



A new framework for detecting short-term fiscal vulnerability for the European Union countries

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A new framework for detecting *short-term fiscal vulnerability* for the European

Union countries

Abstract

This study develops a new framework (*V-L-D*) to detect short-term vulnerabilities in European Union countries' fiscal policy. Vulnerabilities are signalled by the size of cyclically adjusted budgets and public debt, and by their yearly changes. *V-L-D* categorizes fiscal vulnerability into five distinct classes scored from 0 (none) to 4 (extreme). We also explored the correlation between financial market sentiment and fiscal vulnerability. We used *V-L-D* as a predictor and *credit default swaps (CDS)* as dependent and a proxy for the market sentiment in a balanced panel model. The results indicate that CDS are higher and significant when vulnerability is strong and extreme. CDS are higher but are not significant for low and moderate fiscal vulnerability. We also found that governments are less likely to adjust fiscal policy when vulnerability is strong or extreme, and that the probability of fiscal consolidation increases when market sentiment is negative and CDS are higher.

Keywords: fiscal policy, budgetary deficit, fiscal sustainability, primary balance, debt dynamics, European Union

JEL Classification: E62, H12, H6

1. Introduction

In recent decades, governments worldwide have been facing various growing fiscal policy challenges. Reorganising the government's role in the economy after the Great Depression into the *welfare state* led to a significant rise in social public spending, increasing overall government expenditure. Adema, Fron and Ladaique (2011) showed that OECD countries' spending grew by 20% between 1980 and 2007.

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Kotlikoff and Hagist (2009) documented that healthcare public spending increased at a faster rate than GDP growth, and concluded that if social benefits continued to increase over the coming decades at the same rate, many governments would encounter large and unsustainable budgetary deficits. Corsetti and Roubini (1996) and Alesina (2000) argued about the negative effects of growing public social expenditure on fiscal sustainability. Fiscal policy issues have also been emphasized by an extended body of research. For instance, Wilcox (1989), Corsetti and Roubini (1991), Greiner and Semmler (1999), Afonso (2000), and Afonso and Raul (2008) showed fiscal unsustainability in the long run, whereas Claeys (2007), Fatas and Mihov (2009), and Afonso, Agnello, Furceri and Sousa (2009) indicated that fiscal position in Europe has not changed for the last 30 years and has been mildly pro-cyclical. Recent literature (i.e. Ghosh, Kim, Mendoza, Ostry and Qureshi, 2011; Reinhart and Rogoff, 2011) also warned about large increases in primary deficits and public debt over the past forty years due to financial bail-outs, lower government revenues and stimulus spending.

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These findings indicate the existence of vulnerabilities in fiscal policy which, unaddressed in the short or medium term, could render policies incapable of achieving their objectives or responding to various shocks. Hemming, Kell and Schimmelpfennig (2003) showed that fiscal vulnerabilities were instrumental in at least 6 of the 11 crises they investigated. In Russia and Ecuador, public sector solvency and liquidity problems culminated in the sovereign debt default; in Ukraine and Pakistan, debt restructuring was negotiated in the shadow of default; and in Bulgaria and Brazil, persistent and growing fiscal deficits led to currency pressure.

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The financial crisis in 2007–08, followed by the sharp recession and sovereign debt crisis highlighted the importance of fiscal policy to respond to shocks and/or to recover from the crisis. Many economists (i.e. Stiglitz, 2012; Pisani-Ferry, 2012) discussed the contribution of an expansionary fiscal policy towards sustainable economic growth. This is more important for Eurozone member states as they have limited macroeconomic policy tools as a result of their monetary union.

The analytical work conducted since 2009 by the International Monetary Fund (IMF) and the European Commission (EC) has reassessed the importance of employing a toolkit to detect fiscal vulnerabilities

1 and anticipate potential stresses. Thus, the aim of this paper is to develop a new framework to detect
2 fiscal vulnerability in the short term for European Union countries. The paper is structured as follows.
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4 Section 2 presents the related literature. Section 3 defines fiscal vulnerability and describes the *V-L-D*
5 methodology. Section 4 presents the results and further discussions. Section 5 draws some concluding
6 remarks and policy implications.
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10 11 12 13 14 15 **2.Related literature**

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17 Several studies in the literature provide various frameworks to assess fiscal vulnerabilities. We believe
18 that Hemming and Petrie (2000) represents the seminal work in the field. They formulated one explicit
19 definition of fiscal vulnerability and discussed its sources. They also provided a comprehensive list of
20 variables that could be considered in further assessments of fiscal vulnerability. Later, Rial and Vicente
21 (2004) employed a sensitivity analysis to study the vulnerability of public debt in Uruguay. Their
22 investigation is consistent with their own definition of fiscal vulnerability as representing any violation
23 in liquidity and/or solvency requirements due to changes in macroeconomic conditions. Their
24 methodology is appropriate for a highly volatile economic environment like Uruguay. They began their
25 analysis from a baseline scenario and defined additional scenarios assuming that debt determinants
26 (GDP growth rate, interest and exchange rate) vary (increase/decrease) by one and two standard
27 deviations.
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42 The macroeconomic developments post-2008, culminating in the EU sovereign debt crisis, increased
43 interest in the study of fiscal vulnerability. Ghezzi, Keller and Wynne (2010) developed an index of
44 fiscal vulnerability, which incorporates debt tolerance by looking at five components of vulnerability:
45 solvency (basic debt dynamics); fiscal financing needs and debt composition; external financing
46 dependence; financial sector health; and institutional strength. Any judgment of whether debt dynamics
47 indicate a possible default therefore depends on the other factors.
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Baldacci, McHugh and Petrova (2011) used a fiscal vulnerability index. This measures fiscal vulnerability on a continuous basis as a departure from historical norms defined as ten-year country averages, and uses a fiscal stress index to assess a country's susceptibility to extreme tail events. The fiscal vulnerability index was constructed using basic fiscal variables and variables indicating long-term fiscal trends and the management of assets and liabilities. Each variable is standardized using the ten-year average and the standard deviation for each country group and then transformed into cumulative normal distribution. The fiscal stress index was first computed by defining a fiscal crisis, then assessing the signalling power of each indicator using the standard approach applied in the early warning systems, before finally calculating the number of indicators exceeding the thresholds. The authors note the shortcomings of this methodology; these concern the meaning of the historical norms and deviations from them in the case of the vulnerability index, as well as the specific definition of crisis events in the case of the stress index. Baldacci, Petrova, Belhocine, Dobrescu and Mazraani (2011) conducted a more detailed and extensive investigation into fiscal stress using the same methodology as Baldacci, McHugh and Petrova (2011). They, however, built their methodology on the basis of a broader definition of fiscal crisis, including public debt default as well as near-default events.

