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# **DEBT SUSTAINABILITY OF EU MEMBER STATES: A CLUSTER ANALYSIS**

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**Abstract:** The aim of this article is to perform a cluster analysis of the EU member states in terms of their public debt sustainability. To this end, the existing theoretical constructs related to the concept of debt sustainability were reviewed in to determine the advantages and disadvantages of certain indicators for assessing debt sustainability. In the course of the research, the methodological grounds of the analysis were defined and the countries were grouped into four clusters.

**Key words:** public debt, debt sustainability, European Union

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## **Introduction**

**T**he 2008 economic and financial crisis posed serious challenges to the fiscal policies of the EU member states. In view of the steadily accumulating levels of sovereign debt and the sovereign debt crisis which recently affected the Eurozone, sovereign debt sustainability is becoming increasingly important.. The **object of the research** is the sustainability of sovereign debt of EU member states. Its **subject** are the similarities and differences among these countries in terms of their debt sustainability. The **main objective** of the article is to categorize the EU members states into clusters according to pre-defined sovereign debt sustainability indicators and to determine the similarities and differences both among the countries in a given cluster as well as across countries categorized in different clusters. The

**research thesis** the author intends to prove is that strengthening fiscal discipline at EU level would smooth the differences within the clusters of countries with similar degree of debt sustainability.

## **I. The concept of debt sustainability**

By analyzing the sustainability of their sovereign debt, governments can become aware of the risks their fiscal policies may face. In 2002, the International Monetary Fund defined *debt sustainability* as a country's capacity to finance its policy objectives and service its debt without unduly large adjustments, which could otherwise compromise its stability (International Monetary Fund, 2002). According to the concept proposed by the IMF, sustainability combines solvency, liquidity and vulnerability. A government is solvent in the event that the net present value of outstanding debt is less than the net present value of future primary budget balance (European Parliament, 2018). Scientific publications quite often refer to solvency and liquidity as equivalent terms. However, it should be noted that liquidity refers to the ability of the government to repay interests and principal on sovereign debt without facing financial difficulties because of their access to available financial resources. A government becomes vulnerable when there is a danger of an economic crisis caused by insolvency and impaired liquidity of the national economy.

IMF's definition of debt sustainability implies that it may be impaired in the following cases:

- The government has to undertake measures to restructure its debt;
- Sovereign debt increases at faster rates than the capacity of the economy to service the debt;
- The government has realized that the repayment of the accumulated debt will require significant financial resource.

Debt sustainability analyses should take into account certain factors, among which the quality and efficiency of institutions engaged in fiscal policy implementation, political stability/instability in the country, and institutional responsibilities with respect to sovereign debt management (European Commission, 2019). The impact of the political environment in a country on its debt sustainability has been studied extensively. For example, Alesina & Drazen (1991) point out that strong political polarization has a negative effect on a country's instability and its ability to repay its debt. Kohlscheen (2005) compares the default likelihood of parliamentary and presidential republics and reaches the conclusion that the default likelihood of presidential republics is much higher than parliamentary republics because parliaments have greater

control over their national governments executive. Weder & Rijckeghem (2009) proved that the political environment influences debt performance but noted that the role of a set of other variables should be taken into account as well. These include the openness of the economy, its foreign exchange reserves, economic growth and the level of corruption in the country.

The institutional factor also plays a crucial role in debt sustainability studies. Reinhart et al. (2003) assume that institutional failures are a significant barrier to a country's debt *tolerance*, noting that countries which have already had difficulties to service their foreign debt are would very likely have the same difficulties in the future. Fournier & Bètin (2018) prove that government effectiveness is a major determinant of sovereign debt sustainability. Their analysis is based on three broad categories of sets of variables. The first category refers to the process by which governments are selected, monitored and replaced, thus capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government. The second category refers to the ability of the government to formulate and pursue sound policies, capturing perceptions of their quality and regulations that permit and promote private sector development. The third category refers to the rules of law and control of corruption.

