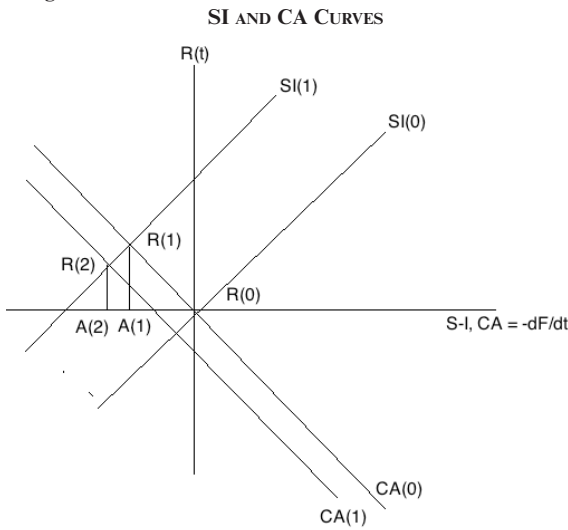
The Populist scenario involves decreases in social (public plus private) saving relative to the GDP. For example, it involves an increase in demand for non-tradables such as housing. External borrowing must finance the difference between investment and saving. The SI function shifts from SI(0) to SI(1). The new equilibrium is at $[R(1), A(1)]$, where $T = 1$ denotes the *medium-run equilibrium*. The real exchange rate appreciates because the price of non-tradable goods rises. The price of tradable goods is determined in the world market. The current account deficit equal to $A(1)$ is balanced by the capital inflow. The debt rises, since the current account deficit is the rate of change of the debt – equation (2). Current account deficits lead to growing debt service payments $r_t F_t$.

The rise in the debt payments decreases the current account function, shifts the curve CA from CA(0) to CA(1). This Populist scenario is potentially dynamically unstable because the increased debt raises the current account deficit, which then increases the debt further. The exchange rate then depreciates to $R(2)$, and since the current account deficit has risen to $A(2)$, and the debt rises *steadily*. The populist scenario – a rise in the demand for non-tradables – is described in Figure 2 and Table 5. The real exchange rate first appreciates and then depreciates below its initial level. The external debt rises steadily.

Table 5
NATREX dynamics of exchange rate and external debt: two basic scenarios

Scenarios R = real exchange rate = domestic/foreign prices, rise is appreciation, F = external debt/GDP; initial period T = 0, medium run T=1, long-run T=2. Derivation of all of the equations is in Stein (2006, ch. 4).	Medium run T = 1	Longer run T = 2
<i>Populist</i> Rise in social in social consumption (time preference), rise in high employment government budget deficit, decline social saving, rise in demand for non-tradables	appreciation $R(1) > R(0)$ Debt rises $F(1) > F(0)$	depreciation $R(2) < R(0) < R(1)$ Debt rises $F(2) > F(1) > F(0)$
<i>Growth oriented</i> Rise in productivity of investment. Rise in growth, rise in competitiveness, increase in trade balance function	appreciation $R(1) > R(0)$ Debt rises $F(1) > F(0)$	appreciation $R(2) > R(1) > R(0)$ Debt declines $F(2) < F(0) < F(1)$

Figure 1

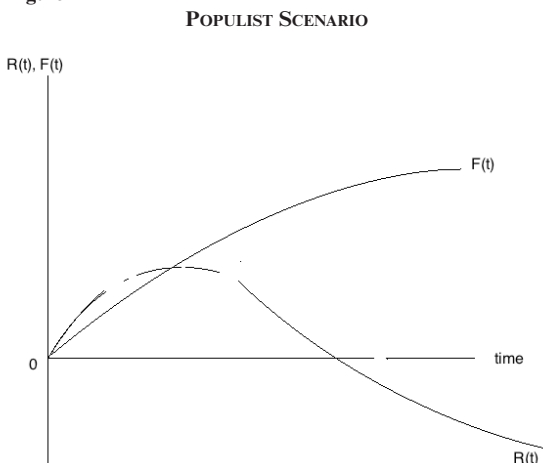


Note: Saving less investment is SI and current account is CA. Decline in social saving shifts SI to SI(1). Real exchange rate appreciates to R(1) and current account declines to A(1). The resulting rise in debt shifts CA to CA(1). Real exchange rate depreciates to R(2) and current account deficit rises to A(2).

Source: Author's conception.

Stability can only occur if the rise in the debt, which lowers net worth equal to capital less debt, reduces social consumption/raises social saving. Thereby, saving less investment rises. *Long-run equilibrium* (denoted by $T = 2$) is reached at a higher debt $F(2) > F(0)$ and a depreciated real exchange rate $R(2) < R(0)$. The longer-run depreciation of the exchange rate $R(2) < R(0)$ can be understood from equation (3). Since the debt is higher than initially, the trade balance $B(2)$ must be higher than initially, to generate the foreign exchange to service the higher transfers $r_t F(2)$. The real exchange rate must depreciate to $R(2) < R(0)$ in order to raise the trade balance to $B(2)$.

