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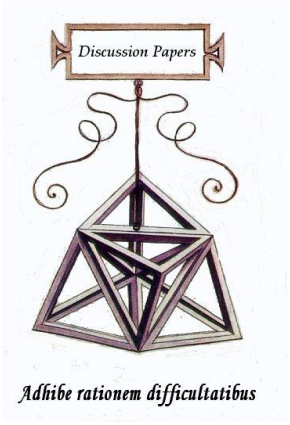

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Self-fulfilling and fundamentals based speculative attacks on public debt

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Abstract

Self-fulfilling and fundamentals based speculative attacks on public debt

The euro area crisis shows some similarities with the crisis that affected the European Monetary System in 1992-93. I argue that the theoretical framework to be used in order to analyze it can also be similar. As a matter of fact, together with the point of view of the government, that should compare costs and benefits of defaulting on the public debt – something already suggested in the literature – it should be considered the point of view of speculators, who look at the state of the economic fundamentals in order to decide whether to attack or not. This helps explaining and interpreting both the recent crisis and the effects of the fiscal and monetary policy measures that have been adopted in order to solve it.

Classificazione JEL: E65, F34, F36.
Keywords: Euro area crisis, economic fundamentals, self-fulfilling expectations, public debt, speculative attacks.

Content

1. Introduction

The current euro area crisis shows some similarities with the one that affected the European Monetary System (EMS) in the years 1992-93. In particular, a parallel with the events that have been characterizing the EMS crisis can be drawn by considering the literature on speculative attacks on fixed exchange rate systems.

According to that literature, it is possible to distinguish three regions of the state of domestic economic fundamentals: a region of absolute weakness, in which the domestic currency is certainly under attack due to the low level of its economic fundamentals, one of absolute strength of the fundamentals in which the exchange rate remains fixed and it is not subject to confidence crises, and an intermediate area (in which fundamentals are neither too weak nor too strong), characterized by a multiplicity of exchange rate equilibria, depending on the state of expectations.

The three regions emerge as a synthesis of two different interpretations of speculative attacks in fixed exchange rate systems: one based on the role played by economic fundamentals, considered by speculators in deciding whether to attack or not to attack, and the other one based on the role played by self-fulfilling expectations, when the central bank compares costs and benefits of the defense of a fixed exchange rate and devalues if the former exceed the latter, depending also on the speculative behavior of the private sector.

As we will argue more in detail below, the current euro area crisis can be interpreted along similar lines, although with some important differences.

It is possible to identify an area in which the economic fundamentals of a given government are so strong that no speculator will have convenience to sell (either on the spot or on the forward market) the treasury bonds issued by that government: nobody would sell an asset whose "true" value is higher than the selling price (the "true" or "intrinsic" value being determined by the underlying excellent state of the fundamentals, implying no risk of debt repudiation).

There is also a region in which economic fundamentals are so "bad" that, even in the absence of speculation, the cost for the government of not reneging it is higher than the benefit and in this region, therefore, everybody will be selling public debt bonds.

And there is an intermediate region, in which the state of economic fundamentals is neither so strong to rule out the risk of an attack by speculators, nor so weak to produce a debt default by the government with certainty.
If the public debt/GDP ratio lies in such an intermediate region, it becomes essential to make sure that the private sector does not coordinate its actions around a destabilizing "one way bet" in which everybody sells bonds. In other words, it becomes essential to reassure the market so as to avoid that a negative state of expectations may self-validate. As I will argue below, self-fulfilling expectations may have played a quite significant role in determining the euro area crisis.
Section 2 below introduces the model. Section 3 proposes a graphical interpretation of the euro area crisis. Section 4 analyzes the possible consequences of fiscal austerity and section 5 contains some concluding remarks.

2. A simple model

Let's consider a "fundamental" variable represented by the public debt/GDP ratio at time t (b_t), as taking value between 0 and 1.
The government may default on the public debt if the benefit of doing so exceeds the cost. The cost of default on the debt, *C*, is assumed to be the constant reputation price that the government would pay independently from the level of the ratio. The benefit, *B*, instead, increases with b_t, since the higher the ratio – namely the weaker the level of the "fundamental" - the more costly its repayment will be (De Grauwe and Ji, 2013). If the private sector fully believes in the stability of public debt (so that nobody is selling government bonds since nobody anticipates the risk of a debt default), the point at which the benefit function meets the cost function identifies the critical level $\bar{b}$ above which the government will certainly default on the debt. The position of the benefit curve, however, is also affected by the market confidence on the stability of b_t, namely on the market's fear that there may be a default on the debt. As a result, the lower the market confidence, the more leftward the benefits curve will shift – implying a higher percentage (ρ) of market participation in the attack - and the lower the critical level $\bar{b}$ above which there will be a default on the debt. In the case in which the whole market expects a default ($\rho = 1$), the benefit of defaulting will exceed the fixed cost of doing it, no matter how strong the level of the economic fundamentals is. This is to introduce, then, the possibility that a speculative attack on the public debt may have a self-fulfilling nature, as in Obstfeld (1986), suggesting a multiplicity of equilibria when considering fixed exchange rates (see Figure 1 below).
The novelty of the present paper, however, is to complete the picture presented by De Grauwe and Ji (2013) along the lines (proposed in the different context of speculative attacks in fixed exchange rates) of Krugman (1979), as summarized by Morris and Shin (1999), or Goldstein (2012). We do this by adding to the point of view of the government, which compares costs and benefits of a default on the public debt, the point of view of market