Apart from the above scientific concept regarding debt sustainability, we should also consider the methods that can be used to measure it. Generally, debt sustainability can be measured by the debt-to-GDP indicator. It shows the extent of a country's debt tolerance taking into account the available resources. A serious challenge for government debt management is to identify the value of its debt-to-GDP ratio at which its debt is sustainable. The main problem here is that at a certain level of this ratio some countries are debt *tolerant* while others are not due to the different capacities and viability of their economies (Gechev, 2005). The most commonly accepted threshold for a sustainable level of debt-to-GDP is 60% (one of the Maastricht criteria for Eurozone membership).

It should be noted that the debt-to-GDP ratio has certain shortcomings including the fact that it does not take into account the debt maturity structure and related interest payments and their effect for the state budget. In this regard, Minasyan (2004) points out that economic theory cannot derive a *single aggregate measure* to assess *debt tolerance*, and therefore, debt sustainability assessment is perceived as a *creative* task. The shortcomings of the debt-to-GDP indicator can be overcome by combining it in the analysis with the short-term debt-to-GDP, long-term debt-to-GDP, interest payments-to-GDP, interest payments-to-government spending and interest payments-to-tax revenue and social security contributions ratios.

## II. Methodology of the analysis

The aim of the analysis is to identify the similarities and differences that exist between EU Member States in terms of debt sustainability. Using a cluster analysis, the EU member states can be grouped into homogeneous groups (clusters) based on the some of the indicators discussed above. Debt sustainability is measured through six indicative ratios:

### ➤ *Short-term debt, % of GDP (SHD)*

The short-term debt-to-GDP indicator reveals the time structure of the debt, and in particular shows the relative share of short-term debt instruments in a country's debt portfolio. A significant advantage of short-term debt is that it can help countries respond in a timely manner to the urgent need to finance emergency/priority policies in certain areas of public life. At the same time, the downside of short-term borrowing is that the government must maintain a constantly available financial resource to repay maturing short-term liabilities. For the purposes of this study, short-term debt comprises central governments' financial instruments, loans, and debt securities with maturity of up to one year.

### ➤ *Long-term debt % of GDP (LD)*

The purpose of the long-term debt-to-GDP indicator again is the same as that of the previous indicator, i.e. it takes into account the time structure of the debt. A significant advantage of long-term borrowing is that it provides governments with a longer time horizon in which they clearly plan the necessary financial resources to pay interest and principal costs, and reduce the risk of debt refinancing, and at the same time defer future debt payments. Long-term debt includes central governments' financial instruments, loans and debt securities with maturity exceeding one year.

### ➤ *Sovereign debt % of GDP (GD)*

The ratio of sovereign debt (including the debts of the central government, the local government and the social security funds) to GDP shows the resources available to an economy to service its debt. The indicator is also part of the socio-economic indicators for sustainable development.

### ➤ *Interest payments (% of GDP) (IP)*

This indicator is included in the analysis because interest payments on sovereign debt are essential in planning the expenditure part of the central government's budget. This ratio shows the extent to which a national economy is able to service its debt. The higher the ratio, the more financial resources are taken out of the economy rather than used for investment purposes, for example. On the other hand, higher levels of GDP mean that the country would service its debt more easily.

➤ ***Interest payments, % of tax and social security revenue (IPS)***

Interest payments as a percentage of tax and social security contributions revenue shows the ability of a country to cover its interest payments with the revenue from taxes and social security contributions.

➤ ***Interest payments, % of government spending (IPE)***

This index shows the relative share of interest payments of sovereign debt in the total government expenditures. When a government has to allocate more resources from the national budget to cover interest payments, less funds will be available for important public services such as healthcare and education. Conversely, when less funds are allocated for interest payments, the government will have more resources for current and capital budget expenditures. Any increase of interest payments quite logically reduces the funds available for other payments and decreases the quality and quantity of certain public services (Zahariev, 2000).

