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The EU Fiscal Risk Matrix – from government debt to climate liabilities

Abstract

The aim of the article is to identify the main components of government overall liabilities based on the Fiscal Risk Matrix classification introduced by the World Bank in 1999, and to estimate the amount and structure of these liabilities in European Union countries (EU Fiscal Risk Matrix). The climate liabilities definition and methodology included in the EU Fiscal Risk Matrix is also a novelty of the research. The study covered EU member states in the period 2018–2019, taking into account available data from the Eurostat database. On this basis, the EU Fiscal Risk Matrix was developed with the estimated structure of the burden of government liabilities for individual countries and the EU as a whole. The article used statistical and comparative analysis. The major conclusion of our research involves the proposal to implement a unified European methodology of government overall liabilities classification based on the EU Fiscal Risk Matrix to assess the fiscal debt burden and transparency of fiscal policy.

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Introduction

Public debt is a constantly recurring topic of consideration among economists, especially in the context of its most broadly understood negative effects. As early as in 1752, D. Hume in his essay *Of Public Credit* stated directly that there were only two events possible: “either the nation must destroy public credit, or public credit will destroy the nation.”¹ Similarly, D. Ricardo referred to the public debt as “one of the most terrible scourges which was ever invented to afflict a nation,” “a system which tends to make us less thrifty, to blind us to our real situation.”² Then, A. Smith “argued that government borrowing would deprive society of resources which could

1 humesociety.org, <https://davidhume.org/texts/empl2/pc> [accessed: 10 August 2021].

2 *The Works and Correspondence of David Ricardo*, ed. P. Sraffa, Cambridge 1951, p. 197.

be invested more productively. He also noted that beyond a certain threshold debt inevitably leads to national bankruptcy.³ In the same context, E.D. Domar stressed that “the problem of the debt burden is a problem of an expanding national income,” asking the question: “so how can a rapidly rising income be achieved?”⁴

The departure from the traditional theory of public finance in the form of a balanced public budget has put most governments on a dangerous path of constantly increasing the borrowing needs of the state budget due to growing investment, social, as well as political needs. Much previous academic research has therefore focused on the analysis of the multilateral consequences of debt and its impact. Examples of this type of studies include:

- negative long-term relationship with the economic growth,⁵
- reducing savings and capital accumulation,⁶
- higher real interest rates and lower private investment,⁷
- strengthening fiscal rule,⁸
- hidden debt and fiscal illusion,⁹
- the crowding out effect,¹⁰
- income inequalities,¹¹
- uncertainty or expectations of the future of public finance,¹²
- the moral aspects and the burden for future generations.¹³

3 F. Balassone, D. Franco, S. Zotteri, *Public Debt: A Survey of Policy Issues*, [in:] *Public Debt, Banca d'Italia*, 1 April 2004, p. 27, <https://doi.org/10.2139/ssrn.2040728>.

4 E.D. Domar, *The “Burden of the Debt” and the National Income*, “The American Economic Review” 1944, Vol. 34, No. 4, p. 166.

5 Cf., e.g.: R.J. Barro, *Government Spending in a Simple Model of Endogenous Growth*, “Journal of Political Economy” 1990, Vol. 98, Issue 5; D.W. Elmendorf, N.G. Mankiw, *Government Debt*, “NBER Working Paper” 1998, No. 6470; C.M. Reinhart, K.S. Rogoff, *Growth in a Time of Debt*, “NBER Working Paper” 2010, No. 15639, <https://doi.org/10.3386/w15639>.

6 Cf., e.g.: P.A. Diamond, *National Debt in a Neoclassical Growth Model*, “The American Economic Review” 1965, Vol. 55, pp. 1126–1150; O.J. Blanchard, *Debt, Deficits, and Finite Horizons*, “Journal of Political Economy” 1985, Vol. 93, Issue 2.

7 Cf., e.g., T. Laubach, *New Evidence on the Interest Rate Effects of Budget Deficits and Debt*, “Journal of the European Economic Association” 2009, Vol. 7, Issue 4, <https://doi.org/10.1162/jeea.2009.7.4.858>.

8 Cf., e.g.: G. Kopits, S.A. Symansky, *Fiscal Policy Rules*, “IMF Occasional Paper” 1998, No. 162; X. Debrun *et al.*, *Tied to the mast? National fiscal rules in the European Union (Constitutions, politics, and economics)*, “Economic Policy” 2008, Vol. 23, Issue 54.

9 Cf., e.g.: C. Kane, R. Palacios, *The Implicit Pension Debt*, “Finance & Development” 1996, Vol. 33, Issue 2; H. Kharas, D. Mishra, *Fiscal Policy, Hidden Deficits, and Currency Crises*, [in:] *World Bank Economists’ Forum*, Vol. 1, eds. S. Devarajan, F.H. Rogers, L. Squire, Washington, D.C. 2001.

10 Cf., e.g., D.W. Elmendorf, N.G. Mankiw, *op. cit.*

11 Cf., e.g., N.G. Mankiw, *The Savers-Spenders Theory of Fiscal Policy*, “NBER Working Paper” 2000, No. 7571.

12 Cf., e.g., V.K. Teles, C.C. Mussolini, *Public debt and the limits of fiscal policy to increase economic growth*, “European Economic Review” 2014, Vol. 66, <https://doi.org/10.1016/j.eurocorev.2013.11.003>.

13 Cf., e.g., J.M. Buchanan, *Public Principles of Public Debt: A Defense and Restatement*, Liberty Fund, Indianapolis 1999.

The constantly growing government liabilities all over the world, especially in the face of emerging economic crises, constitute a significant source of current and future risk for public finance. Contemporarily, special attention has been paid to this problem since the 1980s, when appeared the first collective studies of international institutions, such as the World Bank, the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD), dedicated directly to this topic.

More and more often, a critical approach has been taken not only to the issue of sustainability of government debt, but also to the expanding structure of new types of government liabilities, their hidden and creative character or even the created illusion of fiscal liabilities. This topic was particularly related to the analysis of the scope of transparency of public finance, including, on many occasions, the actual lack of such transparency. As emphasised by the authors of the IMF report entitled *Fiscal Transparency Handbook*:¹⁴ “a government’s ability to respond to fiscal risks partly depends on the quality of its information about the magnitude and likelihood of potential shocks to the public finances. [...] While the quality of fiscal risk disclosure and analysis has improved in recent years, existing practices tend to be incomplete, fragmented, and qualitative in nature.”¹⁵

Fiscal risk, defined as the probability of significant differences between actual and expected fiscal performance,¹⁶ will further intensify in the coming years, influenced by the following factors: low political and social pressure on a return to balanced budgets; continued ongoing external financing of public budgets and servicing of mounting debt; acceleration of debt refinancing after successive crises, as well as the ongoing process of digitalisation and the future change in the structure of the labour market; the continuation of population ageing and the likely acceleration of generational transitions; the increasing consequences of climate change; and the possible occurrence of further epidemiological crises. All of these financial and non-financial developments are usually associated with the need for or high expectations of public funding. Unfortunately, governments of many countries still do not officially estimate and monitor fiscal risk, fearing negative reactions of lenders, especially market investors, and the public (the current and future voters). Indeed, fiscal risk is highly correlated with sovereign ratings, including future public budget solvency problems.

The aim of the article is to identify the main components of government overall liabilities based on the Fiscal Risk Matrix classification introduced by the World Bank, and to estimate the amount and structure of these liabilities in European Union countries (EU Fiscal Risk Matrix). The climate liabilities definition and methodology included in the EU Fiscal Risk Matrix is also a novelty of our research. The study will cover EU member states in the period 2018–2019,

14 *Fiscal Transparency Handbook*, International Monetary Fund 2018, <https://doi.org/10.5089/9781484331859.069>.

15 As the research shows, few countries in the world publish special documents such as the Fiscal Risk Statement. These countries include, *inter alia*: Australia, New Zealand, the United Kingdom, Brazil, Chile, Indonesia, Pakistan.

16 G. Koptis, *Coping with fiscal risk: Analysis and practice*, “OECD Journal on Budgeting” 2014, Vol. 14, Issue 1, <https://doi.org/10.1787/budget-14-5jxrgssdqnlr>.

taking into account available data from the Eurostat database¹⁷. On this basis, a fiscal risk matrix for the EU will be developed with the estimated structure of the burden of government liabilities for individual countries and the EU as a whole.¹⁸ The article will use statistical and comparative analysis.

Fiscal Risk Matrix – methodology of research

The study conducted in this paper is based on the Fiscal Risk Matrix introduced in 1999 by the World Bank.¹⁹ The matrix identifies four types of government liabilities, classified based on two criteria, i.e., the designated or potential duration of the liabilities, and their contractual (legal) basis. A detailed description of the different categories of government liabilities included in the matrix is presented in table 1.

