



Analysis of Some Public Debt Sustainability Alternative Indicators in Several Countries of the World in the Period 2001-2019

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Abstract: The COVID-19 health crisis has brought to light a series of shortcomings not only of a medical nature but also of the social, political, economic, cultural nature of all the countries of the world. In this context, indebtedness, especially public debt, has been the answer to many problems in all the countries of the world. The literature and international organizations are carefully and constantly concerned with improving indicators of public indebtedness assessment, including those for assessing debt sustainability. However, there are many areas still unexplored. Therefore, the article aims to highlight the link between public debt and a number of important macroeconomic indicators, including from the sphere of GDP (estimated according to the method of expenses), through the methods of advance coefficient and elasticity, in 11 countries of the world, in the pre COVID19 pandemic period 2001-2019.

Keywords: debt; elasticity; advance coefficient; pre-COVID19 period; world's economies

JEL Classification: H63; E63; H74

1. Introduction

The year 2020 has emerged as a real epidemiological storm, putting pressure on the entire human society, medical systems being practically countless times on the verge of collapse, and the states of the world, despite the measures taken, are still marked by the difficulty of stabilizing the number of diseases and deaths. Although still pessimistic, the year 2021 is announced, through the prism of the launched vaccines, to bring an oasis of hope in the entire human society. In this context, lending could play an important role in providing financial liquidity to counter the pandemic.

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At the same time, public borrowing plays an important role in balancing public deficits by financing various projects, including those for sustainable development, which can have a countercyclical role in the economy and reduce, through adequate financing, projects to combat aggravating factors (e.g. air pollution, soil degradation, deforestation etc.). According to Lu (2020), amid the pandemic, the pandemic relief measures and the falling revenues have increased global debt by \$20 trillion since the third quarter of 2019 and by the end of 2020 economists expect global debt to reach 365% of world GDP or \$277 trillion.

It is also important to keep indebtedness within sustainable limits, whether it is public or private indebtedness. But the limit is set differently. E.g., Caner & Grennes & Koehler-Geib (2010) set the tipping point at a debt level of 77 percent or more (based on an analysis of the debt of 100 countries over 30 years) but they also asserted that, based on any specific nation wealth, the tipping point could be higher or lower. For the EU, the Maastricht Treaty set the threshold at 60% of GDP for government debt-to-GDP ratio. Every percentage point that exceeds these thresholds is recorded in the literature as leading to a decrease in GDP, depending of the situation, by thousands, hundreds or even tenths of a percentage point of annual GDP growth.

Regardless of the threshold, although with some progress in reducing indebtedness, especially developing countries worldwide are still at a disadvantage in terms of public indebtedness, remaining extremely vulnerable economically, in the medium and long term, in the face of external shocks (e.g. COVID-19, natural disasters such as earthquakes and floods, explosions of resource and import prices, unexpected increases in oil prices, increases in the general volatility of capital markets, etc.). Especially, since some of them were already in a situation of increased risk of indebtedness. It should be noted that, in times of deep crisis, not only developing countries are experiencing heavy debt, but also developed ones. Thus it has being difficult to detect, at that time of deep crisis manifestation, the level at which we can talk about global sustainability for certain indicators of indebtedness, on the basis of abundant use of financial or fiscal products or instruments, public or private, that artificially improve or aggravate the result of indebtedness. In addition, the mere fact that debt is reported to GDP, in times of crisis the economic growth collapsing dramatically, makes the indebtedness to increase artificially. Therefore, a pre-crisis time analysis is needed, which would allow the identification of signal elements that could show some structural shortcomings of the debt indicators pursued.

In times of crisis, and even pre-crisis, low interest rates on the financial-money market, a flexible monetary policy, conducive to indebtedness, also disrupt the achievement of debt sustainability. At the same time, borrowers are often faced with the risk of debt service risks, of debt rollover, also interest rate risk and/or exchange rate risk, including the risk of withdrawing external capital flows, changing the

structure of creditors globally, and consequently the structure of indebtedness in debtor countries, with the likelihood of less inspired and relevant economic decisions in the medium term, therefore the analysis at this time (of deep crisis) can be misleading. Therefore, this paper aims at analyzing the period 2000/2001 – 2019, a period which may indicate the hidden shortcomings of (public) borrowing, but revealed during the COVID19 pandemic.

Related to this fact, the literature on public debt sustainability abounds in indicators, but the best known are those of the IMF, the World Bank and the EU - in the alert mechanism, in the procedure on macroeconomic imbalances. Thus, a number of interesting indicators for indebtedness followed by institutions and specialists are: - Debt service as a proportion of exports of goods and services, Total external debt as a percentage of GDP, or Debt to the creditor as a part of the total (whether bilateral, trade or multilateral relations), Total public debt, Total private debt, Private external debt, Total external debt as a percentage of GDP, Share of short-term debt in total external debt, Need for gross fiscal financing as a percentage of GDP (i.e. the fiscal deficit to which is added the principal due public debt), External financing requirements as a percentage of GDP (to capture both the current account deficit and the principal payment of the due external debt), Risk ratings on tensions or difficulties in repaying external debt , Adequacy of external reserves, or other indicators that capture debt vulnerabilities. Debt burden indicators (i.e. those that track the debt stock or debt service relative to the measures or the ability to pay) are analyzed in relation to certain empirically estimated thresholds. But this article does not aim to analyze the classic indicators of public debt indebtedness or sustainability, but rather tries to look for alternatives to understand public debt in relation to the evolution of private debt, household debt, non-financial corporation debt, total reserves, as well as a number of components of GDP through the advance coefficient and elasticity.

