

The economic importance of fiscal rules*

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Preliminary version - do not quote

Comments and suggestions are very welcome

May 14, 2004

Abstract

The objective of this study is to investigate the effect of the Stability and Growth Pact (SGP) for the cycle, the inflation and the sustainability of the public finances of the Euro Area. We contribute to the debate by estimating national and Euro-area structural VARs, and by using them in order to evaluate the consequences of the modifications to the SGP that have recently been proposed. The SVARs are identified via a mix of short and long run restrictions that are relatively uncontroversial and compatible with most theoretical models of fiscal policy; they also allow simultaneous modeling of fiscal and monetary policy in order to avoid misspecification.

The comparison among the different scenarios highlights the necessity of keeping both the preventive (peer pressure) and the restrictive arm of the pact, because the 3% threshold alone is a necessary but possibly insufficient condition to ensure the sustainability of public finances.

0.1 Introduction

The objective of this study is to investigate the consequences of the Stability and Growth Pact (SGP) for the cycle, the inflation and the sustainability of the public finances of the Euro Area. We contribute to the debate by estimating national and Euro-area structural VARs, and by using them in order to evaluate the consequences of the modifications to the SGP that have recently been proposed. The SVARs are identified via a mix of short and long run restrictions that are relatively uncontroversial and compatible with most theoretical models of fiscal policy; they also allow simultaneous modeling of fiscal and monetary policy in order to avoid misspecification.

*I would like to thank Mike Artis for his supervision and useful comments and discussion; Roberto Perotti for discussing with me the very basic ideas underlying the paper; Jürgen von Hagen and Carlo Favero for very useful insights. All mistakes are mine. The work on this paper was conducted during a visit to the European Central Bank. The views expressed in this paper are mine and do not necessarily reflect those of the host institution.

The comparison among the different scenarios highlights the necessity of keeping both the preventive (peer pressure) and the restrictive arm of the pact, because the 3% threshold alone does not obtain better results in terms of average growth and it may put into danger the sustainability of public finances.

Should the Stability and Growth Pact prove to be ineffective, at least some countries in the eurozone would run unsustainable budgets. The application of the 3 per cent criterion alone and the progressive consolidation proposed by the Commission reduce the probability that the eurozone as a whole runs unsustainable policies, but neither one can guarantee that the intertemporal budget constraint is also respected by single countries. The strict implementation of the Stability Programmes appears to be by far the best option to insure that the Debt/GDP ratio decreases for the eurozone as a whole as well as for all participating countries. Finally, sustainability does not come at the expenses of growth or the capacity of stabilizing the economic cycle.

0.1.1 Economic arguments supporting the SGP

The fiscal rules laid down in the Treaty of Maastricht and reiterated in the Stability and Growth Pact (SGP) are the result of the failure of discretionary fiscal policy in the preceding years. The misuse of fiscal instrument in the 70es and the 80s led to high and persistent deficits, high levels of taxation, rising stocks of public debt, pro-cyclical fiscal stances and ultimately to high inflation in many countries. It was strongly felt that it was necessary to protect the EMU and the new-born European Central Bank (ECB) from these excesses by imposing pre-requisites for joining the Union.

The Maastricht criteria would ensure that only countries with a budgetary discipline compatible with a stable monetary union would enter the EMU. In the end, the participating countries were designated according to political criteria. The fiscal requirements were then reiterated in the SGP (BUTI 2002 JComm-MarkStudies with solution), which remained the only defence line against the possible lack of discipline of the national governments. The aims of the Pact was first, to ensure a policy framework based on low inflation and economic stability and second, to protect the European Central Bank from potential pressure for debt bailouts coming from the national governments.

0.1.2 Why the SGP is under pressure and the Maastricht criteria were not?

After only three years since the start of EMU, the SGP has undergone more criticisms than the Maastricht criteria.

First, the economic outlook seems much less favourable now than in the second phase of the EMU. The improvement in balances experienced until 1999 was largely due to the favourable economic upswing, and the structural surpluses turned out to be insufficient to allow the automatic stabilizers to work fully through the recession of the early 2000. As a result, some countries hit by the

economic slowdown adopted a pro-cyclical fiscal stance, others chose or were forced to infringe the 3% threshold¹.

Second, the structure of incentives has changed. While the possibility of being excluded from participation in the EMU proved to be a powerful incentive to support fiscal restraint, the stick of the sanctions provided by the infraction procedure is relatively weak and uncertain. Calculations by Von Hagen (2002) suggest that after entry in the Union most countries, and especially the big ones, have abandoned the structural consolidation, and that almost all EMU participants have used fiscal policy procyclically, expanding the structural budgets in the good times and consolidating only under the pressure of the 3% limit in times of economic stagnation.

Finally, the experience of the first years of EMU has highlighted that the SGP rules have not been correctly implemented in the conduct of fiscal policies. The correct or incomplete implementation can be attributed to several factors, some of which are summarized by Buti and Giudice (2002). First, the requirement of budget close to balance or in surplus in the medium run is confronted with the lack of consensus of how an output gap, and therefore a structural balance, should be measured. As a result, the only binding (nominal) rule in the SGP makes it intrinsically asymmetric in that it sanctions excessive deficits but does not provide incentives to fiscal consolidation in good times. Second, in presence of current expenses that are difficult to cut, the balanced budget requirement as defined today may result in an insufficient level of investment. More generally, Buiter (XXX) remarks that the SGP and BEPG are badly designed to address the needs of economic realities that may sensibly differ from the EU average in terms of future nominal growth and need for capital. The importance of this issue will then be greater in the forthcoming years, when the enlargement of the Union will increase the heterogeneity in the economics structures of the participating economies. Finally, the respect of the 3% public deficit threshold of the Pact does not explicitly address nor automatically ensure sustainable public finances², and may in theory still expose the ECB to the "unpleasant monetaristic arithmetic" of Sargent and Wallace (1981).

0.2 The proposals for change

The Communication 668 (2002) of the Commission to the Council and the European Parliament has channelled many proposals for change in five points for "improving the interpretation of the Stability and Growth Pact". These can be summarized as follows:

¹The Portuguese government deficit rose to 4.1 per cent of GDP in 2001, and the Commission forecasts indicate a deficit of about 3.8 per cent of GDP for Germany in 2002. The 2002 government deficit is estimated at 2.7 per cent for France and to 2.4 per cent for Italy. Both values sensibly diverge from the stability programmes and do not allow much room for further use of automatic stabilizers (Data source: European Commission, autumn 2002)

²For instance, one-off measure can be used by the national governments as substitutes for structural changes in the budget, and issues as aging population are at the moment not considered.

1. To interpret the "close to balance or in surplus" requirement taking into account the economic cycle. In practice, the cyclically adjusted budget balance would be used instead of the corresponding nominal figure. The 3% upper bound would continue to be enforced in nominal terms. <<NOT EVEN THIS SEEMS TOTALLY CLEAR>>
2. Countries whose public finances are still not "close to balance or in surplus" would be required to achieve an annual improvement in the structural deficit of at least 0.5% of GDP until the condition is met.
3. Pro-cyclical loosening of budget policies would be sanctioned, with the goal of impeding that a favourable phase of the cycle induce the national government to a relaxation of the budgetary discipline.
4. Member states with finances close to balance or in surplus could be allowed temporary deviations in order to "introduce large structural reforms that raise employment or growth potential in line with the Lisbon strategy".
5. Finally, the debt/GDP ratio, so far neglected, would become a more important instrument in assessing the position of a country. Countries with a debt level outside the limit set forth by the SGP would be required to set "ambitious long-term reduction strategies" in their stability and convergence programmes, and the infringement of these commitments would be sanctioned.

The proposals for interpretation of the pact save the letter of the SGP, and try to strike a balance between flexibility and sustainability. The automatic stabilizers could work during the period of consolidation. The process of convergence would be smoothed over time relative to the previous commitments contained in the BEPG to achieve the close in balance or in surplus condition in 2006; furthermore, a fixed speed of convergence is indicated, allowing those countries that are more distant from balanced budget a longer time period.