The cluster analysis was performed with the data for 2011 and 2017 of the selected indices. The importance of 2011 stems from the fact that in that year the EU adopted measures to strengthen the fiscal discipline due to the steadily increasing levels of government debt and budget deficits. Within these measures several institutions (including the European Financial Stability Mechanism and the European Financial Stability Facility) were set up to bail out certain EU member states with severely impaired financial stability. In the same year certain amendments to the Stability and Growth Pact were approved, and a package of six normative documents (one directive and five regulations) was adopted to improve the coordination of fiscal policies at EU level and to strengthen public finances.

The data for 2017 was used to check whether the measures adopted in 2011 decreased or increased the similarities or differences among the member states since statistical data for all member states is available from Eurostat.

The analysis was performed using the K-means clustering method for four clusters determined in advance. The countries were classified according to their degree of debt sustainability as countries with no sustainability, weak sustainability, moderate sustainability and strong sustainability. Cluster centres were calculated after all countries were assigned to the respective clusters.

### **III. Clustering of the EU member states according to their debt sustainability**

Prior to interpreting the clustering results we should determine the statistical significance of the studied indicators for the two years selected for

analysis and single out the variable with the strongest influence with respect to the differentiation.

The analysis of variance (ANOVA, *Table 1*) shows that the significance levels of all the variables studied in both years (2011 and 2017) are below the risk of error of 5% and therefore they are considered statistically significant. It should be borne in mind that the results of the F-test are descriptive and cannot be interpreted as hypotheses for averages. However, a conclusion can be drawn about the differentiation effect of the studied variables. Obviously, in both years, cluster formation was influenced most by the government debt-to-GDP variable and least by the interest payments-to-GDP variable.

*Table 1*

***Statistical significance of debt sustainability variable in 2011 and 2017***

2011						
Variable	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
IP	16.131	3	0.415	24	38.908	0.000
GD	10150.065	3	172.265	24	58.921	0.000
SHD	36.141	3	11.129	24	3.247	0.039
LD	8196.238	3	113.079	24	72.482	0.000
IPE	50.903	3	2.212	24	23.007	0.000
IPS	105.118	3	4.806	24	21.871	0.000
2017						
Variable	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
IP	6.035	3	0.417	24	14.477	0.000
GD	11220.365	3	155.53	24	72.143	0.000
SHD	36.899	3	9.69	24	3.808	0.023
LD	9246.396	3	95.504	24	96.817	0.000
IPE	25.101	3	2.858	24	8.781	0.000
IPS	33.834	3	4.176	24	14.28	0.001

**Source:** Cluster analysis function in SPSS using Eurostat data.

Once the statistical significance of the indicators selected for analysis has been verified, we proceed to interpret the clustering results obtained for the formed groups of countries (*see Table 2*).

**Cluster One** (countries with no sustainability) includes only one country (Greece) in both years. Greece is characterized by extremely high government debt-to-GDP ratios, which significantly (nearly three times) exceed the 60% benchmark.

Table 2

**Clustering of the EU member states and distances to the respective cluster centroids in 2011 and 2017**

Clusters	2011 Distance to the cluster centroid	2017 Distance to the cluster centroid
Cluster One	Greece (0.000)	Greece (0.000)
Cluster Two	Italy (28.810) Portugal (24.138) Hungary (20.951) Germany (18.908) Ireland (17.895) United Kingdom (16.909) Belgium (13.937) Austria (13.645) France (9.693)	Italy (28.310) Portugal (17.541) Cyprus (14.901) France (14.094) Spain (12.374) Belgium (6.318)
Cluster Three	Malta (21.067) Spain (18.046) Latvia (16.919) Slovakia (15.424) Cyprus (13.373) Denmark (13.064) Finland (11.735) Slovenia (11.178) Croatia (10.969) Netherlands (8.059) Poland (4.611)	United Kingdom (23.957) Malta (21.154) Austria (19.491) Poland (18.575) Slovakia (18.562) Croatia (18.086) Slovenia (14.280) Netherlands (13.386) Hungary (12.180) Finland (9.148) Ireland (5.668) Germany (3.970)
Cluster Four	Estonia (27.461) Czech Republic (17.228) Lithuania (16.332) Bulgaria (14.608) Sweden (12.864) Luxembourg (10.715) Romania (8.970)	Estonia (30.096) Lithuania (12.654) Latvia (11.757) Sweden (11.678) Luxembourg (11.474) Bulgaria (7.114) Czech Republic (6.695) Romania (6.294) Denmark (5.010)

