Budget Position and Fiscal Policy Uncertainty: (Re)-Ranking Sovereign Debt Sustainability Using a Model-Based and Consistently Measured Indicator

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Abstract

Fiscal deficits and public debt have risen sharply in the wake of the global financial crisis bringing up the issue of fiscal consolidation. There is, however, considerable uncertainty about the policy mix and timing of such budgetary adjustment and this can have a harmful impact on economic activity. A first step towards reducing the above uncertainty is to have a reliable indicator measuring the fiscal adjustment needed to warrant the long-run sustainability of the government budget. In this paper, we focus on this issue and show, in the context of an endogenous growth model, that forward-looking agents' optimizing behavior typically gives rise to a wealth-based and not to an output-based sustainability index of government policy.

Calibrating the new index from 2001 to 2017 for the 28 European countries along with the U.S. and Japan as reference countries give results that are very different from common wisdom and show that tests of debt sustainability based on the debt-to-GDP ratio are strongly biased and misleading, and may lead to wrong and perverse policy strategies. This may contribute to explain the recent pickup in policy-induced uncertainty and the observed adverse effects on economic activity and growth perspective.

1 Introduction

Uncertainty about future economic and financial policies can have adverse effects on economic active and growth prospects (e. g., Bloom, 2009; IMF, 2012;

Baker et. al., 2016; Kostka and van Roye, 2017). For example, policy-induced uncertainty

Economic policy uncertainty regards several dimensions of economic policies. In particular, who will make economic policy decisions, which kind of economic policy actions will be implemented and the economic effects of these actions. For example, uncertainty related to the economic policies is able to predict slowdown in investment, output, and employment in the United States (Baker et. al., 2016) and negatively affects financial conditions in absence of offsetting policies (Kostka and van Roye, 2017).

In this paper we concentrate our attention on the uncertainty about fiscal policy decisions related to budget sustainability assessment. In particular we develop a model-consistent indicator of fiscal sustainability which aims to overcome the shortcomings of the most widely used sustainability indicator based on the debt-to-GDP ratio (DGR). Having a rigorous and reliable indicator of government budget position is critical to run stabilization policies properly. Otherwise there is a risk of providing misleading policy recommendations, which would not only lead to miss policy targets but also introduce more uncertainty with negative economic and social consequences. For example if the indicator fail to detect an unsustainable policy the government may default on on debt rising financial instabity. Conversselly if the indicator provide the wrong information that a policy is unsustainable when it is not, it may force the government to change the policy and rise taxex or cut public spending.

The sustainability of fiscal policy is arguably one of the most debated issues in current macroeconomics. Following the high debt levels experienced by several developed economies since the early 1980s (see Azzimonti et al., 2014), and especially in the aftermath of the 2007 global crisis, an intense concern over the possible consequences for macroeconomic stability and economic growth is periodically visible both in the academic literature and in the public policy debate.

Fiscal discipline and the sustainability of public finances are commonly evaluated by assessing the time path of the debt-GDP ratio, which displays a stock variable measured relative to a flow variable. In the present paper we argue that this measure is seriously flawed and may lead to wrong and possibly harmful policy measures.

There are at least two major reasons why the debt-GDP ratio is a spurious indicator: (*i*) it is not logically consistent to compare a stock relative to a flow variable, although obvious relationships exist between the two; (*ii*) the implied debt sustainability index is not theoretically consistent with the transversality conditions obtained from dynamic optimizing macroeconomic frameworks, which instead pertain to the asymptotic behavior of pure stock variables.

To illustrate these points clearly, we show, in the context of an endogenous growth model, that forward-looking agents' optimizing behavior typically gives rise to a wealth-based sustainability index of government policy. We are then able to calculate the resulting wealth-based indicator from 1999 onwards for countries which exhibit a positive after-growth real interest rate, in line with asymptotic properties prevailing in growth theory.