2. Description of the Problem in the Context of the Literature Review

Local, regional or global economic and financial crises, whether they are currency crises, debt crises, banking crises, speculative bubbles, etc. they have a historical connection with the level of public and private indebtedness. In this context, the sustainability of public debt is an important factor in preventing crises, ensuring a stable economy and promoting sustainable economic growth. The necessary condition for sustainability of public debt analysis was set by Domar (1944), after that, Blanchard et al. (1990), based on the government inter-temporal budget constraint, formalized the model and introduced two conditions for public debt sustainability: - the convergence, in the long run, to its initial level, of the ratio of debt to GDP, and - the present value of the ratio of the primary budget deficit to GDP

should be equal to the negative of the current level of public debt to GDP (IMF, 2011).

Regarding the fiscal space, in order to analyze the sustainability of public debt Ostry et al. (2010) developed the concept of fiscal space, maximum sustainable debt level, long run debt level, using estimated fiscal response functions. Ghosh et al. (2011) in order to model sustainable public debt also made a clear distinction between long-run public debt and maximum sustainable public debt concepts, default being seen as a problem of inability-to-pay. IMF (2011), for the 1993–2009 period, for a sample of Emerging Markets, re-estimated public debt thresholds, for example for maximum sustainable debt level at 63% to 78% of GDP, and for the long-run debt level well under 60% (in the range 49%-58% of GDP).

When considering regional studies for debt analysis, Cowan et al. (2006) examined the evolution of sovereign debt for Americas, and for Australia, Makin & Pearce (2016) examine the balance sheet implications of escalating public debt, showing that no target debt to GDP level consistent with the optimal levels will be met on current fiscal settings in the medium term for this country. For China, Lu and Sun (2013), Zhang et al. (2014) and Sun (2019) analyzed the sustainability of local government debt and structure, determinants and sustainability of China's debt and for India, Topalova & Nyberg (2010) discusses possible medium-term public debt targets, based on prudent levels of public debt evidence from the literature. In the paper of Selezneva et al. (2016) for Russian Federation, there is presented an overview of the individual debt problems of formation of Russian policy, using a number of indicators reflecting the debt sustainability of the national economy in order to ensure the effective management of the state internal and external debt. When we refer to Japan, Miyazaki & Onji (2017) paper reviews the related studies through a threefold approach: sustainability problem, relations with foreign investors, and coordination problem in the Japanese government bonds market.

3. Methodology and Data Source

The article aims to formulate some alternative way of analyzing debt sustainability or debt problems by the advance coefficient and elasticity putting public debt at the centre of concerns. For data source it has been used the information of the International Monetary Fund (IMF) especially Global Debt Database and other IMF data from various reports and papers (e.g. World Economic Outlook Update, Global Financial Stability Update, from January 2021). The countries considered for the analysis are: Australia, Brazil, Canada, China, Finland, France, Germany, India, Japan, Russian Federation and United States.

Indicators followed:

- The coefficient of advance of the increase of the public debt by the increase of the private debt, loans and debt securities (KPubDPrivD);
- Elasticity of public debt to household debt (EPubDHD);
- Elasticity of public debt to the non-financial corporations' debt (EPubDNFCD);
- Elasticity of public debt to total reserves (EPubDTR);
- Elasticity of public debt to government consumption expenditures (EPubDGCE);
- Elasticity of public debt to gross fixed capital formation (EPubDGFCF);
- Elasticity of public debt to the export of goods and services (EPubDE).

The calculation of elasticity starts from the absolute change, for example for public debt, the absolute change expresses their increase or decrease from one period to another, in absolute size and is determined as follows:

$$\Delta \text{PubD}_{1-0} = \text{PubD}_1 - \text{PubD}_0,$$

In which $\Delta \text{Datpub}_{(1-0)}$ – the absolute change of the public debt, in the current period (1) compared to the base period (0); PubD_1 – public debt in the current period; PubD_0 – public debt in the base period.

The relative change in public debt also results from the ratio between the absolute change in public debt in the current period compared to the base period and their level in the base period:

$$\text{IPubD}_{1-0} = \Delta \text{PubD}_{1-0} / \text{PubD}_0$$

Identically, relative changes are calculated for household debt, debt of non-financial corporations, total reserves (without gold, expressed in US dollars), government consumption expenditures, gross fixed capital formation and export of goods and services.

The elasticity of public debt to household debt measures the extent of the reaction of public debt to changes in household debt. The calculation is performed as follows:

$$\text{EPubDHD} = (\Delta \text{PubD}_{1-0} / \text{PubD}_0) * 100 / (\Delta \text{HD}_{1-0} / \text{HD}_0) * 100 = (\Delta \text{PubD}_{1-0} / \text{PubD}_0) * (\text{HD}_0 / \Delta \text{HD}_{1-0})$$

This indicator expresses the tendency of the public debt to change when the household debt changes and can take the following values: $\text{EPubDHD} > 1$, public debt is very elastic in relation to household debts, there is a tendency to increase the household debt to a greater extent, as an influence for the evolution of public debt;

$E_{PubDHD} = 1$, public debt is elastic in relation to household debt; $E_{PubDHD} < 1$, the inelasticity of public debt to the increase of household debt.