Source: Cluster analysis function in SPSS using Eurostat data.

In 2011, *Cluster Two* (countries with weak sustainability) comprised Belgium, Germany, Ireland, France, Italy, Hungary, Austria, Portugal, and the United Kingdom. They are characterized by *relatively high levels* of

government debt-to-GDP and interest payments-to-GDP ratios. In 2017, the composition of this cluster was quite different because the UK, Austria, Hungary, Ireland and Germany were not part of it and were substituted with Spain and Cyprus instead.

The cluster analysis allow us to calculate the distance of each country to the cluster centre and the average intra-cluster distance, which shows whether the countries converge or diverge within the cluster (Angelov, 2019). The countries in the second cluster clearly converge in terms of their debt sustainability because their average intra-cluster distance decreased by almost three percentage points between 2017 and 2011.

**Cluster Three** comprises countries with medium sovereign debt sustainability. In 2011, there were seven countries in this cluster and in 2017 their number was eight. The differences in the composition of the cluster in the two analysed years shows a marked improvement in terms of debt sustainability between 2017 and 2011. For example, in 2017 Latvia and Denmark were moved from this cluster into Cluster Four due to their improved debt sustainability indicators and were substituted with the UK, Austria, Hungary, Ireland and Germany, which also improved their debt sustainability and moved from Cluster Two (in 2011) to the group of countries with moderate debt sustainability. The only negative change in 2017 is the relocation of Spain to Cluster Two. The relocation of two countries to Cluster Four and five countries from Cluster Two reduced the degree of convergence in Cluster Three and in 2017, the average intra-cluster distance decreased by 1.7 percentage points compared to 2011.

**Cluster Four** comprises countries with strong sovereign debt sustainability. In 2011, it comprised seven countries - Estonia, Czech Republic, Lithuania, Bulgaria, Sweden, Luxembourg and Romania, and in 2017, two more are added - Latvia and Denmark. The comparative analysis of the average intra-cluster distances for the fourth group of countries in the two analysed years shows that in 2017 their convergence improved (i.e. the average intra-cluster distance decreased by 4.04 percentage points in 2017 compared to 2011).

Bulgaria, as a country in the fourth cluster (See Table 2), has extremely low levels of government debt compared to the other EU member states. In her analysis of Bulgaria's competitiveness, Marikina (2017) emphasizes the significance of its *macroeconomic environment* and points out that the country's *budget balance*, *government debt* and *credit rating* contribute to its stable macroeconomic environment, and hence have a positive impact on its competitiveness. On the other hand, although its government debt-to-GDP ratio is significantly lower than the benchmark (60%), our country has a lower average income level than the other Member States, which, combined with the



negative demographic trends, has a negative impact on labour supply and its long-term economic growth (Ralev, 2019). We need an in-depth analysis to find out how its low sovereign debt can be combined with other factors to increase the growth and convergence of our economy considering our intention to enter the Eurozone.

The results of the cluster analysis are then used to calculate the distances between the final cluster centres (see *Table 3*). The separate analyses for 2011 and 2017 lead to the conclusion that the greatest convergence is observed among countries with moderate and strong debt sustainability, and the lowest level of convergence exists between the countries with no sustainability and strong sustainability.