Table 1. Government Fiscal Risk Matrix based on government liabilities criteria

Criteria	Direct (obligations in any event)	Contingent (obligation if a particular event occurs)
Explicit (obligation recognised by a law or contract)	Liabilities classified according to applicable national regulations and budgeting methods. This is the primary category of government liabilities, comprising liabilities that are foreseeable in terms of value and future realisation or maturity.	Liabilities based on regulations or legal agreements that may or may not have a future funding date. Funding often occurs as a result of an underwritten operation with prior credit risk.
Implicit (obligation reflects public and interest group pressures)	Liabilities required for future implementation, the amounts and timing of which are not directly derived from current regulations. However, their implementation will be directly funded by the government due to such public expectations.	Liabilities derived from an informal government pledge based on expected government responses in emergency situations; failure to fulfil these commitments may result in a crisis or moral hazard phenomenon affecting the public or specific groups of actors.

Source: own elaboration based on: H. Polackova, *Contingent Government Liabilities: A Hidden Risk for Fiscal Stability*, "Policy Research Working Papers", The World Bank, No. 1989, November 1999, <https://doi.org/10.1596/1813-9450-1989>; K. Marchewka-Bartkowiak, *Dług potencjalny w świetle macierzy ryzyka fiskalnego*, "Ekonomista" 2007, No. 6.

¹⁷ <https://ec.europa.eu/eurostat/data/database> [accessed: 1 April – 1 June 2021]. Cf. detailed data in appendices 1, 2 and 3.

¹⁸ The aggregate estimate for the EU will be a financial statement. The authors take into account Article 125(1) of the Treaty on the Functioning of the EU which states that "The Union shall not be liable for or assume the commitments of central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of any Member State, without prejudice to mutual financial guarantees for the joint execution of a specific project. A Member State shall not be liable for or assume the commitments of central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of another Member State, without prejudice to mutual financial guarantees for the joint execution of a specific project."

¹⁹ H. Polackova, *Contingent Government Liabilities: A Hidden Risk for Fiscal Stability*, "Policy Research Working Papers", The World Bank, No. 1989, November 1999, <https://doi.org/10.1596/1813-9450-1989>.

According to the adopted assumption, the above types of liabilities will create an additional burden for public finance, which will cause an increase in fiscal risk. In particular, not only their individual growth, but first of all, the possibility of accumulation of different types of liabilities in the long run, becomes dangerous. In the coming decades, we will be facing such a situation in many countries, including the EU. It is therefore suggested that fiscal risk should be measured and reported on a regular basis.

Taking into account the above characteristics, table 2 provides a set of instruments and financial systems, as well as phenomena of a different nature, which are the source of the different categories of liabilities due to the need for public financing. This catalogue is still of an open nature.

Table 2. Government Fiscal Risk Matrix – selected debt instruments

Criteria	Direct	Contingent
Explicit	Government debt (loans, securities) Future public expenditures	State guarantees Umbrella state guarantees State insurance schemes
Implicit	Future public pensions Social security schemes Future public health care financing	Financing of environmental recovery and natural disaster Defaults of subnational governments and state-owned enterprises Banks' failures (public support beyond state insurance) Failures of non-guaranteed pension funds or other social security funds

Source: own elaboration based on: H. Polackova, *Contingent Government Liabilities: A Hidden Risk...*; eadem, *Contingent Liabilities. A Threat to Fiscal Stability*, "PREM Notes" 1998, No. 9, <https://openknowledge.worldbank.org/handle/10986/11522> [accessed: 1 September 2021]; H. Polackova Brix, A. Mody, *Dealing with Government Fiscal Risk: An Overview*, [in:] *Government at Risk: Contingent Liabilities and Fiscal Risk*, eds. H. Polackova Brix, A. Schick, The World Bank and Oxford University Press 2002.

In the following analysis, based on the example of EU member states, attention is focused on the four currently most important types of government liabilities, presented in table 3. Their choice is dictated primarily by such reasons as: the officially introduced EU fiscal rules on general government debt, the reliance of many EU²⁰ and national anti-crisis mechanisms on guarantee schemes, the observed deepening of population ageing across the EU, and the adopted EU strategies for a net zero-carbon EU economy.

The authors will estimate the financial effects of different types of government liabilities, based on available data. The limitations of the conducted research are, primarily, the lack of a uniform methodology for calculating all public sector liabilities, as well as incomplete reporting and availability of data from individual EU member states.

²⁰ E.g.: the European Stability Mechanism (ESM) created during the financial crisis; the European Instrument for Temporary Support to Mitigate Unemployment Risks in an Emergency (SURE) created during the COVID-19 pandemic crisis.

Table 3. EU Fiscal Risk Matrix – analysed government overall liabilities for EU member states

Criteria	Direct	Contingent
Explicit	Government debt	Contingent liabilities
Implicit	Pension liabilities	Climate liabilities

Source: own elaboration.

Typology of government overall liabilities²¹ in EU member states

Government debt (market-based liabilities)

Government debt primarily includes financial instruments such as loans and debt securities (bills and bonds) that have a predetermined maturity and a contractual basis. In national accounts and EU statistics, all operations included in government debt are well defined, both from the subjective and the institutional points of view.²² A uniform and comprehensive treatment of liabilities should also allow for the verification of the whole balance sheet of the public sector and for the comparability of data in international terms.

The government balance sheet, especially its liability side, as well as the financial net worth that shows the balance of the financial assets reduced by the liabilities, are traditionally the subject of ongoing monitoring across the world. The OECD²³ explains that financial net worth indicates the amount of the net government debt (based on financial instruments) and measures the government's capacity to meet its financial obligations at maturity. An increase in the government's financial net worth over time suggests good financial health, because the assets exceed the debts accumulated by the government. Conversely, a negative balance of the financial net worth (net worth deficit) is a sign of the government's indebtedness towards various stakeholders (households, companies, financial institutions), as the financial resources attracted through deposits, securities issuance or loans exceed the assets it owns. The consequence is the worsening of the fiscal position, forcing governments to recalibrate their fiscal policies by either cutting spending, raising taxes or escalating the refinancing process. According to J.N. Ferrer and R. Musmeci,²⁴ the financial net worth and its annual changes in value represent a key indicator of the government's good governance, by showing the shifts in the value of the assets and liabilities under the stewardship of the government. However, they also signalled

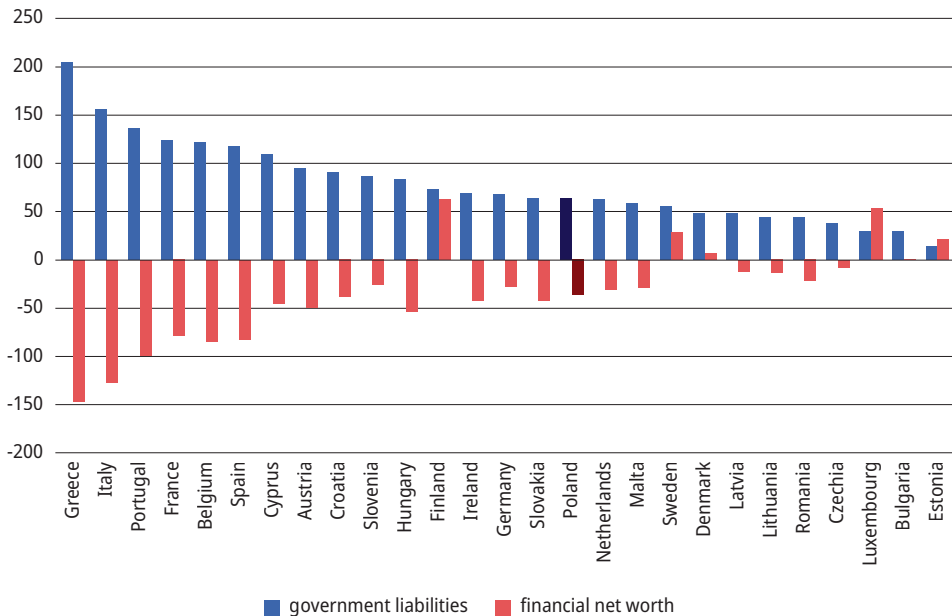
21 In order to standardise terminology, the article assumes that 'government liabilities' are all liabilities of the government (public sector, in the EU – general government sector), while 'government debt' means liabilities based on market instruments, such as loans and securities.

22 More in: *Manual on Government Deficit and Debt: Implementation of ESA 2010*, Eurostat 2019.

23 OECD, *Financial net worth of general government*, [in:] *Government at a Glance 2015*, OECD Publishing, Paris 2015, https://doi.org/10.1787/gov_glance-2015-en.

