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## Public debt and economic growth

Background report for the Finnish Economic Policy Council

### Executive summary

High levels of public debt raise concerns of debt sustainability. Servicing the debt puts public finances under pressure when interest rates rise. Based on economic literature there might be further reasons to be concerned about public indebtedness. While debt financed government spending can stimulate economic activity in the short run, persistently high and increasing debt ratios may have a detrimental effect on economic growth in the long run.

Deeper understanding of the potentially harmful effects of public indebtedness is particularly relevant for Finland today. First, because the share of general government debt to GDP has been rising since 2009, jumped to its historically highest level in 2020 and is projected to increase in the long term. Second, currently public discussions mostly revolve around the issue of debt sustainability when interest rates rise, ignoring other relevant aspects. Thirdly, the issue of debt stabilization will remain on the agenda as the EU's common fiscal rules limiting public debt will soon be revisited. The key questions of interest will be at what level of debt countries should aim and whether to accept a slower pace of debt reduction in the highly indebted countries. This would imply accepting higher debt ratios for long.

The relationship between debt and growth is complex. While economic theory suggests that high debt may have an adverse effect on growth, low growth could also lead to high debt, for reasons unrelated to debt. The relationship between debt and growth could also be confounded by a third factor, such as the general macroeconomic framework, affecting both. Furthermore, the relationship depends on country-specific characteristics and is likely to change over time. All these features pose a challenge to the empirical assessment of the debt-growth nexus, biasing the results if not properly addressed.

Accommodative monetary policy and the European Central Bank's asset purchase programs have kept financing conditions for sovereigns belonging to the EMU favorable for long. Finland has no imminent debt sustainability concerns as the cost of public debt is low, even though the public debt ratio is at its historically highest level and projected to increase. Even so, economic literature points to several channels through which debt can adversely impact long term economic growth. These channels can be seen as risk factors that Finland should be wary about.

High public debt can lead to higher distortionary taxes, lower future incomes, and intergenerational inequity. Taxes collected to finance interest payments distort economic activity, including diminished incentives to work,

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save and invest. In the long run, the key to raising future national income and potential output is higher national saving and productive investment. By reducing these, high debt can undermine long term growth.

Over the long term, interest payments on a rising stock of debt consume an ever-growing portion of government expenditure, leaving less resources for growth-enhancing productive investment, R&D, and education. Even without explicit political decisions, high public debt creates expectations about future tax hikes and the private sector seems to start dissaving. These findings contradict the Ricardian equivalence hypothesis, which states that households are forward looking and increase their saving in response to increases in government borrowing. Companies, on the other hand, may anticipate the increase in costs following a future tax increase and delay investment. A reduction in productive investment and capital accumulation will eventually reduce the growth potential of the economy.

As government debt stock continues to grow, the increased government borrowing competes for funds in the capital markets. Public debt can crowd out private investment by reducing capital available for productive private investment because public debt substitutes physical capital in investment portfolios, or by increasing borrowing costs for private investment. When public debt reaches elevated levels, investors require higher compensation for the higher risk, increasing yields on sovereign debt. As benchmark interest rates in the economy, these are then transmitted to the rest of the economy, raising borrowing costs for the private sector.

Many of the above-mentioned channels run through the sovereign spread or interest rates in the economy and are currently kept aside by the ECB. Given the mandate and independence of the ECB, there is uncertainty about when interest rates and hence borrowing costs will again normalize. Once the central bank terminates its bond purchases, not only will governments' interest payments rise but also the mechanisms previously turned off will again become active.

Empirical evidence points to the importance of debt trajectory. High and rising debt ratios are found to be detrimental to growth, but the effect is weaker (or vanishes) when ratios are declining. From this perspective, the upward trend of Finland's public debt ratio since 2009 constitutes a risk factor for long run economic growth. If the government's debt trajectory continues its upward trend, at some point investors may start to question the government's ability to repay debt and therefore demand higher interest rates. Over time, this combination of slower capital accumulation and higher interest rates will drive down business confidence and investment even further, additionally slowing down productivity growth. In an extreme case, entering a crisis with a high public debt may limit the government's ability to respond, forcing it to pro-cyclical fiscal tightening that slows down recovery.

Empirical research using a variety of methods, time and country coverage lends support to the detrimental effect of high public debt on growth although no strong causal relationship has been established. Country-specific characteristics such as the macroeconomic and institutional framework that are related to the propensity to use debt to finance productive investment rather than consumption expenditure, a track record of responding to rising public debt in a timely manner and laying out fiscal plans to anchor expectations about future fiscal policy, all reduce uncertainty and help raise a country's fiscal limit. Country-specific features may evolve over time, implying that the debt-growth -relationship in a country need not be constant. These findings also provide evidence in favor of country specific debt limits or debt reduction trajectories in the EU and underline the importance of commitment to fiscal rules such as the Finnish budgeting framework and the EU's fiscal rules also from a growth perspective.