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BlackRock Investment Institute (2011) introduced the BlackRock Sovereign Risk Index to assess the credit risk of sovereign debt issuers. They used several variables organized into four categories: fiscal space; the external finance position; financial sector health; and willingness to pay. The index was computed using a weighted version of individual z-scores. It proved to be highly correlated with five-year Credit Default Swap (CDS) spreads. Hayes (2011) presented the Barclays Capital Fiscal Vulnerability Index (FVI), which was computed using 16 indicators of fiscal vulnerability across 57 countries. Fiscal vulnerability was assessed by examining the cost of insuring against a government defaulting on its bonds, as measured by CDS rates. The choice of vulnerability indicators and the weights given to them in the overall FVI are determined by their ability to account for cross-country variation in CDS rates. The indicators are grouped under five headings: solvency, government financing needs, external financing dependence, financial sector health and institutional strength. The composite

1 index (FVI) is reported as a z-score of or each country. A positive z-score indicates that a country's
2 fiscal resilience is above-average, while a negative score indicates below-average resilience.
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5 Schaechter et al. (2012) introduced six tools to assess fiscal vulnerability and risks organized by their
6 time-horizon: indicators measuring short time pressures including gross financing needs; market-based
7 measures of sovereign risk default (CDS and RAS); a measure of potential spillovers; indicators
8 assessing medium to long-run vulnerabilities and measuring the fiscal consolidation required to stabilize
9 debt; a measure of the adverse impact of growth and interest shocks on the debt trajectory; and a
10 measure of the debt outlook. Berti, Salto and Lequien (2012) presented an early warning index of fiscal
11 stress named 'S0' that relies on a non-parametric signals approach. They followed the existing definition
12 of fiscal stress to study the key variables' behaviour, and determined the thresholds for fiscal risk for
13 each variable and the composite indicator. Their contribution was the introduction of the
14 competitiveness-financial variables in the early warning system.
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31 **3. Short-term fiscal vulnerability framework: methodological aspects**

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33 Detecting fiscal vulnerability is difficult. This study aims to provide a new framework to assess
34 vulnerability in fiscal policy over the short term for European Union countries. Much of the relevant
35 work in this field has focused on measuring or signalling fiscal vulnerability around episodes of defined
36 fiscal crises. This research therefore aims to develop a new methodology to detect short-term fiscal
37 policy vulnerabilities, which do not necessarily imply immediate fiscal stress/crisis.
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45 For the purpose of this study, it is important to understand the concept of fiscal vulnerability. Much of
46 the relevant literature was acknowledged in that sense (Furman and Stiglitz, 1999; Brixi, Shatalov and
47 Zlaoui, 2000; Hemming and Petrie, 2000; Detragiache and Spilimbergo, 2001; Allen, Rosenberg, Keller,
48 Setser and Roubini, 2002; Hemming, Kell and Shimmelpfennig, 2003; Rial and Vicente, 2004; Daniel,
49 Davis, Fouad and Van Rijckeghem, 2006; Bruglio, Cordina, Farrugia and Vella, 2008; Aizenman and
50 Pasricha, 2010; Frankel and Saravelos, 2010; Baldacci, McHugh and Petrova, 2011; Hayes, 2011;
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Leiner-Killinger, 2011; Greene, 2012; Jedrzejowicz and Kozinski, 2012; Missale, 2012). Fiscal vulnerability can be determined by *inherent* factors such as poor size and composition of government revenue and expenditure; poor structure of public debt; and weak fiscal institutions, budgeting and management of government assets and liabilities etc., which can induce a kind of *intrinsic* vulnerability to fiscal policy. If these weaknesses are nurtured by the governments and they do not foster economic growth, then the intrinsic vulnerabilities could self-fulfil into a fiscal crisis. There are also *exogenous* factors such as poor economic conditions, financial sector spillovers, demographic issues, political or environmental changes, etc., which are not specific to fiscal policy but could generate exogenous vulnerabilities affecting the size and/or dynamic of fiscal variables. For example, the 2007-08 financial crisis required substantial government aid from state budgets, which prompted significant growth in public debt, exposing fiscal policy to a higher degree of vulnerability.

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The sources of fiscal vulnerability described in the existing literature (i.e. Hemming and Petrie, 2000; Cottarelli, 2011 and Greene, 2012) revealed that the effects of such vulnerabilities are eventually seen in the *size* and/or *changes* of the *budgetary deficit* and/or *public debt*. Stoian and Iorgulescu (2014) found that central and eastern European countries registered lower public debt-to-GDP ratios and higher debt growth rates compared to the advanced EU economies. This suggests that even if one country has a small public debt, if its dynamics accelerate rapidly, it should signal to the government to monitor its progress over time and to adjust the primary surplus accordingly to avoid unstable debt trajectories in the medium and/or long term.

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Thus, we can define *fiscal vulnerability* as ‘*any kind of intrinsic weakness in the existing fiscal policy or exogenous shocks that lead to a significant deterioration in the level and/or dynamics of the budgetary deficit and/or public debt over the short term that will limit the government’s ability to achieve its goals*’.

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This study’s framework for detecting fiscal vulnerability is consistent with this definition. We decomposed our measure of overall fiscal vulnerability (V) into two components: capturing vulnerability through the size of fiscal variables (the *level indicator* [L]), and capturing vulnerability through their

changes over two consecutive years (the *dynamic indicator* [D]). We used *cyclically adjusted balance* and *public debt* as leading fiscal variables to detect vulnerability. Establishing the measure of fiscal vulnerability is done through equation (1):

$$V = L + D \quad (1)$$

where, L and D can take values of 0, 1, and 2 as is described below.

L detects the vulnerabilities signalled by the size of the *cyclically adjusted balance* (CAB) and *public debt* through *distance-to-stability* ($D-S$). We use the *cyclically adjusted balance* for two reasons. It includes interest payments on public debt from previous years, thus capturing the influence of past deficits, as sources of vulnerability within the current fiscal policy. A surplus can become an overall deficit if interest payments are large, prompting governments to borrow money or raise taxation. On the other hand, variations in the budget balance can give a misleading picture of the fiscal stance, as a fiscal improvement during upswings can mask deterioration in underlying public finances (Bouthevillain and Quinet, 1998). The *distance-to-stability* measure signals the possibility of current public debt deviating from its steady state and having an unstable trajectory in the medium term and/or in the long run if governments do not reduce their deficit. The estimation of $D-S$ is based on the public debt dynamic model, detailed in Appendix 1. $D-S$ measures the difference between the actual primary balance and the one needed to stabilize the public debt, taking into account real GDP growth rate and interest rates on public debt. Fiscal vulnerability signalled by the size of the cyclically adjusted balance and/or of the public debt through $D-S$ is defined in the year when CAB is larger than a specific threshold, which is determined below, and/or $D-S$ takes a value of 1, as shown in Appendix 1.