Comparison of the updated stability and convergence programmes of 2001-2002 and 2002-2003

	Real GDP growth (percentage change)					Budget balance (as a percentage of GDP)					Debt (as a percentage of GDP)				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
Belgium															
Update of Nov. 2001	1.3	3	2.5	2.4		0	0.5	0.6	0.7		103.3	97.7	93	88.6	
Update of Nov. 2002	0.7	2.1	2.5	2.5		0	0	0.3	0.5		106.1	102.3	97.9	93.6	
Germany*															
Update of Dec. 2001	1½	2½	2½	2½		-2	-1	0	0		60	59	57	55½	
Update of Dec. 2002	½	1½	2¼	2¼	2¼	-3¼	-2¼	-1½	-1	0	61	61½	60½	59½	57½
Greece															
Update of Dec. 2001	3.8	4	4			0.8	1	1.2			97.3	94.4	90		
Update of Dec. 2002	3.8	3.8	4	3.7	3.6	-1.1	-0.9	-0.4	0.2	0.6	105.3	100.2	96.1	92.1	87.9
Spain															
Update of Dec. 2001	2.4	3	3	3		0	0	0.1	0.2		55.7	53.8	51.9	50	
Update of Dec. 2002	2.2	3	3	3	3	-0.2	0	0	0.1	0.2	55.2	53.1	51	49	46.9
France															
Update of Dec. 2001	2.5	2.5		-1.4	-1.3	-0.5	0		56.3	55.7	54.5	52.9			
Update of Dec. 2002	1.2	2.5	2.5	2.5	2.5	-2.8	-2.6	-2.1	-1.6	-1	58.7	59.1	58.9	58.3	57
Ireland															
Update of Dec. 2001	3.9	5.8	5.3			0.7	-0.5	-0.6			33.7	33.8	34.1		
Update of Dec. 2002	4.5	3.5	4.1	5		-0.5	-0.7	-1.2	-1.2		34.1	34	34.5	34.9	
Italy															
Update of Nov. 2001	2.3	3	3	3.1		-0.5	0	0	0.2		104.3	101	98	95.4	
Update of Nov. 2002	0.6	2.3	2.9	3	3	-2.1	-1.5	-0.6	-0.2	0.1	109.4	105	100.4	98.4	96.4
Luxembourg															
Update of Nov. 2001	5.3	5.7	5.6			2.8	3.1	3.4			4.6	4.2	3.9		
Update of Jan. 2003	0.5	1.2	2.4	3.1		-0.3	-0.3	-0.7	-0.1		5.1	4.1	3.8	2.9	
Netherlands															
Update of Oct. 2001	2	2¼	2¼			1	1	1			47.7	45	42		
Letter of Dec. 2001	1½	2½	2½	2½	2½	0.4	0.2	0.5	1	1.2	48	45	42		
Update of Dec. 2002	0.25	0.75	2.75	2.75	2.75	-0.7	-1	-0.7	-0.4	0.1	51.9	51.2	49	47.4	45.3
Austria															
Update of Nov. 2001	1.3	2.4	2.8	2.8		0	0	0.2	0.5		59.6	57.2	54.7	52.1	
Update of Mar. 2003	0.9	1.4	2	2.5	2.5	-0.6	-1.3	-0.7	-1.5	-1.1	67.8	67	65.1	63.8	62.1
Portugal															
Update of Dec. 2001	1.75	2.5	3	3		-1.8	-1	0	0.4		55.7	55.5	54	53.2	
Update of Dec. 2002	0.7	1.3	2.7	3.1	3.5	-2.8	-2.4	-1.9	-1.1	-0.5	58.8	58.7	57.5	55.3	52.6
Finland															
Update of Nov. 2001	1.6	2.7	3			2.6	2.1	2.6			42.9	43	41.8		
Update of Nov. 2002	1.6	2.8	2.6	2.5	2.4	3.8	2.7	2.1	2.6	2.8	42.5	41.9	41.9	41.4	40.7
Euro area (average)															
Update of 2001	2	2.8	2.8			-0.9	-0.5	0	0.1		67.2	65.5	63.3		
Update of 2002-2003	1	2.1	2.6	2.7	2.6	-2.2	-1.8	-1.1	-0.7	-0.2	69.7	68.6	66.7	65.3	63.1

Whenever alternative scenarios were presented, the table shows either the more cautious one or the one retained by the government as the baseline scenario. Budget balance figures do not include UMTS proceeds.

Note:

*

The figures for Germany indicate ranges rather than point estimates.

< XXX.tab.stab.programs.compared)

Condition 4 is difficult to evaluate, and could allow substantial deviations from the balanced budget, under the conditions that the country implementing the structural reforms must have finances in order (this almost certainly excludes from rule 4 the countries with an excessive debt) and the deviation has to be approved by the community institutions (no unilateral or automatic implementation would be allowed).³

The aim for sustainability is somehow taken into account in conditions 3 and 5. It should be noted, however, that none of the 5 points explicitly addresses the problem of sustainable public finances. Buiters and Grafe (2002) argue that the

³The proposals are accompanied by several statements. The Commission commits itself to paying more attention to the quality of the member states' budgets, and to enforce credibly the new proposed rules. At the same time, a code of best practice in collecting national statistics will be proposed in order to reduce the scope for creative accounting. These statements may have some practical importance, but their effect is extremely difficult to assess and therefore I will base my analysis on the five rules cited above only.

concept of sustainable and stabilizing fiscal policies depends on the structure of the economy, and cannot be correctly assessed using the nominal targets defined in the SGP. They propose an alternative rule of sustainability of public finances, based on economic fundamentals, the "permanent balance rule", which takes into account the dynamics of debt induced by inflation and real growth. Beside addressing directly the point of concern for the sustainability of the monetary union, such a rule would allow the fast-growing future members of EMU to run higher deficits in order to finance the necessary updating of their infrastructures. I use a simplified, easy-to-check version of their government solvency constraint as a possible scenario for reform. The difference with their formulation is that it does not rely on the intertemporal budget constraint, which has no practical implication for the short run⁴, but on the simple following rule:

6. The debt/GDP ratio cannot increase, and countries "with debt levels well above the 60% of GDP reference value should outline a detailed strategy to reduce their debt level to below the reference value" (European Commission, cited above).⁵

0.3 The empirical literature on fiscal policy

In order to investigate the effect of fiscal policy on output and vice versa, one needs to identify the different components of fiscal policy itself. Fiscal policy is a complex aggregate, with several purposes, and influenced by many variables. It includes an automatic component, related to the inertia of taxes and expenditure, and depending mainly on its own past. The automatic stabilizers follow the output gap. A third component is mostly related to the dynamics of the interest rate, and a fourth one follows from the discretionary decisions of the governments.

Structural regressions have been widely used to disentangle the components of fiscal policy. Van den Noord (2002) groups the structural methods into three categories. A first approach runs regression of fiscal variables on different sets of explanatory variables. This approach gives reliable results only if the set of explanatory variables is sufficiently wide, and may suffer from misspecification if the correct lags are not included. A second approach uses macroeconomic models, whose equations are calibrated. Macro models have the advantage of allowing to identify different kinds of shocks, but suffer from the same problems just described, because the equations need first to be estimated in order to calibrate the elasticities in the model. The third approach is used by OECD, and consists of a mix of different methodologies. The elasticities of the cyclical components of taxes and expenditure are computed relative to a measure of the output gap independently estimated.

⁴The reason being that a government can always promise future surpluses to justify current deficits.

⁵Commissioner Pedro Solbes has been reported by press to have given an arbitrary but indicative value of 4% yearly reduction in the debt/GDP ratio.

A fairly recent approach tries to overcome the difficulties of correctly specifying a model by using structural VARs, which require only minimal identifying assumptions. The VARs are widely used in the empirical studies of monetary policy, but their use in the analysis of fiscal policy is fairly recent. A number of important contributions have shown that the approach can give useful results. Blanchard and Perotti (1998) use a SVAR with taxes, government spending and GDP, all in real terms, to investigate the dynamic effects of shocks in government spending and taxes in the US. A similar work, with different specification of the model, is in Fatas and Mihov (1999). Favero (2002) and others have shown that fiscal and monetary policy cannot be estimated separately, because the interaction effects would bias the estimates.