participants, who will anticipate correctly, if they form their expectations in a rational way and if they are fully informed, what is the critical level of the public debt/GDP ratio above which public debt is not sustainable anymore and at which, then, they should all start selling the public bonds that they hold.

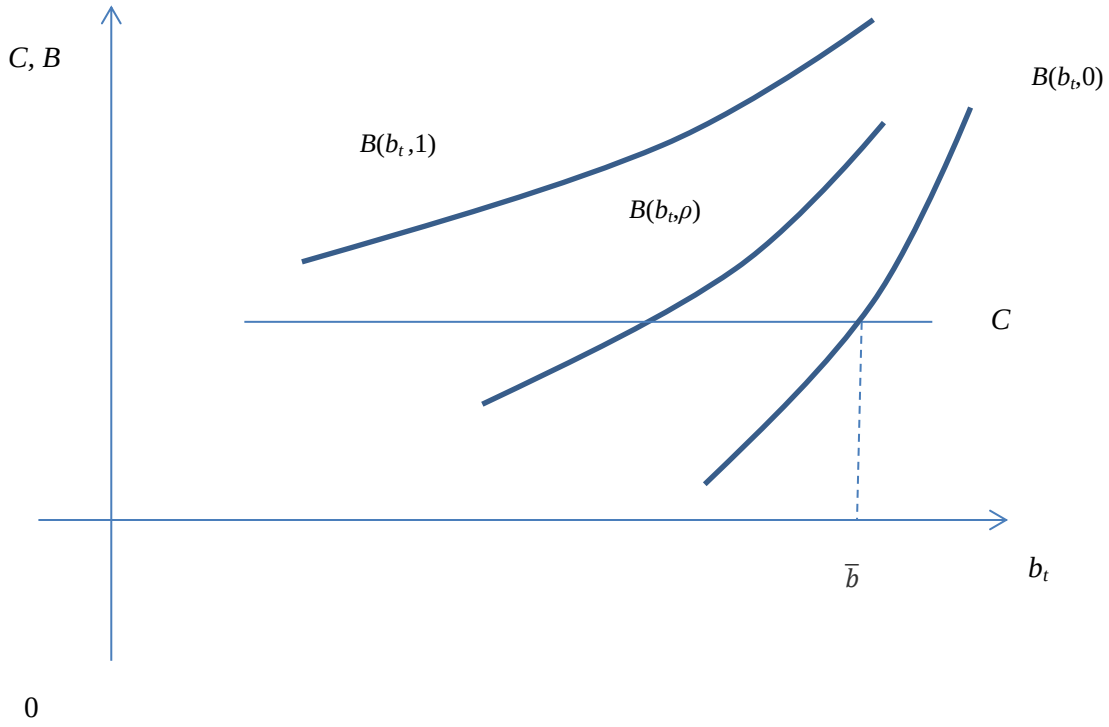

Figure 1: Government's comparison between costs and benefits of a default

This is obtained by considering the public debt/GDP stability condition:

(1) $$db_t = (f_t - t_t) + (i_t - g_t)b_t \leq 0$$

The stability condition can be derived easily by considering the dynamic equation of public debt:

$$dB_t = (F_t - T_t) + iB_t$$

where B_t is the level of public debt at time *t*, F_t is government expenditure, T_t is the level of taxation - so that $(F_t - T_t)$ is the primary deficit - and i_t is the nominal interest rate to service the public debt. From the equation above, by dividing through by the nominal GDP, thereby considering the public debt/GDP ratio, it follows that:

$$db_t = (f_t - t_t) + (i_t - g_t)b_t$$

where low case letters refer to the ratio of the respective capital letter with GDP, and g_t is the rate of growth of nominal GDP.

The nominal interest rate, however, may contain a risk premium component that increases with b_t.
As a first approximation, we can consider the interest rate i_t as given by a linear equation depending on an exogenously given (possibly foreign) benchmark interest rate ($\bar{\imath}$) and on the value taken by b_t, depending on the sensibility α:

$$i_t = \bar{\imath} + \alpha b_t \tag{2}$$

This means that for all values of g_t such that $db_t = (f_t - t_t) + (\bar{\imath} + \alpha b_t - g_t)b_t \leq 0$ we are in the stability area and speculators will not attack. If for simplicity we assume that the primary deficit is equal to 0, the stability region is included in the range (0, $\underline{b}$), where $\underline{b}$ indicates the value the of the public debt/GDP ratio below which the stability condition is satisfied, and no speculator will therefore sell public debt bonds. Equation $db_t = \alpha\, b_t^2 - (g - \bar{\imath})b_t$ reaches its minimum at the level of $b_t = \frac{g_t - \bar{\imath}}{2\alpha}$ and has a zero value at points $b_t = \underline{b} = \frac{g_t - \bar{\imath}}{\alpha}$ and $b_t = 0$ (see Figure 2 below corresponding to the case in which $g_t - \bar{\imath} > 0$).
Figure 2 below also shows both the case of a primary surplus and the case of a primary deficit.
In case of a primary surplus ($f_t < t_t$) the curve shifts downwards and the stability region (by considering only the positive solution) gets larger since:

$$\underline{b}' = \frac{(g_t - \bar{\imath}) + \sqrt{(g_t - \bar{\imath})^2 - 4\alpha(f_t - t_t)}}{2\alpha} > \underline{b} = \frac{(g_t - \bar{\imath})}{\alpha}$$

In the case of a primary deficit, instead, the curve shifts upwards and the stability region gets reduced to the range 0 - $\underline{b}''$.

The relationship between i_t and b_t, however, may well turn out to become non-linear, as proved by De Grauwe and Ji (2013). Function *i* might then become[1]:

$$i_t = \bar{\imath} + \alpha\sqrt{b_t} \tag{3}$$

In the case of equation (3) above, the stability area would get reduced compared to the case of equation (2): while in the case of a linear relationship between interest rate and public debt the stability region would be represented by the interval $(0 - \underline{b})$, in the non-linear case above it would become $(0 - \underline{b}^l)$, where $\underline{b}^l < \underline{b}$. Still considering the case in which the primary deficit/surplus will be equal to 0, then, the critical value separating the stability from the

[1] This is just one of the many possible non-linear equations applying to the case of $0 < b_t < 1$. Needless to say, for $b_t > 1$, the case of a larger interest rate reaction to the public debt/GDP ratio would be represented by an exponential function of b_t in which the power is greater than 1.

instability region (ignoring the negative solution), will be $\underline{b}^{l} = (\frac{g_t - \bar{\imath}}{\alpha})^2 < \underline{b} = \frac{g_t - \bar{\imath}}{\alpha}$, as clearly shown in Figure 3 below.

An opposite situation would emerge in the case in which the interest rate responds less than proportionally to b_t. In that case (still for $0 < b_t < 1$), the interest rate might follow an equation of the type:

$$i = \bar{\imath} + \alpha {b_t}^2 . \tag{4}$$

In this case the stability area is wider, and this is the situation that many European countries experienced during the first years of life of EMU, when they enjoyed a "honeymoon" effect.[2] This it is also shown in Figure 3 below, in which the minimum value of db_t would be obtained for $b_t = \sqrt{\frac{g - \bar{\imath}}{3\alpha}}$, and the corresponding critical level of b_t is $\underline{b}^{u} = \sqrt{\frac{g - \bar{\imath}}{\alpha}} > \underline{b} = \frac{g_t - \bar{\imath}}{\alpha}$.

This might well explain by itself the fact that countries with similar public debt/GDP ratios experience different situations, some of them being subject to speculative attacks, some not being attacked.[3]

[2] This is the expression that Krugman (1991) used in order to define the leeway on fundamentals enjoyed by a central bank establishing a credible target zone. In future research we will apply the target zones methodology to investigate further the current problem.

[3] In the middle of a crisis, the parameter α itself may change endogenously in a procyclical way. When the probability of a government's default increases, the quadratic reaction function to b_t might change parameters, so that α increases to α'. If that is the case, the sustainability equation changes shape, so as to further reduce the stability region, as clearly proved by the fact that the critical values are negatively related to α.