24 J.N. Ferrer, R. Musmeci, *Beyond Public Debt. The Hidden Rapid Erosion of EU Government Balance Sheets is a Financial Threat to Society*, "CEPS Research Report" March 2019, No. 10.

Figure 1. Government debt and financial net worth in EU member states in 2019 according to ESA methodology (% GDP)



Source: own elaboration based on the Eurostat database: <https://ec.europa.eu/eurostat/data/database> [accessed: 1 April – 1 June 2021].

the rapid erosion of the EU government balance sheets and argued for the introduction of a national public financial management strategy aimed at reforming government accounts and coupling economic growth with responsible fiscal policy.

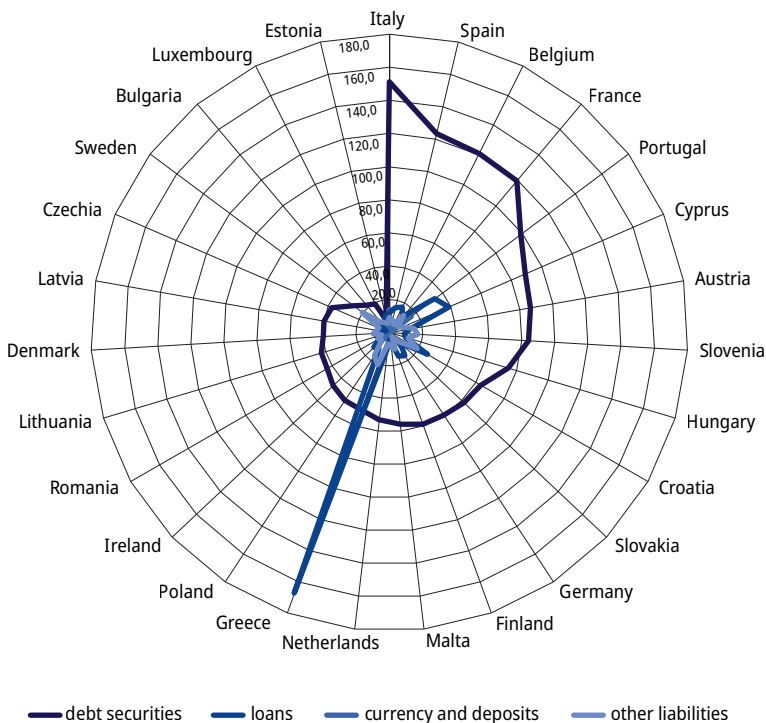
These conclusions are related, among other things, to the fact that the EU accounts pay less attention to the analysis of financial net worth, focusing primarily on the level of gross government debt and its changes over time. Moreover, Eurostat uses two presentations of general government debt, i.e., based on the ESA 2010 (European System of Accounts) methodology, similar to the SNA (System of National Accounts) used worldwide, and an additional, simplified EDP (Excessive Deficit Procedure) method for the purpose of assessing the EU debt criterion. As a result, the key factor in assessing the national public finance of EU member states is the gross debt-to-GDP ratio and not the net debt-to-GDP ratio.

In the article, the analysis of government market-based debt in EU member states starts with the ESA methodology based on the ratio to GDP and the balance sheet in 2019 as the reporting year (figure 1). As can be seen from the data presented, the highest level of government gross debt of almost 205% of GDP was recorded in Greece, while the lowest, 13.3% of GDP, in Estonia. On average, in EU member states, the ratio of liabilities to GDP amounted to 79%. As far as the balance sheet approach is concerned, it is worth emphasising that only five

countries reported the balance as the value of net public assets, which means a sufficient level of liability security. On the other hand, as many as 23 countries surveyed had liabilities higher than financial assets, which means high fiscal risk associated with the lack of financial security on the side of financial assets. The presented ranking shows that the highest balance sheet's liabilities concern mainly euro area countries. Poland was ranked 16th out of 27 countries, with a negative balance.

The structure of government debt is dominated by debt securities, especially government securities (figure 2). The highest level of these instruments is found in the Italian portfolio (about 150% of GDP); in turn, the highest value of liabilities was reported by Greece (about 160% of GDP). Within individual instruments, it is worth noting that this EU average was observed for: currency and deposits in five countries, debt securities in nine countries, loans in four countries and other liabilities in nine countries.

Figure 2. Structure of government debt in EU member states in 2019



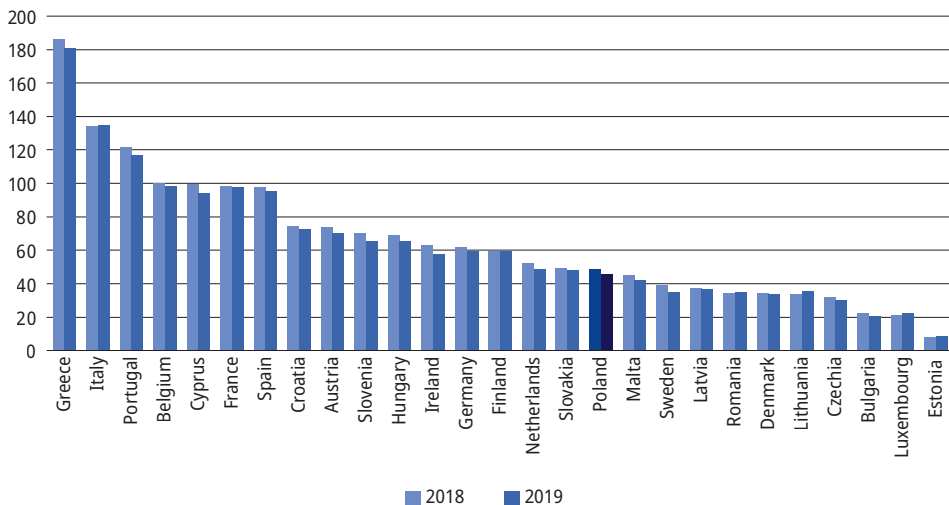
Source: own elaboration based on the Eurostat database.

As mentioned earlier, in the EU, the reference indicator for assessing the level of general government debt is based on Excessive Deficit Procedure methodology. As it was noted, the clear advantage of EDP debt is that no assumptions about the prices, marketability or liquidity

of government assets need to be made. Thus, in periods of market turbulence, the prices and marketability of government assets may fluctuate and complicate the compilation of the net debt concept, whereas gross debt remains a robust indicator. Nevertheless, a direct comparison between EDP debt and international headline fiscal figures (e.g., the US and Japan) is not advisable without adjustments due to differences in their compilation methods.²⁵

The disadvantage of this solution, however, is the incomplete picture of the total government debt and the introduced methodological dualism, which makes it difficult to unambiguously assess the fiscal risk of the government liabilities in question. As can be seen from the chart below (figure 3), the ratio of general government gross debt to GDP in the case of the EDP methodology is by definition lower than in the case of liabilities based on the ESA 2010 methodology, even by as much as about 10 percentage points.

Figure 3. Government debt in EU member states in 2018 and 2019 according to EDP methodology (% GDP)



Source: own elaboration based on the Eurostat database.

The risk assessment based on EDP debt refers to the ratio of debt of GDP as the reference level for the “excessive debt” criterion. Thus, as can be seen from the comparative analysis of EU member countries, in the period 2018–2019 as many as 14 countries exceeded the acceptable level of 60%, of which three countries reached more than three and two times its value.

The above analysis leads to the conclusion that government debt for the majority of EU member states gives rise to high fiscal risks associated primarily with the absence or low col-

²⁵ D.H. Lojsh, M. Rodríguez-Vives, M. Slavik, *The size and composition of government debt in the euro area*, “European Central Bank Occasional Paper Series” 2011, No. 132.

lateral in the form of financial assets and exceeding the acceptable norms of the debt-to-GDP ratio. An unambiguous interpretation of this budget item is also not supported by the double accounting methodology.

Contingent liabilities

Contingent liabilities represent potential obligations that may become actual public liabilities, which the government is bound to accept if certain circumstances occur. The ESA 2010²⁶ framework outlines that although contingent liabilities are not recorded in the balance-sheet accounts, they are important for public policy and analysis, and specific data needs to be regularly collected by each country. Even though no payments may turn out to be due for contingent liabilities, a high level of contingencies may indicate an undesirable level of risk on the part of the units offering them.

A great number of previous studies from the beginning of the 21st century indicated that additional budget burdens in a given year in many countries stemmed not only from financing the planned borrowing needs, but also from sudden and off-balance-sheet events that required current coverage by public funds. This brought about the materialisation of fiscal risk, resulting from the increase in contingent liabilities, which ultimately was also the cause of crises (currency or financial ones).²⁷ Subsequent studies, especially after 2008, showed a further escalation of the problem. That is why J.N. Ferrer and R. Musmeci in 2019²⁸ also argued that contingent liabilities have to be still considered as an important source of fiscal risk, due to their potentially large impact on public budgets.