Following Blanchard and Quah, some authors use long run restrictions, which are relatively easy to conciliate with economic theory. This is the case of Dalsgaard and De Serres (2000), who estimate a SVAR for the 11 EMU countries⁶. Garcia and Verdelhan (2000) use a specification scheme a' la Clarida-Gali', including both short and long run restrictions, which is very similar to the one of this paper. They apply it to synthetic Euro Area data, including yearly GDP, inflation, real short term interest rate and budget balance, and manage to identify four types of shocks: supply, demand, monetary and fiscal. They also estimate cyclically adjusted budget balances and a synthetic indicator of policy mix. Bruneau and de Bandt (1999), Hoppner (2000) and Reutter and Westermann (2000) concentrate on France and Germany.

Our paper enters in this last stream of research, and tries to identify fiscal shocks on the basis of a minimal set of long and short-run restrictions. A structural VAR has some properties that make it particularly suitable for the present study. First, it allows to estimate a measure of the cycle that is completely consistent with the model itself, without requiring a measure of the economic cycle as input. It also avoids the necessity to use specific and possibly restrictive fiscal and monetary policy rules⁷. The presence of a sufficient number of lags takes also care of the problem of forward-looking behavior of policymakers, because VAR models can be interpreted as reduced forms of forward-looking models (see e.g. Favero 2002).

A specific advantage of SVARs is that at least some identifying restrictions can be specified in the form of behavioral rules. This is for instance the case of the Blanchard and Quah long run restrictions that separate temporary from permanent shocks on the basis of their very own definitions. Behavioral restrictions can normally be conciliated with a large variety of economic models, and are therefore easier to accept. Three of our restrictions are of this nature.

⁶Their restrictions are that only supply shocks have a permanent effect on output, and that nominal shocks have a permanent impact on prices only.

⁷The budgetary process is quite complex and time consuming in most countries, monetary policy reaction functions may be even forward looking. The VAR structure provides with a very general backward looking model which can be interpreted as the reduced form of a forward looking one, and also includes all the relevant lags, reducing the risks of misspecification.

0.4 The model

The model is a structural VAR (SVAR) in which the policy shocks are identified from reduced form shocks by means of a combination of short-run and long-run restrictions. In this section the SVAR leading to the identification of fiscal shocks is explained. The model is estimated both for individual euro area countries and for the euro zone as a whole. The vector of macroeconomic variables X includes real GDP growth y , inflation π , a monetary stance indicator (dr , variations of the short term interest rate r) and a fiscal policy indicator ds , defined as variation of the deficit of general government as a percentage of GDP. These variables have been chosen because they are those that ultimately determine the solvency of the government according to the formula:

$$\Delta b = s + \left(\frac{\pi+y}{1+\pi+y} \right) b$$

where b is the Debt/GDP ratio, s is the deficit, $r = i - \pi$ is the real interest rate, depending on the common nominal interest rate i and the country-specific inflation rate π , y is real GDP growth. The variables of the SVAR are thus the same as in the solvency constraint (the debt can be recovered from the others).

In its structural form, the model is driven by four shocks: an aggregate supply shock (ε_s), an aggregate demand shock (ε_d), a monetary shock (ε_m) and a fiscal shock (ε_f).

In order to identify the structural innovations ε , the unrestricted, reduced form VAR is estimated by OLS:

$$X = \sum_{L=1}^T C(L)X + e$$

where matrixes are defined as follows:

$$X = \begin{pmatrix} y \\ \pi \\ dr \\ ds \end{pmatrix}; e = \begin{pmatrix} e_y \\ e_\pi \\ e_r \\ e_s \end{pmatrix}; \varepsilon = \begin{pmatrix} \varepsilon_s \\ \varepsilon_d \\ \varepsilon_m \\ \varepsilon_f \end{pmatrix}$$

The VAR can be expressed in its moving average form using the lag operator L :

$$X = \sum_{L=0}^{\infty} A(L)e$$

with $E(ee') = \Sigma$ and $A(0) = I$. In order to convert in the structural form, we use the transition matrix A (without arguments):

$$X = \sum_L A(L)A^{-1}e = \sum_L B(L)\varepsilon$$

where

$$\varepsilon = A^{-1}e \quad (1)$$

$$B(L) = A(L)A^{-1} \quad \forall L \quad (2)$$

A is the unknown transition matrix from the unrestricted residuals e to the identified, structural policy shocks ε . Six identifying restrictions are necessary in order to identify these structural innovations from the reduced form VAR. Following a solidly established tradition, we identify supply shocks as the only ones that have a permanent effect on output. This implies three zeros in the long run, structural form matrix $B(1)$.

The short run restrictions concern the matrix $B(0)$. The chosen assumptions are that monetary shocks do not have a contemporaneous effect on GDP or inflation, and budgetary shocks do not have a contemporaneous effect on inflation⁸. Since $A(0)A = B(0)$ (from equation 1 when $L = 0$) and $A(0)$ is the identity matrix, the zero restrictions can be imposed on A directly. This model specification has the advantage of allowing contemporaneous reaction of the interest rate to fiscal shocks, which is possible if monetary policy is forward looking. It also avoids imposing a “block restriction” in the impact matrix, which would imply that fiscal policy does not have an immediate impact on growth ($a_{14} = 0$). Albeit very popular in the literature (e.g. Favero 2002), this restriction would not be very convincing, because fiscal policy is a component of the aggregate demand.

The long run, structural matrix $B(1)$ and the A matrix appear then as follows:

$$B(1) = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ b_{21} & b_{22} & b_{23} & b_{24} \\ b_{31} & b_{32} & b_{33} & b_{34} \\ b_{41} & b_{42} & b_{43} & b_{44} \end{bmatrix}, A = \begin{bmatrix} a_{11} & a_{12} & 0 & a_{14} \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix}$$

For these restrictions, some signs of the A matrix need to be normalized; see Christiano, Eichenbaum, and Evans (1999) for a discussion of this issue. I chose a normalization so that the structural disturbances correspond to what are normally considered positive shocks.

0.5 The estimation

The model is estimated using quarterly data for real GDP growth, inflation, changes in the interest rates and in the ratio between surplus and GDP. Real growth and inflation are in year-to-year rates in order to take care of some seasonality. The choice of the quarterly frequency is due to the presence of contemporaneous restrictions in the SVAR, which would make little sense if implemented on yearly data. The price to pay is that, given the inavailability of fiscal data at frequencies higher than annual, the deficit/GDP ratio has to be interpolated from yearly data for most countries. Following Favero (2002?), the model is generally estimated on a sample starting in 1981, in order to concentrate on monetary regimes that stabilize inflation around a target value. The

⁸No restriction is imposed on demand shocks. A reason for the different effect of fiscal and demand shocks is that fiscal policy is often linked to measures that have supply side effects, such as changes in privatizations or change in subsidies.

regressions cover the period 1981:I-2002:IV, the data series come from the ECB and AMECO databases. For most countries, a parsimonious parametrization of three lags could be accepted, and has been used in order to ensure completely comparable results.

The reduced form models are estimated country by country with Ordinary Least Squares. The long run matrix $A(1)$, sum of all the lags, is reported below for the EMU aggregate, and in appendix for the single countries.

$$\begin{pmatrix} dy \\ \pi \\ dr \\ ds \end{pmatrix} = \begin{bmatrix} 0.80 & -0.01 & 0.01 & -0.21 \\ 0.03 & 0.94 & 0.01 & 0.14 \\ 0.14 & 0.06 & 0.96 & -0.21 \\ -0.05 & -0.02 & -0.01 & 0.66 \end{bmatrix} \begin{pmatrix} e_y \\ e_\pi \\ e_r \\ e_s \end{pmatrix}$$

The Eurozone estimation seems to be characterized by strong persistence in all the variables, especially in inflation, which depends heavily on its on past, and for which the hypothesis of unit root can just be rejected. Increases in real growth, in the deficit/GDP ratio and, surprisingly, even in the interest rate have a positive effect on inflation. Real growth is also fairly persistent, confirming the existence of protracted cycles. Real growth is slower when inflation increases, and in presence of higher interest rates. Finally, the negative effect of fiscal policy on output is in accordance with other empirical studies which use VAR techniques and focus on the same time period, e.g. Perotti (2002). Furthermore, this coefficient seems relatively robust, as it is also negative (although often not significant) in all individual countries, with the exception of Portugal.