Figure 2



Note: Rise in social consumption, increase demand for non-tradables, generates trajectory $R(t)$ and external debt trajectory $F(t)$. Initial $R(0)$, $F(0)$ at origin.

Source: Author's conception.

The *Growth scenario* is summarized in the lower half of Table 5. The perturbation is a rise in the productivity of investment in tradables. Investment rises because of the rise in the rate of return. The difference between investment and saving is financed by a capital inflow. The exchange rate appreciates to $R(1) > R(0)$ which reduces the trade balance and initially produces a current account deficit. The current account deficit equal to $[I - S]$ raises the debt. The trade deficit provides the resources to finance capital formation, which raises the growth rate and the competitiveness of the economy.

The B function which relates the value of the trade balance to the real exchange rate R increases with a rise in the overall productivity/competitiveness of the economy. For example, the reallocation of resources leads to the production of higher quality/value goods that can compete in the world market. The trajectory to longer-run equilibrium differs from that in the Populist scenario. The crucial aspect implied by the Growth scenario is that the economy is more competitive. At exchange rate $R(1)$, the trade balance function CA increases, shifts to the right. The real exchange rate appreciates and there are now current account surpluses, excess of saving over investment. As a result, the debt then declines to a new equilibrium $F(2) < F(0)$. The trajectory of the debt is not monotonic. The dynamic process in the Growth scenario is summarized in the lower half of Table 5 The real exchange rate appreciates steadily to a higher level $R(2) > R(1) > R(0)$. The external debt reaches a maximum and then declines to $F(2) < F(0) < F(1)$.

NATREX analysis of the European situation

I analyze the European experiences within the framework of the NATREX model. Summary data in Table 6 shows that over the period 1998–2010 there were large current account deficits in Greece, Portugal and Spain, and lesser amounts in Ireland and Italy, relative to the euro area. The external debts of these countries rose due to current account deficits – as a result of what the NATREX model calls a rise in time preference: a decline in government saving and/or a rise in demand for non-tradables.

The role of the government sector is described in Table 6 by the row labeled Government balance. In Greece, Portugal and Italy, the current account deficits were produced by a rise in government consumption/decline in government saving.

Table 6
Summary data 1998–2010

	Euro area	Greece	Ireland	Spain	Portugal	Italy
Current account/GDP	m = -0.26 sd = 0.85	m = -8.6 sd = 3.5	m = -1.75 s = 2.16	m = -5.4 s = 2.8	m = -9.45 s = 1.78	m = -1.7 s = 1.47
Government balance	m = -2.38 s = 0.54	m = -4.76 s = 2.11	m = -2.24 s = 2.7	m = -1.28 s = 0.31	m = -4.5 s = 0.09	m = -3.16 s = 1.27
House price appreciation (% change)	m = 5.16 s = 1.97	m = 10.1 s = 3.8	m = 13.3 s = 7.24	m = 9.71 s = 5.43	m = 3.3 s = 2.8	m = 5.11 s = 3.7
GDP deflator (% change)	m = 1.7 s = 0.59	m = 3.23 s = 0.84	m = 2.45 s = 3.21	m = 3.1 s = 1.35	m = 2.67 s = 1.04	m = 2.35 s = 0.72
Growth (% change)	m = 1.6 s = 2.0	m = 2.7 s = 2.8	m = 4.2 s = 5.1	m = 2.7 s = 2.4	m = 1.52 s = 2.06	m = 0.72 s = 2.14

Source: Federal Reserve St. Louis, International Economic Trends.

In Spain and Ireland, the government sector was not the major cause of a decline in social saving/rise in social consumption. Table 7 indicates the large capital gains resulting from investment in housing/non-tradables in Ireland and Spain, relative to the euro area. The mean capital gain was: Ireland 13.3 percent, Spain 9.71 percent and the euro area 5.16 percent. Irish and Spanish banks borrowed abroad at low rates of interest and loaned these funds to the housing industry. The anticipated return was the marginal product of capital plus the anticipated capital gain. Investors within and without the euro area ignored the default risk. Moreover they assumed that the capital gain could continue to exceed the mean rate of interest. The rise in the house price index reflected the increase in the demand for non-tradables (see Table 6, row labeled House price appreciation). In Ireland, Spain and Greece, there was a significant rise in the demand for non-tradables.

The movement of the real exchange rate, equal to the ratio of prices relative to the euro area, is reflected in Table 6 by the row labeled GDP deflator. In all five countries, both the government sector and the rise in the demand for non-tradables by the private sector led to an appreciation of the real exchange rate, current account deficits and the growth in the external debt ratio dF_t/dt . This is expressed in equation (2). The SI curve shifted from SI(0) to SI(1) in Figure 1 changing the medium-run equilibrium to [R(1), A(1)] from [R(0), A(0) = 0]. The appreciation of the real exchange rate, measured by the GDP deflator, was higher in all five countries relative to the euro area.