D detects vulnerabilities signalled by changes over two consecutive years in the cyclically adjusted balance (ΔCAB) and public debt ($\Delta Debt$), both expressed as GDP ratios. The two-year period is chosen to diminish the influence of any temporary factors on the relevant indicators in one given year and to provide a better picture of their evolution, which lead to the decision to initiate fiscal adjustments. The period also captures a large short-term deterioration in the leading indicators that led to the decision to pursue the fiscal adjustment. It excludes medium-term developments that are not necessarily linked to

1 these decisions. Rising ratios suggests that *CAB* and/or *public debt* increase faster than GDP. Fiscal
2 vulnerability signalled by the dynamic of cyclically adjusted balance and/or public debt is defined when
3 the cumulated changes over two consecutive years in fiscal variables are larger than a specific threshold.
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7 In order to establish a relevant threshold beyond which the size of the cyclically adjusted balance, as
8 well as changes in *CAB* and in public debt as GDP ratios, indicate fiscal vulnerability, the following
9 approach was employed. We focused on countries which consolidated their fiscal policy in order to
10 correct the imbalances. However, we fully acknowledge that some countries could decide, for various
11 reasons, not to tackle their fiscal problems firmly and to increase their deficit and/or accumulate debt
12 instead, arguing that they have the necessary fiscal space. Nevertheless, according to the ‘crisis
13 hypothesis’, governments find it much easier to stabilize decisively in times of crisis than in times of
14 moderate economic problems (Alesina, Ardagna and Trebbi, 2006).
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16 We studied the size of the cyclically adjusted budget and cumulated changes for two consecutive years
17 in *CAB* and public debt to GDP ratios in the year before fiscal adjustments were made. We assumed that
18 over this period, all of these indicators increased to a level that triggered fiscal consolidation.
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20 A period of fiscal adjustments was defined as *a period of few consecutive years characterized by small*
21 *improvements in the cyclically adjusted primary balance, which includes at least one year when the*
22 *improvement was at least 1.5 per cent of GDP as in Alesina and Ardagna (2010), or a period of few*
23 *consecutive years when the average improvement in the cyclically adjusted primary balance is at least 1*
24 *percent of GDP per year.*
25

26 Using annual data over the period 1990–2013 for 28 EU countries, we found 64 episodes of fiscal
27 adjustments (see Table 1 in Appendix 2). The dataset used is described in Appendix 3. Studying the
28 values for *CAB*, ΔCAB , and $\Delta Debt$ in the year preceding the fiscal adjustment, we calculated the median
29 in order to establish the threshold that would indicate fiscal vulnerability. Using a median eliminates the
30 influence of the large values recorded for some countries. Ireland, for example, registered a 47 p.p. rise
31 in its public debt to GDP ratio in 2010 compared to 2008 and a 20 p.p. deterioration in its *CAB*
32 compared to the previous year, clearly representing an outlier. The following thresholds were evidenced:
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(i) a deficit of 4.7 p.p. of GDP for the cyclically adjusted budget balance; (ii) a deterioration of the CAB of 2.3 p.p. of GDP for two consecutive years; and (iii) an increase of the public debt to GDP ratio of 6.1 p.p. of GDP for two consecutive years. In order to detect fiscal vulnerability, we looked for values larger than the median from the upper 50% of data distribution. The level indicator (L) monitoring the vulnerability signalled by the size of the cyclically adjusted balance by the size of public debt through the *distance-to-stability* takes the following values:

$$L = \begin{cases} 2, & \text{if } CAB \leq -4.7 \text{ p.p. and } D - S = 1, \\ 1, & \text{if } CAB \leq -4.7 \text{ p.p. or } D - S = 1, \\ 0, & \text{if } CAB > 4.7 \text{ p.p. and } D - S = 0 \end{cases} \quad (2)$$

The dynamics indicator (D) monitoring the vulnerability signalled by the changes for two consecutive years in CAB and in the public debt takes the following values:

$$D = \begin{cases} 2, & \text{if } \Delta CAB \geq 2.3 \text{ p.p. and } \Delta Debt \geq 6.1 \text{ p.p.}, \\ 1, & \text{if } \Delta CAB \geq 2.3 \text{ p.p. or } \Delta Debt \geq 6.1 \text{ p.p.}, \\ 0, & \text{if } \Delta CAB < 2.3 \text{ p.p. and } \Delta Debt < 6.1 \text{ p.p.} \end{cases} \quad (3)$$

Finally, using the V - L - D framework, five categories of fiscal vulnerability (V) can be established as in (4):

$$V = \begin{cases} 4, & \text{indicating extreme fiscal vulnerability} \\ 3, & \text{indicating strong fiscal vulnerability} \\ 2, & \text{indicating moderate fiscal vulnerability,} \\ 1, & \text{indicating low fiscal vulnerability} \\ 0, & \text{indicating no fiscal vulnerability} \end{cases} \quad (4)$$

For instance, when V - L - D indicates extreme fiscal vulnerability, it implies that both the level and the dynamics indicators detect vulnerabilities in the fiscal policy. Fiscal consolidation is therefore required. When V is zero, it implies non-vulnerability. When V takes values of 3, 2, or 1, both and/or only one of the indicators (L or D) show vulnerabilities in fiscal policy. The V - L - D framework can detect fiscal vulnerability over the short term using data reported for the current year and for the previous two years. Thus, governments could use information provided by V - L - D to correct fiscal policy for the next year or the same year if they employ this framework on higher frequency data (i.e. quarterly). We also believe that V - L - D represents a tool which allows governments to make fiscal adjustments in real time.

1 Governments, like humans, procrastinate when they have to make changes, such as implementing fiscal
 2 consolidation. Buitier (2004), explaining why policy-makers prefer to run Ponzi schemes and roll over
 3 the public debt instead of smoothly adjusting fiscal policy, argued that when there is no terminal date for
 4 repaying the debt as in fiscal sustainability model, or even if there is one but it is far in the future, there
 5 is an obvious temptation for a debtor to put off the day of reckoning as long as possible. He also
 6 suggested that even after 200 years of deficits, the debtor can always argue that they have the rest of
 7 eternity to run the necessary primary surpluses. A forward-looking methodology of assessing fiscal
 8 vulnerability would indicate the potential risks at which fiscal policy could be exposed only a few years
 9 later. It depends only on governments deciding whether they will make the necessary adjustments to
 10 avoid the long-term risks. When *V-L-D* signals fiscal vulnerability, it also warns governments that fiscal
 11 policy should be adjusted.