Changes in the real interest rate are highly persistent and suggest the presence of a unit root in the Eurozone and in some national cases. However, the hypothesis of a unit root is rejected by our tests. These coefficients cannot be interpreted as a response function of the monetary authority, since real and nominal interest rates are only partially correlated, still the positive reaction of real interest rates to increasing inflation seems to be a constant in all the countries.

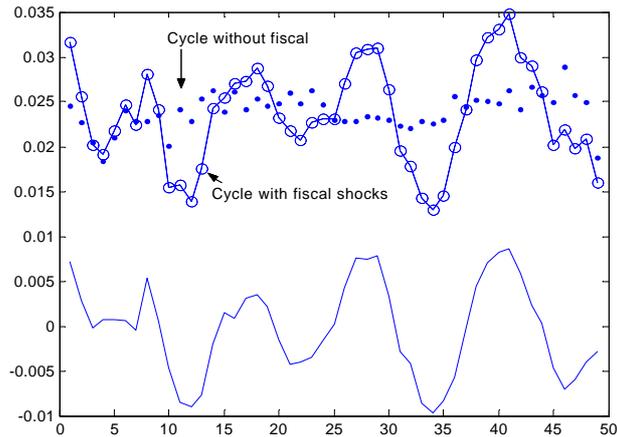
The last equation models the changes in the deficit/GDP ration as function of real growth, inflation and real interest rate. The deficit appears *prima facie* to react slightly countercyclically in the Eurozone and in most countries as well, with the exceptions of some countries characterised by a high level of public debt (Italy and Belgium), and in which the fiscal stance seems rather more procyclical. The stabilizing effect will be better assessed with the structural model, in which one of the shocks is explicitly identified as fiscal.

0.6 The historical effect of European fiscal policy

A first point to be assessed is whether, in the past, discretionary fiscal policy has been effective in smoothing the economic cycle, or whether a procyclical component has been predominating, thus increasing the amplitude of the cycle. Indeed, some authors (CITE) argued that in the past fiscal policies have proved to be more pro-cyclical than anti-cyclical in the euro area. This claim, however, is usually supported by contemporaneous or lagged correlations between the

fiscal stance and the cycle or similar measures. In this paper, fiscal policy is qualified on the basis of the information contained in the full model: procyclical if it increases the amplitude of the cycle, anticyclical if it reduces the cycle. The problem of choosing an arbitrary lag is solved in a way consistent with the model, because all the lags are present in the impulse responses.

In order to evaluate the effect of fiscal policy on the cycle, we first build a measure of the business cycle consistent with the estimated model by shutting down the supply shocks. Then, we compare it with the business cycle excluding the fiscal shocks. The reason for which we do not simply build a fiscal induced cycle and measure its variance is that there are relevant interactions between the effects of demand, fiscal and monetary shocks, and we want to capture them in the simulation. Figure <XXX> shows the resulting measure of cycle for the EMU aggregate in the 1990s, tables <XXX> and <XXX> report in column one the observed variability of the cycle and of inflation and in column two the result of the simulation.



< XXX.PIX.cycle.for.the.EMU.aggregate >

Mean square of real growth (y)							
Observed							
With >>>	FIS shocks	Bootstrapped fiscal shocks		No shocks		No stab	
			Diff		Diff		Diff
emu	0.0125	0.011	13.6%	0.0103	21.4%	0.0126	-0.8%
ita	0.0131	0.0129	1.6%	0.0128	2.3%	0.0129	1.6%
fra	0.0137	0.014	-2.1%	0.0108	26.9%	0.0143	-4.2%
aut	0.0128	0.0129	-0.8%	0.0126	1.6%	0.0128	0.0%
bel	0.0173	0.0166	4.2%	0.0162	6.8%	0.0168	3.0%
nld	0.011	0.0143	-23.1%	0.0122	-9.8%	0.01	10.0%
deu	0.0174	0.0186	-6.5%	0.0177	-1.7%	0.0172	1.2%
prt	0.0174	0.0201	-13.4%	0.0181	-3.9%	0.0174	0.0%
esp	0.0142	0.0144	-1.4%	0.0143	-0.7%	0.0141	0.7%
grc	0.021	0.026	-19.2%	0.0194	8.2%	0.021	0.0%
fin	0.0346	0.0343	0.9%	0.033	4.8%	0.0333	3.9%

Mean square inflation (p)							
With >>>	Observed FIS shocks	Bootstrapped fiscal shocks		No shocks		No stab	
			Diff		Diff		Diff
emu	0.0095	0.0098	-3.1%	0.0086	10.5%	0.0109	-12.8%
ita	0.0115	0.0119	-3.4%	0.0118	-2.5%	0.0114	0.9%
fra	0.0071	0.0066	7.6%	0.0063	12.7%	0.0081	-12.3%
aut	0.0066	0.0061	8.2%	0.0050	32.0%	0.0063	4.8%
bel	0.0072	0.0073	-1.4%	0.0067	7.5%	0.0070	2.9%
nld	0.0109	0.011	-0.9%	0.0108	0.9%	0.0104	4.8%
deu	0.0088	0.0081	8.6%	0.0072	22.2%	0.0086	2.3%
prt	0.0236	0.0306	-22.9%	0.0267	-11.6%	0.0198	19.2%
esp	0.0076	0.0075	1.3%	0.0069	10.1%	0.0091	-16.5%
grc	0.0358	0.0335	6.9%	0.0320	11.9%	0.0374	-4.3%
fin	0.0098	0.0094	4.3%	0.0086	14.0%	0.0110	-10.9%

< XXX.TAB.variance.of.cycle >

< XXX.TAB.variance.of.prices >

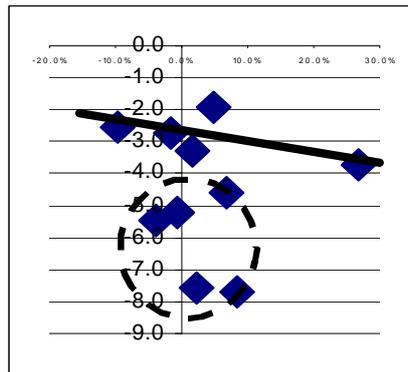
The comparison between the two columns shows what happens when the discretionary part of fiscal policy is shut down, letting the automatic stabilizers and every systematic component operate freely: in other words, column two does not refer to a world without fiscal policy, but simply to one in which rules predominate over discretion.

The absence of the fiscal impulses does not always reduce the variability of the cycle⁹. In some cases, the discretionary fiscal shocks even turn out to be strongly pro-cyclical¹⁰. The relative “change” column measures the effect

⁹The averages of growth and inflation are intentionally omitted from the tables. The reason is that the effect of fiscal impulses on average growth is quite reduced, as public spending cannot sustain growth forever and has to be repaid at some point in time. In our model the effect is zero in the long run, because of the long-run identifying restrictions, therefore the differences would never be significant.

¹⁰Alesina and Perotti (1997) argue that supply-side factors that can be important in allowing

of fiscal activism on the amplitude of the cycle: for positive numbers, discretionary fiscal measures have increased the variability of the cycle. The ranking of changes is the following: France, the Eurozone taken as a whole, Greece, Belgium, Finland, Italy, Austria, Spain, Germany, Portugal and the Netherlands. This changes are represented against the average deficit of the countries in the 1990es in graph <XXX>.



< XXX.picture.change.from.no.shock.and.ave.def.90s >

If the average level of deficit is taken as a proxy for the propensity to the active use of fiscal policy two groups of countries emerge: in high deficit countries (>5%) discretionary fiscal policy achieved modest results in terms of cycle smoothing, low deficit countries seem to provide some evidence of a positive relation between deficit and cycle smoothing. The data points are however too few to draw any important conclusion from this graph. Overall, the lack of any robust relation and the cases of increased depth of the cycle may suggest that fiscal activism in Europe has been, in reality, simply deficit spending, without an important role in terms of stabilization.

This simulation is somewhat biased, because it shuts down the component of fiscal policy which is likely to be misused by politicians without introducing any alternative behavior. The second experiment takes this objection into account. Instead of simply shutting down the fiscal shocks, we bootstrap them, thus creating a “synthetic government” that acts randomly (without any objective of output stabilization). It appears that some countries have successfully managed to conduct an anti-cyclical fiscal policy, but this result cannot be generalized. Among the countries with high deficits in the 1990s, only Germany and Portugal appear to have used fiscal policy countercyclically with success, along with Greece and the Netherlands. The effect is not relevant in the other countries.

fiscal consolidation without recessive effects. Empirical evidence seems to confirm the presence of supply side-effects: eight countries reduced their structural budget deficit by at least 0.5 percentage points of GDP each year since 1998, and only one of them (Italy) showed growth rates below the EU average.