Similarly, they were calculated: $E_{PubDNFCD}$, E_{PubDTR} , $E_{PubDGCE}$, $E_{PubDGFCE}$ and E_{PubDE} .

The public debt change index in period (1) compared to period (0) ($I_{PubD_{1/0}}$) analyzes the relative change of public debt and is calculated based on the relay: $I_{PubD} = PubD_1 / PubD_0$, in which $PubD_1$ and $PubD_0$ are the public debt in the current period, respectively base period. The private debt change index ($I_{PrivD_{1/0}}$) in period (1) compared to period (0) is calculated just the same, as the ratio between private debt from the current period and that from the base period. Thus, the advance coefficient of the increase of public debt by the increase of private debt ($K_{PubDPrivD}$) is an indicator that reflects the correspondence between the evolutions of the two indicators. It is calculated based on the relation:

$K_{PubDPrivD} = I_{PubD_{1/0}} / I_{PrivD_{1/0}}$, where: K - the advance coefficient of the increase of the public debt by the increase of the private debt;

Depending on the growth rate of the two component indices, the coefficient can take the following values: $K > 1$ means a more accentuated increase of the private debt compared to the public debt; $K = 1$, when both debt indexes have identical growth rates; $K < 1$ reflects a slower increase in private debt compared to an increase in public debt.

4. Results Obtained

Used usually for assessing the sustainability of public debt, the ratio of public debt on GDP shows for the eleven countries selected, that in the analyzed period the public debt registered serious inflammations. Thus, Japan, United States, France and Brazil show spectacular increases in 2019 compared to 2000, Japan even almost with 100pp. Only the Russian Federation and India recorded declines in public debt relative to GDP.

When considering private debt, private indebtedness brings additional challenges to public and private budgets, and in crisis situations, nation states are called upon to take over some of these challenges and risks and prevent bottlenecks in the economy, providing, also through increased flexibility in tax, a normal and continuous flow of capital for borrowers (through advantageous loans, deferrals, repayments, freezing of interest rates, etc.). Therefore the analysis of public-private debt, their mode of substitution or complementarities, can prove to be extremely relevant. Thus, a substantial increase in private debt in 2019 compared to 2000 was recorded in countries such as China, France, Canada, Finland and Australia, which are generally ahead of the share of public debt in GDP for most countries analyzed.

Reductions in private debt as a share of GDP were recorded only in Japan and Germany, but for Japan they remained extremely high, for example above the 133% of GDP threshold set out in the European alert mechanism for consolidated private sector debt.

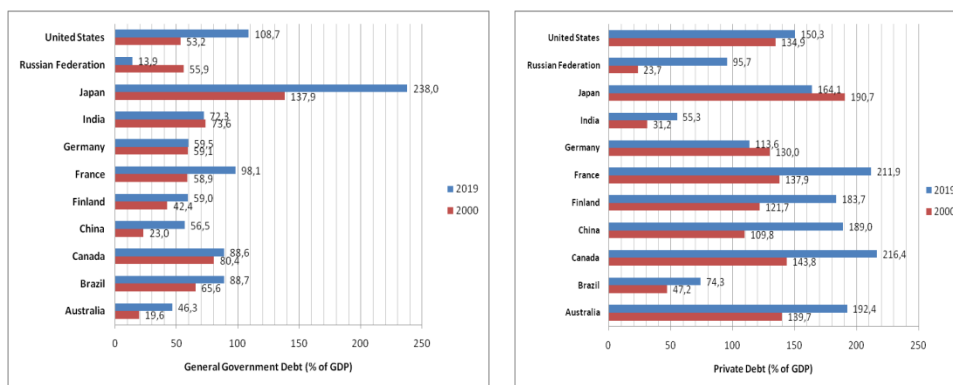


Figure 1. Comparing Public Debt and Private Debt in Years 2000 and 2019, for Eleven Countries of the World

Source: author's processing, IMF data base

It is known that in times of crisis, the public debt relative to GDP is likely to evolve faster than the private debt, debt of non-financial corporations and households' debt, as the state needs additional financing, including stabilizing the activity of the social partners. At the same time, simultaneously with the increase of the needs, therefore of the expenses, the revenues from taxes decrease, so the pressure moves on a short term on the budget deficit and subsequently on the public debt. In the pre-crisis period, expectations are more pronounced ahead of the increase in private debt than in public debt, amid rising indebtedness of non-financial corporations and households.

Thus, the advance coefficient shows outrunning (including evolutions at the same pace) of public debt by private debt in analyzed countries for: Australia (between 2001-2007, 2015, 2017-2018), Brazil (2001, 2003-2014, 2018-2019), Canada (2001-2008, 2010-2019), China (2002-2004, 2006, 2008, 2010-2015, 2019), Finland (2001-2008, 2011, 2013-2019), France (2001-2002, 2004-2008, 2010-2019), Germany (2001-2002, 2006-2008, 2011-2019), India (2001-2015, 2017-2019), Japan (2005-2008, 2012-2019), Russian Federation (2001-2008, 2011-2019), United States (2001-2003, 2005-2007, 2013-2019) (see Table 1).