24 4. Results and discussion

25 The *V-L-D* framework for detecting short-term overall fiscal vulnerability for EU countries was
 26 employed on a dataset (see Appendix 3) from 1990–2013 for 28 EU countries. The total number of
 27 observations was 516. The *V-L-D* indicated 310 episodes (years) of fiscal vulnerability, out of which 26
 28 were extreme, 62 were strong, 94 moderate and 128 low (see Table 2 in Appendix 2). For the other 206
 29 observations, *V-L-D* detected no fiscal vulnerability.

30 In order to check if the *V-L-D* sends the right signals, we explored the correlation between financial
 31 market sentiment and the *V-L-D* results for overall fiscal vulnerability as a predictor. We employed a
 32 balanced panel model with random effects and one categorical variable over the period 2008–13. The
 33 model is described by equation (5):

$$34 Y_{it} = \alpha + \beta_j D_j + \gamma Z_{it} + \varepsilon_{it} \quad (5)$$

35 where:

36 Y_{it} is the CDS defined as a dependent variable for country i at time t ;

D_j is overall fiscal vulnerability which takes values of 0, 1, 2, 3 and 4 and it is defined as a categorical variable, $j = \overline{0, 4}$;

Z_{it} is a set of control variables for country i at time t represented by the nominal GDP growth rate and by the trade deficit;

α is the constant;

β_j is the coefficient of category j of factor variable;

γ is the coefficient of control variable;

ε_{it} is the error term.

The five-year CDS in US dollars at the end of the year used as a dependent variable in the equation (5) is a proxy for the market sentiment. The categorical variable (*vulnerability*) is the variable of interest, represented by V as in equation (4). Being a categorical variable, it is displayed in five distinct categories depending on the vulnerability score. Some descriptive statistics are reported in Table 2. The nominal GDP growth rate (*growth*) accounting for the domestic economic condition and the trade deficit of goods and services as GDP ratio (*external*) accounting for the external imbalances were introduced as control variables. Control variables were used to check robustness.

Table 2: Fiscal vulnerability categories, 2008-2013

<i>Vulnerability</i>	Freq.	Percent	Cum.
0	16	15.69	15.69
1	22	21.57	37.25
2	28	27.45	64.71
3	24	23.53	88.24
4	12	11.76	100.00
Total	102	100.00	

The panel consists of 17 EU countries: Bulgaria, Denmark, the Netherlands, France, Finland, Germany, Ireland, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, and Sweden for

which we found available data during 2008–13. The data for CDS was collected from Reuters and the data for the GDP growth rate and for the trade deficit were provided by Ameco.

Three distinct equations were estimated. In the first regression (5.1), only the correlation between the market sentiment and fiscal vulnerability was explored. In the second (5.2) and third regression (5.2), control variables were added in order to check if the relationship between market sentiment and fiscal vulnerability still holds. Investors could ask for a higher risk premium not only when they believe that governments are confronted with an increased exposure to solvency risk due to debt accumulation, but also when the economic conditions are bad and when the countries are exposed to external shocks due to a poor trade balance combined with deteriorated fiscal conditions.

$$CDS_{it} = \alpha + \beta_j D_j + \varepsilon_{it} \tag{5.1}$$

$$CDS_{it} = \alpha + \beta_j D_j + \gamma growth_{it} + \varepsilon_{it} \tag{5.2}$$

$$CDS_{it} = \alpha + \beta_j D_j + \gamma_1 growth_{it} + \gamma_2 external_{it} + \varepsilon_{it} \tag{5.3}$$

The panel was estimated using the GLS method and random effects as indicated by the Hausman test and using zero fiscal vulnerability as the base category for the categorical variable. The results are reported in Table 3.

Table 3: Random effects GLS regression

Variables	(1)	(2)	(3)
<i>Vulnerability</i>			
1	-16.62 (60.21)	10.41 (58.61)	8.006 (59.12)
2	53.85 (59.03)	100.7* (59.07)	94.55 (58.80)
3	99.41* (60.16)	144.1** (59.87)	138.0** (59.74)
4	118.1* (71.28)	193.1*** (73.51)	200.9*** (74.21)
<i>growth</i>		9.666*** (3.293)	7.059* (3.661)
<i>external</i>			-6.538** (3.168)
<i>constant</i>	148.9*** (50.59)	91.59* (52.84)	106.1** (50.95)
Hausman test			

Prob> χ^2	0.1764	0.5661	0.3661
R-sq	0.0914	0.1623	0.2093

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

The results show that financial markets react to strong and extreme fiscal vulnerability by increasing CDS. These two categories are significant for each regression employed, suggesting a robust relationship between market sentiment and heavy deterioration in fiscal policy. When using a categorical variable as explanatory, a base category has to be set up for comparison. Thus, the estimated coefficients indicate how much the dependent variable corresponding to category j is larger than the dependent variable corresponding to the base category. Taking, for instance, regression (5.3) as an example, the coefficients indicate that CDS in situations of extreme fiscal vulnerability (denoted by category 4) are 200 points higher than CDS in situations when fiscal policy is not vulnerable. The CDS for categories 3 and 4 of fiscal vulnerability are larger than the CDS for the base category and are statistically significant and hold for all of the regressions. Concerning the categories of low (1) and moderate (2) fiscal vulnerability, the panel indicates that even if CDS are higher compared with the base category (zero vulnerability), the coefficients are not statistically significant. This suggests that investors' beliefs concerning risk induced by low and moderate fiscal vulnerability are somehow similar to situations when fiscal policy is not vulnerable. Thus, they do not systemically ask for a higher risk premium during periods with low and moderate vulnerability as they do for situations when fiscal policy is signalled as being strong or extremely vulnerable, but do so randomly. These findings are consistent with De Grauwe and Ji (2012) who suggested that during boom years, investors price sovereign risk favourably compared with times of crisis when, driven by panic, they usually overprice the risk. The authors also advocate that financial markets' behaviour influences governments' response to fiscal vulnerability. When economies are flourishing and investors are optimistic and more prone to underpricing risk, governments are not stimulated to adjust fiscal policy, even if it signals vulnerability. Extensive deterioration in economic and fiscal conditions, which are assessed as fiscal stress, lead to changes in market sentiment in the sense of increasing sovereign risk. Thus, governments will have to consolidate their fiscal policy.