Our last “experiment of thought” aims at giving a measure of the maximum cost of forgiving fiscal policy by eliminating that part of the budget that explicitly reacts to the economic cycle, the automatic stabilizers. The economic cycle is reconstructed under the condition that the budget deficit does not react to variations in the output, and keeping the rest of the parameters of the model unaltered. This experiment is different in nature from the previous ones: the previous simulation exercises did not change the parameters describing systematic policy and were robust to the Lucas critique, this one changes some parameters of the VAR itself. However, if the automatic stabilizers did not exist, the parameters describing the equations of the economy could also be different. Such new parameters cannot obviously be estimated, as they belong to a virtual scenario, therefore we keep those estimated from the data, and we simulate under a *ceteris paribus* assumption. For this reason, the results are to be taken with extreme caution. Considering that an eventual bias may affect all the estimations in the same direction, the ranking of the countries may be more informative than the absolute value of the results. Column <XXX> presents the results in absolute values and in percentage changes from the observed ones.

The results are quite striking, as it appears that the automatic stabilizers do not have an important role in smoothing the cycle in most countries, as only the Netherlands and to a minor extent Finland have managed to significantly reduce the magnitude of economic fluctuations. At the other extreme there is France, where the automatic stabilizers have significantly contributed to widen the cycle. In most countries, however, the effect is irrelevant.

The overall evidence suggests that fiscal policy has had in the 1990s a limited (if any) smoothing effect on the cycle.

0.7 Reforming the Stability Pact

0.7.1 The simulation

The previous analysis was conducted in a medium run perspective, that is over more than one economic cycle. It may be very well possible that some proposals of reform of the Pact may have in the short run a strong expansive or recessive effect, and in the current stagnating economic environment this is what the proponents of reforms of the Pact are aiming for.

This section attempts an evaluation of the different scenarios in relative terms in the short run. This is done via simulations covering a period of 4 years after the end of the sample. The choice of a relatively short period also maximises the short-run forecasting properties of VAR models, while containing within acceptable limits the problems of out-of-sample estimation of all econometric models. A further advantage is that simulations including the stability programmes presented by the member states in 2002 and covering the next 4 years can be run.

A problem arising in this simulation exercise is that the beginning of the EMU towards the end of sample may lead to a structural break in the conduct of economic policies. More precisely, the monetary authority, now targeting union-

wide aggregates, will appear as little or no reactive to the national policymakers. We take care of the problem by imposing in the simulation a constant real interest rate equal to the last one observed in the country. The second problem is that the governments may have greater incentives to use the fiscal lever if they perceive that there will be no “monetary punishment”. This issue, simply, remains open, because the small number of data point imposes to assume the pre-EMU estimated VARs as the best possible approximation of the current economic structure.

Four perspective scenarios are depicted. In the first, no limit to public deficits is imposed on the estimated model, which can forecast freely. The second scenario imposes the 3% limit to deficits.

The third and fourth scenarios show what happens when the SGP is taken more seriously. The third scenario is a "soft approach to close to balance or in surplus" and corresponds to the recent proposal of the Commission according to which the countries in a position not close to balance or in surplus should improve their structural budgets by 0.5% of GDP each year until the condition is met. The fourth and possibly most demanding scenario imposes on the model the most recent stability stability programmes.

The final scenario shows what may happen if the preventive arm of the pact completely fails, and a country repeatedly runs deficits of exactly 3% from the end of sample onwards. Is the 3% threshold sufficient to ensure sustainable public finances? What is the effect on growth?

0.7.2 How to evaluate the different policy rules

It is always difficult to evaluate the quality of a government policy. In the case of the SGP, we are helped by the objectives of the Pact: “Whereas the Stability and Growth Pact is based on the objective of sound government finances as a means of strengthening the conditions for price stability and for strong sustainable growth conducive to employment creation¹¹”. We can test whether such objectives have been reached or not, and simulate and evaluate the economic outcomes of the different scenarios.

Both criteria are taken into account. Price stability and high growth are assumed to describe a good economic environment. We do not provide for an explicit weighting of these goals, and limit ourselves to show the rankings for each of them. The other criterion is sustainability of public finances. Any rule that puts at risk the solvency of a participating government should be discarded as potentially harmful to the independence of the central bank and to the financial stability of the union. In our simplified world, we will simulate 4 years ahead and discard all the rules which provoke an increase in the debt/GDP ratio. In other words, rule 6 in section <XXX> is the weakest possible constraint allowed.

¹¹Council Regulation (EC) No 1466/97 of 7 July 1997 on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies

0.7.3 Results: growth and inflation

Table <XXX> shows the results of our simulations. For each scenario, the average growth and inflation are reported.

	No constraints		max 3		0.5 consol		sp 2002		always 3	
	Yg	Pg	Yg	Pg	Yg	Pg	Yg	Pg	Yg	Pg
emu	2.38%	0.94%	3.06%	0.21%	3.37%	-0.16%	3.74%	-0.56%	3.02%	0.25%
ita	1.77%	3.20%	1.77%	3.20%	2.07%	3.34%	1.98%	3.30%	1.64%	3.11%
fra	2.44%	2.24%	2.66%	2.09%	3.53%	1.75%	2.95%	1.97%	2.69%	2.07%
aut	2.17%	1.81%	2.17%	1.81%	2.23%	1.97%	2.12%	1.71%	2.07%	1.63%
bel	2.43%	1.39%	2.43%	1.39%	2.58%	1.18%	2.34%	1.52%	2.09%	1.94%
nld	1.98%	2.89%	1.98%	2.89%	2.44%	3.23%	2.13%	3.00%	1.86%	2.81%
deu	2.68%	1.05%	2.56%	1.10%	3.36%	0.72%	3.02%	0.89%	2.59%	1.09%
prt	0.84%	4.87%	0.77%	4.95%	-0.10%	6.17%	0.26%	5.62%	0.81%	4.87%
esp	2.45%	4.20%	2.45%	4.20%	2.68%	3.55%	2.39%	4.38%	2.14%	5.14%
grc	3.71%	1.74%	3.71%	1.74%	3.84%	0.50%	3.68%	1.96%	3.51%	3.29%
fin	2.95%	2.34%	2.95%	2.34%	3.15%	2.24%	2.70%	2.49%	2.38%	2.74%

< XXX.TAB.mean.var.cycle >

The first scenario appears immediately to be a sub-optimal one. The average growth of the economy is never greater than in the alternative scenarios, and despite this only in Finland the variance of output growth is minimal. The average inflation rate is always high. Similar results are reported for the second scenario.

The progressive approach to close to balance via structural surplus seems to provide the best results both in terms of high real growth and low inflation. The average growth is higher than in alternative scenarios in nine cases out of eleven (the exceptions being the Eurozone as a whole and Portugal), and the average inflation is minimal in seven cases (Eurozone, France, Belgium, Germany, Spain, Greece and Finland). The performance is less positive in terms of standard deviations, but it should be kept in mind that the short run forecasting horizon does not cover a full business cycle, therefore the higher variance is partially a consequence of the higher projected growth rates following economic stagnation.

The implementation of the Stability Programmes 2002 (sp 2002) is somehow similar to the consolidation scenario, because the goal of both is to reach progressively the position of close to balance or in surplus, with the difference that the latter imposes a progressive structural consolidation but explicitly leaves the automatic stabilizers into play. The SP 2002 produce the highest average growth for the eurozone as a whole and for Portugal, and the results are quite similar to those obtained with the previous scenario.

Overall, scenarios three and four produce high growth and low inflation in almost all cases, adding substance to the thesis that the SGP taken seriously can produce desirable macroeconomic outcomes even in the short run. This results are in accordance with a number of empirical studies which found no indication that countries which reduce budget deficits substantially experience lower growth rates than average.

In the last scenario each country repeatedly runs deficits of exactly 3%, reaching lower real growth but surprisingly also quite low inflation.