The debt ratio stabilizes if the trade balance $B(R(t); Z(t))$ is sufficiently large to earn the income to service the debt, adjusted for growth. Since the appreciation of the real exchange rate, the percent change in the GDP deflator (relative to the euro),

Table 7
Residential property prices in EU countries, annual % change, new and existing houses

	Germany	Ireland	Greece	Portugal	Spain	Italy	France	Euro area
1996	-1.1	-	9.9	1.7	1.4	2.4	-	2.0
1997	-1.9	-	8.2	3.6	2.8	3.4	0.1	2.3
1998	-1.6	22.6	14.4	4.5	5.8	-1.4	1.9	2.5
1999	1.4	22.5	8.9	9	7.7	0.8	7.1	4.9
2000	0.2	20.5	10.6	7.7	8.6	3.9	8.8	6
2001	0.2	14.0	14.4	5.4	9.9	6.0	1.9	5.5
2002	-1.9	6.1	13.9	0.6	15.7	12.6	8.3	6.8
2003	-1.2	14.3	5.4	1.1	17.6	7.2	11.7	6.4
2004	-1.4	11.5	2.3	0.6	17.4	7.0	15.2	7.2
2005	-1.5	7.2	10.9	2.3	13.4	8.6	15.3	7.6
2006	0.3	13.4	12.2	2.1	10.4	5.8	12.1	6.4
2007	0.3	0.9	-	1.3	5.8	5.0	6.1	4.3
Mean	-0.68	13.3	10.1	3.3	9.71	5.11	8.05	5.16
Standard deviation	1.1	7.23	3.8	2.8	5.43	3.7	5.27	1.97

Source: Bank for International Settlements (BIS), Housing Statistics IFC Bulletin 31 Annex 1.

Table 8

GDP deflator, percent change from year ago

	Euro area	Greece	Ireland	Portugal	Spain	Italy	US
1998	1.0	5.2	6.6	3.79	2.5	2.7	1.1
1999	1.6	3	4.1	3.29	2.6	1.8	1.5
2000	1.3	3.4	6.1	3.24	3.5	1.9	2.2
2001	2.4	3.1	5.5	3.57	4.2	2.9	2.3
2002	2.6	3.4	4.5	3.73	4.3	3.3	1.6
2003	2.2	3.9	2.8	3.0	4.1	3.1	2.2
2004	1.9	3	2	2.46	4	2.6	2.8
2005	2.0	2.8	2.5	2.51	4.3	2.1	3.3
2006	1.9	3.1	3.8	2.77	4.1	1.8	3.3
2007	2.4	3	1.1	3.18	3.3	2.6	2.9
2008	2.1	3.5	-1.4	1.58	2.4	2.8	2.2
2009	1.0	1.3	-4	0.545	0.6	2.3	0.9
2010	0.8	3.3	-1.7	0.98	0.4	0.6	1.0

Sources: Federal Reserve Bank St. Louis, International Economic Trends, Eurostat.

was higher in all five countries, the trade balance could not rise to service the debt. A necessary condition for the debt ratio to stabilize is that the real exchange rate depreciates to increase the trade balance: see equation (3) above.

Table 8 shows that, in the last few years, there has been some real exchange rate depreciation in Ireland, but not in Greece and Italy. From Table 2, one sees growing current account deficits in all of the countries.

Conclusions

I use the NATREX model to explain the causes of the rise in the external debt, generated by the current account deficit. They were produced by both the government budget deficit and the rise in the demand for non-tradable, which in turn appreciated the real exchange rate. This is the movement to the medium run equilibrium $R(1)$, $A(1)$ in Figure 1. *Large budget deficits do not have a 1-1 correspondence with an external debt.* The IMF analysis showed that the US current account balance closely tracked the saving-investment balance of households, while the fiscal balance showed little correlation (IMF 2011). The SGP rules must be viewed in the context of the NATREX model above.

No sustained improvement in the external debt can occur unless the growth scenario occurs. Growth and the trade balance function must increase. In the shorter run, the real exchange rates of the five countries must depreciate relative to the euro. It is problematic if this is occurring. Bailouts and austerity policies will

be ineffective in reducing the growth of the debt unless the trade balance function $B(R(t))$ increases relative to the debt service $(r - g)F(t)$. The right hand side of equation (2) must decline.

The euro *per se* has not been adversely affected by the debt crises of the five countries. The value of the euro-US dollar depends upon the fundamentals, the two scenarios, in both areas, not just in either one (see also Stein 2006, chapter 5). The country crises are not a euro crisis.

References

- Cabral, R. (2010), "The PIGS' External Debt Problem", *VoxEU.org*, 8 May.
- European Economic Advisory Group (EEAG, 2011), *EEAG Report on the European Economy*, Munich: CESifo.
- International Monetary Fund (IMF, 2011), *IMF Performance in the Run-Up to the Financial and Economic Crisis*, Washington DC.
- Stein, J.L. (2006), *Stochastic Optimal Control, International Finance and Debt Crises*, Oxford: Oxford University Press.