Table 2. Advance Coefficient of Public Debt by Private debt, for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	1,1	1,2	1,2	1,2	1,2	1,2	1,1	0,8	0,7	0,8	0,8	0,9	0,9	0,9	1,0	0,9	1,0	1,0	0,9
Brazil	1,0	0,9	1,0	1,0	1,0	1,1	1,0	1,2	1,0	1,1	1,1	1,1	1,1	1,0	0,9	0,8	0,9	1,0	1,0
Canada	1,0	1,1	1,0	1,1	1,0	1,0	1,1	1,0	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
China	0,9	1,0	1,2	1,0	0,9	1,0	0,9	1,1	0,9	1,1	1,0	1,1	1,0	1,0	1,0	0,9	0,9	0,9	1,0
Finland	1,0	1,0	1,0	1,0	1,1	1,1	1,2	1,1	0,8	0,9	1,0	0,9	1,0	1,0	1,0	1,0	1,1	1,0	1,0
France	1,0	1,0	0,9	1,0	1,0	1,1	1,0	1,0	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Germany	1,0	1,0	0,9	0,9	0,9	1,0	1,0	1,0	0,9	0,8	1,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1
India	1,0	1,0	1,0	1,1	1,2	1,2	1,1	1,1	1,0	1,1	1,0	1,0	1,0	1,0	1,0	0,9	1,0	1,0	1,0
Japan	0,9	0,9	0,9	0,9	1,0	1,0	1,0	1,0	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Russian Federation	1,4	1,3	1,6	1,5	1,6	1,6	1,5	1,2	0,8	0,9	1,0	1,0	1,1	1,0	1,0	1,0	1,0	1,0	1,0
United States	1,0	1,0	1,0	0,9	1,0	1,1	1,0	0,9	0,8	0,9	0,9	0,9	1,0	1,0	1,0	1,0	1,0	1,0	1,0

Source: author's calculation. IMF data base; Note: in the table it is mention only the year t of analysis

It is observed from the evolution of the advance coefficient for the analyzed countries that it was usually unitary or supra-unitary at the end of the analysis interval. The year 2009, marked by the international financial crisis, was emphasized by an escalation of sovereign public debt over the level of private debt evolution, the advance coefficient slightly decreasing. If we analyze the elasticity of public debt related to household debt (both indicators, expressed as a percentage of GDP) (see Table 2) we can notice interesting results.

Table 2. Elasticity of Public Debt to Household Debt, for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	-2,2	-1,2	-1,1	-1,4	-1,9	-1,8	-1,0	-9,9	8,9	-22,0	-8,8	35,8	5,5	3,4	2,5	3,1	-2,2	-2,4	-4,8
Brazil	-0,1	-2,8	1,3	-0,3	-0,1	-0,4	-0,2	-0,2	0,5	-0,7	-0,6	0,3	-0,8	0,6	6,6	-6,0	6,7	1,4	0,7
Canada	0,6	-0,6	-1,5	-1,2	-0,4	-0,2	-0,7	0,4	1,3	121,0	-0,6	3,2	2,1	2,3	1,1	0,2	2,6	139,4	-2,9
China	0,3	0,4	0,1	-0,2	0,0	-0,3	0,2	1,6	0,9	-0,1	-0,2	0,3	0,7	1,1	0,4	1,1	0,8	0,6	0,8
Finland	-2,6	-0,2	0,6	0,0	-0,5	-0,6	-4,4	-1,2	2,3	-53,9	12,1	3,3	5,8	4,2	4,7	-0,6	-5,0	-2,6	-0,9
France	-0,8	1,2	1,6	0,5	0,3	-0,7	0,0	1,6	2,5	1,2	1,6	4,5	4,0	10,6	0,9	1,4	0,2	-0,1	0,0
Germany	1,2	-24,4	14,6	-1,3	-2,8	0,2	0,7	-0,8	2,9	-3,0	0,8	-1,8	1,8	1,5	4,3	7,1	11,6	-7,1	-1,9
India	0,4	0,3	0,1	0,0	-0,1	-0,2	-0,7	-8,2	0,2	10,9	-296,2	23,9	-0,2	-0,2	0,6	-0,1	0,1	0,0	0,5
Japan	-3,5	-4,2	-2,9	-2,0	-0,4	0,1	2,3	2,4	2,0	-1,3	-4,8	-1,4	-4,1	-1,7	0,9	1,9	-0,9	0,4	0,4
Russian Federation	-0,3	-0,7	-0,3	-0,4	-0,5	-0,8	-0,7	-0,8	-6,5	-0,5	0,2	0,4	0,6	3,7	-0,1	1,2	-0,8	-1,2	0,2
United States	0,0	0,7	0,8	2,6	-0,3	-0,4	0,3	-5,2	26,1	-2,0	-1,0	-0,9	-0,6	0,1	-0,1	7,5	1,8	-0,4	-3,3

Source: author's calculation. IMF data base. Same above notation.