0.7.4 Results: public finances

In the long term, the sustainability of public finance is the most important criterion to assess whether the monetary union is sustainable or not. Here the long run independence of the central bank is at stake, as monetary and fiscal policy are linked via the intertemporal budget constraint: if the fiscal authorities run an unsustainable path of deficits and raising debt, they can ultimately force the central bank to inflate in order to avoid insolvency (the "unpleasant monetaristic arithmetic"). Table <XXX> compares the Debt/GDP ratio 2002 with the simulated ratios in 2005 under the different scenario assumptions. Grey cells show increasing debt/GDP projected.

Debt level: scenarios						
	2002 Level	2005: scenarios				
		free	max 3	0.5 cons	sp 2002	always 3
emu	69.6%	78.5%	68.9%	64.7%	59.9%	69.4%
ita	110.0%	113.0%	113.0%	104.0%	107.0%	117.0%
fra	58.6%	68.1%	63.8%	50.8%	59.3%	63.2%
aut	63.2%	54.9%	54.9%	45.7%	61.0%	68.3%
bel	106.0%	86.1%	86.1%	78.1%	91.8%	105.0%
nld	51.0%	56.4%	56.4%	44.3%	52.6%	61.3%
deu	60.9%	62.0%	64.0%	49.3%	55.6%	63.7%
prt	57.5%	71.2%	70.7%	63.1%	66.5%	71.2%
esp	55.0%	49.7%	49.7%	39.0%	52.7%	66.0%
grc	106.0%	96.2%	96.2%	84.5%	98.3%	110.0%
fin	42.4%	9.3%	9.3%	0.4%	24.0%	49.2%

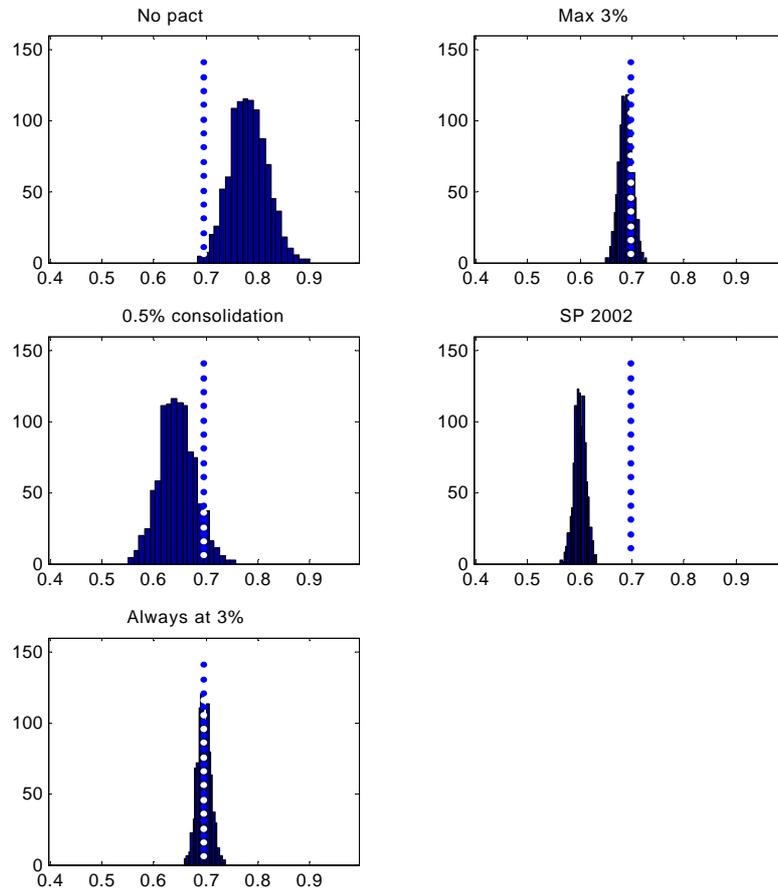
< XXX.TAB.debt/GDP.ratio >

The table seems to suggest that unsustainable public finances are more than a theoretical case. Comparison between the two first scenarios shows that if the pact were abolished and public finances were left free, a number of countries would still remain below the 3% reference value, namely Italy, Austria, Belgium, Germany, Spain, Greece and Finland. This "spontaneous" virtuous behaviour would not be sufficient for Italy and Germany to reduce the debt ratio. The 0.5% structural consolidation and the Stability Programmes 2002 are similar and both guarantee decreasing debt ratios. The Stability Programmes 2002 are slightly insufficient for France and the Netherlands, but the ratio overall shows a very limited increase.

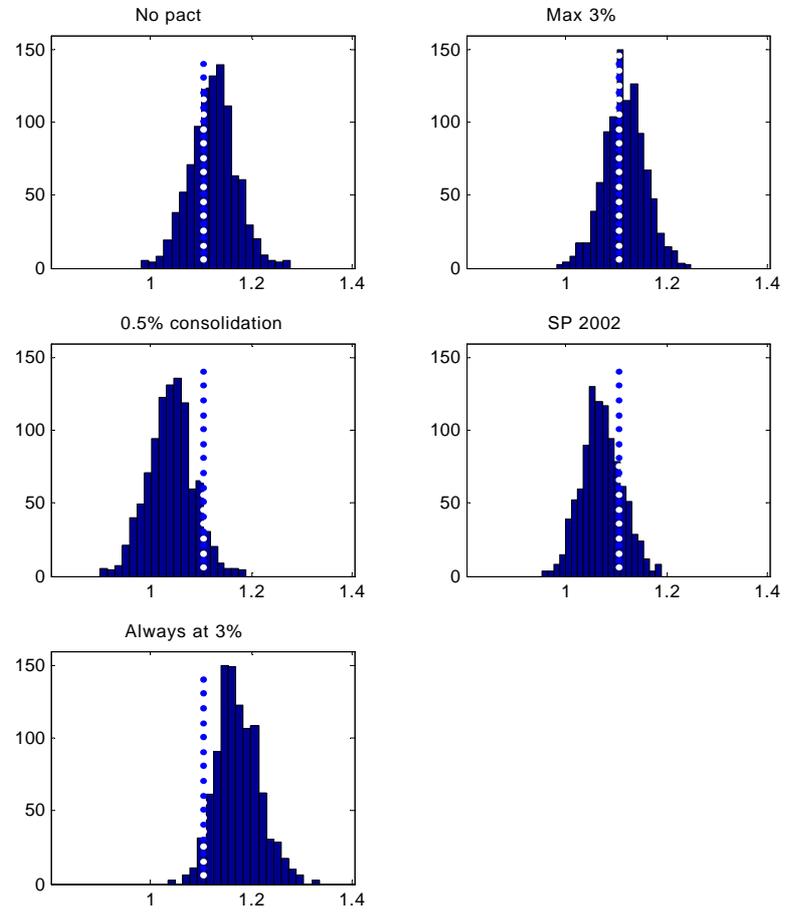
Finally, the 3% reference value alone cannot ensure the sustainability of public finances in the Eurozone. The comparison between the last column and the current Debt/GDP ratio in the first column shows an increase in the debt ratio for all countries, Belgium being the only exception.

An obvious limit of the previous table is that it is calculated in absence of economic shocks. We generalize these results by stochastic simulation. The shocks are bootstrapped from the ones observed within sample, while the fiscal stances are the ones described in the scenarios. Each distribution of probability is obtained by simulating 1000 times. The four graphics below show the distribution of the Debt/GDP ratios in each scenario for the four biggest economies of

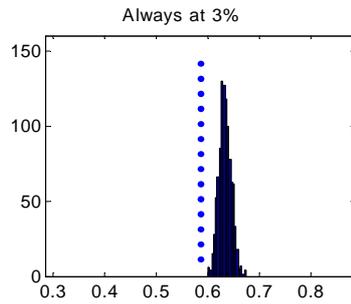
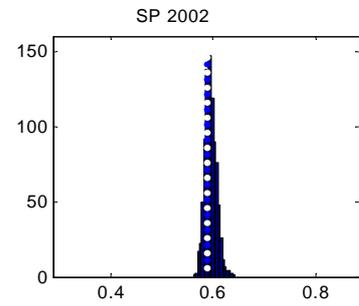
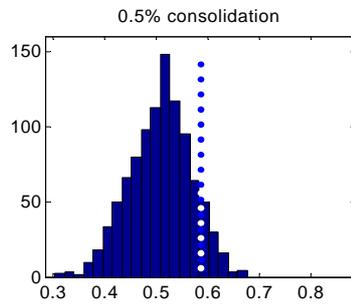
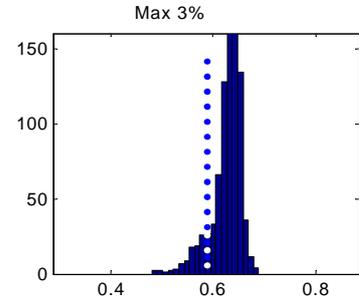
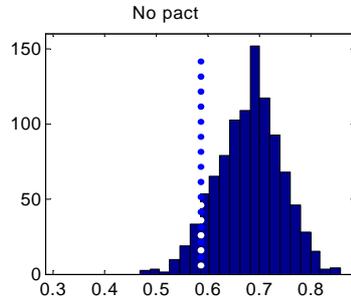
the Eurozone and for the Eurozone as a whole, the following table synthetizes the results for all the countries.