In EU member states, information on contingent liabilities should be sent to the European Commission in the annual Stability and Convergence Programmes under the European Semester. However, the scope of information contained in these documents is non-standardised and very limited. According to the methodology adopted by Eurostat, contingent liabilities are not included in official government liabilities, although some of them are based on financial instruments and operations whose credit risk is measurable and possible to be estimated.

As can be seen from the data below, the problem of occurrence and increase of contingent liabilities is still present (figure 4). Between 2018 and 2019, an almost twofold increase in the analysed liabilities was observed, with the ratio of contingent liabilities to GDP exceeding 100% of GDP in ten EU member states in 2019. The group of countries with a ratio between 50% and 100% of GDP included Poland.

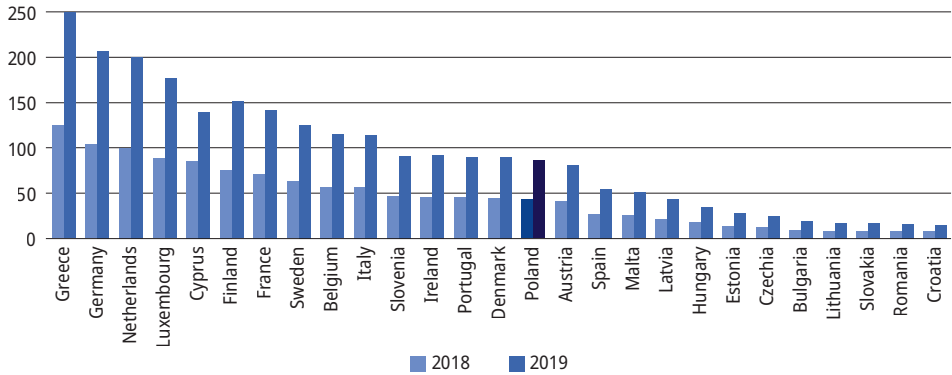
The publication *Eurostat Statistics Explained*²⁹ classifies contingent liabilities into four main groups, which are typically measured as percent of GDP: (i) government guarantees, which is

²⁶ *European System of Accounts, ESA 2010*, Eurostat, Publications Office of the European Union, Luxembourg 2013, p. 125–126.

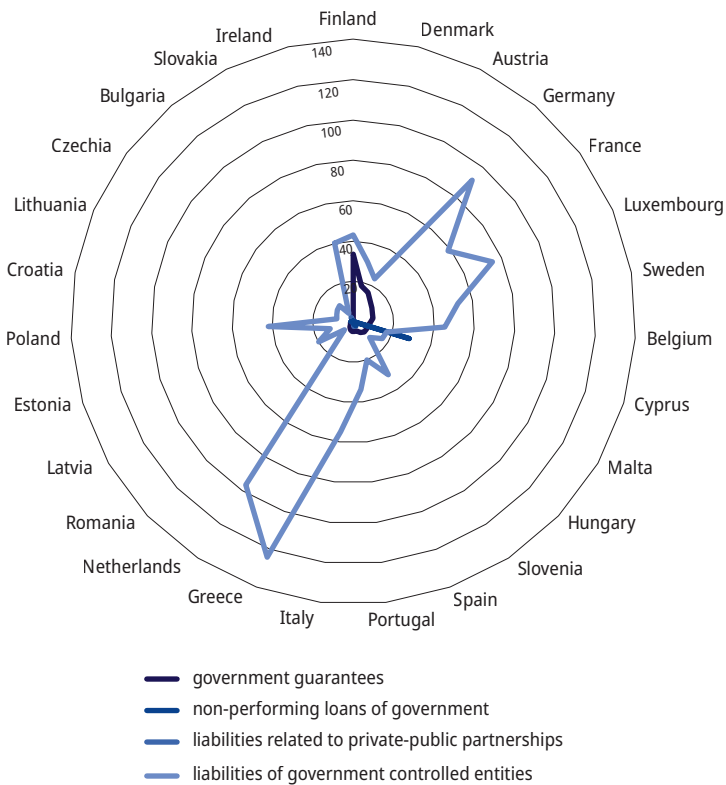
²⁷ Cf., *inter alia*: H. Kharas, D. Mishra, *op. cit.*; *Government at Risk: Contingent Liabilities and Fiscal Risk*, eds. H. Polackova Brixí, A. Schick, The World Bank and Oxford University Press 2002.

²⁸ J.N. Ferrer, R. Musmeci, *op. cit.*

²⁹ *Contingent liabilities and non-performing loans – statistics. Eurostat Statistics Explained*, Eurostat 2021.

Figure 4. Contingent liabilities (% GDP) in EU member states

Source: own elaboration based on the Eurostat database.

Figure 5. Structure of contingent liabilities (% GDP) in EU member states in 2019

Source: own elaboration based on the Eurostat database.

the most common type of contingent liabilities; (ii) liabilities related to public-private partnerships (PPPs) recorded off-government-balance-sheet; (iii) liabilities of government controlled entities (public corporations) classified outside general government; and (iv) government non-performing loans (NPLs, assets). As can be seen from the sample data for 2019, off-balance-sheet liabilities dominate in most EU member states not only from the subject matter perspective (government financial guarantees), but more importantly from the entity perspective (government guarantees provided to institutions).

This means that contingent liabilities are mainly in the form of guarantees issued by the government for agencies, companies or controlled banks which are not officially included in the general government sector but which are legally entitled to incur debt on behalf of the government (Treasury) (figure 5). Such a solution may cause both fiscal illusion and moral hazard, because if the institutions in question are threatened with bankruptcy, the government may rescue them at any cost so as not to burden the Treasury with liabilities it guarantees. This situation may also be dangerous from the point of view of, e.g., the banking sector, as it introduces a clear hierarchy of rescuing individual institutions (including financial institutions) in case of a financial crisis.

Pension liabilities

The concept of implicit pension liabilities is not new, though it sometimes goes by different names, being also referred to as ‘implicit pension debt’ or ‘social debt’.³⁰

A paper published under the aegis of the EC Directorate-General for Economic and Financial Affairs³¹ concludes that, for a reliable and comprehensive assessment of the public finance soundness, it is required to examine public pension liabilities especially against the background of the population-ageing Europe, which will lead to a significant increase in the future public pensions debt. The paper explains that the unfunded public pension scheme (also known as Pay-As-You-Go pension system) is an implicit pension liability, because this particular scheme is mandatory by law and its obligations are mostly covered by compulsory pension contributions imposed by governments while the accumulated pension rights have to be satisfied in the future from government revenues.

According to E. Ponds, C. Severinson and J. Yermo,³² the valuation and disclosure of pension liabilities is often less than transparent, and delays in their reporting “may be hiding potentially huge fiscal liabilities that are being passed on to future generations.” Moreover, J.N. Ferrer and R. Musmeci³³ elaborate more on the issue of reporting obligations related to contingent liabilities and argue that additional fiscal risks still remain hidden. It is the case of the unfund-

30 B. Deboeck, P. Eckefeldt, *Taking stock of implicit pension liabilities*, “Quarterly Report on the Euro Area” 2020, Vol. 19, No. 2, European Commission, Directorate-General for Economic and Financial Affairs.

31 H. Oksanen, *Public Pensions in the National Accounts and Public Finance Targets*, “European Economy, European Commission, Directorate-General for Economic and Financial Affairs, Economic Papers” July 2004, No. 207.

32 E. Ponds, C. Severinson, J. Yermo, *Funding in Public Sector Pension Plans: International Evidence*, “OECD Working Papers on Finance, Insurance and Private Pensions” 2011, No. 8, <https://doi.org/10.1787/5kgcfnm8rgmp-en>.

33 J.N. Ferrer, R. Musmeci, *op. cit.*

ed pension liability that should be considered as implicit debt due to its particular features: a contractual obligation that governments are bound to honour.

In the literature, one can find mainly three concepts of pension liabilities: accrued-to-date liabilities, closed system liabilities and open system liabilities.