Once private wealth is taken into account for an empirical evaluation of the long-run fiscal balance, results appear to be fundamentally different from common wisdom. In particular, we show that the fiscal position is sustainable for both Germany and Italy, and strongly unsustainable for both Japan and France. These findings are obscured if one concentrates on the dynamics of the debt-GDP ratio.

The present paper is connected to a large body of empirical and theoretical literature. Sustainability indicators and tests of debt solvency relying upon the time path of the debt-GDP ratio have been suggested by many authors: see, e.g., Miller (1983), Buiter (1983, 1985, 1987), Blanchard (1990), Horne (1991), Ize (1991), Buiter et al. (1993), Croce and Juan-Ramon (2003) for empirical strategies based on indicators, and Hamilton and Flavin (1986), Trehan and Walsh (1988), Bohn (1998, 2008) for strategies based on tests.[1] Recently, analytical frameworks concerned with the sovereign debt sustainability issue are in a voluminous literature dealing with the so-called "fiscal space", defined as the "room" in a government's budget that allows it to increase the deficit without jeopardizing the sustainability of its financial position (see, e.g., Heller, 2005; Ostry et al., 2010, 2015; Baldacci et al., 2011; Bi and Leeper, 2013; Ghosh et al., 2013; Fournier and Fall, 2015). However, no existing indicators are free of major inconsistencies stressed here. Exceptions are Bruce and Turnovsky (1999) and Aizeinman and Jinjarak (2010) who came close to our approach. The first provides a dynamic indicator based only on capital stock and not on total wealth; the second measures the outstanding public debt relative to the de facto tax base or the tax-years needed to repay the public debt.

In a different context (the environment), an analogous approach to our own has also been suggested by Arrow et al. (2004), who refer to the net worth of an entity (the government or the country) as a base for assessing sustainability.

The policy implications of our findings are straightforward and relevant. Specifically, fiscal rules such as those enshrined in the Fiscal Compact in the European Union, prescribing a reduction of the difference between the debt-GDP ratio and the 60 percent Maastricht reference value at an average rate of one-twentieth per year, are misleading, for they abstract from the evolution of households' total wealth, which

ch is relevant for fiscal solvency. The sustainability results here obtained for both Germany and Italy are instructive.

Overall, the analysis developed in this paper proposes an alternative perspective, largely overlooked by the fiscal policy literature and policy makers, in order to assess the degree of fiscal discipline on the grounds of dynamic macroeconomic theory. It shows that incorporating agents' wealth in the formulation of budgetary policy indicators turns out to be essential to guarantee logical consistency in monitoring fiscal sustainability and implement proper policy measures.

Applying a proper measure a fiscal sustainability including private wealth and capital as key factors, the common wisdom is changed and countries char-

[1] Literature reviews can be found in Balassone and Franco (2000), Larch and Nogueira Martins (2007), and Marini and Piergallini (2008).

acterized by a low debt sustainability like Italy are found to be weakly unsustainable so they need just low fiscal correction. On the other side countries characterized by low debt has to implement restrictive fiscal adjustment in the form of lump sum taxation.

The paper proceeds as follows. Section 2 reports the model. Section 3 calibrates the model for the European Countries and two external reference countries (United States and Japan). Section 4 concludes.

2 The Model

In this section we sketch out the basic structure of the dynamic macroeconomic model used in Canofari-Piergallini-Piersanti (2018) - hereafter CPP (2018) - used to obtain the new sustainability indicator. which allow fiscal policy to play a key role on the long-run economic growth and the intertemporal aspect of changes in the government's budget balance to be addressed in a more natural and convenient way.[2] All variables are time dependent, though the time index is suppressed for notational convenience.