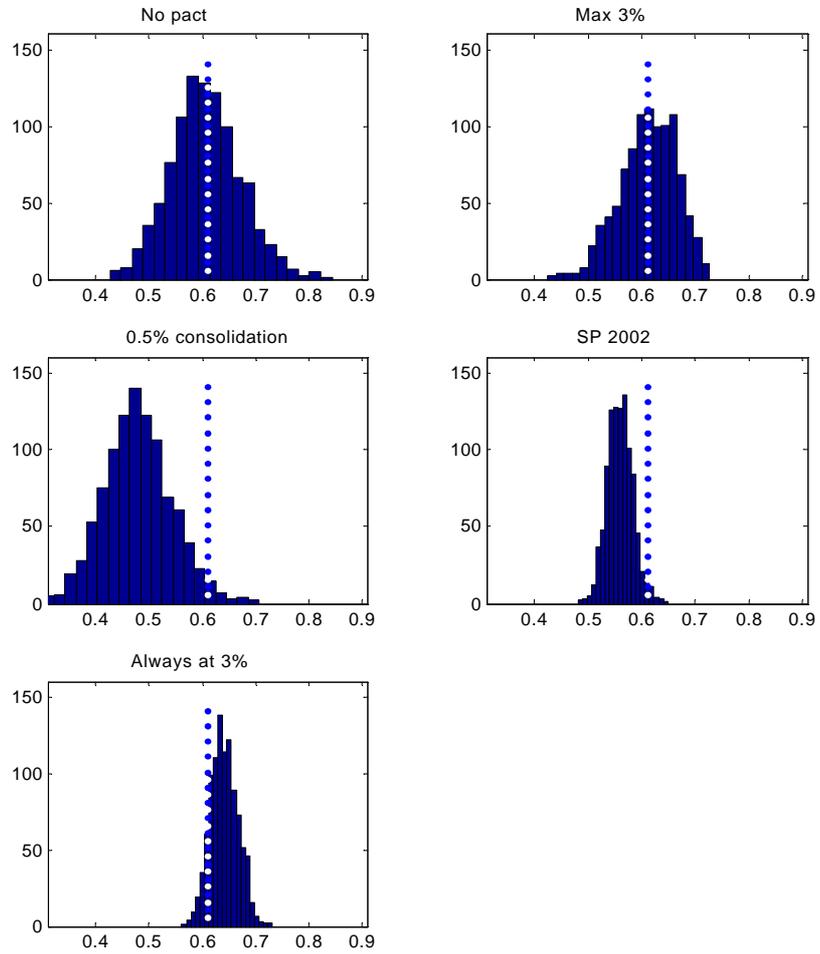
EMU



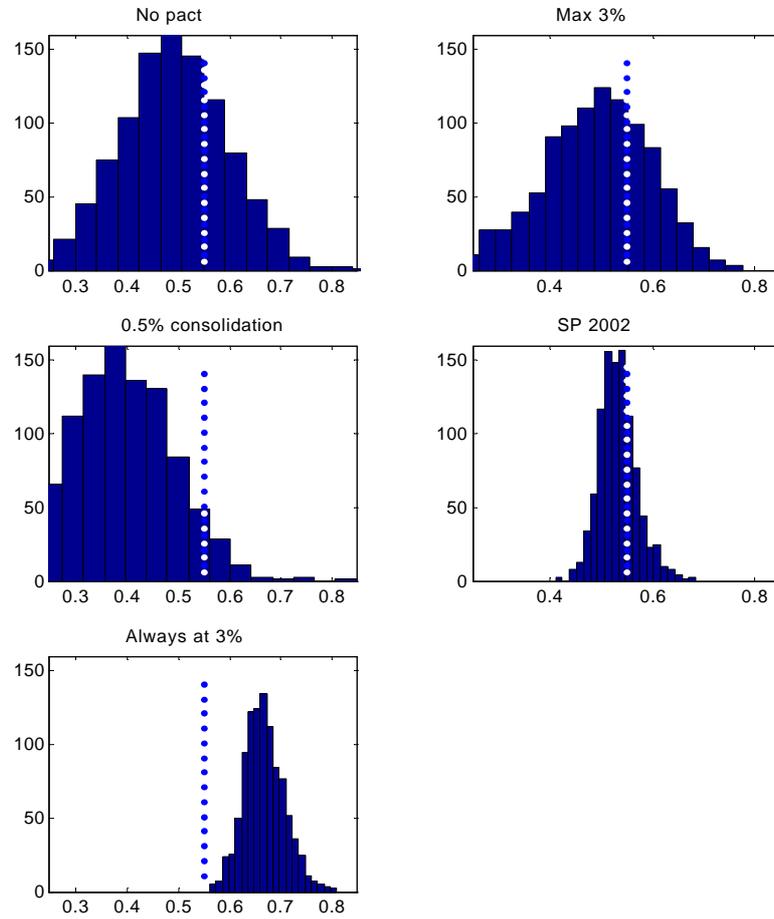
Italy



France



Germany



Spain

Table <XXX> summarizes the results for all the countries.

Exploding debt

	Sc 1	Sc 2	Sc 3	Sc 4	Sc 5
	2005	2005	2005	2005	2005
emu	99.6%	29.2%	7.0%	0.0%	52.5%
ita	69.2%	64.2%	9.8%	19.4%	95.9%
fra	93.0%	90.9%	8.8%	78.8%	100.0%
aut	3.3%	3.7%	0.0%	11.9%	99.8%
bel	0.1%	0.0%	0.0%	0.0%	44.2%
nld	69.9%	68.9%	30.1%	73.8%	100.0%
deu	46.2%	54.2%	2.8%	2.9%	89.2%
prt	90.1%	86.6%	67.8%	97.2%	99.8%
esp	28.6%	29.6%	6.1%	33.8%	100.0%
grc	21.8%	14.0%	4.5%	6.0%	83.3%
fin	0.4%	0.1%	0.0%	0.0%	100.0%
At least 1	100.0%	100.0%	85.0%	99.9%	100.0%

< XXX.tab.exploding.debt >

The numbers in the table are the probability that the debt/GDP ratio of a country increases in the forecasting horizon. Probabilities greater than 5 per cent are in bold.

Consistently with the results of table <XXX>, the stochastic simulation shows that the risk of increasing debts is high. Should the Stability and Growth Pact prove to be ineffective (scenario 1), at least five countries (Finland, France, Germany, the Netherlands and Portugal) and the eurozone as a whole would run unsustainable budgets with a probability greater than 50 per cent. The application of the 3 per cent criterion alone and the progressive consolidation proposed by the Commission (scenarios 4 and 2, respectively) seem to be an improvement, because they radically reduce the probability that the eurozone as a whole runs unsustainable policies, but neither one can guarantee that the intertemporal budget constraint is also respected by single countries (4 countries at risk in scenario 2, 3 in scenario 4). Scenario 3 (The 2002 Stability Programmes) appears to be by far the best, in that it insures that the the Debt/GDP ratio decreases for the eurozone as a whole as well as for all participating countries except Portugal.