The following pension liability analysis is based on data³⁴ collected from the OECD and Eurostat databases,³⁵ calculated according to the methodology of “accrued-to-date” liabilities, reflecting the pension entitlements of the retired population as well as the pension entitlements that have been accrued until the end of the reference period by future beneficiaries. The accrued-to-date method, also known as the closed group without future accruals method, includes only the benefits that current members (hence: closed group) have earned up to the present period in the calculation (hence: without future accruals). This method provides an estimate of the cost of a hypothetical termination of a pension scheme at the reference date, i.e., the amount due if the accrued future pension entitlements had to be paid out at the reference date.³⁶ Of course, it should be stressed that the methodology adopted is not optimal. As indicated in the Eurostat study, “There is no ideal treatment of these cases under current national accounting rules, the basic problem being that they do not recognise the *accrued liabilities* stemming from certain cash transactions (regular pension contributions or lump sum payments). A reason for the current treatment could be that the commitment to pay a pension in future is typically not recognised as an IOU given to the future pensioner. In addition, its quantity may not be well defined but may depend on interpretation of the rules and various economic assumptions (future interest rate, for example).”³⁷

The main conclusion of the presented data for pension systems for 2018 (figure 6) in EU member states is the relatively very high level of government liabilities, which in most countries exceeds the GDP two, three or even four times. Denmark is an exception in this regard. The country records the lowest share of pension liability in the national GDP (2.88%), being less exposed to fiscal risks arising from it. The case of Denmark may be explained by relying on K. Kaier’s and Ch. Müller’s³⁸ line of reasoning, according to which the demographic composition

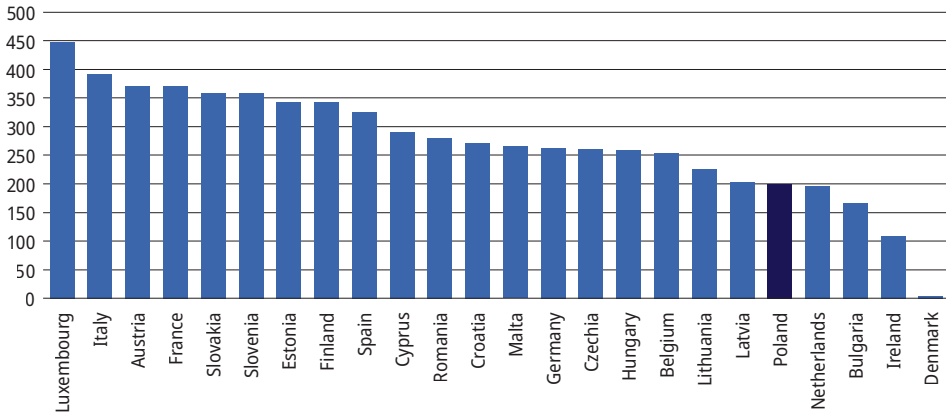
34 Data from EU member states, except the countries for which there is no recent data available, i.e., Greece, Portugal, Sweden. In the case of Poland, the data is based on World Bank projections for the Social Insurance Institution for 2020: <https://stat.gov.pl/en/topics/national-accounts/accrued-to-date-pension-entitlements-in-social-insurance/estimating-accrued-to-date-pension-liabilities-adl-for-poland-in-2015-using-the-prost-model,2,1.html> [accessed: 10 August 2021].

35 SNA and ESA methodology of national accounts. The System of National Accounts 1993 (SNA-93) and the European System of Accounts (ESA-95) recognise pension obligations as employer liabilities only if these obligations are funded, i.e., if they are (fully or partially) matched by segregated assets.

36 C. Girodet *et al.*, *New data collection on accrued-to-date social insurance pension entitlements in a national accounts context. Main findings*, “OECD Statistics Working Papers” 2020, No. 5, p. 10, <https://doi.org/10.1787/93abd66a-en>.

37 H. Oksanen, *op. cit.*, p. 6.

38 K. Kaier, Ch. Müller, *New figures on unfunded public pension entitlements across Europe: Concept, results and applications*, “Diskussionsbeiträge” 2013, No. 52, Albert-Ludwigs-Universität Freiburg, Forschungszentrum Generationenverträge.

Figure 6. Pension liabilities (% GDP) in EU member states in 2018

Source: own elaboration based on the Eurostat database.

represented by the number of retirees, as well as the average age established by national regulations for leaving the labour market impact the country's level of future pension expenditures.

Overall, the large share of public pension liabilities in GDP entails substantial risks for the EU member states and has to be mitigated through proper regulations. In this respect, J. Rauh³⁹ warns that the nature of the risk connected with the pension systems for public finances and the economy is fundamentally longer-term. Hence, decision-makers have to establish whether the actual pension system is sustainable on a longer timeframe, in the absence of additional government support through fiscal policy adjustments.

Climate liabilities

A new type of financial liability that came to the forefront of international and national governments' concern is the climate liability⁴⁰ of a country, directly connected with the scale of the CO₂ gas emissions. In this regard, a report published in 2019 by the IMF⁴¹ draws attention to the importance of shaping a holistic national strategy that would integrate climate risks and climate financing into macro-fiscal frameworks. In the European Union, the current European

³⁹ J. Rauh, *Fiscal Implications of Pension Underfunding*, paper prepared for the Annual Macroprudential Conference of Sveriges Riksbank, De Nederlandsche Bank, and Deutsche Bundesbank in Stockholm, 15–16 June 2018.

⁴⁰ In this paper, we discuss the financial valuation of climate liabilities, also referred to in the literature as climate debt, carbon debt or more broadly – ecological debt. More in: R. Warlenius (Lund University, Sweden), *Calculating Climate Debt. A Proposal*, paper submitted to ISEE 2012, the 12th Biennial Conference of the International Society for Ecological Economics, 2012.

⁴¹ *Fiscal Policies for Paris Climate Strategies – from Principle to Practice*, "IMF Policy Paper" 2019, Issue 010, International Monetary Fund, <https://doi.org/10.5089/9781498311717.007>.

Green Deal sets a strategic climate target for 2050 of net zero greenhouse gas emissions.⁴² This target entails setting unit commitments for individual member states and consequently their financial valuation.

Valuing a country's liability for climate damage is a recent topic, scarcely addressed by existing studies. It is proposed to use a carbon price⁴³, carbon fee⁴⁴ or carbon tax⁴⁵ as a cost-effective climate policy solution to estimate the climate liability associated with a given level of CO₂ emissions.

Existing studies have advanced various levels of the carbon costs to be borne by countries. For instance, a report issued by the OECD priced CO₂ emissions at EUR 30/tCO₂, the low-end estimate of the cost of carbon. The report of the High-Level Commission on Carbon Prices⁴⁶ estimated an explicit carbon-price level that is consistent with achieving the Paris Climate Agreement temperature target, namely a cost of US\$ 40–80/tCO₂ by 2020 and US\$ 50–100/tCO₂ by 2030 for each tonne of carbon emissions. The Climate Leadership Council⁴⁷ argued for the introduction in 2021 of an economy-wide fee on CO₂ emissions starting at US\$ 40/tCO₂ and increasing every year by 5% above the inflation rate. Similarly, the IMF⁴⁸ relies on a US\$ 35 carbon price per tonne of CO₂ in 2030 to compute the burden to be witnessed by various economic sectors that are CO₂ emitters.

Our analytical approach has as a starting point the lower-end estimate of the carbon costs in 2020, which is US\$ 40/tCO₂, as established by the High-Level Commission on Carbon Prices report. This threshold level is further used in our own computations in order to estimate the climate financial liability at EU-level and country-level from both an overall economy emissions dimension and economic sector emissions dimension.

The authors assume that climate (financial) liabilities are the amount of the carbon liability expressed in millions of US dollars, illustrating the value of the pollution generated through CO₂ emissions that the originating country has to pay for (cf. appendix 3). However, assuming that the EU will be net zero-emission in 2050, the authors estimate climate financial-based liabilities as the cumulative value of annual obligations, which should be taken into account by

42 Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions – The European Green Deal (COM(2019) 640 final), 11 December 2019.

43 Cf., e.g.: N. Kaufman *et al.*, *A near-term to net zero alternative to the social cost of carbon for setting carbon prices*, "Nature Climate Change" 2020, Vol. 10, Issue 11, <https://doi.org/10.1038/s41558-020-0880-3>; I. Mitchell, L. Robinson, A. Tahmasebi, *Valuing Climate Liability*, Center for Global Development, CGD Note, January 2021.

44 Cf., e.g., Climate Leadership Council, *The Four Pillars of Our Carbon Dividends Plan*, 2019, <https://clcouncil.org/our-plan/> [accessed: 1 September 2021].

45 Cf., e.g.: W. Nordhaus, *The Climate Casino. Risk, Uncertainty, and Economics for a Warming World*, Yale University Press 2015; S. DeWeerd, *Researchers find new ways to calculate carbon prices and climate liability*, "Anthropocene" 1 September 2020, <https://www.anthropocenemagazine.org/2020/09/whos-responsible-for-carbon-emissions-and-how-can-we-put-a-price-on-their-costs-to-society/> [accessed: 1 September 2021].

46 High-Level Commission on Carbon Prices, *Report of the High-Level Commission on Carbon Prices*, The World Bank, Washington, DC 2017.