## Introduction

As a result of the COVID-19 -pandemic, the average debt ratio of the EU countries peaked at its historically highest level at the end of 2020. While in half of the countries the debt ratio remained below the 60 % threshold, in many countries public debt has been accumulating faster than the GDP for long, including in Finland. In the short run, public debt can be used to stimulate economic activity in a downturn. Persistently high and increasing

debt ratios, however, raise the question whether in the long run, instead of stimulating the economy, public debt rather becomes a drag on economic growth.

This report, prepared as a background report for Finland's Economic Policy Council, provides a literature review on both theoretical and empirical economic research on the relationship between public debt and long run economic growth. The purpose is to find out what economic research has to say about high public debt-to-GDP ratio and economic growth, through which channels an adverse impact can manifest itself, and what are the implications for Finland and for the upcoming revision of the EU's fiscal rules.

The topic is particularly relevant for Finland today as the EU's fiscal rules will soon be revisited. The key questions of interest will be at what level of debt countries should aim and whether to accept a slower pace of debt reduction in the highly indebted countries (European Fiscal Board, 2020). This would imply accepting higher debt ratios for long. The matter is particularly relevant for Finland also because Finland's debt ratio has been steadily increasing since 2009 and is projected to continue its upward trend until the next decade (European Commission 2021). A thorough understanding of the economic literature and of the mechanisms through which public debt may adversely affect growth is needed to formulate plausible policy recommendations.

### Theoretical reasons for the adverse impact of high public debt on economic growth

While debt financed government spending can stimulate aggregate demand and output in the short run, theoretical literature points to a negative link between public indebtedness and GDP growth in the long run.

Economic theory provides us with a variety of mechanisms through which public debt may be harmful for economic growth. High public debt can adversely affect capital accumulation and growth via higher long-term interest rates (Modigliani 1961), lower saving rate in the economy (Gale and Orzag 2003, Teles and Mussolini 2014), by crowding out private investment (Spencer and Yohe 1970, Broner et al. 2013), via Ricardian effects (Barro 1996) or by creating a climate of uncertainty about future fiscal policy and expectations of higher future distortionary taxation (Cochrane 2011). Public indebtedness may also hinder the country's ability to respond to a future crisis forcing it to growth-reducing procyclical fiscal policy (Aghion and Kharrouhi 2007, Woo 2009, Jordà et al. 2014) or self-imposed austerity (Mauro et al. 2015).

Among the potential mechanisms, those operating through the interest rate channel are less relevant when the central bank holds a significant share of sovereign debt on its balance sheet. Sovereign debt held by the central bank ceases to exist in economic terms as both the creditor and the debtor are the same entity, and the central bank returns interest payments back to the national government (De Grauwe 2021). Once the central bank terminates its bond purchases, not only will governments' interest payments rise, and the existing stock of debt will have to be financed at prevailing market rates but also the mechanisms previously turned off will again become active.

Central banks' interventions and their implications for government debt have given rise to a few influential economic papers. When the economy's grow rate  $g$  is higher than the rate of return on government bonds  $r$ , the government can run a big deficit and then just roll over the debt, i.e. borrow new money to pay the principal and interest, with no fiscal cost. If  $r < g$ , the debt to GDP ratio will slowly decline even if the government runs a budget deficit (Blanchard 2019, Cochrane 2021.) This is a well understood principle also in Finland and often raised in discussions on fiscal sustainability and government borrowing. The issue is particularly relevant today as the asset purchases by the European Central Bank (ECB) allow governments in the euro area to borrow at particularly low rates, keeping  $r$  low.

The fact that government debt has no fiscal cost means that the borrowing need never be repaid with higher tax revenues or lower government spending, suggesting that public borrowing can continue forever. But this analysis turns out to be incomplete. The relationship  $r < g$  is not constant but will evolve over time. As the government keeps borrowing to finance its budget deficits, sooner or later more debt will drive up borrowing

costs, raising  $r$ . This implies that there is a maximum debt to GDP ratio and that fiscal expansion cannot go on forever (Boskin 2020, Cochrane 2021).

Even if  $r-g$  contributes to a declining debt ratio and debt sustainability, every country possesses a fiscal limit that is different from the fiscal limit posed by sovereign debt default. Reis (2021) shows analytically that  $r < g$  is like seigniorage revenue, allowing for a small steady state deficit, but that significant deficits must be repaid with surpluses eventually. The limit to government debt depends not only on  $r$ , but also on the marginal product of capital ( $m$ ) in the economy (Reis 2021).

While debt allows for tax smoothing in the face of transitory disturbances or lumpy government expenditure (Niemann et al. 2013), over the long term, the key to raising future national income and potential output is higher national saving and productive investment. Even in the absence of fiscal costs, public debt may undermine economic growth by reducing saving and capital accumulation and therefore have welfare costs (Blanchard 2019). The bigger the difference  $m-r$ , the higher the profitability of the foregone investment, the bigger the loss caused by high public debt in terms of economic growth and welfare, and the further below the growth rate the safe rate must be for the intergenerational transfer to be welfare improving (Blanchard 2019, Boskin 2020). If an economy has over-accumulated capital, hence has low  $m$ , by reducing capital accumulation, public debt may even increase efficiency and welfare.