We also studied government's reactions to adjusting their fiscal policy during periods of vulnerability. In this sense, we employed a logit model for balanced panel data using a dummy variable (*adjustment*) as

our dependent variable, which takes the value of 1 for the years when we identified episodes of fiscal adjustments (see Table 1 in Appendix 2) and 0 otherwise. Equation (6) describes the model:

$$\Pr(Y_{it} = 1|X_{it}) = F(\beta_0 + \beta_1 X_{it}) \tag{6}$$

where:

Y_{it} is the dependent variable describing the fiscal adjustment for country i and time t which takes values of 0 and 1;

X_{it} is the set of explanatory variable for country i and time t represented by the overall adjusted vulnerability or the *CDS*;

β_0, β_1 represent the coefficients to be estimated.

Two distinct equations were estimated. Equation (6.1) investigates whether the probability of adjusting fiscal policy increases with the change in the status of overall fiscal vulnerability from one category to another. This should be consistent with the ‘crisis hypotheses’. Thus, we used a categorical variable (*adjusted vulnerability*) as a predictor with two distinct categories: 0 and 1. The decision to reshape the original categorical variable (*vulnerability*) used in Panel 1 was based on previous results, which made us conclude that financial markets find situations characterized by strong and extreme vulnerability as more relevant. This new variable which was introduced in equation (6.1) aims at revealing if the probability of adjusting fiscal policy increases when fiscal vulnerability changes from low and moderate to strong and extreme. In this case, the base is represented by the zero category, which corresponds to low and moderate fiscal vulnerability. Equation (6.2) explores the correlation between the probability of taking fiscal consolidation when fiscal policy is vulnerable but also controlling for the market sentiment (*CDS*).

$$\Pr(\text{adjustment}_{it} = 1 | \text{adjusted vulnerability}_j) = F(\beta_0 + \beta_1 \text{adjusted vulnerability}_j) \tag{6.1}$$

$$\Pr(\text{adjustment}_{it} = 1 | \text{CDS}_{it}) = F(\beta_0 + \beta_1 \text{adjusted vulnerability} + \beta_2 \text{CDS}_{it}) \tag{6.2}$$

Both equations are estimated using a balanced panel data set consisting of 12 European Union countries: Denmark, the Netherlands, France, Germany, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, and Spain over the 2008–13 period. Compared to panel 1, from panel 2 we dropped Bulgaria, Finland, France, Ireland, and Sweden, for which we observed no change in *adjustment* or in *adjusted vulnerability* during the period investigated. We used annual average for *CDS* assuming that it will be more relevant for our investigation if we take into account that fiscal adjustments could be undertaken throughout the year. The results are reported in Table 4:

Table 4: Random effects logit regression

Variables	Panel 2		Odds ratio	
	(1)	(2)	(1)	(2)
<i>adjusted vulnerability</i>				
1	-1.951*** (0.714)	-3.748*** (1.070)	0.142*** (0.101)	0.023*** (0.025)
<i>CDS</i>		0.0134*** (0.00397)	1.013*** (0.004)	
<i>Constant</i>	0.526 (0.373)	-1.147** (0.519)	1.692 (0.630)	0.317** (0.164)
Observations	72	72		

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

The results indicate that the probability of consolidating fiscal policy when vulnerability goes from ‘low and moderate’ to ‘strong and extreme’ decreases. When adding the control variable, we find that the odds of taking fiscal adjustments increase when market sentiment becomes poorer. This result is consistent with De Grauwe and Ji (2012) who suggested that governments are more willing to consolidate their fiscal policy when market sentiment is negative. Our findings do not reject the ‘crisis hypothesis’; they just show that governments are less likely to take fiscal adjustments in times of strong and extreme vulnerability. Moreover, the theory also suggests the existence of various lags (recognition, decision, implementation, and impact) between the time when the problem occurs and the time when policy responds. We can also assume that over periods with fiscal stress, governments might adjust fiscal policy in the sense of a slight improvement of the adjusted primary balance but not in the sense defined in this paper or in the sense found in the literature.

5. Conclusions

Along with the increased interest in assessing fiscal vulnerability in recent years, this paper's value lies in its introduction of a new framework (*V-L-D*) to detect short-term fiscal vulnerability for the European Union countries. *V-L-D* consists of two indicators: one level indicator signalling the vulnerabilities coming from the size of the cyclically adjusted balance and the public debt, and one dynamic indicator capturing the vulnerabilities generated by their changes in the short run. Many of the existing studies researching the assessment of fiscal vulnerability have relied on identifying thresholds for various fiscal or financial variables thought to influence fiscal vulnerability, but many of these thresholds have been estimated based on historical norms. In return, our research provides a fiscal vulnerability indicator which is constructed using thresholds that are identified from periods when governments decided to pursue fiscal consolidation, implying that they confronted some kind of fiscal distress, which did not necessarily lead to a fiscal crisis.

The *V-L-D* categorizes fiscal vulnerability into five classes having scores from zero, which corresponds to non-vulnerability up to 4, which indicates extreme fiscal vulnerability. The *V-L-D* detects short-term fiscal vulnerability because it relies on data collected for the current year and for the previous two years. We believe that governments are short-sighted and even if the forward-looking methodologies of assessing fiscal vulnerability detect vulnerabilities over the next few years, governments will generally not consolidate fiscal policy to address these particular issues in advance, but will act only when the distress becomes unavoidable. Therefore, we decided to place more emphasis on what happened in the recent past. Governments could use the information provided by the *V-L-D* to make changes in fiscal policy to avoid increasing exposure to various risks. Additionally, *V-L-D* could provide useful information for investors when pricing sovereign risk.