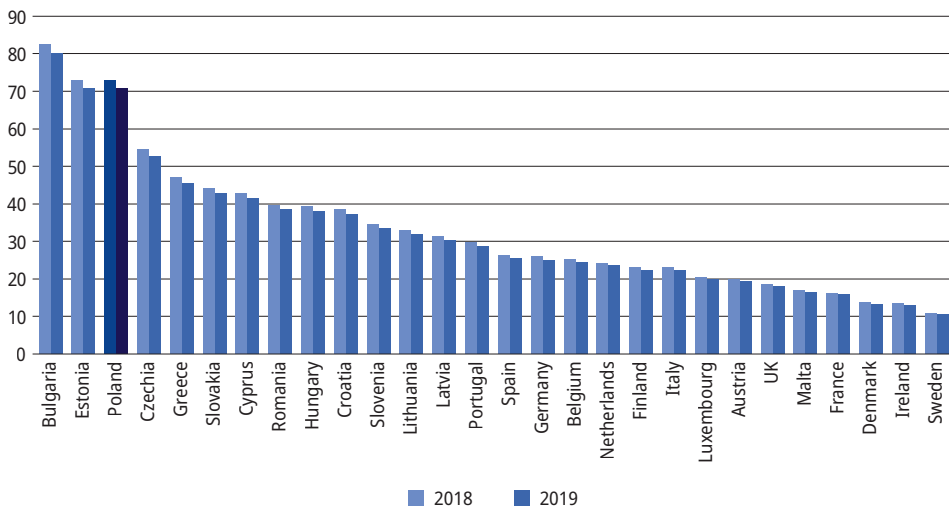
47 Climate Leadership Council, *The Four Pillars...*

48 *Fiscal Policies for Paris Climate Strategies...*

individual countries in their financial strategies and whose maturity (implementation) expires in 2050 (according to the agreed assumptions of the European Green Deal). Estimates of climate financial liabilities are not discounted, but they are assumed to decrease annually if a member country manages to meet its climate targets. In this way, it is possible to monitor the present value of future climate liabilities, valued in money terms at their declared carbon reduction path. This assessment can also imply a change in the nature of climate liabilities to direct and explicit, contrary to the traditional Fiscal Risk Matrix classification as contingent and implicit.

Thus, as figure 7 below shows, climate liabilities, estimated on the basis of the above methodology, are at the highest level (above 50% of GDP) for four countries in Central and Eastern Europe, including Poland; in turn, a relatively lowest level (below 20% of GDP) characterises Western European countries. The average level of the analysed liabilities for the EU member states is about 33% of GDP.

Figure 7. Climate liabilities (% GDP) of EU member states



Source: own elaboration based on the Eurostat database.

Along with other types of liabilities, climate change is increasingly being considered by rating agencies for assessment of sovereign risk and its impact on credit ratings. Among the seven most important channels of climate change transmission on sovereign risk, the subject of detailed analysis is the fiscal impacts of climate-related disasters and fiscal consequences of adaptation and mitigation policies.⁴⁹ It should be noted that the adoption of legal rules limiting government market-based debt, especially in the EU in the form of the debt criterion,

⁴⁹ U. Volz et al., *Climate Change and Sovereign Risk*, Centre for Sustainable Finance, SOAS University of London et al. 2020, https://eprints.soas.ac.uk/33524/1/Climate%20Change%20and%20Sovereign%20Risk_final.pdf [accessed: 1 September 2021].

may affect the need to create more and more new debt instruments, financing climate obligations directly or exclusively. This will certainly have an impact on the overall assessment of a country's financial credibility.

EU Fiscal Risk Matrix

In this part of the article, the authors estimated the scale of the burden of the examined government liabilities on individual EU countries by adding up their values for one selected period, i.e., 2018. The authors are aware that the adopted methodology is not appropriate from the accounting point of view, but it allows for comparative analysis between member states in terms of fiscal risk assessment and a rough assessment of the financial impact on individual public budgets in the future.

The analysis of government overall liabilities conducted above indicated that each EU member state is burdened with liabilities under the four examined financial and non-financial mechanisms (market securities and loans, guarantees, demographic trends and climate change). Table 4 below summarises the most important measures of liabilities in total for the EU member states. This table includes the average values for the different types of liabilities cited above. However, it can be additionally pointed out that the average cumulative amount of government overall liabilities in 2018 in the EU was 107% of GDP for each country.

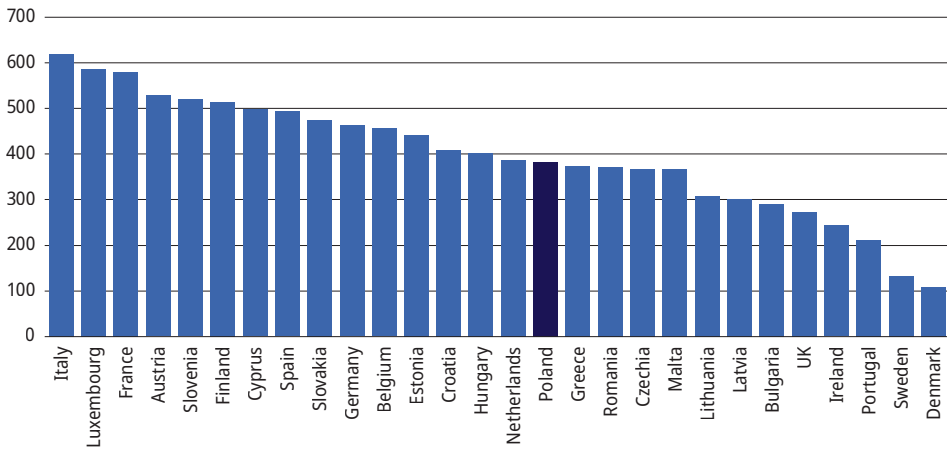
Table 4. Government liabilities for the EU – overall statistics in 2018 (% GDP)

	Government debt	Contingent liabilities	Pension liabilities	Climate liabilities
minimum	12.89	6.85	2.88	10.88
maximum	201.29	124.47	448.18	82.56
average	79.03	44.55	271.27	33.61
standard deviation	41.35	31.54	94.62	18.31

Source: own elaboration.

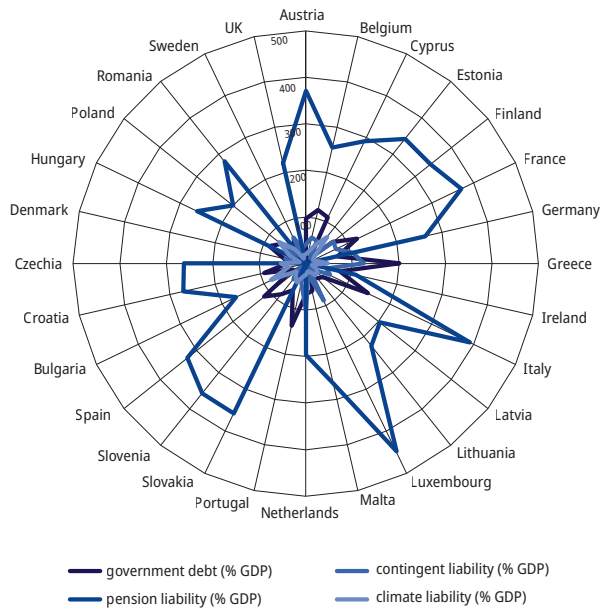
The adding up of government liabilities for each member state (given the indicated limitations in the availability of data) shows that the GDP level is exceeded as much as even several times. Therefore, a preliminary conclusion should be drawn that the growing amount of government liabilities with the inability to generate funds (which is already happening) to cover the liabilities in question will make member states more and more dependent on market (external) financing as a result of an increasingly intensive debt refinancing process. In 2018, i.e., 10 years after the financial crisis, and two years before the pandemic crisis, the total level of liabilities of individual EU member states was between 100% and more than 600% of GDP (figure 8). Therefore, it can be concluded that despite the many anti-crisis measures taken after 2008, member states were not prepared for the next crisis (pandemic crisis) and its fiscal (as regards growing government liabilities) impact from 2020 onwards.

Figure 8. Assessment of government overall liabilities in EU member states in 2018 (% of GDP)



Greece, Portugal, Sweden, the UK – incomplete data.
 Source: own elaboration based on the Eurostat database.