The representative household's utility function is described by an intertemporal isoelastic function of the form

$$\begin{aligned} U &= \int_t^{\infty} \frac{1}{\sigma} \left(C G_C^{\varepsilon} \right)^{\sigma} e^{-\beta(v-t)} dv, \\ \varepsilon &> 0, \ -\infty < \sigma < 1, \ \varepsilon\sigma < 1, \ 1 > \sigma \left(1+\varepsilon\right), \end{aligned} \tag{1}$$

where C = private consumption, G_C = government spending on consumption goods, ε = impact of government consumption on the welfare of private agents, σ = parameter linked to the intertemporal elasticity of substitution ξ by $\xi = 1/\left(1-\sigma\right)$ (or $\sigma = \left(\xi - 1\right)/\xi$), and the constraints on the coefficients are imposed to ensure conventional concavity properties.

The household faces the following budget constraint:

$$\dot{W} \equiv \dot{K} + \dot{B} = rB + \left(1-\tau\right) Y - \left(1+\varkappa\right) C - T, \tag{2}$$

where $W \equiv K + B$ = real wealth, K = private capital stock, B = government bonds, r = real rate of interest, τ = (constant) tax rate on income, $\varkappa$ = (constant) tax rate on consumption, T = lump-sum tax (transfer if negative) playing the role of a "balancing item".[3]

[2] These features are typical of a set of models notably collected under the heading of endogenous growth models: see, e.g., Barro (1990), Jones and Manueli (1990), Rebelo (1991), Jones *et al.* (1993), Pecorino (1993), Ireland (1994), and Turnovsky (1996, 2000). An extra, worthy advantage of the above analytical framework is that it explicitly models the public investment-growth relationship which the IMF-World Bank staff, following a recurring criticism by many observers, now recognizes to be critical for a comprehensive monitoring of debt sustainability over the long term. See, e.g., Wyplosz (2011), Buffie *et al.* (2012), and IMF (2012, 2014, 2016).

[3] Notice that, in order to take account of different tax rates on income and the interest on bonds, we set the tax rate on r equal to 0, so that r is also the after-tax real interest rate.

The production function is described by

$$Y = AG_I^{\alpha} K^{1-\alpha} = A \left(\frac{G_I}{K} \right)^{\alpha} K, \ 0 \leq \alpha \leq 1, \tag{3}$$

where Y = output, G_I = government spending on infrastructures, A = index of technological knowledge.

The economy-wide resource constraint is

$$\overset{\bullet}{K} = Y - C - G, \tag{4}$$

where $G \equiv G_c + G_I$.

The government budget constraint is

$$\overset{\bullet}{B} = rB + G - \tau Y - \varkappa C - T. \tag{5}$$

Solving the model for the long run balanced growth rate equilibrium under constant shares of output for government expenditure, and assuming, for convenience, that sovereign bonds consist only of perpetuities, paying a coupon rate of one unit, we can rewrite the government budget constraint (6) as

$$\frac{\overset{\bullet}{b}}{r} = b + \left[\frac{\gamma_C + \gamma_I - \tau}{(1-\alpha)(1-\tau)} \right] rK - \varkappa \varphi K - T, \tag{6}$$

where b is the number of outstanding bonds, $1/r$ is the value of the government bond, $B = b/r$ is the value of the outstanding debt, φ is the (constant) consumption-capital ratio and γ_C and γ_I the (constant) shares of government expenditure on consumption and investment, respectively[4].

Integrating (6) over the range $[t, \infty)$, leads to

$$\int_t^{\infty} T_v e^{-r(v-t)} dv = \frac{b_t}{r} + \int_t^{\infty} r \left[\frac{\gamma_C + \gamma_I - \tau}{(1-\alpha)(1-\tau)} - \varkappa \varphi \right] K_t e^{-(r-\mathbf{g})(v-t)} dv. \tag{7}$$