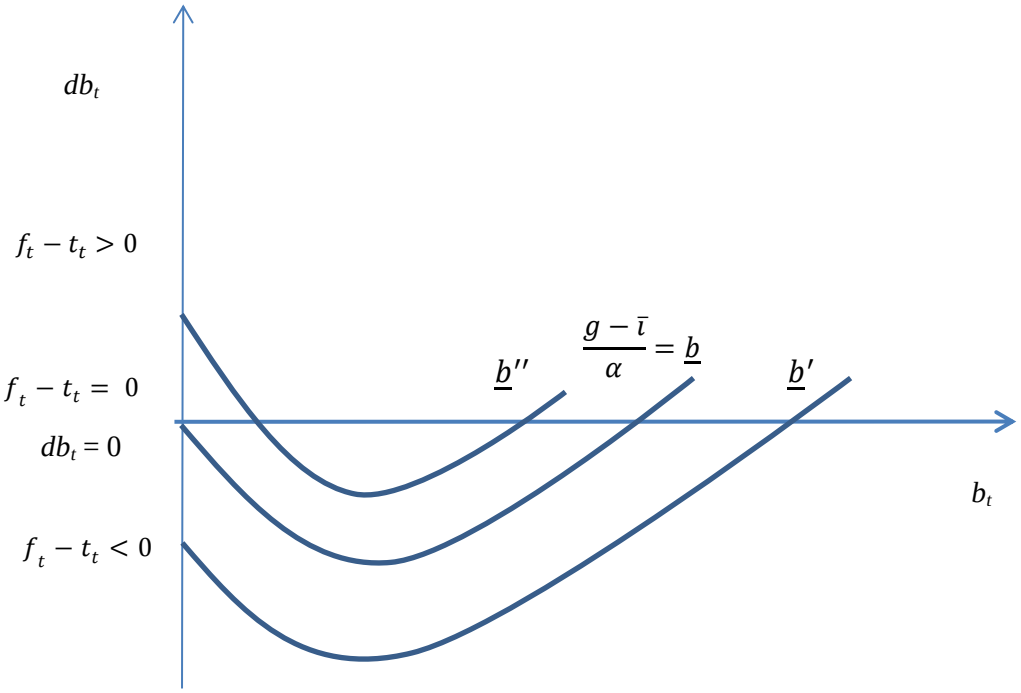

Figure 2: Sustainability functions identifying different critical values of b_b depending on the value of the primary deficit/surplus.

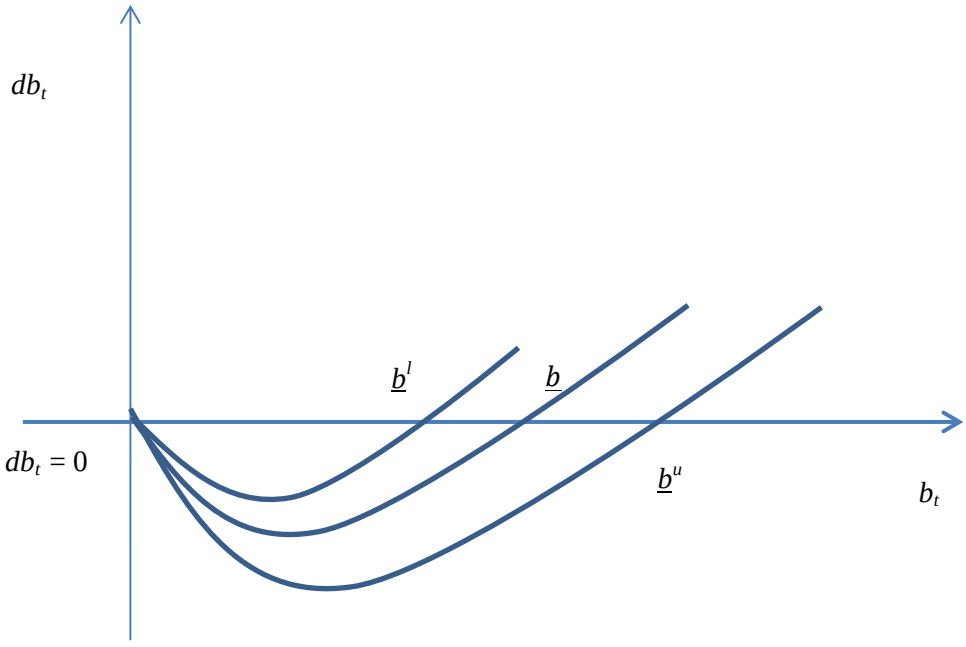

Figure 3: Sustainability condition with different interest rate reaction functions (in the case of a zero primary deficit)

A further element to consider, however, is the possible presence of a credibility premium (*CP*), depending on the market expectation of a government's default, that might increase the nominal interest rate. An increase in *i* resulting from a higher credibility premium, would also imply a reduction of the critical level separating the stable from the unstable region, so as to further enlarge the latter.

The credibility premium may well result from the comparison, correctly anticipated by the private sector, between the benefit and the cost of default for the government. Any time $B > C$ (not only because of a worsening of the state of fundamentals, but also because of a self-fulfilling market expectation of a government instability), such an inequality may affect the credibility premium by increasing it:

$$i = \bar{\imath} + \alpha b_t + CP(B, C) \tag{5}$$

When considering government debt, then, the state of the fundamentals is not independent of the state of expectations, differently from the case of speculative attacks in fixed exchange rates.

A worsening in the state of expectations would shift *B* upwards, thereby enlarging the region of potential instability, and it would also affect the public debt sustainability equation through its effects on the interest rate, thereby reducing the area of stability. As a result, even a public debt level otherwise stable and not subject to speculative attacks may become unstable when the state of expectations changes in a self-fulfilling way.

Interest rate *i* increases, then, not only because a higher b_t implies a higher risk premium on it, but also because the market perception of risk may increase with the worsening of public debt, so as to worsen the state of expectations, thereby modifying the public debt sustainability equation, and reducing the area of stability.