So, we find supra-unitary or unitary values in countries such as: Australia (2001-2019), Brazil (2002-2003, 2015, 2017, 2018), Canada (2003-2004, 2009, 2010, 2012-2015, 2017-2019), China (2008, 2014, 2016), Finland (2001, 2007-2015, 2017, 2018), France (2002-2003, 2008-2014, 2016), Germany (2001-2005, 2009-2010, 2012-2019), India (2008, 2010-2012), Japan (2001-2004, 2007-2014, 2016), Russian Federation (2009, 2014, 2016, 2018), United States (2004, 2008-2011, 2016-2017, 2019).

Interestingly, although with over proportional values throughout the analysis period, in Australia the tendencies of the elasticity EPubDHD are decreasing in periods 2001-2004, 2007, 2009, 2011, 2013-2018 and increasing in periods 2008, 2010, 2012, 2019. Also, almost explosive supra-unitary elasticity was recorded in: Australia (2010, 2012), Canada (2010, 2018), Finland (2010), Germany (2002), India (2011), United States (2009). Some of these governments are federal states, having a financial pressure also from provincial level, especially on the ground of increase spending of health care and increase transfers to households. Thus, for 2020, the burst of COVID-19 pandemic, it is natural to have an explosion of general government debt (% of GDP) and increase elasticity considering household debt. The post 2020 period will be analyzed in further studies.

If we analyze the connection between the public debt and the debt of non-financial corporations through elasticity, we find that the supra-unitary or unitary values are registered in: Australia (2001-2004, 2006, 2008-2016, 2018-2019), Brazil (2002, 2005, 2009-2010, 2013, 2015, 2017-2018), Canada (2002, 2004, 2006, 2007, 2009, 20011, 2012, 2016-2018), China (2001-2004, 2006-2009, 2013-2014, 2016-2017, 2019), Finland (2002-2007, 2009-2015, 2018), France (2002-2006, 2008-2010, 2012-2013, 2017), Germany (2002-2003, 2005-2010, 2012-2019), India (2001, 2009, 2015, 2019), Japan (2001-2002, 2004-2004, 2008-2009, 2011-2013, 2017), Russian Federation (2001-2006, 2009, 2011-2012, 2017-2018), United States (2002-2004, 2008-2013, 2018-2019).

Table 3. Elasticity of Public Debt to the Debt of Non-Financial Corporations, for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	3.0	7.4	5.7	-18.8	-0.9	-1.4	-0.4	5.7	-5.1	-2.3	-5.6	7.4	2.2	3.5	1.6	-4.1	-0.3	1.8	-19.5
Brazil	0.2	1.2	0.6	0.4	1.0	-0.5	0.2	-0.1	4.7	9.2	-0.4	0.2	-1.1	0.9	1.4	-0.6	-1.1	1.4	0.7
Canada	0.2	-1.1	0.8	9.7	0.2	-1.2	-1.2	0.7	3.0	-0.8	3.1	1.0	0.1	-0.2	0.7	1.5	31.2	-1.0	-0.3
China	5.4	3.4	-4.3	-14.7	0.0	-1.4	-1.3	-6.8	1.5	-0.3	0.2	1.8	1.0	0.6	5.4	-4.0	-0.9	-2.5	
Finland	0.7	3.9	2.3	-1.3	-46.0	-1.5	-2.7	-0.4	10.6	6.5	3.5	9.0	1.3	1.4	1.3	0.1	-0.5	2.3	0.4
France	-0.2	-5.1	-3.8	5.6	1.8	-2.5	-0.1	1.4	5.9	-3.6	0.7	1.0	-2.0	0.4	0.2	0.6	2.2	-0.1	0.0
Germany	-0.7	1.4	8.7	-0.4	-1.9	6.8	-29.5	1.3	6.2	-2.0	0.7	1.2	-1.5	1.2	-3.3	-2.5	-1.9	-2.4	-1.3
India	12.6	0.5	-0.4	-0.2	-0.3	-0.6	-0.8	-0.1	1.0	-0.9	0.7	-0.5	-0.6	0.3	-3.2	0.0	-0.2	0.1	-3.4
Japan	-2.2	-2.9	-0.6	-1.1	1.5	-0.8	0.3	1.1	3.2	-0.6	5.4	-3.2	-1.1	-0.9	0.6	0.9	1.5	0.3	0.3
Russian Federation	-2.2	-1.2	-1.6	-3.6	-2.7	-11.4	-0.8	-0.7	3.3	-0.2	-1.5	1.2	0.6	0.9	0.1	0.6	3.1	1.4	-0.8
United States	0.0	-4.3	-1.6	-42.5	-0.8	-0.5	0.1	3.8	-5.8	-2.0	-4.2	5.3	2.2	-0.2	0.1	0.8	-0.3	1.0	2.2

Source: author's calculation. IMF data base. Same above notation.

From the above data, the negative sign of coefficients of elasticity indicates a relationship of inverse dependence between public debt and that of non-financial corporations, and in: Australia (2004, 2006, 2009-2011, 2016, 2019), Brazil (2013, 2017), Canada (2002, 2006-2007, 2018), China (2003-2004, 2006-2008, 2017-2019), Finland (2004-2007), France (2002-2003, 2006-2007, 2010, 2013), Germany (2005, 2007, 2010, 2013, 2015-2019), India (2015, 2019), Japan (2001-2002, 2004, 2012-2013), Russian Federation (2001-2006, 2011), United States (2002-2004, 2009-2011). This really emphasizes that only the years 2006, 2008, 2012 mark for

almost all the analyzed countries positive relative changes of the debt of the non-financial corporations, overlapping almost faithfully over the periods of crisis onset.