Equation (7) is the intertemporal budget constraint of the government, requiring that the present value of government expenditures less tax receipts on economic activity, that is, the present value of the primary budget deficit, plus the current value of debt, must equal the present value of current and future lump-sum tax payments. Solving (7) under $r > \mathbf{g}$ and dividing through by the size of the current wealth leads to

$$F_t \equiv \int_t^{\infty} \frac{T_v e^{-r(v-t)}}{W_t} dv = \frac{(b_t/r)}{W_t} + \frac{r \left[\frac{\gamma_C + \gamma_I - \tau}{(1-\alpha)(1-\tau)} \right] - \varkappa \varphi}{r - \mathbf{g}} \frac{K_t}{W_t}, \tag{8}$$

[4]For more dettails on model solution see Canofari, Piergallini and Piersanti (2018).

where $\mathbf{g}$ is the constant balanced growth rate (see Canofari, Piergallini and Piersanti, 2018).

Equation (8) determines the present discounted value of T required for the government to be intertemporally solvent.

Equation (8) is a key relationship of the model and provides a sensible index to assess the intertemporal (or long-run) sustainability of a government fiscal balance. It measures the present value of fiscal policy adjustment necessary to ensure the long-run sustainability of government debt. Following Bruce and Turnovsky (1999), we call F a *sustainability index of fiscal policy.*

Further comments are in order to better appreciate the efficacy of the index F. First, observe that all values are derived relative to the current size of wealth, differently from Bruce and Turnovsky (1999) where values are expressed relative to private capital. Overall, this avoids the shortcoming of the debt-GDP ratio, where a stock variable is measured relative to a flow variable. Second, the right-hand side includes two (correctly normalized) components. The first is the current stock of government debt. The second is the present value of the primary budget deficit. Hence, the left-hand side computes the value of fiscal policy adjustment (here assumed to take the form of lump-sum taxes) required to warrant the viability of the long-run fiscal balance as reflected by the two components in the right-hand side of (8). Finally, being based on endogenous growth model, the index provides a "dynamic scoring" of government debt that takes into account the intertemporal nature of fiscal policy and its impact on the growth rate and other macroeconomic variables, and by which we can assess a country's fiscal position as follows. When $F \leq 0$, fiscal policy is said to be sustainable; when $0 < F \leq (b_t/r)/W_t$, fiscal policy is said to be weakly unsustainable; when $F > (b_t/r)/W_t$, fiscal policy is said to be strongly unsustainable.

An extra advantage of our sustainability index is that it does not imply any threshold level for the debt, which is puzzling and highly questioned in academic literature.[5] Rather, it provides a well-defined measure of fiscal policy adjustments required to bring back the government balance on a sustainable path. Obviously, we do not believe our index to solve the "impossible mission" of determining exactly which debt is sustainable and which is not (Wyplosz, 2011). Nonetheless, we think it fruitfully answers to the issue of finding a "simple, transparent and standardized tool that can be easily implementable to all countries".[6] It is a dynamic scoring of the government fiscal balance that switches emphasis from levels to paths and computes how much adjustment is required to converge to the stability path. It also implies that the adjustment process need not necessarily occur immediately, but better spanned over a longer planning horizon to avoid the deep recessions resulting from huge fiscal contractions and the risk of possible devilish dynamics driven by self-fulfilling expectations of debt non-sustainability.[7] As Wyplosz (2011) notes, sacrificing growth in the

[5] See, e.g., Cordella *et al.* (2010), Wyplosz (2011), Panizza and Presbitero (2014), Pescatori *et al.* (2014), Egert (2015), Schadler (2016), and Chudik *et al.* (2017).

[6] Wyplosz (2011, pp. 10-11).

[7] See, e.g., De Grauwe and Ji (2012), and Canofari *et al.* (2015).

short and even in the long run to imprecisely known risks concerning a particular debt ceiling can be very costly to any country. Indeed, in the presence of multiple equilibria and self-fulfilling dynamics of debt (un-)sustainability, a fully solvent government with a high level of debt might be moved to implement restrictive fiscal policies to reduce the supposed risks that a change in investors' sentiments would push the country towards the bad equilibrium. Yet, these policies may be very harmful and self-defeating, as they reduce growth and increase the debt-to-GDP ratio especially if implemented during a recession (DeLong and Summers, 2012; Cafiso and Cellini, 2014; House *et al.*, 2017).