In standard overlapping generations models of growth, the decrease in public saving associated with debt accumulation leads to dissaving in the private sector, reducing capital accumulation and so weakens economic growth (Modigliani 1961, Diamond 1965, Blanchard 1985).

This crowding-out effect of public expenditure rests on the idea of a finite pool of financial resources, whereby private investment is replaced by government spending (Spencer and Yohe 1970). As such, sovereign debt is a burden for next generations because it reduces the flow of income coming from a lower stock of private capital (Modigliani 1961). The crowding-out effect can become large when government debt leads to tightening credit conditions for private investment (Modigliani 1961, Broner 2013). The more the government borrows, the less capital there is available for private enterprises, resulting in higher borrowing costs for private investment.

Therefore, even debt that results from counter-cyclical fiscal policy may not be costless for future generations. This cost may be offset if the debt is used to finance highly productive public capital or human capital, which increase productivity and contribute to the real income of future generations (Modigliani 1961, Aizenman 2007). Public expenditure may also promote private investment and contribute to economic growth by maintaining the rule of law, enforcing contracts, and regulating financial markets (Aizenman 2007).

In contradiction with Ricardian Equivalence, public debt may have an impact on growth through reduced saving. Diamond (1965) suggests that taxes collected to finance interest payments reduce savings because taxpayers smooth their consumption over time. He further claims that internal debt can be even more detrimental to growth than external debt because it substitutes physical capital in investment portfolios. Similarly, Teles and Mussolini (2014) propose a model with overlapping generations and endogenous growth in which government indebtedness extracts part of the savings of the young to pay interest on the debts of the older generation who are no longer saving. Like a pay-as-you-go pension system, this income transfer between generations reduces the saving rate in the economy, decreasing capital accumulation.

The composition of debt matters for growth as well. External debt can promote investment up to a point but when foreign investors question the country's repayment ability, "debt overhang" (Krugman 1998, Cohen 1993, Clements et al. 2003) will reduce investors' willingness to provide capital, with ensuing negative impact on investment and growth. Internal debt, on the other hand, is less subject to such risk if the country retains full taxing powers (Gros 2011). Domestic investors may still doubt the government's commitment to full repayment of debt using conventional taxes and fear resorting to inflationary finance instead (Cochrane 2010, Niemann et al. 2013, Aguiar et al. 2013), eroding domestic bond holders' confidence. Moreover, domestic debt can produce

an additional reduction in private investment insofar domestic debt purchases replace productive investment (Diamond 1965, Broner et al. 2013).

High public debt may also change consumers' and enterprises' expectations about future fiscal policy and affect their consumption and investment decisions even before those expectations materialize. This is the basis of Ricardian equivalence, which suggests that companies and households anticipate a future tax increase, resulting in reduced investment and consumption today (Barro 1996). Higher uncertainty about the future may be a reason for companies to delay investment and to wait and learn more about future conditions before undertaking an investment project that is costly to reverse. Uncertainty always increases in a deep recession, but it can also be related to future decisions on government expenditure and taxes, which have an impact on businesses' costs and real returns (Chatterjee 2013, Cochrane 2011.) In the absence of central bank intervention, rising debt typically results in higher yields on sovereign debt. These are then transmitted to the rest of the economy, raising borrowing costs for the private sector (Codogno et al. 2013, Laubach 2009, Baum et al. 2013). All in all, the cost of public debt includes not only the taxes necessary to service the debt but also the distortions associated with those taxes. As higher distorting taxes diminish incentives to work, save and invest, tax distortions create a natural fiscal limit to government debt (Leeper et al. 2011).

Economics literature also shows that the optimality of fiscal policy in each phase of the business cycle matters not only for the short term but also for long term economic growth. Importantly, countercyclicality stemming from discretionary measures is found to be more important for growth than countercyclicality resulting from automatic stabilizers (Aghion and Kharrouhi 2007). However, if public debt has reached a level where it constrains the scope of countercyclical fiscal policies, this may impact growth first because fiscal policy is not growth-enhancing but also because highly pro-cyclical and volatile fiscal policy tends to reduce economic growth (Woo 2009). Research also shows that fiscal and monetary policies that speed the recovery process can reduce scarring effects (Cerra et al. 2013, Jordà et al. 2020).

Pro-cyclical fiscal policy can also impact growth via reduced saving. Gale and Orzag (2003) emphasize that public deficits reduce national income regardless of whether interest rates rise. Over the long term, the key to raising future national income and potential output is higher national saving and productive investment. While deficits can boost the economy in the short run by increasing aggregate demand – because they *reduce* national saving – in the long run reduced saving hampers long run economic performance.

### *Implications for Finland*

The mechanisms operating through the interest rate channel are currently less relevant for Finland, as the central bank holds a significant share of sovereign debt on its balance sheet but will become important once the ECB terminates its bond purchasing programs. The channels through reduced saving, capital accumulation, uncertainty and expectations about future distortionary taxation remain potentially relevant for Finland.