Ultimately, the viability of the monetary union will depend on the solvency of each of the participating member countries. We conduct a simple back-of-the-envelope calculation under the assumption that the probabilities in table <XXX> are independent from each other. The results are those reported in the last line, which gives for each scenario the probability that all countries in the EMU run sustainable public finances. Once again, the Commission proposal to consolidate the structural budget balance by 0.5% of GDP each year seems

to be the best solution to ensure sustainability, both at the aggregate level and for each member.

0.8 Conclusions

The present paper tried to assess the effect of the Stability and Growth Pact on the European economy, and to look at the foreseeable effect of the proposals for reforming it.

A set of structural VARs for several eurozone countries and for the eurozone as a whole was used to assess the cost of forgiving discretionary fiscal policy and automatic stabilizers. The same models were used for forecasting the years to come, under different policy assumptions. The use of structural VARs allowed us to estimate jointly the effect of fiscal and monetary policy.

The investigation highlighted a number of facts.

The effect of fiscal policies has been in the past at best limited and sometimes counterproductive in terms of variability of growth. Automatic stabilizers have had a limited role in most countries, and the discretionary component of fiscal policies has probably increased the variability of the cycle as well as the depth of public debts. Furthermore, the restricted impulse response functions suggest that the fiscal policy has generally had a limited and ambiguous effect on output.

The simulation of the forthcoming years confirms the limited scope for activist fiscal policy in the EU. The progressive approach to a position of close to balance or in surplus proposed by the EU Commission seems to be a desirable policy option, since it combines sustainable public finances, desirable macro-economic outcomes and, by providing all the countries with a given speed of convergence, allows more time whenever the necessary correction is bigger in size. However, the Stability Programmes 2002 obtain similar results.

Finally, the comparison among the different scenarios highlights the necessity of keeping both the preventive (peer pressure) and the restrictive arm of the pact, because the 3% threshold alone does not guarantee government solvency in all cases.

Overall, our assessment ends up being a defence of the status quo as expressed by the rules in the Stability and Growth Pact and the commitments taken in the Stability Programmes, possibly complemented by the Commission's proposal of structural consolidation. The out-of-sample estimations point out that the serious application of these rules and commitments ensures sustainable public finances in the medium term. Sustainability does not come at the expenses of growth or the capacity of stabilizing the economic cycle.

0.9 Appendix

< XXX.Insert.table.ADF.here >

Stationarity test for the variables: Aumented Dickey Fuller and Phillips-Perron tests on stationarity of the variables (real growth, inflation, interest rate and deficit/GDP ratio). The tests contains a constant, whenever significant.

Unit root tests

	Variable	t-Stat	Prob		t-Stat	Prob	
FIN	y	-3.50	0.010 **		-1.90	0.055 *	
	p	-3.64	0.007 ***		-3.74	0.005 ***	
	r	-3.44	0.012 **		-3.44	0.012 **	
	s	-2.90	0.004 ***	o	-3.13	0.002 ***	o
EMU	y	-2.96	0.042 **		-2.95	0.044 **	
	p	-2.87	0.053 *		-3.12	0.029 **	
	r	-1.86	0.060 *	o	-1.90	0.055 *	o
	s	-3.47	0.001 ***	o	-3.54	0.001 ***	o
ITA	y	-2.61	0.095 *		-3.37	0.015 **	
	p	-3.73	0.005 ***		-4.05	0.000 ***	o
	r	-0.84	0.350	o	-0.90	0.324	o
	s	-2.08	0.036 **	o	-3.85	0.000 ***	o
FRA	y	-2.10	0.245		-3.16	0.026 **	
	p	-5.35	0.000 ***		-3.17	0.002 ***	o
	r	-3.21	0.023 **		-3.20	0.023 **	
	s	-3.29	0.001 ***	o	-3.37	0.001 ***	o
AUT	y	-2.61	0.095 *		-3.99	0.002 ***	
	p	-2.87	0.053 *		-2.78	0.065 *	
	r	-2.14	0.229		-2.14	0.229	
	s	-3.24	0.002 ***	o	-3.60	0.001 ***	o
BEL	y	-2.91	0.049 **		-3.94	0.003 ***	
	p	-1.74	0.077 *	o	-1.75	0.076 *	o
	r	-2.10	0.035 **	o	-2.11	0.034 **	o
	s	-2.66	0.085 *		-4.63	0.000 ***	o
DEU	y	-3.18	0.025 **		-3.32	0.017 **	
	p	-4.01	0.002 ***		-2.12	0.034 **	o
	r	-0.77	0.379	o	-2.75	0.071 *	
	s	-1.99	0.046 **	o	-4.13	0.000 ***	o
NLD	y	-3.06	0.036 **		-1.00	0.283	o
	p	-3.35	0.017 **		-2.08	0.253	
	r	-0.97	0.291	o	-0.97	0.295	o
	s	-1.29	0.180	o	-3.60	0.001 ***	o
PRT	y	-3.32	0.017 **		-3.32	0.017 **	
	p	-1.66	0.091 *	o	-1.16	0.221	o
	r	-2.44	0.015 **	o	-2.33	0.020 **	o
	s	-2.29	0.022 **	o	-4.24	0.000 ***	o
ESP	y	-2.41	0.141		-3.10	0.030 **	
	p	-3.02	0.003 ***	o	-2.54	0.012 **	o
	r	-1.36	0.159	o	-3.25	0.021 **	o
	s	-2.65	0.009 ***	o	-3.96	0.000 ***	o

Figure 1:

One, two or three stars indicate that the null hypothesis of a unit root is rejected at a 10%, 5% or 1% level.

0.10 Appendix

0.10.1 The identification of the model

The three long run restrictions on $B(1)$ imply that

$$\begin{aligned} A(1)AA^{-1}e &= B(1)\varepsilon = B(1)A^{-1}e \\ A(1) &= B(1)A^{-1} \\ A(1)A &= B(1) \end{aligned}$$

where $A(1)$ is totally known and the zeros of the $B(1)$ are the long run restrictions.

The short run restrictions (instantaneous, on $B(0)$) imply that

$$A(0)AA^{-1}e = B(0)A^{-1}e$$

Since $A(0)$ is identity matrix, then $A = B(0)$ and all restrictions on $B(0)$ apply to the transition matrix A .

Finally, the normalization of restricted residuals ε implies that

$$E(\varepsilon\varepsilon') = I$$

since $\varepsilon = A^{-1}e$ or $A\varepsilon = e$, then

$$E(ee') = E(A\varepsilon\varepsilon'A') = AA' = \Sigma.$$

0.11 Appendix

The long run responses of the unrestricted VAR, for each country

Long run coefficients (reduced form)									
EMU	0.80	-0.01	0.01	-0.21	BEL	0.60	-0.10	0.01	-0.09
	0.03	0.94	0.01	0.14		0.00	0.94	0.03	0.04
	0.14	0.06	0.96	-0.21		0.24	0.07	0.93	0.07
	-0.05	-0.02	-0.01	0.66		0.11	-0.11	-0.06	0.37
ITA	0.77	0.01	0.01	0.04	DEU	0.85	-0.09	-0.08	-0.12
	-0.02	0.95	0.02	0.00		0.02	0.91	0.07	0.08
	0.29	0.06	0.91	-0.08		0.13	0.06	0.83	-0.12
	0.14	-0.02	-0.06	0.51		-0.02	-0.03	0.07	0.59
FIN	0.84	-0.04	-0.10	-0.05	NLD	0.58	-0.27	-0.07	-0.28
	0.05	0.92	0.03	0.04		0.01	0.95	0.00	0.02
	-0.03	0.08	0.92	0.00		0.15	-0.01	0.95	-0.08
	-0.29	0.09	0.03	0.40		-0.18	-0.05	-0.04	0.56
FRA	0.77	0.00	-0.04	-0.13	PRT	0.84	0.00	0.02	0.30
	0.05	0.93	0.01	0.09		0.02	0.96	0.00	-0.31
	0.12	0.04	1.01	-0.29		0.02	0.03	0.85	0.09
	-0.05	0.00	0.01	0.77		-0.04	-0.01	0.04	0.55
AUT	0.69	-0.08	0.03	-0.03	ESP	0.83	-0.01	0.00	-0.10
	-0.01	0.91	0.06	0.01		0.09	0.93	-0.01	0.30
	0.12	0.07	0.89	-0.06		0.14	0.15	0.84	-0.27
	-0.06	0.10	0.11	0.53		-0.06	0.00	0.03	0.63

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