3 Indicator Calibration

In this section we calibrate the fiscal sustainability indicator for 28 European countries. As a benchmark, we also compute the index for United States and

We use yearly data from Ameco and OECD database over 2001-2017[8].

For our purposes, let we rewrite the fiscal sustainability indicator (8) as follows,

$$F_t = \int_t^{\infty} \frac{T_v \; e^{-r(v-t)}}{W_t^H} dv = \frac{B_t}{W_t^H} + \frac{VB_t}{W_t^H}, \tag{9}$$

where $W_t^H \equiv K_t + NFW_t$ where K_t is the real stock of private capital and NFW_t the real net financial wealth, and VB_t the present value of primary surpluses computed as

$$VB_t = \frac{r\left[\dfrac{\gamma_C + \gamma_I - \tau}{(1-\alpha)(1-\tau)}\right] - \varphi\varkappa}{r - \mathbf{g}} K_t. \tag{10}$$

As explained below, F_t measures the fiscal adjustment required to ensure the viability of public finance. Specifically, fiscal policy is defined strongly sustainable if $F_t < 0$, weakly unsustainable if $0 < F_t < \frac{B_t}{W_t^H}$ and strongly unsustainable if $F_t > \frac{B_t}{W_t^H}$.

Table 1, shows the countries characterized by a negative average after growth interest rate over 2001-2017. As it is well known, if the after growth interest rate is negative, fiscal sustainability is warranted by a positive growth dividend (see e.g. Bohn, 2008; Barret, 2018). Therefore, we compute F_t only for countries which exhibit a positive after growth real interest rate, consistently with equation (8).

[8]Variables description is in the Data Appendix.

Table 1 - Average after growth interest rate, 2001-2017*	
Country	$\mathbf{r - g}$
Turkey	-0,10081
Romania	-0,04523
Estonia	-0,04073
Latvia	-0,02746
Bulgaria	-0,02478
Ireland	-0,023
Luxembourg	-0,01734
Lithuania	-0,01646
Czech Republic	-0,0114
Sweden	-0,0062
Iceland	-0,00499
Malta	-0,00423
Poland	-0,0042
*It worhy of note that the impact of inflation is the key factor determing the negative after growth interest rate in a number of countries such as Turkey, Romania, Estonia, Latvia and Bulgaria	

Accordingly with equation (10) and in order to measure VB_t, Table 2 and 3 first show the average values for all parameters required to determine F_t and α (the output elasticity to public investment) for which official data are not available. We approached this issue as follows.

Starting with the capital-wealth ratio

$$K_W \equiv \frac{K}{W} = \frac{r - \mathbf{g}}{(1+\varkappa)\varphi - \dfrac{r\alpha}{1-\alpha}} \tag{11}$$

Using (11) we calibrate α using the average value of the remaining model parameters as follows

$$\alpha \equiv \alpha_c = \frac{r - \mathbf{g}}{[K_W(\varphi + \varphi\varkappa + r) - (r-g)]}, \tag{12}$$

Table 2 - Average values for parameters, 2001-2017				
Country	$\gamma_c + \gamma_I$	τ	g	r
Norway	0,4367099	0,4422103	0,016317	0,017684
Netherlands	0,4264587	0,3132675	0,013323	0,018163
Denmark	0,517189	0,376253	0,010543	0,031201
Belgium	0,480232	0,372129	0,014536	0,021797
Finland	0,508657	0,394376	0,013418	0,018551
Germany	0,4294754	0,331221	0,013132	0,020585
Italy	0,4408448	0,312748	0,001837	0,024741
Austria	0,484265	0,346574	0,015045	0,021818
Portugal	0,4365296	0,27743	0,004689	0,023017
United States	0,3472825	0,252173	0,018997	0,027982
Greece	0,4542297	0,293295	0,000154	0,018351
France	0.5244487	0,358438	0,012426	0,020566
Spain	0,3957516	0,269941	0,016473	0,019586
United Kingdom	0,3993102	0,256886	0,017855	0,023555
Slovenia	0,4506114	0,287466	0,021984	0,027758
Hungary	0,4511532	0,277481	0,021817	0,02313
Japan	0,3669752	0,253663	0,0085178	0,0099018