Finland's general government debt as a share to GDP rose sharply between 2009 and 2016, declined slightly during the following three years and jumped to its historically highest level in 2020 (see Figure 1). Although the economy recovered fast and is forecast to grow in the coming years, the public debt ratio is projected to grow in the medium and long term (Ministry of Finance 2021). According to the European Commission's (2021) assessment, Finland faces medium-term fiscal sustainability challenges.

A reminder of the fact that borrowing costs depend on the amount of debt was recently offered by the credit rating agency Fitch Ratings.<sup>2</sup> In affirming Finland's AA+ rating in October 2021, the agency pointed out that Finland's debt to GDP ratio is expected to rise farther away from the median of the other 'AA' sovereigns (43,7 % vs. 70,7% for 2021), and to remain higher in the median term. Short term risks to high debt were mitigated by favorable financing conditions.

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<sup>2</sup> <https://www.fitchratings.com/research/sovereigns/fitch-affirms-finland-at-aa-outlook-stable-22-10-2021>

The latter point underlines the fact that not only the yield on government bonds  $r$  depends on the debt to GDP ratio but also on the bond purchases by the ECB. Within its bond purchasing programs, the ECB exchanges money for bonds, expanding money supply in the economy. The purpose of the operation is to accelerate inflation in the euro area. As the ECB can only buy bonds from private bond holders in the secondary markets, the central bank's purchases push bond prices up and interest rate on bonds down, ensuring favorable financing conditions for sovereigns. When the ECB reaches its inflation target, winding-up of bond purchases and ultimately raising interest rates will follow. If the central bank reduces its possession of sovereign debt, the existing stock of debt will have to be refinanced at higher market rates.

A large share of external debt has been identified as a risk factor as access to market finance depends on foreign investors' assessment on the country's repayment ability. Domestic debt, on the other hand, is found to crowd out private investment. The European Commission (2021) sees the current share of Finnish government debt held by non-residents (63%) as a risk factor, but from the point of view of crowding out, the share of domestic debt<sup>3</sup> (37%) does not seem irrelevant either.

The central bank having become governments' single biggest creditor creates uncomfortable interdependencies (Fiedler et al. 2020). While expansive monetary policies are appropriate when inflation is subdued, the central bank may be hesitant to raise interest rates, or to reduce its holdings of government debt, when public debt ratios are high. If inflation threatened to exceed the target, the ECB would face a tradeoff between maintaining price stability and debt sustainability, having implications for financial stability and the cohesion of the Economic and Monetary Union (EMU) (Fiedler et al. 2020).

Although financing conditions for sovereigns remain favorable so that  $r < g$ , moderate deficits will keep the debt ratio stable and primary surpluses will take it down only in case of a one-off fiscal expansion (Cochrane 2021). This is somewhat different from the Finnish case today, as the debt to GDP ratio was steadily increasing between 2008-2015 (see Figure 1 below) and is projected to increase in the medium term. The crisis in the early 1990s is more in line with the analysis, as the sharp but temporary rise in the debt ratio was followed by several consecutive years of primary surpluses taking the debt ratio down.

Interestingly, in 2008-2015, during the years of steadily increasing debt ratio, the difference between the Finnish 5-year government bond yield and nominal growth rate was 0,7 %-points on average and primary balance -0,2% on average. During that period,  $r > g$  and primary surpluses would have been needed to take the debt ratio down. During the following years, in 2016-2019, primary balances of the same magnitude (-0,1% on average) were sufficient to a slightly declining debt ratio because the nominal growth rate exceeded the yield on government 5-yr. bond by 2,8 %-points on average. This period coincides with the beginning of the ECB's government bond purchasing programs<sup>4</sup>.

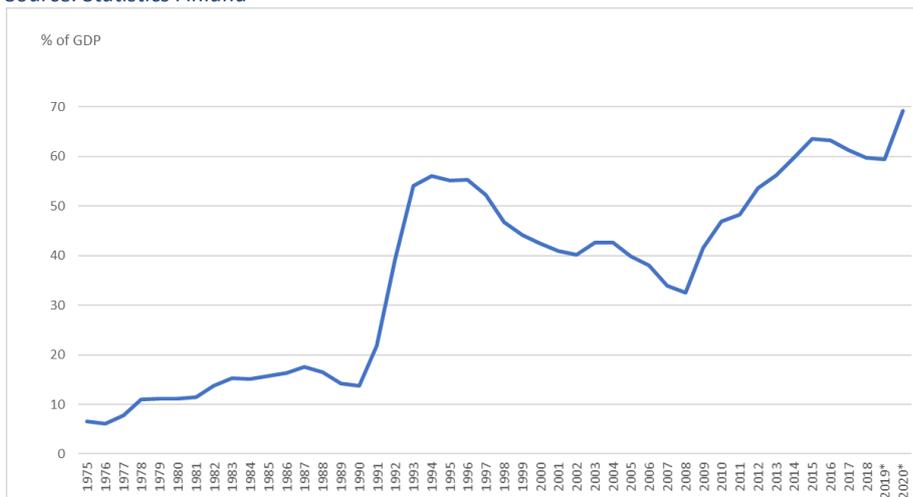
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<sup>3</sup> Joint External Debt Hub.