As a result, the range of values that can be taken by b_t is divided in three regions: the region 0-$\underline{b}$ characterized by stability; the region $\bar{b}$-1 characterized by instability, and the intermediate gray area $\underline{b}$-$\bar{b}$ characterized by multiple equilibria, depending on the degree of coordination of speculators or, which is the same, depending on the state of expectations (see Figure 4 below).

Let us stress once more that the stability region, however, differently from the case of fixed exchange rates, is not constant and independent of the state of expectations, but changes together with it, so that an initially stable situation may become unstable because the stability condition is not satisfied anymore and a speculative attack may have a self-fulfilling nature.

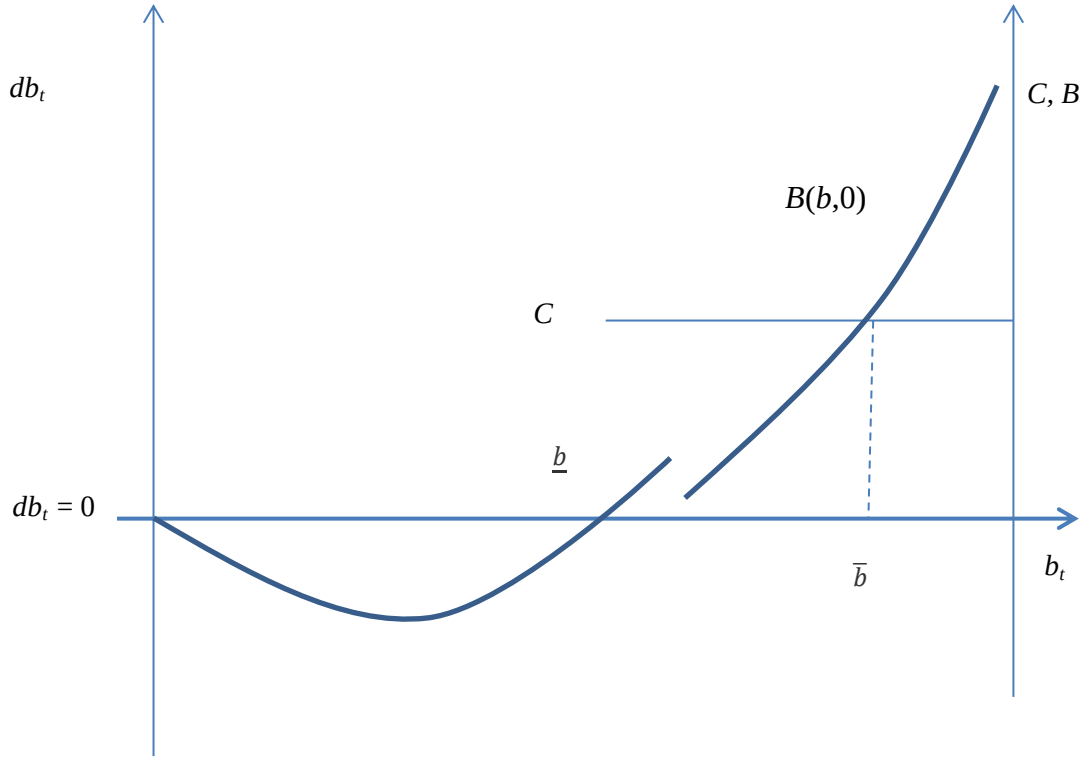

Figure 4: The stable, unstable and intermediate regions.

3. A graphical interpretation of the Euro area crisis

The graphical approach presented above allows to interpret rather easily how the Euro area crisis originated and how it has been evolving over time.
The global financial crisis induced the intervention of national fiscal authorities, so as to increase their b_t. At the same time the "honeymoon effect" came to an end and the stability curve changed shape. For both reasons some euro area countries, even with a relatively unchanged public debt/GDP ratio, then, may have moved from the region 0-$\underline{b}$ to the region $\underline{b}$-$\bar{b}$ characterized by multiple equilibria and by the possibility of self-fulfilling crises.
As we have observed above, other countries, like for example the US or the UK, may well be characterized by a different public debt sustainability equation, reflecting for example a lower interest rate sensitivity to b_t (a lower α) or even a different functional form reflecting a higher credibility level. This implies that in the US or the UK the critical level $\underline{b}$ separating the region of stability from the region of multiplicity of equilibria may be larger than the one characterizing the euro area countries. In turn, this would explain why the US and the UK were not subject to speculative attacks in spite of the equally high public debt/GDP ratios (see Figure 5 below).