Table 3 - Average values for parameters, 2001-2017				
Country	$\varphi = \frac{C}{K}$	α_c	$r - g$	$\varkappa$
Norway	0,150851	0,916758	0,001367	0,301123
Netherlands	0,169699	0,918148	0,004839	0,246054
Denmark	0,195134	0,882367	0,020658	0,357328
Belgium	0,194482	0,913158	0,007261	0,247942
Finland	0,179698	0,922216	0,005133	0,258655
Germany	0,191199	0,913407	0,007453	0,189678
Italy	0,191614	0,890064	0,022904	0,23931
Austria	0,152937	0,894668	0,006772	0,271297
Portugal	0,218407	0,912956	0,018327	0,218808
United States	0,291156	0,915044	0,008986	0,103707
Greece	0,180125	0,91364	0,018196	0,200162
France	0,181802	0,914961	0,00814	0,282798
Spain	0,172008	0,91138	0,003114	0,194256
United Kingdom	0,240085	0,921131	0,005699	0,187527
Slovenia	0,264147	0,92197	0,005774	0,270917
Hungary	0,261017	0,936455	0,001313	0,312781
Japan	0,1916	0,955802	0,001384	0,131122

Next, we display the average value of F_t and of its basic components $\frac{B_t}{W_t^H}$, and $\frac{VB_t}{W_t^H}$ in Table 4.

The table shows that on average the first five countries in Table 3 are strongly sustainable ($F_t < 0$), Italy and Germany are found to be weakly sustainable, whereas the others strongly unsustainable ($F_t > \frac{B_t}{W_t^H}$). Our index therefore provides a new method for assessing sovereign debt sustainability which leads to results radically different from those based on the official debt-to-GDP indicator. This is not without policy implications as the new method points to fiscal policy strategies in the opposite direction of those so far recommended for many European countries. For example, fiscal policy strategies strongly suggested for countries like Italy and France (to take the most remarkable cases) on the basis of the debt-to-gdp sustainability indicator, appear as misplaced based on the above wealth-based-indicator. Thus strong fiscal corrections for Italy are not only unrequired but even harmful, as they reduce growth and increase the debt-to-GDP ratio especially if implemented in a dowturn.