The elasticity of public debt in relation to the evolution of total reserves may underline the ability to cover debt through the movements and restructuring of total reserves (see Table 4). Thus, public debt (expressed as a percentage of GDP) is elastic in relation to the evolution of total reserves (expressed in millions US \$) in: Australia (2001, 2009, 2010-2014, 2019), Brazil (2002, 2005, 2014-2018), Canada (2003-2004, 2012, 2015), China (2009, 2014, 2016-2019), Finland (2001, 2007-2008, 2012, 2015, 2017, 2018), France (2003, 2016), Germany (2002-2003, 2010, 2012-2013, 2016-2019), India (2010-2012), Japan (2005, 2009, 2012-2016, 2018), Russian Federation (2009, 2011-2013, 2016), United States (2004, 2006, 2008, 2010, 2012, 2016). The negative sign of some elasticity coefficients does not necessarily mean a reduction of the total reserves from year to year but it can also underline a more consistent restructuring of the public debt as in the case of Germany.

Table 4. Elasticity of Public Debt to Total Reserves (Without Gold, Expressed in US Dollars), for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	13.6	-0.8	-0.2	-0.9	-0.5	-0.3	0.1	0.9	1.5	-30.1	1.7	3.0	1.0	5.4	-0.7	0.4	0.1	-0.1	1.1
Brazil	0.3	2.4	-0.2	-0.7	-1.0	-0.1	0.0	-0.3	0.2	-0.2	-0.1	0.3	0.9	2.5	-8.7	3.4	2.9	19.6	-0.6
Canada	0.2	-0.3	2.3	1.1	0.4	-0.2	-0.3	0.2	0.7	0.5	0.0	1.1	0.2	-0.2	1.0	0.2	-0.3	0.3	-0.8
China	0.2	0.2	0.1	0.0	0.0	-0.1	0.3	-0.3	1.1	-0.1	0.0	0.5	0.5	15.5	-0.3	-1.7	1.7	-1.9	4.5
Finland	-45.0	-0.1	0.5	0.0	0.5	0.1	-1.2	3.3	0.7	-0.5	0.4	1.5	0.4	-1.0	-1.3	-0.2	1.3	1.3	-0.1
France	0.1	-0.3	1.1	0.1	-0.1	-0.1	0.0	-0.2	0.5	0.1	-0.2	0.3	-0.5	-0.6	0.1	1.5	-0.2	0.0	0.0
Germany	0.2	-6.7	-6.5	-0.7	-0.5	0.1	-0.6	-0.9	0.3	3.3	-0.4	2.3	35.2	0.5	0.8	-2.3	16.1	16.7	-176.8
India	0.3	0.1	0.0	0.0	-0.7	-0.2	-0.1	0.2	-0.3	-1.9	-2.4	3.6	-0.2	-0.1	0.3	0.0	0.1	-0.1	0.3
Japan	0.6	0.4	0.1	0.2	64.2	0.0	-0.1	0.8	6.2	0.8	0.4	-1.2	1.9	-3.0	1.0	-1.4	-0.2	1.7	0.2
Russian Federation	-0.6	-0.4	-0.4	-0.4	-0.6	-0.5	-0.3	0.6	27.9	0.3	1.0	1.1	-3.0	-0.8	-0.2	4.0	-0.3	-0.8	0.2
United States	0.0	0.2	0.5	9.6	0.0	-1.4	0.1	1.2	0.2	7.2	0.4	2.2	-0.4	0.0	0.0	-7.9	-0.1	0.4	0.6

Source: author's calculation. IMF data base, *International Financial Statistics (IFS)*. Note: in the table year *t* of analysis

If we want to see if the change in government consumption expenditures produces changes in public debt for the analyzed countries, we can observe (in Table 5) supra-unitary or unitary coefficient of elasticity in: Australia (2001-2019, supra-dimensional effect 2008 and 2012), Brazil (2002-2004, 2006-2019), Canada (2002-2007, 2009-2010, 2012, 2015, 2018-2019, over dimensional effect 2007), China (2001-2002, 2006-2010, 2013-2019), Finland (2001, 2003, 2005-2015, 2018), France (2001-2006, 2008-2014, 2016-2017), Germany (2001-2005, 2007-2019), India (2001, 2003, 2010-2011, 2014-2015), Japan (2001-2005, 2007-2016), Russian Federation (2001-2009, 2012-2014, 2017-2018), United States (2002-2006, 2008-2011, 2016, 2018-2019).