In order to test the relevance and usefulness of this framework, we explored the correlation between financial market sentiment and fiscal vulnerability. We conducted this investigation on a balanced panel of 17 EU countries during 2008–13. The results showed that market sentiment turns negative when fiscal

1 policy is strongly or extremely vulnerable. Thus, investors will increase CDS spreads, asking for a
2 higher risk premium when fiscal conditions are deteriorating severely.
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5 Additionally, we employed a logit panel model with random effects in order to investigate if
6 governments are adjusting fiscal policy when it is signalled as vulnerable. Using a panel of 12 EU
7 countries during 2008–13, we found that governments are less likely to adjust during periods of strong
8 and extreme fiscal vulnerability but more prone to adjustment when market sentiment becomes negative
9 and when CDS are increasing.
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16 17 18 19 20 **References:**

21
22
23 Adema, W., Fron, P. and Ladaique, M. (2011) 'Is the European Welfare State Really More Expensive?:
24 Indicators on Social Spending, 1980-2012; and a Manual to the OECD Social Expenditure Database
25 (SOCX)'. OECD Social, Employment and Migration Working Papers, No.124(OECD Publication).
26
27

28
29
30 Afonso, A., Agnello, L., Furceri, D. and Sousa, R. (2009) 'Assessing Long Term Fiscal Developments:
31 A New Approach'. European Central Bank, Working Paper Series No.1032, March 2009.
32
33

34
35
36 Afonso, R. and Rault, C. (2007) 'What Do We Really Know About Fiscal Sustainability in the EU? A
37 Panel Diagnostic'. European Central Bank, Working Paper Series No.820, October 2007.
38
39

40
41 Afonso, A. (2000) 'Fiscal Policy Sustainability: Some Unpleasant European Evidence'. ISEG, Working
42 Paper, No.12/2000/DE/CISEP, August 2000.
43
44

45
46
47 Aizenman, J. and Pasricha, G. (2010) 'Fiscal fragility: what the past say about the future'. NBER,
48 Working Paper, No.16478, October 2010.
49
50

51
52 Alesina, A., Ardagna, S. and Trebbi, F. (2006) 'Who Adjusts and When? The Political Economy of
53 Reforms'. IMF Staff Papers, Vol. 53, Special Issue.
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58
59
60
- Alesina, A. and Ardagna, S. (1998) 'Tales of Fiscal Adjustment', *Economic Policy*, Vol. 13, No. 27, pp.489-585.
- Allen, M., Rosenberg, C., Keller, C., Setser, B. and Roubini, N. (2002) 'A Balance Sheet Approach to Financial Crisis'. IMF, Working Paper, WP/02/210.
- Baldacci, E., McHugh, J. and Petrova, I. (2011) 'Measuring Fiscal Vulnerability and Fiscal Stress: A Proposed Set of Indicators'. IMF, Working Paper, WP/11/94.
- Baldacci, E., Petrova, I., Belhocine, N., Dobrescu, G. and Maazrani, S. (2011) 'Assessing Fiscal Stress'. IMF, Working Paper, WP/11/100.
- Berti, K., Salto, M. and Lequien, M. (2012) 'An early-detection index of fiscal stress for EU countries'. European Commission, Economic Papers 475, December 2012.
- BlackRock Investment Institute (2011) 'Introducing the BlackRock Sovereign Risk Index. A More Comprehensive View of Credit Quality', BlackRock Investment Institute, June 2011.
- Bouthevillain, C. and Quinet, A. (1998) 'The Relevance of Cyclically-Adjusted Public Balance Indicators—The French Case'. Paper presented at Workshop on Public Finance, Perugia, 28-29 November .
- Brixi, P., Shatalov, S. and Zlaoui, L. (2000) 'Managing Fiscal Risk in Bulgaria'. The World Bank, Policy Research, Working Paper 2282, January 2000.
- Bruglio, L., Cordina, G., Farrugia, N. and Vella, S. (2008) 'Economic Vulnerability and Resilience. Concepts and Measurements'. UNU-WIDER Research Paper, No. 2008/55, May 2008.
- Buiter W.H. (2004 revised) 'Fiscal Sustainability'. Paper presented at The Egyptian Center for Economic Studies, Cairo. Available at <<www.willmbuiter.com/ehypt.pdf>>
- Claeys, P. (2007) 'Sustainability of EU fiscal policies: A panel test'. In Institut de Recerca en Economia Aplicada 2007, Documents de Treball 2007/02.

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- Corsetti, G. and Roubini, N. (1996) 'European versus American Perspectives on Balanced-Budget Rules'. *The American Economic Review*, Vol. 86, No. 2, pp. 408-413.
- Corsetti, G. and Roubini, N. (1991) 'Fiscal Deficits, Public Debt, and Government Solvency: Evidence from OECD Countries'. NBER, Working Paper, No.3658.
- Cottarelli, C. (2011) 'The Risk Octagon: A Comprehensive Framework for Assessing Sovereign Risks'. Paper presented at a seminar held at the Sapienza University (Rome, 25 January 2011) and Politeia (London, 26 January 2011).
- Daniel, J., Davis, J., Fouad, M. and Van Rijckeghem, C. (2006) 'Fiscal Adjustments for Stability and Growth'. International Monetary Fund pamphlet series, no.55.
- De Grauwe, P. and Ji, Y. (2012) 'Mispricing of Sovereign Risk and Macroeconomic Stability in the Eurozone'. *Journal of Common Market Studies*, Vol. 50, No. 6, pp.866-880.
- Detragiache, E. and Spilimbergo, A. (2001) 'Crises and Liquidity: Evidence and Interpretation', IMF, Working Paper, WP/01/2.
- Fatas, A. and Mihov, I. (2009) 'The Euro and Fiscal Policy'. NBER, Working Paper, No.14722, February 2009.
- Frankel, J. and Saravelos, G. (2010) 'Are Leading Indicators of Financial Crisis Useful for Assessing Country Vulnerability? Evidence from the 2008-09 Global Crisis'. NBER, Working Paper, No.16047, June 2010, p. 2.
- Furman, J. and Stiglitz, J. (1998) 'Economic Crisis: Evidence and Insights from East Asia'. In Brainard, W. and Perry, G. (eds) *Brookings Papers on Economic Activity*, Vol. 29, No. 2, pp.5-6.
- Ghezzi, P., Keller, C. and Wynne, J. (2010) 'Our measure of fiscal vulnerability: A systematic global approach', Barclays Capital Economic Research, September 10.