<sup>4</sup> <https://www.ecb.europa.eu/mopo/implement/app/html/index.en.html#pspp>

Figure 1. Finland's general government debt as a share to GDP over time, 1975 – 2020

Source: Statistics Finland

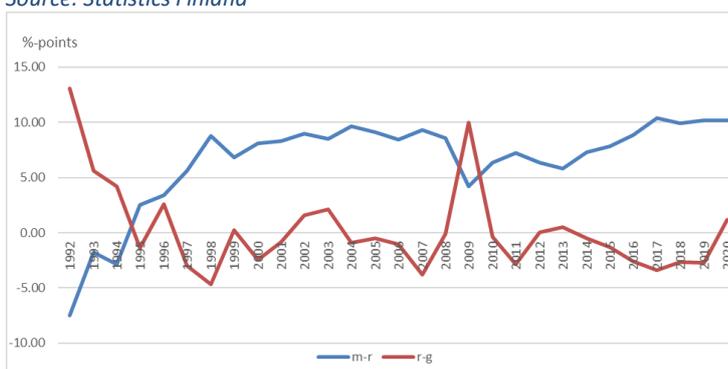


Although the welfare effects of a decreasing capital stock are a priori unclear, there is some evidence that the Finnish economy is underinvesting rather than over accumulating capital (Kangasharju et al. 2021). Figure 2 shows that the difference  $m-r$  has been rising over the long term, while the difference  $g-r$  has been close to zero on average. Based on theory, it is not clear, what the relevant time span is, but there is some indication that any decrease in capital accumulation due to high debt is likely to harm growth and welfare in Finland<sup>5</sup>.

The cost of debt includes not only the taxes necessary to service the debt but also the distortions associated with those taxes and the lower income for future generations resulting from reduced saving and capital accumulation. This cost may be offset if the debt is used to finance highly productive public capital or human capital, which increase productivity and contribute to the real income of future generations.

Figure 2. Differences between marginal product of capital ( $m$ ), safe rate ( $r$ ) and nominal GDP growth rate ( $g$ ) in Finland in 1992-2020.

Source: Statistics Finland



## Empirical evidence on the debt-growth -nexus: cross-country heterogeneity and time varying relationships

Empirical research using a variety of methods, time and country coverage lends support to the detrimental effect of high public debt on growth although no universally applicable conclusions can be drawn. According to recent empirical literature no common threshold exists beyond which the adverse effect occurs (Ebenhardt and

<sup>5</sup> Marginal product of capital measured as the ratio of net operating surplus to capital stock of Finnish non-financial corporation, safe rate as the 5-year government bond yield.

Presbitero 2015, Chudik 2017, Gómez-Puig and Sosvilla-Rivero 2017), unless the countries are similar enough (Ahlborn and Schweickert 2017, Kumar and Woo 2015, Checherita-Westphal and Rother 2012, Cecchetti et al. 2011).

Cross-country heterogeneity of the debt-growth -nexus has also been observed on several occasions in the past. There are examples of countries with relatively low debt levels that have encountered difficulties with debt and subdued growth, while others have sustained high levels of indebtedness for long and still grown strongly (Chudik et al. 2017). Empirical evidence also points to the importance of debt trajectory. High and rising debt ratios are found to be detrimental to growth, but the effect is weaker (or vanishes) when ratios are declining (Chudik et al. 2017, Pescatori et al. 2014).

Not only is the link between public debt and economic growth characterized by cross-country heterogeneity but the relationship may also change over time within countries. In this case the results derived from time invariant models can be seen to represent averages over time.

As country heterogeneity has entered the analysis only quite recently, there is plenty of research delivering average results for a group of countries such as the advanced, OECD, emerging and EU countries. Data on several countries has often been used for practical reasons with various panel methods being the most common empirical method in the literature (see Table 1).

There are several reasons for the relationship between debt and growth to differ across countries (see Ebenhardt and Presbitero 2015 and references therein). First, institutional quality at higher income levels may alleviate the negative consequences of debt. For example, countries with high-quality institutions may have a higher propensity to finance productive investment rather than government consumption (Kourtellos et al. 2013). Second, country-specific characteristics related to past crises and the macroeconomic and institutional framework may affect a country's capacity to tolerate high levels of debt. Some countries may have a historical track record of responding to rising public debt with fiscal adjustment at a right time (Ghosh et al. 2013). Third, vulnerability to debt depends on debt composition – domestic vs. external, foreign vs. domestic currency denominated, long vs. short term. Fourth, Ahlborn and Schweickert (2017) have recently shown that economic systems - defined by production technology and welfare systems - entail different degrees of fiscal uncertainty, which determines negative long-run effects of public debt on economic growth. These are essentially the reasons why countries may start facing problems at very different levels of debt – in other words, they face a country-specific *fiscal limit*.

Reverse causality poses a challenge to the empirical assessment of the relationship between debt and growth. While economic theory suggests that high debt has an adverse impact on growth, low growth could also lead to high debt, for reasons unrelated to debt. The relationship between debt and growth could also be confounded by a third factor affecting both.