*Table 3*

***Distances between final cluster centres***

<b>Distances between final cluster centres</b>	<b>2011</b>	<b>2017</b>
<b>Clusters One and Four</b>	204.105	198.123
<b>Clusters One and Three</b>	164.208	150.959
<b>Clusters One and Two</b>	116.431	94.819
<b>Clusters Three and Four</b>	39.911	47.241
<b>Clusters Two and Four</b>	88.342	103.471
<b>Clusters Two and Three</b>	48.621	56.264

**Source:** Cluster analysis function in SPSS using Eurostat data.

*Table 4* shows the final cluster centres. As we already mentioned, **Cluster One** includes only one country (Greece), which has extremely high levels of government debt. In 2011, Greece faced serious financial difficulties caused by its growing budget deficit, political uncertainty and the need to revolve its outstanding debt (Nikolova, 2017). To overcome the crisis, the country borrowed several loans from the International Monetary Fund, the European Central Bank, the European Commission and the European Financial Stability Facility with the promise to implement an austerity program aiming to strengthen the fiscal discipline and improve its debt sustainability.

Although the level of the government debt-to-GDP indicator in Greece in 2017 was slightly above the value recorded in 2011, its other indicators included in the analysis improved significantly. The interest payments-to-government spending decreased by 6.86 percentage points in 2017 compared to 2011. A significant improvement is also observed with regard to its interest payments-to-GDP ratio, which was almost two times lower in 2017 compared to 2011. A marked improvement is also observed for the interest payments-to-tax revenue and social security contributions ratio, from 20.21% in 2011 to

7.51% in 2017. This, in turn, allows more fiscal revenue resources to be allocated for implementation of programs in important public sectors.

Table 4

*Final cluster centres*

INDEX/CLUSTERS		IP	GD	SHD	LD	IPE	IPS
2011	Cluster One	7.30	172.10	6.65	164.89	13.46	20.21
	Cluster Two	3.47	94.70	8.02	78.95	7.00	9.16
	Cluster Three	2.13	55.78	4.48	50.30	4.67	6.28
	Cluster Four	1.01	27.00	3.14	22.95	2.47	3.35
2017	Cluster One	3.10	176.20	9.08	163.76	6.60	7.51
	Cluster Two	2.83	108.65	6.56	97.27	6.18	7.24
	Cluster Three	1.86	66.13	3.57	60.64	4.52	5.28
	Cluster Four	0.74	31.49	1.79	28.84	1.97	2.31

Source: Cluster analysis function in SPSS using Eurostat data.

Despite the fact that Greece remains in the first cluster and is still considered debt-unsustainable, the reforms implemented in the last few years have led to a significant improvement of its indicators based on interest payments, which is a serious step towards strengthening the country's sustainability to sovereign debt.

The distinctive feature of the countries included in *Cluster Two* is the high and gradually increasing levels of their government debt-to-GDP ratios in the period 2011-2017. Some of these countries (e.g. Ireland, Italy, Portugal, Spain, Hungary and Cyprus) received financial assistance (*bail-out loans*) to increase their fiscal discipline and strengthen their sovereign debt sustainability. Due to this additional financial resource, combined certain reforms, some of the contributes classified as Cluster Two in 2011 were classified as Cluster Three in 2017 and to improve their debt sustainability to a certain extent. However, despite the fact that some of the countries in Cluster Two improved their interest payments-related ratios, the overall level of their sovereign debt-to-GDP ratios remains well above the 60% benchmark. A positive indication for their growing debt sustainability is the fact that in 2011 all of these countries were in an Excessive Deficit Procedure, while in 2017 the procedure was applied only to Spain and France. This procedure is applied to EU member states who systematically fail to meet the criteria for consolidated debt-to-GDP (60%) and planned or actual budget deficit-to-GDP (3%) ratios.

*Cluster Three* comprises countries that are classified as moderately resilient to sovereign debt. In 2011, their average sovereign debt-to-GDP ratio remained below the 60% benchmark while in 2017 it was slightly above it.