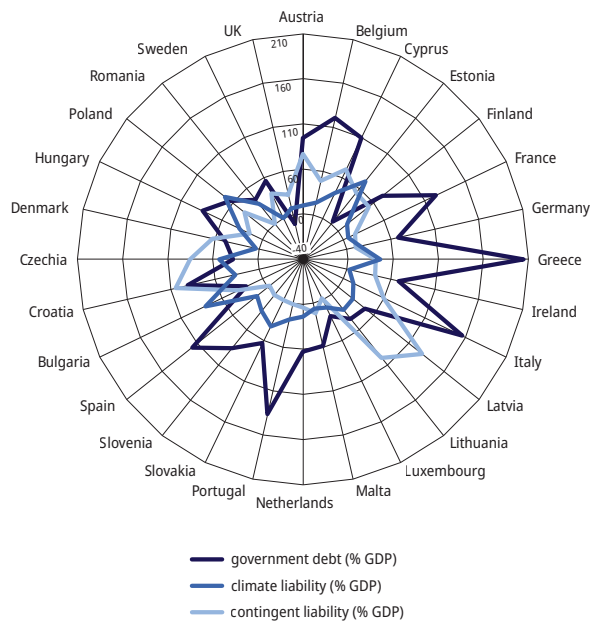
Figure 9. Structure of government overall liabilities in EU member states (% GDP) – in alphabetical order, divided into eurozone and non-eurozone countries



Greece, Portugal, Sweden, the UK – incomplete data as regards pension liabilities.
 Source: own elaboration based on the Eurostat database.

In most member states, the structure of government overall liabilities is dominated by pension liabilities (figure 9), with climate liabilities having the lowest share (figure 10). It should be noted, however, that it is increasingly difficult to clearly identify instruments that finance specific liabilities, because most often they are government bonds. For example, government green bonds financing climate goals are classified as direct government liabilities – payments under guarantees (included in budget expenditures) are often covered by the issuance of bonds. Similarly, more and more countries also finance pension schemes by incurring public debt. In turn, to reduce the use of bonds, public authorities create schemes that issue government-guaranteed bonds outside the public sector.

Figure 10. Structure of government overall liabilities in EU member states (% GDP), excluding pension liabilities – in alphabetical order, divided into eurozone and non-eurozone countries



Source: own elaboration based on the Eurostat database.

The above practices of establishing various creative financial mechanisms at the public sector level fall within the broad framework of government debt management. However, the dynamically changing structure and level of liabilities may make it increasingly difficult to strategically approach their management within aggregate institutional (e.g., the same ministries or public debt management agencies) and operational (integrated management tasks) arrangements. These practices may also force *ad hoc*, emergency actions, split between public and state institutions, create low transparency and limited monitoring capacity.

Conclusions

Among the most important conclusions from the above analysis, the following remarks and recommendations can be made:

- EU Fiscal Risk Matrix is the proposal for EU member states and the European Commission to classify government overall liabilities and assess the fiscal risk based on it.
- Four major types of government liabilities should be analysed in the EU Fiscal Risk Matrix, all of which occur in every EU member state.
- In most EU member states, the highest level of government liabilities concerns pension liabilities, while the lowest – climate liabilities; climate liabilities can be estimated with the use of the new methodology proposed by the authors.
- In the case of contingent liabilities, it would be recommended to increase the scope and detailedness of information published by EU member states (e.g., based on more detailed and unified information included in the stability or convergence programmes).
- In order to improve the transparency of public finances it is important to clearly indicate the sources of financing of public financial mechanisms (e.g., special purpose public funds), with particular emphasis on the debt refinancing process.
- It is recommended to introduce the monitoring of the presented four types of liabilities at the EU level and at the national level by national parliaments and/or separate fiscal councils.

It should also be added that the wide structure of government overall liabilities is becoming a subject of interest of rating agencies estimating sovereign risks. Additionally, some types of government liabilities burden national budgets not only as a consequence of fiscal solutions introduced by national governments, but also as a consequence of the Community's financial mechanisms (e.g., contingent liabilities used at the EU level, such as ESM or SURE).

Moreover, in the face of the ongoing pandemic crisis and its expected fiscal repercussions, including further increase in government overall liabilities as a consequence of introduced programmes based on public commitments, EU member states may be exposed to yet another debt crisis in the near future. In this context, it is recommended to include the risk of government overall liabilities (e.g., a demographic risk, a climate risk) in the risk management conducted by government debt managers.

References

- Balassone F., Franco D., Zotteri S., *Public Debt: A Survey of Policy Issues*, [in:] *Public Debt*, Banca d'Italia, 1 April 2004, <https://doi.org/10.2139/ssrn.2040728>.
- Barro R.J., *Government Spending in a Simple Model of Endogenous Growth*, "Journal of Political Economy" 1990, Vol. 98, Issue 5.
- Blanchard O.J., *Debt, Deficits, and Finite Horizons*, "Journal of Political Economy" 1985, Vol. 93, Issue 2.
- Buchanan J.M., *Public Principles of Public Debt: A Defense and Restatement*, Liberty Fund, Indianapolis 1999.
- Climate Leadership Council, *The Four Pillars of Our Carbon Dividends Plan*, 2019, <https://clcouncil.org/our-plan/>.

- Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions – The European Green Deal (COM(2019) 640 final), 11 December 2019.
- Contingent liabilities and non-performing loans – statistics. Eurostat Statistics Explained*, Eurostat 2021.
- Deboeck B., Eckefeldt P., *Taking stock of implicit pension liabilities*, “Quarterly Report on the Euro Area” 2020, Vol. 19, No. 2, European Commission, Directorate-General for Economic and Financial Affairs.
- Debrun X. et al., *Tied to the mast? National fiscal rules in the European Union (‘Constitutions, politics, and economics’)*, “Economic Policy” 2008, Vol. 23, Issue 54.
- DeWeerd S., *Researchers find new ways to calculate carbon prices and climate liability*, “Anthropocene” 1 September 2020, <https://www.anthropocenemagazine.org/2020/09/whos-responsible-for-carbon-emissions-and-how-can-we-put-a-price-on-their-costs-to-society/>.
- Diamond P.A., *National Debt in a Neoclassical Growth Model*, “The American Economic Review” 1965, Vol. 55.
- Domar E.D., *The “Burden of the Debt” and the National Income*, “The American Economic Review” 1944, Vol. 34, No. 4.
- Elmendorf D.W., Mankiw N.G., *Government Debt*, “NBER Working Paper” 1998, No. 6470.
- European System of Accounts, ESA 2010*, Eurostat, Publications Office of the European Union, Luxembourg 2013.
- Ferrer J.N., Musmeci R., *Beyond Public Debt. The Hidden Rapid Erosion of EU Government Balance Sheets is a Financial Threat to Society*, “CEPS Research Report” March 2019, No. 10.
- Fiscal Policies for Paris Climate Strategies – from Principle to Practice*, “IMF Policy Paper” 2019, Issue 010, International Monetary Fund, <https://doi.org/10.5089/9781498311717.007>.
- Fiscal Transparency Handbook*, International Monetary Fund 2018, <https://doi.org/10.5089/9781484331859.069>.
- Girodet C. et al., *New data collection on accrued-to-date social insurance pension entitlements in a national accounts context. Main findings*, “OECD Statistics Working Papers” 2020, No. 5, <https://doi.org/10.1787/93abd66a-en>.
- High-Level Commission on Carbon Prices, *Report of the High-Level Commission on Carbon Prices*, The World Bank, Washington, DC 2017.
- Kaier K., Müller Ch., *New figures on unfunded public pension entitlements across Europe: Concept, results and applications*, “Diskussionsbeiträge” 2013, No. 52, Albert-Ludwigs-Universität Freiburg, Forschungszentrum Generationenverträge.
- Kane C., Palacios R., *The Implicit Pension Debt*, “Finance & Development” 1996, Vol. 33, Issue 2.
- Kaufman N. et al., *A near-term to net zero alternative to the social cost of carbon for setting carbon prices*, “Nature Climate Change” 2020, Vol. 10, Issue 11, <https://doi.org/10.1038/s41558-020-0880-3>.
- Kharas H., Mishra D., *Fiscal Policy, Hidden Deficits, and Currency Crises*, [in:] *World Bank Economists’ Forum*, Vol. 1, eds. S. Devarajan, F.H. Rogers, L. Squire, Washington, D.C. 2001.
- Kopits G., *Coping with fiscal risk: Analysis and practice*, “OECD Journal on Budgeting” 2014, Vol. 14, Issue 1, <https://doi.org/10.1787/budget-14-5jrxgssdqnl>.
- Kopits G., Symansky S.A., *Fiscal Policy Rules*, “IMF Occasional Paper” 1998, No. 162.
- Laubach T., *New Evidence on the Interest Rate Effects of Budget Deficits and Debt*, “Journal of the European Economic Association” 2009, Vol. 7, Issue 4, <https://doi.org/10.1162/jeea.2009.7.4.858>.
- Lojsh D.H., Rodríguez-Vives M., Slavík M., *The size and composition of government debt in the euro area*, “European Central Bank Occasional Paper Series” 2011, No. 132.
- Mankiw N.G., *The Savers-Spenders Theory of Fiscal Policy*, “NBER Working Paper” 2000, No. 7571.