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- Greene, J.E. (2012), 'Public Finance: An International Perspective', World Scientific Publishing Company.
- Greiner, A. and Semmler, W. (1999) 'An Inquiry into the Sustainability of German Fiscal Policy: Some Time-Series Tests'. *Public Finance Review*, Vol. 27, No. 2 (March 1999), pp. 220-236.
- Hayes, S. (2011) 'Fiscal vulnerability: a stocktake'. *The IFS Green Budget*, February 2011.
- Hemming, R., Kell, M. and Schimmelpfennig, A. (2003) 'Fiscal Vulnerability and Financial Crisis in Emerging Market Economies'. IMF, Occasional Paper, No. 218.
- Hemming, R. and Petrie, M. (2000) 'A Framework for Assessing Fiscal Vulnerability'. IMF, Working Paper, WP/00/52.
- Jedrzejowicz, T. and Kozinski, W. (2012) 'A framework for fiscal vulnerability assessment and its application to Poland'. Bank for International Settlements, Vol.67, pp.285-294.
- Ghosh, A., Kim, J., Mendoza, E., Ostry, J. and Qureshi, M. (2011) 'Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies'. NBER, Working Paper, No.16782, February 2011.
- Kotlikoff, L. and Hagist, C. (2009) 'Who's Going Broke? Comparing Growth in Healthcare Costs in Ten OECD Countries'. *Hacienda Pública Española*, IEF, Vol.188, No.1 (March), pp.55-72.
- Leiner-Killinger, N. (2011) 'Fiscal Vulnerabilities in the CESEE Countries: the Role of Fiscal Policy Structures and Budgetary Discipline'. Proceedings of OeNB Workshops, No.17, pp.61-77.
- Missale, A. (2012) 'Sovereign debt management and fiscal vulnerabilities'. Bank for International Settlements, Vol.65, pp.157-176.
- Pisani-Ferry, J. (2012) 'Should Europe Emulate the US?'. Project Syndicate. Available at "<http://www.project-syndicate.org/commentary/why-america-s-economy-is-recovering-faster-than-europe-s-by-jean-pisani-ferry>".

Reinhart, C. and Rogoff, K. (2011) 'A Decade of Debt'. NBER, Working Paper, No.16827, February 2011.

Schaechter, A. et al. (2012) 'A Toolkit to Assessing the Fiscal Vulnerabilities and Risks in the Advanced Economies'. IMF, Working Paper, WP/12/11.

Stiglitz, J. E. (2012) 'Monetary Mystification'. Project Syndicate. Accessed at "<http://www.project-syndicate.org/commentary/quantitative-easing-3--qe3--and-the-problems-of-the-fed-and-ecb-s-expansionary-monetary-policy-by-joseph-e--stiglitz>".

Stoian, A. and Iorgulescu, F. (2014) 'Some Stylized Facts on Public Debt Dynamics in the Advanced and Emerging Economies of the European Union'. Paper presented at the 16th INFER Annual Conference, Pescara, Italy, 29-31 May.

Wilcox, D. W. (1989) 'The Sustainability of Government Deficits: Implications of the Present-Value Borrowing Constraints'. *Journal of Money, Credit, and Banking*, Vol.21, No.3, pp.291-305.

APPENDIX 1: *Distance-to-Stability (DS)*

The dynamics of public debt can be described starting with the one period budget constraint:

$$B_t = B_{t-1} + i \cdot B_{t-1} + PB_t \quad (1)$$

where: $B_{t/t-1}$ = nominal general government debt at the end of year $t/t-1$; I = nominal interest rate paid on government debt; PB = primary balance which equals primary government expenditures less tax revenues.

The dynamics of public debt-to-GDP ratio can be derived from equation (1) by division through Y_t .

$$\frac{B_t}{Y_t} - \frac{B_{t-1} \cdot Y_{t-1}}{Y_{t-1} \cdot Y_t} = i \cdot \frac{B_{t-1} \cdot Y_{t-1}}{Y_{t-1} \cdot Y_t} + \frac{PB_t}{Y_t} \quad (2)$$

where Y_t = GDP at current prices.

With small letters for ratios to GDP and y the growth rate of nominal GDP, equation (2) can be rewritten as:

$$b_t - b_{t-1} \cdot \frac{1}{1+y} = b_{t-1} \cdot \frac{i}{1+y} + pb_t \tag{3}$$

Hence, the public debt ratio evolves according to:

$$b_t = \frac{1+i}{1+y} \cdot b_{t-1} + pb_t \tag{4}$$

Now, if government aims at stabilizing the public debt, the condition is that: $b_t = b_{t-1}$ which is consistent with the steady state of public debt to GDP ratio. Keeping the debt on a stable trajectory avoids or diminishes the risk of running an unsustainable fiscal policy in the long run:

$$b_t = \frac{1+i}{1+y} \cdot b_t + pb_t \tag{5}$$

Using equation (5), we can estimate the primary balance (pb_t^*) which allows fulfilling the debt stabilization as in:

$$pb_t^* = \frac{i-y}{1+y} \cdot b_t \tag{6}$$

The *distance-to-stability* represents the difference between the actual and the stabilizing primary balance:

$$D - S = pb_t - pb_t^* \tag{7}$$

It indicates if governments are able to achieve the required primary surplus in order to avoid putting the debt on an unstable path. If $D-S$ is negative, this can create the condition that the public debt to diverge from its steady state. Thus, we have two distinct situations:

$$D - S = \begin{cases} 0, & \text{if } pb_t \geq pb_t^* \\ 1, & \text{if } pb_t < pb_t^* \end{cases} \tag{8}$$

In the case when $D-S$ takes value 0 this indicates that governments managed to stabilize public debt and the absence of fiscal vulnerability and when $D-S$ takes value 1 this show that the government failed in

achieving stabilization and that the level of public debt could induce fiscal discomfort due to a temporarily departure from its steady state.

APPENDIX 2: Tables

Table 1: Fiscal adjustments episodes, 1990-2013

Country	Year	Country	Year
Belgium	1993; 2006; 2012:2013	Lithuania	2010:2013
Bulgaria	2003:2004; 2010:2012	Luxembourg	2000:2001; 2005:2008
Czech Republic	2004; 2010:2013	Hungary	1999:2000; 2003:2004; 2007:2012
Denmark	2003:2004; 2013	Malta	1999:2000; 2004:2005; 2009
Germany	1992:1994; 1996; 2000; 2011:2012	The Netherlands	1993; 1996; 2004:2005; 2011:2013
Estonia	2000; 2009:2010	Austria	1996:1997; 2001; 2005; 2011:2013
Ireland	2000; 2003:2004; 2011:2013	Poland	2011:2012
Greece	1991; 1996; 2005; 2010:2011	Portugal	1992; 2003:2004; 2006:2007; 2011:2013
Spain	1996:1997; 2010:2013	Romania	2010:2012
France	1996; 2011:2013	Slovenia	2012
Croatia	2012:2013	Slovakia	2011:2013
Italy	1991:1993; 1995:1997; 2007; 2011:2013	Finland	1996:1998; 2000
Cyprus	2000; 2004:2007; 2012:2013	Sweden	1996:1998; 2000
Latvia	2000:2001; 2009:2012	United Kingdom	1994:1998; 2001; 2010:2012