None of the existing papers claim to be able to establish a strong causal link from public indebtedness to economic growth. Although the endogeneity problem is generally acknowledged, the strategies to tackle it are relatively little justified in parts of the literature. The criticism applies mostly to early empirical studies (see Panizza and Presbitero 2014). The instrumental variable (IV) approach has been the most popular way to address endogeneity in various panel regressions (Kumar and Woo 2015, Cecchetti et al 2011, Checherita-Westphal and Rother 2012, Baum et al. 2013) and within Generalized Method of Moments (GMM) estimations (Afonso and Jalles 2013, Kumar and Woo 2015, Salotti and Trecroci 2016, Gómez-Puig and Sosvilla-Rivero 2017). Typically, the debt variable is instrumented with its lagged values.

Panizza and Presbitero (2014) were the first to raise the issue of instrument validity in the debt-growth literature and to question the results obtained in these studies. Although the new instrumental variable proposed by the authors cannot entirely escape criticism either, their paper was a clear call for better strategies to isolate the impact of debt on growth.

Besides the IV approach, the endogeneity issue has been addressed by using a dependent variable less likely correlated with debt (Baum et al. 2013, Salotti and Trecroci 2016), using estimators better able to account for the unobserved heterogeneity in the model (Eberhardt and Presbitero 2015, Chudik et al. 2017), and by analyzing a longer period to alleviate concerns of reverse causality (Checherita-Westphahl and Rother 2010, Pescatori et al. 2014).

More recently, several researchers have investigated the presence of Granger causality between public debt and economic growth to verify the direction of causality (Gómez-Puig and Sosvilla-Rivero 2015, Donayre and Taivan 2017, Jacobs et al. 2020). Although Granger causality is not a formal test of causality but rather of prediction ability, the findings provide additional support for the heterogeneity in the relationship between debt and growth across both time periods and countries.

The empirical specification to analyze the debt-growth nexus is typically derived from Solow's neoclassical growth model (see e.g. Gómez-Puig and Sosvilla-Rivero 2017), where the growth rate of real per capita GDP ( $g_t$ ) for a given country is:

$$g_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^n \delta_i X_{it} + \beta d_t + \varepsilon_t$$

where  $y_{t-1}$  is the initial real per capita GDP,  $d_t$  is the public debt-to-GDP ratio and  $X_t$  includes a set of explanatory variables (for the core set of growth determinants included as explanatory variables see e.g. Kumar and Woo 2015).

Early studies using the IV approach within in a panel framework with data spanning from 1970 to 2010 deliver average results for OECD countries (Cecchetti et al. 2011, Afonso and Jalles 2013), countries of the euro area (Checherita-Westphahl and Rother 2010, Baum et al. 2013) or for advanced countries more in general (Pescatori et al. 2014, Kumar and Woo 2015). These studies focus on finding nonlinearities and threshold effects, finding debt ratios beyond which the impact of public debt on growth turns from positive to negative between 85% and 100%.

Panizza and Presbitero (2014) question the relevance of the instrumental variables (IV) used in the previous studies and present results based on a new IV. Contrary to typical findings in the literature, the impact of debt on growth turns from negative significant to positive but insignificant. Their analysis clearly calls for better strategies to isolate the impact of debt on growth, but as the proposed instrument lacks relevance for the countries of the euro area, the results cannot be taken as conclusive.

Eberhardt and Presbitero (2015) analyze a sample of 118 developing, emerging and advanced economies over the period 1960 to 2012. The common correlated effects (CEE) estimator by Pesaran (2006) allows them to explicitly take account for unobserved heterogeneity. They provide some evidence that countries with higher average public debt ratios are more likely to see a negative effect on their long-run growth performance. Given that differences between countries exist, appropriate policies must also differ across countries. The authors could not confirm the presence of a threshold for individual countries, however. This is likely due to the exogenous threshold levels used (60% and 90%). The results emphasize the complexity of the relationship as well as the importance of country specificities.

Egert (2015) confirms the impression coming from the previously cited literature: the relationship between debt and growth is very sensitive to modelling choices such as the time and country coverage, data frequency and the number of observations required in each nonlinear regime. When nonlinearity is detected, the negative nonlinear effect starts at relatively low levels (between 20% and 60% of GDP) in advanced economies. The important outcome of his analysis is that the instability of the threshold across studies might be due to the nonlinear effects changing over time in addition to changing across countries and economic conditions. This conjecture is supported by Yang and Su (2018) who provide evidence of a time-varying and state dependent threshold for the US.

The sample in Salotti and Trecroci (2016) consists of a panel of 20 OECD economies from 1970 to 2009 with a debt ratio of 54% on average. Their results suggest a statistically and economically significant elasticity of investment of -0.10, while a 30% difference in the debt ratio can explain as much as 0,35% lower annual productivity growth. The authors point out that although a negative response of private investment to debt does not necessarily imply overall detrimental effect on GDP growth, it contributes negatively to GDP growth in the medium and long term.