Table 4, average fiscal sustainability indicator, 2001-2017

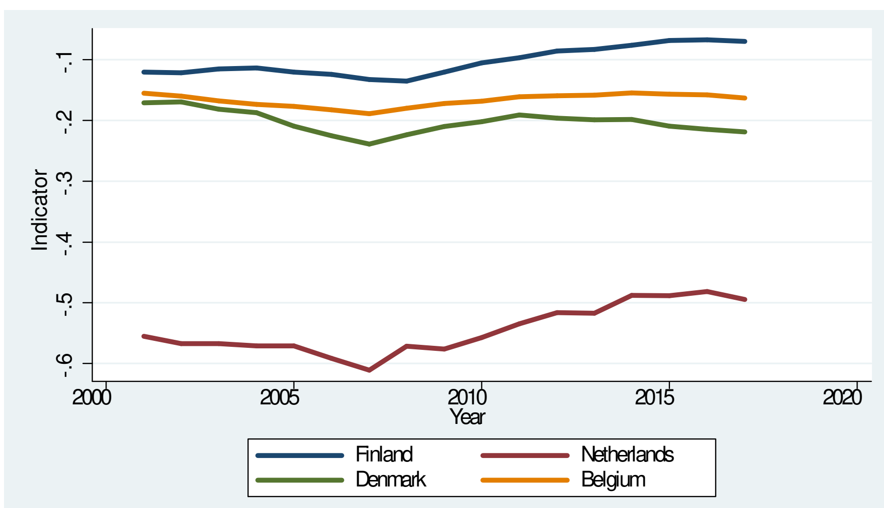
Country	$\frac{B_t}{W_t^H}$	$\frac{VB_t}{W_t^H}$	F_t
Norway	0,1257	-31,2034	-31,0777
Netherlands	0,12925	-0,67376	-0,54451
Denmark	0,116013	-0,31865	-0,20263
Belgium	0,203936	-0,37082	-0,16689
Finland	0,133412	-0,23673	-0,10332
Germany	0,16937	-0,12984	0,039528
Italy	0,224569	-0,105	0,119574
Austria	0,160669	0,236666	0,397335
Portugal	0,227736	0,421197	0,648934
United States	0,15907	0,589551	0,748621
Greece	0,295885	0,562302	0,858188
France	0,180044	0,936081	1,116125
Spain	0,14979	1,172252	1,322042
United Kingdom	0,129801	1,223221	1,353023
Slovenia	0,161833	1,27947	1,441303
Hungary	0,245472	3,271528	3,517
Japan	0,3564907	3,445404	3,801895

Table 5 classifies countries according to their public finance sustainability using our model-based indicator for fiscal sustainability.

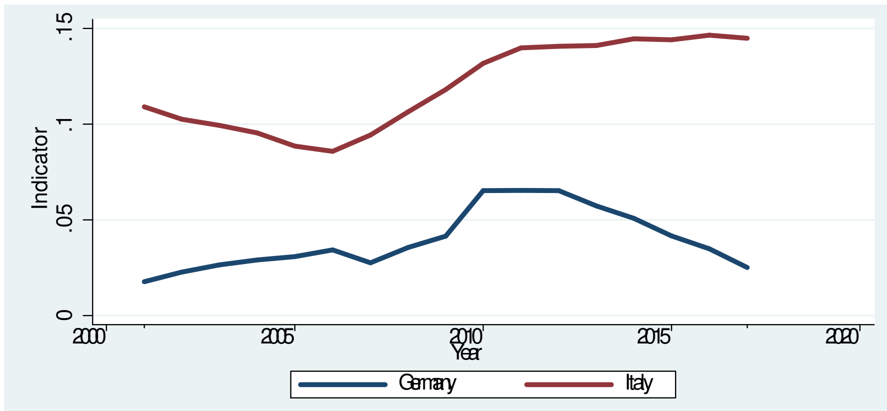
Table 5, Countries' classification		
Strongly Sustainable	**Weakly Sustainable**	**Strongly Unsustainable**
Norway	Germany	Austria
Netherlands	Italy	Portugal
Denmark		United States
Belgium		Greece
Finland		France
		Spain
		United Kingdom
		Slovenia
		Hungary
		Japan

In order to go more deeply into the issue and have a better understanding of how fiscal sustainability evolves over time, the following picures also display the dynamics of F_t for group of countries with similar features. While not changing the average results, they make visible how the F_t indicator has moved over time, disclousing the perverse effect on countries' debt sustainability (e.g. Italy,) of policy choices made after the great financial crisis.