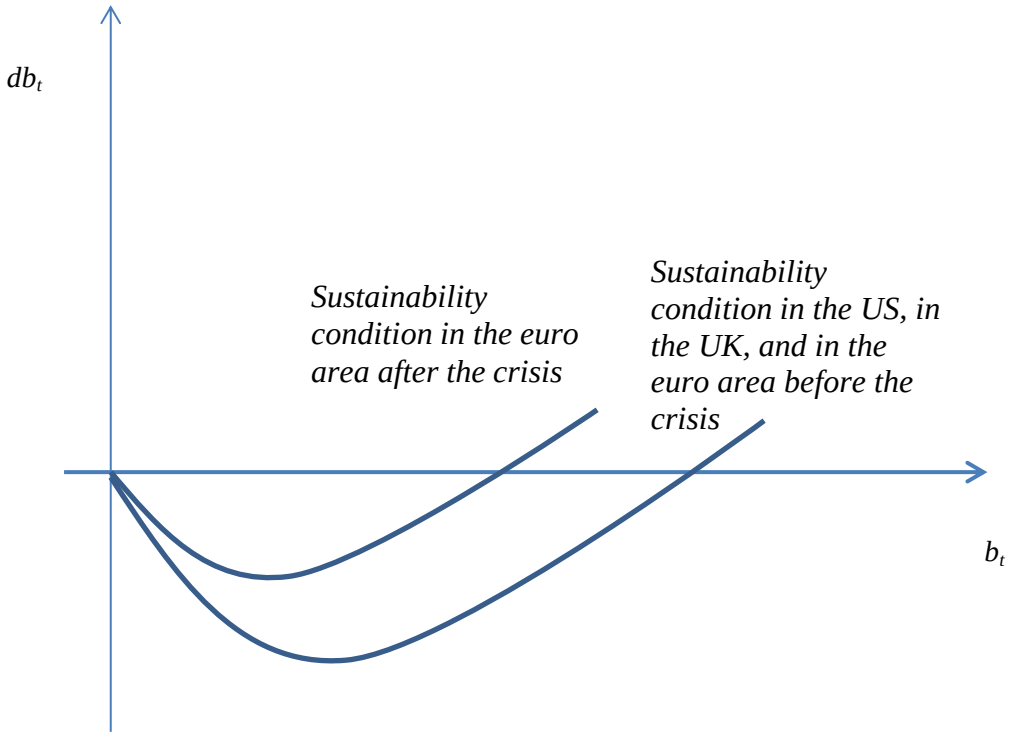

Figure 5: Sustainability conditions in the Euro area and in stand alone countries.

In Europe, the effects of the financial crisis may have implied, then, not only a worsening of the state of fundamentals b_t, but also a gradual change of the relationship between i and b_t. During the "honeymoon" days, the interest rate function was of quadratic type (as in equation (4) above, for example), reflecting a high confidence in public debt sustainability, and implying a rather large stability region (see De Grauwe and Ji, 2013). At the same time, the *B*-*C* relationship was reflecting a high market confidence, so that the region of instability was very narrow and confined only to extremely high levels of public debt, as shown in Figure 6 below:

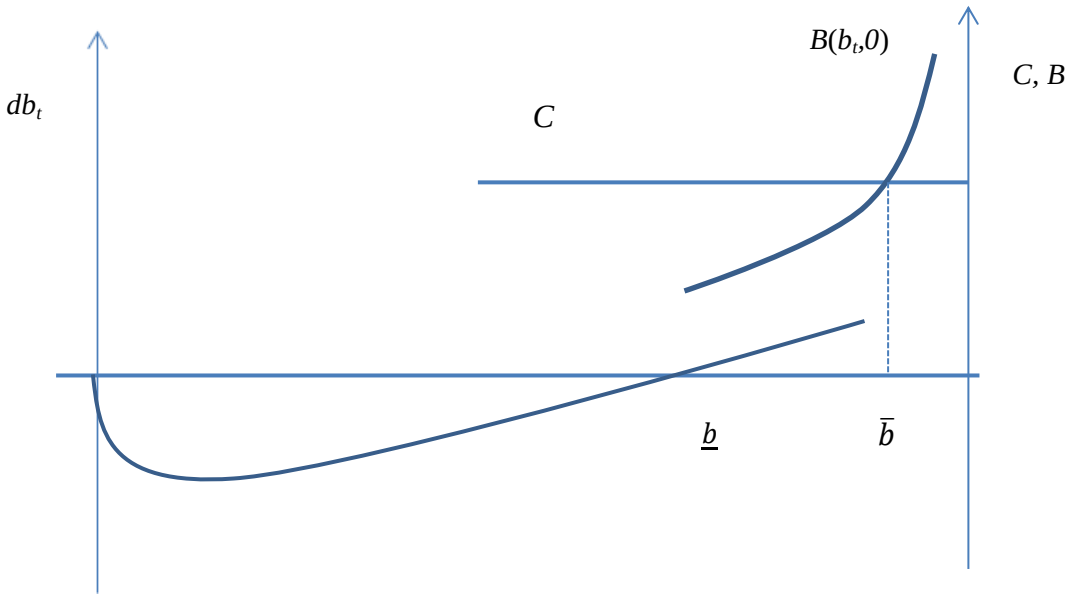

Figure 6: The "honeymoon" years of EMU

Almost a decade later, in some European countries, the need to intervene to save national banks or more generally the need to respond to the difficulties of the global financial and economic crisis, however, changed the situation. The benefits of default may have increased dangerously due to the attacks on public debt resulting from the reduced confidence in its sustainability. In some of the weaker countries of the euro area the crisis implied, therefore, both a leftward shift of the *B* function, and a change in the structure of the interest rate function, transforming itself into a square root type function (of the form represented for example in equation (3) above), characterized by a lower critical level $\underline{b}$ (see Figure 7 below).