However, in 2017 their debt sustainability was slightly better compared to 2011. Their average interest payments-to-GDP ratio decreased from 2.12% in 2011 to 1.85% in 2017. The ratio of interest payments to tax revenues and social security contributions decreased by about one percentage point in 2017 compared to 2011. All the countries included in this cluster in the two surveyed years were subject to the Excessive Deficit Procedure in 2011. The only exceptions are Croatia and Finland, which terminated the procedure in July 2011. A significant improvement was observed in 2017, when none of these countries exceeded the deficit benchmark (the procedure was terminated in June 2017 for Croatia and in December 2017 for the UK).

The countries in *Cluster Four* maintain low levels of government debt, both in absolute terms and as a percentage of GDP. In 2011, the government debt-to-GDP ratio of all countries in the cluster was below 40%, and in 2017 it was below 41%. According to the maturity structure of their debt, these countries prefer long-term debt instruments (securities and loans) over short-term ones, which, in turn, allows them to plan in advance the interest and principal payments. On average, in 2011, their short-term debt-to-GDP ratios were about 3% and in 2017 - about 2%. Prioritizing long-term debt to short-term debt reduces the risk of refinancing and restructuring their sovereign debt.

The countries in *Cluster Four* have extremely low levels of interest payments on their sovereign debt. Their average interest payments-to-GDP ratio was below 1.8% in 2011 and 1.3% in 2017. The countries in this cluster have low ratios of interest payments to government spending, with the indicator being below 4% in both 2011 and 2017. Another significant feature of this cluster of countries, which is a proof for their debt sustainability, is that it includes countries (e.g. Estonia, Luxembourg and Sweden) against which the Excessive Deficit Procedure has never been launched.

## Conclusion

The clustering analysis identified four relatively homogeneous groups of countries with converging sovereign debt sustainability. The analysis singled Greece in a separate cluster as a country with no sustainability and with far worse ratios than all other member states. The countries in the second and third clusters (countries with weak and moderate sustainability) have greater degree of convergence both within the individual clusters and in terms of distances between final cluster centres. The countries in the fourth cluster are characterized by strong sovereign debt sustainability due to the relatively low values of their sustainability ratios.

The comparative analysis of those clusters in 2011 and 2017 shows that the adoption of stricter fiscal discipline results in their convergence in terms of their debt sustainability indicators. An integral part of future research on sovereign debt sustainability should be some of the major fiscal risks to which the European Commission (2017) attributes high budget deficits, rising debt levels, relatively low economic growth and an aging population.

## References

- Angelov, A. (2019). Publichni razkhodi za obrazovanie v stranite-chlenki na ES: klasteren analiz. Narodnostopanski arkhiv, Svishtov: Akademichno izdatelstvo „Tsenov“, vol. 1, pp. 59-74. Retrieved from: <https://dlib.unisvishtov.bg/bitstream/handle/10610/4058/4f0f725188fcd61d0f435ef7faf4fa1a.pdf?sequence=1>
- Gechev, R. (2005). Ustoichivo razvitie: sistemoobrazuvashiti faktori i regulativni mekhanizmi, *Disertatsionen trud za prisazhdane na nauchna stepen „doktor na ikonomicheskite nauki“*, Sofia: University of National and World Economy.
- Zahariev, A. (2000). Defitsitnoto finansirane v Republika Bŭlgariya. Sbornik s dokladi ot nauchna konferentsiya: *Fiskalnata strategiya na Republika Bulgaria i natsionalnite ikonomicheski prioriteti v protsesa na prisaedinyavane kam Evropeiskiya sayuz*, Sofia: UNWE Publishing House, pp. 95-104.
- Marikina, M. (2017). *Konkurentosposobnost na bdlgarskoto stopanstvo – konkurentni predimstva i nedostatatsi*, Sofia: UNWE Publishing House.
- Minasyan, G. (2004). *Vanshen dalg: Teoria, praktika, upravlenie*. Sofia: Ciela.
- Nikolova, V. (2017). Dalgova politika v stranite ot Evropeiskiya sayuz. Sbornik s dokladi ot mezhdunarodna nauchna konferentsia: *Ikonomicheski predizvikelstva: migratsiya, globalizatsiya ustoichivost, politiki*, Sofia: UNWE Publishing House, pp. 297-304. Retrieved from: [https://www.unwe.bg/Uploads/Conference/Documents/economics-conference\\_2018\\_70019\\_Economic\\_challenges\\_migration\\_%20globalization\\_sustainability\\_policies.conference.2016.pdf](https://www.unwe.bg/Uploads/Conference/Documents/economics-conference_2018_70019_Economic_challenges_migration_%20globalization_sustainability_policies.conference.2016.pdf)
- Raleva, St. (2019). Strukturni karakteristiki na ikonomicheskia rastezh v Bulgaria, Sbornik s dokladi ot mezhdunarodna nauchna konferentsiya: *Ikonomicheski predizvikelstva: razvitie, blagosustoyanie, integratsiya*, Sofia: St. Kliment Okhridski University Publishing House, pp. 33-49.
- Alesina, A., & Drazen, A. (1991). Why are stabilizations delayed? *American Economic Review*, 81 (5), 1170-1188. Retrieved November 9, 2019