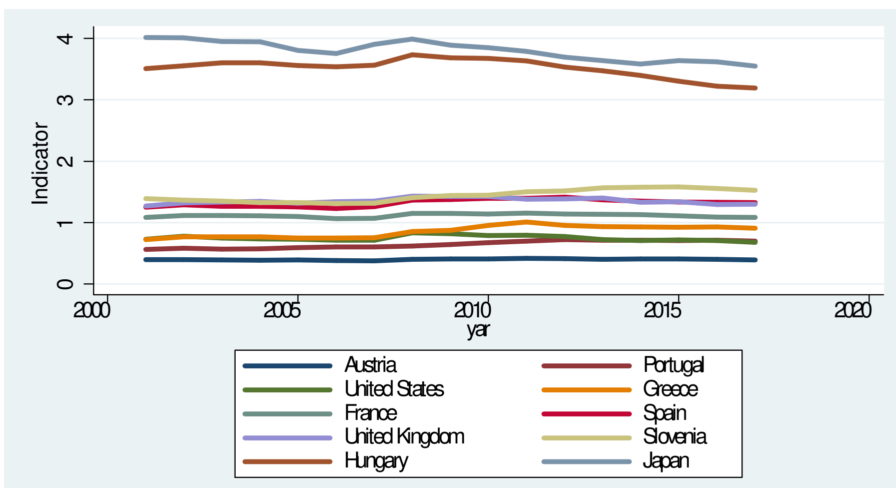
Strongly sustainable countries, 2001-2017



Weakly sustainable countries, 2001-2017



Strongly unsustainable countries, 2001-2017



4 Conclusion

Economic policy uncertainty is a key factor explaining the declining dynamics of many macro-variables. In this paper we argue that in order to reduce uncertainty about the fiscal policies is necessary to adopt a proper measure of fiscal sustainability providing clear information about the magnitude of the fiscal adjustment required to ensure fiscal sustainability.Fiscal sustainability is commonly evaluated on the basis of the debt-GDP ratio. This way of monitoring debt solvency is arguably not consistent with transversality conditions obtained from optimizing macroeconomic frameworks.

In this paper we consider a wealth/capital-based sustainability index of government debt policy derived from a baseline endogenous growth model. We calibrate the index from 2001 to 2017 for the 28 European countries and U.S.and Japan as reference countries. Results are different from common wisdom. As markable example, we show that the fiscal position is weakly sustainable for Italy and Germany. The paper provide clear information concerning the necessity of fiscal policies necessary to ensure public finances sustainability.

5 Data Appendix

Data Description- Yearly Data (2001-2017)		
Variable's name	Description	Source
Real GDP	Real GDP expressed in national currency	Ameco
Real growth rate (g)	Percentage change of real GDP (Average)	Computation on Ameco
GDP deflator	Price deflator gross domestic product	Ameco
Indirect taxes (T_i)	Taxes linked to imports and production (indirect taxes)	Ameco
Real Indirect taxes	Indirect taxes /Real GDP deflator ratio	Computation on Ameco
Real consumption	Private final consumption expenditure at 2010 prices	Ameco
Consumption tax rate ($\varkappa$)	Real indirect taxes /real consumption ratio (Average)	Computation on Ameco
TR	Total revenue: general government	Ameco
Income taxes (T_d)	$T_d = TR - T_i$	Ameco
Real income taxes	T_d/ Real GDP deflator ratio	Computation on Ameco
Income tax rate (τ)	Real income taxes /real GDP ratio (Average)	Ameco
Government debt	General government consolidated gross debt	Ameco
Real Public Debt (B_t)	Government debt/GDP deflator ratio	Computation on Ameco
Private Capital Stock (K_t)	Net capital stock at 2010 prices: total economy	Ameco
Consumption/capital ratio (φ)	Real consumption/ real net private capital stock ratio (Average)	Computation on Ameco
Inflation rate	Percentage change of GDP deflator (Average)	Computation on Ameco
Interest rate	Interest as percent of gross public debt of previous year	Ameco
real interest rate (r)	interest rate/inflation rate differential (Average)	Computation on Ameco
Real wealth (W_t^H)	Real Net Housold's Wealth	Ameco and OECD
Total primary expenditure (G)	Total exenditure excluding interes	Ameco
Real primary expenditure (G_r)	G/ GDP deflator ratio	
(γ_I+γ_c)	G_r/real GDP ratio (Average)	Computation on Ameco

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