Table 5. Elasticity of Public Debt to Government Consumption Expenditures, for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	14,2	7,2	-9,2	17,8	21,1	-29,4	1,8	320,0	9,7	-21,2	21,2	-416,5	-23,9	-15,3	3,0	3,5	-1,8	1,5	4,7
Brazil	0,9	5,4	1,6	1,5	-0,7	-4,5	4,8	4,7	1,2	1,1	1,6	-2,2	-1,7	2,5	5,0	2,6	-6,5	-3,1	3,2
Canada	0,6	-1,7	-7,8	2,2	1,0	-1,1	-392,5	0,6	1,5	-1,1	-0,4	-10,7	-0,5	0,3	2,2	0,7	0,8	-9,2	-2,3
China	-2,7	-2,5	-0,7	0,3	-0,4	-10,8	-10,2	15,3	15,8	3,7	-0,1	0,7	23,6	-25,1	1,5	11,2	97,3	3,1	19,1
Finland	-3,8	-0,5	2,8	-0,6	-5,9	11,1	4,1	-1,0	2,4	-8,2	-2,1	3,5	2,7	-54,1	-12,7	0,3	0,8	-9,8	-0,9
France	1,1	1,3	3,7	-5,5	22,6	3,1	0,1	11,4	3,1	-7,0	-3,0	3,6	4,6	26,9	-0,6	-7,8	-1,0	0,2	-0,1
Germany	3,8	2,0	12,3	-1,0	-16,5	0,4	1,6	1,1	1,2	-6,0	1,2	1,5	-1,6	18,1	-8,7	-3,9	67,4	-11,6	-1,5
India	1,6	-0,8	-6,3	0,1	-1,0	0,8	0,7	-0,2	-0,2	1,9	-2,0	-0,3	0,3	2,0	-1,2	0,0	0,2	0,1	0,5
Japan	1,6	2,0	10,3	-10,9	37,4	0,2	13,3	2,0	1,4	-4,6	1,9	9,6	-3,6	-24,2	1,1	5,2	0,6	0,9	0,6
Russian Federation	-2,3	-2,1	-16,2	5,0	48,8	-11,1	34,7	-2,4	2,0	-0,2	-0,4	4,1	2,7	-6,5	-0,7	-0,7	2,7	1,6	0,7
United States	0,0	1,3	4,1	-25,1	1,3	6,2	0,5	2,8	3,4	-21,5	-1,3	-0,9	-0,5	0,1	-0,1	-2,6	0,7	-18,2	-4,8

Source: author's calculation. IMF data base Note: in the table year t of analysis

Taking into account the coefficient of elasticity of public debt in report to fix capital formation, for selected countries, for the analyzed period we can see supra-unitary or proportional coefficients of elasticity in: Australia (2001-2019), Brazil (2001-2002, 2004-2006, 2009, 2012-2013, 2015, 2017-2019), Canada (2002-2004, 2007-2009, 2011-2012, 2015, 2017-2019), China (2001-2002, 2006-2014, 2016-2019), Finland (2001, 2003, 2005-2015, 2017, 2019), France (2001-2006, 2008-2014, 2016), Germany (2003-2005, 2007-2010, 2012-2019), India (2001-2002, 2006, 2008, 2010-2011), Japan (2001-2005, 2008-2009, 2011-2012, 2015-2016), Russian Federation (2001-2014, 2017), United States (2002-2004, 2006, 2008-2011, 2013, 2016, 19) (Table 6). Given that in most countries analyzed the public debt as a percentage of GDP increases from year to year, the negative sign of elasticity betrays a trend of disinvestment in the economy, signalling the inability of most countries to capitalize debt through investment projects.

Table 6. Elasticity of Public Debt to Gross Fixed Capital Formation, for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	2,1	-1,4	-3,1	-7,8	-2,8	9,3	-1,7	13,4	-12,4	-6,5	78,8	2,1	-3,1	-3,9	-4,5	-1,5	-1,1	-2,4	-2,2
Brazil	4,4	-4,9	0,8	-1,1	1,0	-3,9	-0,5	-0,3	-3,7	-0,5	-8,0	3,1	-3,5	-0,7	-1,6	-0,6	-1,1	1,1	2,0
Canada	0,5	2,6	-24,7	-1,2	-0,4	-0,2	-2,2	2,8	-3,4	0,5	3,3	1,1	-0,6	-0,7	-3,0	-0,1	3,9	1,5	1,0
China	2,6	1,2	0,4	-0,4	0,4	1,7	-6,3	-1,9	2,3	-2,1	1,8	224,3	62,6	-5,7	-0,9	-20,8	6,8	1,7	-3,8
Finland	4,6	0,3	7,6	-0,1	-2,1	7,0	-1,7	-3,2	-4,4	-4,5	2,0	5,4	-1,0	-2,6	-5,7	-0,1	-1,1	-0,8	1,0
France	205,2	-1,3	17,7	1,5	1,1	-1,4	0,0	3,7	-3,2	15,5	2,1	20,6	-1,7	-1,6	-0,5	1,7	0,1	-0,1	0,0
Germany	0,4	-0,4	-2,2	-1,0	-117,0	-0,2	-2,1	5,1	-2,0	11,4	-0,7	-34,0	1,6	-3,4	5,2	-8,7	-3,3	-1,6	-1,2
India	4,9	2,5	0,6	-0,1	-0,3	-1,4	-0,7	-1,5	0,4	38,1	4,3	0,3	0,1	0,2	-0,6	0,0	-0,4	0,0	-0,9
Japan	-2,1	-1,2	-1,7	-3,2	1,3	-0,4	0,2	-7,0	-1,4	-0,7	2,5	1,3	0,4	0,6	2,6	-1,1	-0,4	0,6	0,7
Russian Federation	-1,7	3,0	-8,6	163,0	8,4	-8,1	-1,3	-1,2	-25,1	-1,1	1,4	4,3	5,0	-7,0	-0,3	-0,5	-5,2	0,8	0,9
United States	0,0	-1,0	12,9	5,4	-0,3	-4,4	-0,2	-3,0	-1,5	-4,1	2,0	0,8	1,4	-0,1	0,4	-2,5	-0,8	0,6	15,0