- from [https://dash.harvard.edu/bitstream/handle/1/4553028/alesina\\_why\\_stabilizations.pdf?sequence=2](https://dash.harvard.edu/bitstream/handle/1/4553028/alesina_why_stabilizations.pdf?sequence=2)
- European Commission (2017). Debt sustainability monitor 2016, *European Economy, Institutional paper 047*. Retrieved November 9, 2019 from [https://ec.europa.eu/info/sites/info/files/ip047\\_en.pdf](https://ec.europa.eu/info/sites/info/files/ip047_en.pdf)
- European Commission (2019). Fiscal sustainability report 2018: Volume 1, *European Economy, Institutional paper 094*. Retrieved November 9, 2019 from [https://ec.europa.eu/info/sites/info/files/economy-finance/ip094\\_en\\_vol\\_1.pdf](https://ec.europa.eu/info/sites/info/files/economy-finance/ip094_en_vol_1.pdf)
- European Parliament (2018). *Debt sustainability assessments: The state of the art*. Retrieved November 9, 2019 from [http://www.europarl.europa.eu/RegData/etudes/IDAN/2018/624426/IPOL\\_IDA\(2018\)624426\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/IDAN/2018/624426/IPOL_IDA(2018)624426_EN.pdf)
- Fournier, J., & Bètin, M. (2018). Sovereign defaults: Evidence on the importance of government effectiveness, *OECD Economics department working papers № 1494*. Retrieved November 9, 2019 from <https://www.oecd-ilibrary.org/docserver/e6eb6668-en.pdf?expires=1572798670&id=id&acname=guest&checksum=9F8AA217A4DE01700F0B6F0795B464ED>
- International Monetary Fund (2002). *Assessing sustainability*. Retrieved November 9, 2019 from <https://www.imf.org/external/np/pdr/sus/2002/eng/052802.pdf>
- Kohlscheen, E. (2005). Sovereign risk: constitutions rule, *Warwick economic research papers №731*. Retrieved November 9, 2019 from [http://ageconsearch.umn.edu/record/269624/files/working\\_paper\\_731.pdf?subformat=pdfa](http://ageconsearch.umn.edu/record/269624/files/working_paper_731.pdf?subformat=pdfa)
- Reinhart, C., Rogoff, K., & Savastano, M. (2003). Debt intolerance, *Brookings Papers on Economic Activity, Vol. 1*, pp. 1-74. Retrieved November 9, 2019 from <https://mpira.ub.uni-muenchen.de/13932/1/rrs.pdf>
- Weder, B., & Rijkceghem, C. (2009). Political institutions and debt crises, *Public choice 138 (3-4)*, 387-408. Retrieved November 9, 2019 from <http://research.sabanciuniv.edu/11452/1/fulltext3.pdf>

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