Table 2: Episodes of fiscal vulnerability, 1990-2013

Country	<i>Extreme- Year(s)</i>	<i>Strong- Year(s)</i>	<i>Moderate- Year(s)</i>	<i>Low – Year(s)</i>
Belgium	-	1993; 2009	1992	1994; 1996; 2005; 2010:2013
Bulgaria	-	-	2009	2010:2013
Czech Republic	2001:2002	2009	2003; 2010:2012	1999:2000; 2004:2006; 2008; 2013
Denmark	-	2010	1993; 2009	1992; 1994; 2011:2012
Germany	1995	2010	1993; 1996; 2002; 2009	1994; 1997:1999; 2001; 2003:2005
Estonia	-	-	1999; 2008	1998; 2009; 2012
Ireland	2008:2010	2011:2013	-	2002; 2007
Greece	2009	1992:1993; 2004:2005; 2008; 2010:2011	1994; 2001; 2006:2007; 2012:2013	1995:1997; 2000; 2003
Spain	2009	2008; 2010:2012	2013	-
France	-	1993; 1995; 2003; 2009:2010	1992; 1994; 1996; 2011:2013	1990:1991; 1997:1998; 2002; 2004:2005; 2008
Croatia	-	2011	2011:2012	-
Italy	-	1992:1994	1990:1991; 1996; 2005; 2009:2010; 2012:2013	1995; 2001; 2003; 2006; 2008; 2011
Cyprus	2003; 2010	2009; 2011:2012	2013	2002
Latvia	2008	2009	1999; 2010	2000:2003; 2007
Lithuania	2009	2008	1999:2000; 2010:2011	2001:2002; 2012:2013
Luxembourg	-	-	1992; 2009	2002:2004; 2008
Hungary	2006	2002:2003	2004:2005; 2007:2010	1999; 2012
Malta	1997; 2003	1998:1999; 2008	1996; 2004;	2000:2002; 2009; 2011:2012
The Netherlands	-	1995; 2009	2002; 2010; 2012:2013	1992:1993; 2003:2004; 2008; 2011
Austria	-	1995; 2009:2010	1994; 2004	1993; 1996:1997; 2003; 2012:2013
Poland	2010	2009	2003; 2008	1997:1998; 2001:2002; 2004:2006; 2012:2013
Portugal	2005; 2009:2010	1994	1993; 1995:1996; 2001:2002; 2006; 2011:2013	1992; 1998; 2003:2004; 2008
Romania	2009	2007:2008; 2010:2011	2012	2006
Slovenia	2013	2009:2011	2012	2000:2001; 2003:2005; 2008
Slovakia	2000; 2010	1999; 2009	2001:2002; 2011:2013	2008
Finland	-	1992:1993; 2009:2010;	1991; 1994; 2013	1995:1996; 2012
Sweden	-	-	-	1996; 2002; 2009; 2011; 2013
United Kingdom	1993; 2009:2010	1992; 1994; 2008; 2011	1995; 2002:2003; 2012:2013	1996; 2004:2007

APPENDIX 3: Dataset

For the purpose of our study, we used a dataset consisting of annual data for several key fiscal variables for 28 countries of the European Union. The data was provided by Ameco. The complete list of the variables included in our investigation is presented below:

(1) Variables used for calculating *distance-to-stability*:

- b_t is the general consolidated gross debt-to-GDP ratio at time t ;
- pb_t is the primary balance-to-GDP ratio at time t (net lending (+) or net borrowing (-));
- y is the GDP growth rate calculated as the percentage variation of the GDP;
- i is the implicit interest rate on public debt (the interest payments for current year ratio to the public debt from previous year).

(2) Variables used for identifying the *fiscal adjustments episodes*:

- Cyclically adjusted primary balance percentage to potential GDP.

(3) Variables used in calculating V employing $V-L-D$ framework:

- General government consolidated gross debt-to-GDP ratio;
- Cyclically adjusted balance percentage to potential GDP.

The dataset ranges from 1990 to 2013. However, considering that our investigation develops on multiple layers, that it takes into consideration several variables, and that it includes 28 countries, the data might not be available for the entire range. In the table below, we present the dataset used for each country and for each of the three important stages of our analysis: identifying the *Fiscal adjustments* episodes; establishing the *Threshold* for *CAB* and *Debt*; establishing the final scores for the overall *Vulnerability*.

Country	Period				Country	Period			
	<i>Fiscal adjustment</i>	<i>Threshold</i>		<i>Vulnerability</i>		<i>Fiscal adjustment</i>	<i>Threshold</i>		<i>Vulnerability</i>
		<i>CAB</i>	<i>Debt</i>				<i>CAB</i>	<i>Debt</i>	
Belgium	1990:2013	1990:2013	1990:2013	1992:2013	Lithuania	1997:2013	1998:2013	1995:2013	1999:2013
Bulgaria	2002:2013	2002:2013	1997:2013	2003:2013	Luxembourg	1990:2013	1990:2013	1990:2013	1992:2013
Czech Republic	1997:2013	1997:2013	1995:2013	1999:2013	Hungary	1997:2013	1997:2013	1995:2013	1999:2013
Denmark	1990:2013	1990:2013	1990:2013	1992:2013	Malta	1995:2013	1995:2013	1995:2013	1997:2013
Germany	1990:2013	1990:2013	1991:2013	1993:2013	The Netherlands	1990:2013	1990:2013	1990:2013	1992:2013
Estonia	1995:2013	1995:2013	1995:2013	1997:2013	Austria	1990:2013	1990:2013	1990:2013	1992:2013
Ireland	1990:2013	1990:2013	1990:2013	1992:2013	Poland	1995:2013	1995:2013	1995:2013	1997:2013
Greece	1990:2013	1990:2013	1990:2013	1992:2013	Portugal	1990:2013	1990:2013	1990:2013	1992:2013
Spain	1995:2013	1995:2013	1990:2013	1997:2013	Romania	2002:2013	2002:2013	1995:2013	2004:2013
France	1990:2013	1990:2013	1990:2013	1980:2013	Slovenia	1998:2013	1998:2013	1995:2013	2000:2013
Croatia	2009:2013	2009:2013	2009:2013	2011:2013	Slovakia	1997:2013	1997:2013	1995:2013	1999:2013
Italy	1990:2013	1990:2013	1990:2013	1986:2013	Finland	1990:2013	1990:2013	1990:2013	1992:2013
Cyprus	1998:2013	1998:2013	1995:2013	2000:2013	Sweden	1993:2013	1993:2013	1994:2013	1996:2013
Latvia	1997:2013	1997:2013	1995:2013	1999:2013	UK	1990:2013	1990:2013	1990:2013	1992:2013

For Review Only

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