Unlike the studies cited previously, Gómez-Puig and Sosvilla-Rivero (2017) provide results for individual countries in the euro area based on a time series analysis covering years 1960-2015 and considering the stationary and non-stationary nature of the variables. As the two variables of interest - public-debt-to-GDP and GDP per capita growth rates – evolve very differently across countries, the authors conjecture that average results for EMU countries may differ from those for single countries. In fact, they document highly heterogeneous effects with the threshold ranging from 61% in Belgium to 21% in France, and 44% on average for the EMU countries considered. The threshold found for Finland, 40% of GDP, was crossed already in 1992. The authors report the marginal effect of public debt ratio on real GDP per capita growth to vary widely across countries in the euro area ranging from -0,52 in case of Finland to -0,1 for Austria.

Notwithstanding the vast amount of empirical research, not all the empirical studies provide insight on the mechanism through which public indebtedness undermines growth. There is empirical evidence of channels via private sector dissaving, reduction in private investment and capital accumulation (Kumar and Woo 2010, Checherita-Westphal and Rother 2012, Salotti and Trecroci 2016) crowding out of public investment (Picarelli et al. 2019), increased uncertainty and expectations of future fiscal policy (Ahlborn and Schweigert's 2017). Evidence also points to debt composition and country characteristics constraining government choices having implications for economic growth (Eberhardt and Presbitero 2015). Altavilla et al. (2017) and Becker and Ivashina (2018) provide empirical evidence of the European sovereign debt crisis to show that the increase in domestic government bond holdings by the banking sector took place at the expense of corporate lending, crowding out private investment.

Jordà et al. (2014) provide empirical evidence showing that the government's fiscal position greatly influences the depth of the recession and the speed of recovery from a financial crisis. Entering a crisis with a high public debt may limit the government's ability to respond, leading to slower recovery. At this point the government faces a *debt limit* beyond which debt cannot be rolled over (Ghosh et al. 2013). The difference between current debt ratios and the estimated debt limits provides an estimate of a country's 'fiscal space' – the room for fiscal maneuver (Ghosh et al. 2013). Even in the absence of external pressure, sometimes countries with high debt undertake self-imposed austerity measures, running smaller deficits or larger surpluses when sovereign borrowing costs rise (Mauro et al. 2015).

Table 1 Summary of empirical research. \* Threshold for public debt after which the impact on growth becomes negative.

Study	Sample	Econometric method	Average threshold*	Average impact
Checherita-Westphahl and Rother (2010)	12 Euro area countries from 1970 to 2008	Panel fixed effects model corrected for heteroskedasticity and autocorrelation and with instrumental variables (IV)	90-100% of GDP	1 pp. increase in debt-to-GDP ratio associated with approx. 0.1 pp. lower annual GDP growth
Cecchetti et al. (2011)	18 OECD countries from 1980 to 2010	Panel fixed effects with instrumental variables (IV)	85% of GDP	10 pp. increase in debt-to-GDP associated with 0.17 pp. lower GDP per capita growth
Baum et al. (2013)	12 Euro area countries from 1990 to 2007	Dynamic panel threshold model estimated with generalized method of moments (GMM)	Positive impact of debt vanishes at 60-70% and becomes negative at 95% of GDP	1 pp. increase in debt-to-GDP ratio associated with 0.07 pp. lower annual GDP growth
Afonso and Jalles (2013)	155 developed and developing countries from 1970 to 2008	Various panel techniques complemented with GMM estimators	58% of GDP for the countries of the euro area and lower for Finland (not specified)	Growth impact of a 10% increase in the debt ratio is -0.2%
Panizza and Presbitero (2014)	17 OECD countries from 1980 to 2010, excl. Finland	Panel fixed effects with instrumental variables (IV)	No strong evidence of a threshold	No strong evidence of a negative growth effect
Kumar and Woo (2015)	38 advanced and emerging economies 1970-2007, excl. Finland	A variety of panel methods including estimation with system-GMM	90% of GDP in advanced economies	10 pp. increase in the debt-to-GDP ratio associated with 0.15 pp. lower GDP growth
Eberhardt and Presbitero (2015)	118 countries from 1961 to 2010	Standard linear regression models estimated with the correlated effects (CEE) estimator	No evidence for systematic non-linearity in the debt-growth relationship within individual countries	Some evidence for the debt-growth relationship to vary across countries
Egert (2015)	44 countries from 1960 to 2010	Bivariate regressions with exogenous thresholds	20-60% of GDP in advanced economies	10 pp. debt-to-GDP ratio associated with 0.1-0.2 pp. lower annual GDP growth
Gómez-Puig and Sosvilla-Rivero (2015)	11 EMU countries from 1980 to 2013	Granger-causality test for individual countries	Evidence of bi-directional causality across time and countries. Positive Granger-causality from debt to growth in the short run in Finland	Elasticity of investment to the debt/GDP -ratio up to -0.10 for debt level of 54 % (average of the sample countries)
Salotti and Trecroci (2016)	20 OECD countries from 1970 to 2009	Panel fixed effects estimated with the system-GMM estimator	Weak evidence for a threshold at 85-90% of GDP	Elasticity of GDP growth to the debt/GDP -ratio between -0.02 and -0.07
Chudik et al. (2017)	19 advanced economies from 1965 to 2010	Panel autoregressive distributed lag (ARDL) specification	No evidence for a common threshold	Marginal effect of public debt changes on real GDP per capita growth -0.22 on average, -0.52 in Finland
Gómez-Puig and Sosvilla-Rivero (2017)	11 Euro area countries from 1960 to 2015	Two-stage least squares (2SLS) instrumental variable techniques for individual countries	44% of GDP on average, 40% of GDP for Finland	Neutral growth effect becomes negative at 60% of GDP for Nordic countries
Ahlborn and Schweickert (2017)	111 developed and developing countries from 1971 to 2010	Panel fixed effects and 2SLS	Direction of Granger-causality between debt and growth found to vary across countries. Evidence of bi-directional causality Finland.	
Donyare and Taivan 2017	20 OECD countries from 1970 to 2009	Error correction model for individual countries		
Jacobs et al. 2020	31 OECD countries from 1995-2013	Recursively identified panel Vector autoregressive (VAR) model	No Granger-causality from debt to growth but from growth to debt in the short run	