The public debt/GDP ratio moved then into the $\underline{b}$-$\bar{b}$ region - partly because it increased, but mainly because of the change of the sustainability condition - in which a multiplicity of equilibria is possible, depending on the state of expectations of the private sector and depending on the presence of institutions capable to reassure the markets.

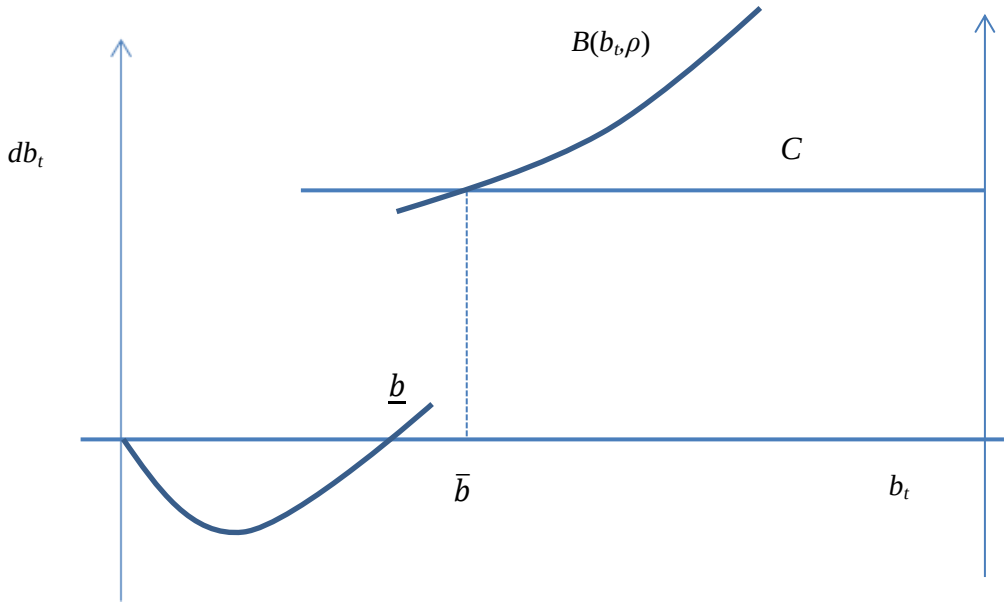

Figure 7: The euro area crisis

4. The effects of fiscal austerity and of ECB's unconventional monetary policy

Some of the euro area governments found themselves in front of a dilemma relative to what should be done. The first thing to do might have appeared to be to reduce the public debt, so as to go back into the stability region. However, a reduction of public debt does not necessarily imply a reduction of the public debt/GDP ratio. As a matter of fact, fiscal austerity may well produce negative effects if a fiscal contraction produces a lower GDP growth due to fiscal multipliers that are larger than 1 (Krugman, 2010, Blanchard and Leigh, 2013, Cottarelli, 2013). In such a case, b_t might be unaffected if not even worsened, so as to leave unaffected (if not increased) the interest rate i.
Moreover, if the negative effect on GDP is persistent, its rate of growth falls permanently and if that is the case, the public debt sustainability condition would change shape, thereby reducing the stability area. This can be shown by introducing a simple modification in our model. The rate of growth of GDP can be thought of as composed by a constant part $\bar{g}$ and by a part which depends on the fiscal stance: fiscal austerity would reduce economic growth because of its traditional Keynesian effects. We can represent this little modification in our model as follows:

$db_t = (f_t - t_t) + (i_t - g_t)b_t \leq 0$, where

$g_t = \bar{g} + \beta(f_t - t_t)$ and $i_t = \bar{\imath} + \alpha b_t$

The critical level $\underline{b}'$, then, will be smaller than $\underline{b}$, the one obtained when ignoring the negative effect of fiscal austerity on GDP growth since, when $(f_t - t_t) < 0$, it turns out that:

$$\underline{b} = \frac{(\bar{g} - \bar{\imath}) + \sqrt{(\bar{\imath} - \bar{g})^2 - 4\alpha(f_t - t_t)}}{2\alpha} > \underline{b}' =$$
$$= \frac{(\bar{g} + \beta(f_t - t_t) - \bar{\imath}) + \sqrt{(\bar{\imath} - \beta(f_t - t_t) - \bar{g})^2 - 4\alpha(f_t - t_t)}}{2\alpha}$$

Needless to say, things would be made even worse if the credibility premium increased as a result of the instability produced by fiscal austerity, by further increasing the interest rates.