- Manual on Government Deficit and Debt: Implementation of ESA 2010*, Eurostat 2019.
- Marchewka-Bartkowiak K., *Dług potencjalny w świetle macierzy ryzyka fiskalnego*, "Ekonomista" 2007, No. 6.
- Mitchell I., Robinson L., Tahmasebi A., *Valuing Climate Liability*, Center for Global Development, CGD Note, January 2021.
- Nordhaus W., *The Climate Casino. Risk, Uncertainty, and Economics for a Warming World*, Yale University Press 2015.
- OECD, *Financial net worth of general government*, [in:] *Government at a Glance 2015*, OECD Publishing, Paris 2015, https://doi.org/10.1787/gov_glance-2015-en.
- Oksanen H., *Public Pensions in the National Accounts and Public Finance Targets*, "European Economy, European Commission, Directorate-General for Economic and Financial Affairs, Economic Papers" July 2004, No. 207.
- Polackova H., *Contingent Government Liabilities: A Hidden Risk for Fiscal Stability*, "Policy Research Working Papers", The World Bank, No. 1989, November 1999, <https://doi.org/10.1596/1813-9450-1989>.
- Polackova H., *Contingent Liabilities. A Threat to Fiscal Stability*, "PREM Notes" 1998, No. 9, <https://openknowledge.worldbank.org/handle/10986/11522>.
- Polackova Bixi H., Mody A., *Dealing with Government Fiscal Risk: An Overview*, [in:] *Government at Risk: Contingent Liabilities and Fiscal Risk*, eds. H. Polackova Bixi, A. Schick, The World Bank and Oxford University Press 2002.
- Ponds E., Severinson C., Yermo J., *Funding in Public Sector Pension Plans: International Evidence*, "OECD Working Papers on Finance, Insurance and Private Pensions" 2011, No. 8, <https://doi.org/10.1787/5kgcfnm8rgmp-en>.
- Rauh J., *Fiscal Implications of Pension Underfunding*, paper prepared for the Annual Macropprudential Conference of Sveriges Riksbank, De Nederlandsche Bank, and Deutsche Bundesbank in Stockholm, 15–16 June 2018.
- Reinhart C.M., Rogoff K.S., *Growth in a Time of Debt*, "NBER Working Paper" 2010, No. 15639, <https://doi.org/10.3386/w15639>.
- Teles V.K., Mussolini C.C., *Public debt and the limits of fiscal policy to increase economic growth*, "European Economic Review" 2014, Vol. 66, <https://doi.org/10.1016/j.euroecorev.2013.11.003>.
- Volz U. et al., *Climate Change and Sovereign Risk*, Centre for Sustainable Finance, SOAS University of London et al. 2020, https://eprints.soas.ac.uk/33524/1/Climate%20Change%20and%20Sovereign%20Risk_final.pdf.
- Warlenius R., *Calculating Climate Debt. A Proposal*, paper submitted to ISEE 2012, the 12th Biennial Conference of the International Society for Ecological Economics, 2012.
- The Works and Correspondence of David Ricardo*, ed. P. Sraffa, Cambridge 1951.

Websites

- <https://davidhume.org/texts/empl2/pc>
- <https://ec.europa.eu/eurostat/data/database>
- <https://stat.gov.pl/en/topics/national-accounts/accrued-to-date-pension-entitlements-in-social-insurance/estimating-accrued-to-date-pension-liabilities-adl-for-poland-in-2015-using-the-prost-model,2,1.html>
- humesociety.org

Appendix 1. Government debt and financial net worth in EU member states (2019)

Country	Ratio of government liability in GDP (%)	Annual growth rate of government liabilities (%)	Ratio of financial net worth in GDP (%)	Annual growth rate of financial net worth (%)
European Union*	96.5	4.0	-55.5	2.6
Austria	94.41	0.98	-49.16	-1.49
Belgium	120.98	5.79	-84.53	4.67
Bulgaria	29.91	2.78	0.01	-100.38
Croatia	90.93	2.88	-38.57	-4.22
Cyprus	109.11	3.74	-45.00	8.41
Czechia	37.74	0.90	-7.67	-2.33
Denmark	47.87	5.03	6.24	476.53
Estonia	13.30	11.85	21.05	-5.26
Finland	72.91	2.99	62.74	18.57
France	123.72	5.13	-78.74	4.02
Germany	68.25	0.74	-27.86	-7.97
Greece	204.78	3.82	-146.79	3.39
Hungary	83.54	5.70	-53.86	5.74
Ireland	69.09	0.86	-42.49	-0.41
Italy	156.04	6.60	-126.71	7.65
Latvia	47.82	7.77	-11.77	13.61
Lithuania	44.43	17.18	-13.64	-0.19
Luxembourg	29.95	9.93	52.98	13.28
Malta	58.50	5.50	-28.59	6.74
Netherlands	62.46	-0.98	-31.05	-6.55
Poland	63.32	2.52	-36.49	1.19
Portugal	136.43	3.28	-99.39	1.83
Romania	44.37	13.10	-21.98	23.71
Slovakia	63.52	4.63	-42.12	7.13
Slovenia	86.17	8.31	-26.02	18.63
Spain	117.33	5.90	-82.76	8.86
Sweden	56.07	-2.15	28.47	23.61

* Data without the UK.

Source: own elaboration based on the Eurostat database.

Appendix 2. Typology of contingent liabilities (as % of GDP, 2019)

Country	Government guarantees	Liabilities related to private-public partnerships	Government non-performing loans	Liabilities of government controlled entities
Austria	16.07	0.12	0.06	23.9
Belgium	8.49	0.37	0.03	45.34
Bulgaria	0.12	0.00	0.03	10.53
Croatia	1.09	0.08	1.24	8.36
Cyprus	7.44	0.08	28.77	17.19
Czechia	0.16	0.00	0.60	9.82
Denmark	18.21	0.19	0.41	30.44
Estonia	1.37	0.07	0.05	11.93
Finland	33.42	0.02	0.07	43.03
France	11.64	0.00	0.00	58.7
Germany	13.19	0.00	0.07	91.73
Greece	4.09	0.15	0.29	124.28
Hungary	7.39	1.13	0.03	11.20
Ireland	0.00	0.66	0.18	39.96
Italy	4.80	0.01	0.00	54.88
Latvia	1.43	0.01	0.12	19.84
Lithuania	0.84	0.03	0.06	8.93
Luxembourg	10.45	0.00	0.00	75.06
Malta	7.40	0.05	0.00	16.66
Netherlands	3.03	0.00	0.04	96.8
Poland	1.18	0.00	0.12	42.06
Portugal	4.83	2.26	1.39	33.81
Romania	2.00	0.00	0.00	5.88
Slovakia	0.01	2.42	0.16	4.71
Slovenia	6.46	0.00	2.48	31.55
Spain	4.94	0.27	0.23	20.03
Sweden	9.99	0.00	0.59	52.57
United Kingdom	0.2	1.09	0.01	32.22

Source: own elaboration based on the Eurostat database.

Appendix 3. Carbon emissions and level of the climate liability in EU member states (2018)

Country	Carbon emissions (m tonnes)	Share of country-level CO ₂ emissions in EU total CO ₂ emissions (%)	Climate liability (m US\$)	Ratio of climate liability in GDP (%)
European Union	3.598.0251	100.00	143921.00	26.98
Austria	69.24964	1.92	2769.99	0.62
Belgium	105.35226	2.93	4214.09	0.79
Bulgaria	44.32375	1.23	1772.95	2.58
Croatia	18.27829	0.51	731.13	1.20
Cyprus	8.37086	0.23	334.83	1.34
Czechia	106.33865	2.96	4253.55	1.70
Denmark	37.97783	1.06	1519.11	0.43
Estonia	17.91955	0.50	716.78	2.28
Finland	48.2898	1.34	1931.59	0.72
France	349.36757	9.71	13974.70	0.51
Germany	785.42439	21.83	31416.98	0.81
Greece	75.65595	2.10	3026.24	1.47
Hungary	50.46944	1.40	2018.78	1.23
Ireland	42.08321	1.17	1683.33	0.42
Italy	359.73053	10.00	14389.22	0.72
Latvia	8.33818	0.23	333.53	0.98
Lithuania	14.04748	0.39	561.90	1.03
Luxembourg	11.36905	0.32	454.76	0.64
Malta	2.0032	0.06	80.13	0.53
Netherlands	172.76881	4.80	6910.75	0.76
Poland	340.68223	9.47	13627.29	2.28
Portugal	55.73919	1.55	2229.57	0.93
Romania	77.36243	2.15	3094.50	1.24
Slovakia	36.27233	1.01	1450.89	1.38
Slovenia	14.58924	0.41	583.57	1.08
Spain	287.46069	7.99	11498.43	0.82
Sweden	44.55439	1.24	1782.18	0.34
United Kingdom	414.00617	11.51	16560.25	0.58

Source: own elaboration based on the Eurostat database.