Source: author's calculation. IMF data base; Note: in the table year t of analysis

Taking into account the coefficient of elasticity of public debt in report to exports of goods and services, we can see supra-unitary or unitary coefficients of elasticity in: Australia (2001-2006, 2008-2016, 2019), Brazil (2008, 2010, 2013, 2015-2017),

Canada (2004-2005, 2007-2010, 2012-2013, 2015, 2017), China (2001, 2007, 2009, 2013-2014, 2016-2019), Finland (2002-2003, 2005, 2007-2015, 2018), France (2002-2006, 2008-2009, 2012-2014, 2016), Germany (2002-2003, 2008, 2010, 2013-2019), India (2001, 2007, 2010, 2013, 2019), Japan (2001, 2008, 2011-2012, 2015), Russian Federation (2001-2009, 2012-2014, 2017), United States (2003-2004, 2008-2009, 2012-2014) (Table 7). The negative sign indicates an opposite evolution or divergence between the indicators pursued (public debt and exports).

Table 7. Elasticity of Public Debt to the Export of Goods and Services, for Eleven Countries of the World, in the Period 2001-2019

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Australia	-4.7	1.6	1.0	-23.0	-1.2	-1.1	0.7	1.3	-3.5	4.2	6.7	-2.0	5.2	-62.7	-2.5	17.5	0.2	0.2	1.6
Brazil	0.1	0.9	-0.9	-0.5	0.2	0.6	0.3	-1.6	-0.3	-26.8	-0.4	0.6	2.9	-0.5	1.0	-2.4	16.5	0.2	-0.8
Canada	-0.3	0.5	0.6	-4.2	1.4	0.3	1.3	3.3	-1.0	1.1	0.1	-4.2	-11.5	-0.1	18.4	-0.5	8.4	-0.3	0.9
China	-2.4	0.5	0.2	-0.1	0.0	-0.4	-8.0	0.9	-1.1	-0.2	0.2	-0.4	-1.9	-1.8	-0.4	-2.0	6.4	-1.3	-2.0
Finland	0.7	1.2	-1.4	-0.1	-1.5	-0.7	-6.2	-1.6	-1.4	2.0	2.3	-46.8	-2.4	-1.6	-2.2	0.4	-0.4	-1.1	-0.2
France	0.8	-1.3	-1.3	1.7	1.0	-1.2	0.4	6.9	-1.8	0.3	0.5	1.1	5.6	1.5	0.2	-2.2	0.2	-0.1	0.4
Germany	-0.5	1.3	-36.0	0.3	0.5	-0.1	-0.8	5.3	-0.9	1.1	-0.5	0.5	2.9	-18.6	-1.9	2.0	-2.1	-19.1	2.0
India	6.2	0.6	0.5	-0.1	-0.2	-0.4	1.6	-0.1	0.2	-2.2	0.3	-0.3	2.1	0.2	-0.2	0.0	-0.8	0.1	-1.6
Japan	-1.7	0.9	0.7	0.5	0.4	0.0	-0.1	-11.5	-0.3	0.2	-9.2	-1.2	0.2	0.1	-4.7	-0.3	-0.1	0.2	-0.1
Russian Federation	1.3	3.4	-240.5	11.2	-12.6	8.1	1.7	-1.9	-3.1	0.4	0.7	-2.0	-2.7	4.6	0.2	0.3	-4.0	-0.3	-0.4
United States	0.0	-0.8	-5.7	1.9	-0.3	-0.3	0.1	1.6	-1.4	0.8	0.5	-292.8	13.1	3.3	0.0	-0.4	-0.4	0.9	-0.4

Source: author's calculation. IMF data base; Note: in the table year t of analysis

5. Conclusion

Debt and public debt sustainability indicators can clarify the situation of public finances of any country in the world. Although there are many indicators of public debt sustainability, few have the ability to report on other macroeconomic indicators of the nominal and real economy. In this sense, this article aims to analyze less typical indicators for the analysis of public debt such as: the coefficient of advance of the increase of the public debt by the increase of the private debt, loans and debt securities, elasticity of public debt to household debt, elasticity of public debt to the non-financial corporations' debt, elasticity of public debt to total reserves, elasticity of public debt to government consumption expenditures, elasticity of public debt to gross fixed capital formation, elasticity of public debt to the export of goods and services. The results indicate quite accurately the moments of tension in the economy, when the public debt registered increases. Also the accelerations or decelerations, synchronizations or desynchronizations, super-unit or subunit effect of the public debt in relation to the followed indicators suggest the need to restructure the public debt to better tune to the necessities of the analyzed countries' economies.

6. Further Research

The article presents a series of limitations such as: - a relatively moderate number of countries analyzed worldwide - only 11; - the article covers the period 2000/2001 – 2019 (the period 2020-2021 or 2022 will be analyzed in future studies), mainly targets the precise period of pre-COVID19; - a modest number of indicators, not being the classic indicators analyzed by the literature on public debt sustainability; - the analysis is empirical but does not present an econometric development, etc.

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