All this would mean, then, that fiscal austerity would have a double negative effect. It would worsen b_t, the level of the fundamental, by making it larger (as it has actually been the case in the euro area), and it would reduce at the same time the stability area by causing a reduction of the critical level $\underline{b}$ to $\underline{b}'$ (see Figure 8 below). [4]

[4] The opposite would occur, of course, if fiscal austerity had no negative persistent effects on g_t and if that implied instead a strong positive response of the interest rate, that would fall anticipating the improved future stability of public finances (see, for example, Giavazzi and Pagano, 1990 and Bertola and Drazen, 1993). If that is the case, a fiscal contraction produces both a reduction in b_t that affects i_t in a way that depends on the parameter α (the interest rate sensitivity to variations of the public debt/GDP ratio) and a widening of the stability area. Even in the case of a reduction of g_t, however, the interest rate effect may prevail, so that even in this case b_t would be reduced over time. This would affect positively the credibility premium, so as to enlarge the stability area (the opposite of what is represented in Figure 8).

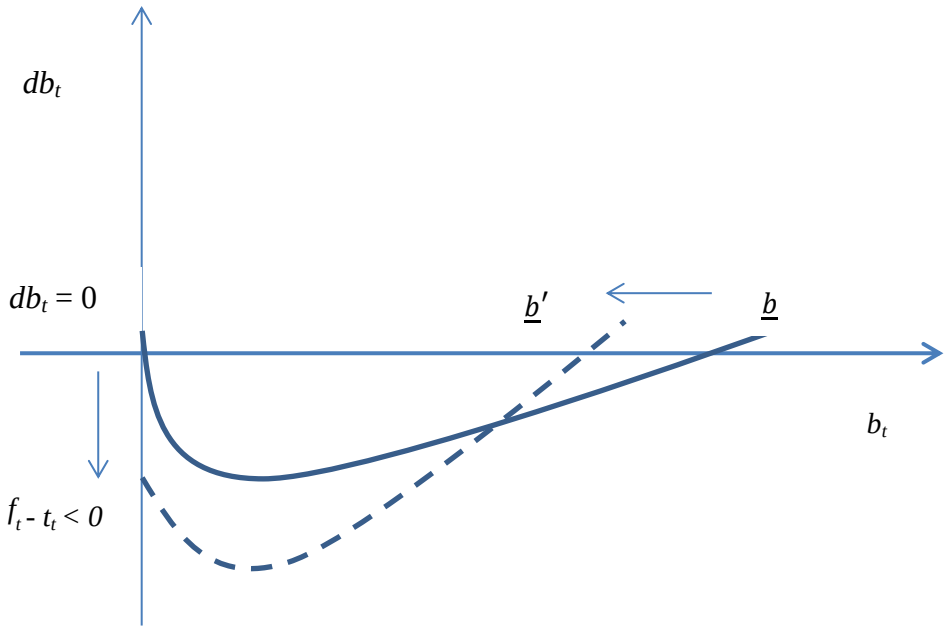

Figure 8: A downward shift of the sustainability equation with the enlargement of the region of instability due to the negative effects of fiscal austerity on GDP growth.

The approach taken by the ECB has been twofold, instead. She intervened by providing liquidity so as to reduce the interest rate. By doing so, the ECB reduced i_t as much as possible, therefore increasing the stability region.[5] At the same time, however, with her "unconventional" policies, and with the firm position taken by President Draghi during the Summer 2012, the ECB reassured the markets so as to extinguish promptly the fire of the crisis and avoid the realization of a self-fulfilling speculative attack by establishing its role of lender of last resort (Wyplosz, 2011 and De Grauwe, 2011a, 2011b). As we have already discussed above, the same cannot be said for fiscal contraction since it might fail on both aspects: on one hand it might not allow a reduction of the public debt/GDP ratio, and on the other hand it might produce perverse effects on market expectations, since the recessionary effects of fiscal austerity may worsen the perspectives for public debt sustainability.

5. Concluding remarks

The literature on speculative attacks on fixed exchange rates – that found application also to interpret the 1992-93 EMS crisis - merged the two competing explanations (the one based on diverging fundamentals, and the one based on self-fulfilling attacks) within a single framework, and identified three

[55] The proposal made by JPMorgan (2010) of subsidizing the interest rates of the euro area countries characterized by high public debt/GDP ratios and subject to speculative attacks can also be interpreted easily within the current framework, since it would imply moving an enlargement of the stability area.

regions for the level of fundamentals: the region of stability, in which fundamentals are so strong that no attack will ever take place; the region of instability, in which fundamentals are so weak that even if no speculators join in the attack a devaluation will take place; and an intermediate region in which fundamentals are neither so strong to rule out the risk of an attack, nor so weak to generate an attack with certainty. Within this "gray" region, a multiplicity of equilibria is possible, so that an attack will take place only if speculators are able to coordinate their actions.

The recent attacks on public debt in the euro area have generated many analyses, but as far as we know, no paper has interpreted them within the framework fully used by the literature on speculative attacks on fixed exchange rates.

Our analysis allows us to explain in a graphical and rather intuitive way the events that have been characterizing the recent crisis of the Euro area.

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