### Implications for Finland

The few empirical studies providing country-specific results point to a turning point, beyond which public debt becomes harmful for growth in Finland, lower than the current 69% of GDP (Afonso and Jalles 2013, Gómez-Puig and Sosvilla-Rivero 2017). Not only the debt ratio but also the debt trajectory is found to matter for growth. High and rising debt ratios are found to be detrimental to growth, but the effect is weaker (or vanishes) when ratios are declining (Chudik et al. 2017, Pescatori et al. 2014). From this perspective, the upward trend of Finland's public debt ratio constitutes a risk factor for long run economic growth.

The relationship between debt and growth differs across countries for reasons related to the macroeconomic and institutional framework and the structure of debt. A country's fiscal limit depends on the whole range of fiscal institutions prevailing in the country, with fiscal expectations and credibility as their integral elements (Leeper et al. 2011, Ahlborn and Schweickert 2017). The Finnish budgeting framework and the EU's common fiscal rules are part of these fiscal institutions in Finland. By committing to a fiscal plan, the government can reduce uncertainty, contribute to a good investment climate, and so increase its fiscal limit (Leeper et al. 2011, Ghosh et al. 2013).

There is research-based evidence of high public debt leading to private sector dissaving, reduction in private investment and lower capital accumulation (Kumar and Woo 2010, Checherita-Westphal and Rother 2012, Sallotti and Trecroci 2016). The crowding out effect is likely to be more pronounced in a country with a high portion of domestic debt as domestic debt purchases displace productive investment in the country (Broner et al. 2013). On the other hand, a large portion of external debt subjects the country to the risk of a sudden stop of financial flows (debt overhang). At the end of the second quarter of 2021, 37% of the Finnish government debt was held by domestic residents and 63% by non-residents<sup>6</sup>, suggesting that both channels may be relevant for Finland.

### Implications for the reactivation and revision of the EU's fiscal rules

Economics literature points to country-specific features behind the adverse effects of public indebtedness on long-term economic growth. Consequently, no common threshold exists beyond which public debt becomes harmful for growth. These findings suggest that any constraints on public debt should also take country specificities into account, lending support to country specific limits or targets on public debt.

There is not enough country-specific evidence to pin down a threshold for each EU country. Uncertainty about the optimal level raises the question whether reducing public debt before indebtedness clearly becomes a problem could also exert a negative effect on growth. As such, there seems to be a tradeoff between the negative consequences of public debt on growth and the potentially negative consequences of reducing debt (Elmeskov and Sutherland 2012), especially for countries with high investment needs (Ostry et al. 2015).

The most compelling argument for reducing debt in the absence of certainty about its optimal level is that of risk management. According to the risk management view on public debt, by reducing debt today, the government prepares for unanticipated events that would require the government to borrow massively, and so lowers the risk of a sovereign crisis tomorrow. Furthermore, once issued, the debt becomes a burden to the economy through the distortionary effect of taxation required to service the debt (Ostry et al. 2015.)

To mitigate the potentially harmful effect of fiscal consolidation on economic growth, the following points emerge from economic literature.

- Select the timing of adjustment based on the business cycle and tighten fiscal policy when growth is near normal (Blanchard and Leigh 2013). Countercyclical fiscal policy is optimal both in the short and long run. Creating economic buffers in an upturn smooths out the business cycle while allowing to reduce public debt.
- Carefully choose the size of adjustment and use instruments that are growth friendly (Elmeskov and Sutherland 2012, Alesina et al. 2015). Don't cut productive investment (Picarelli et al. 2019, Darvas and Wolff 2021).
- Combine fiscal consolidation with structural reforms that boost potential growth (Gomez-Puig and Sosvilla-Rivero 2017, Blanchard and Cottarelli 2010).
- Living with debt can sometimes be an alternative to paying down the debt with distortionary taxation. Countries with ample fiscal space should allow the debt ratio to decline through economic growth rather than pay down the debt with higher taxation (Ostry et al. 2015).

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<sup>6</sup> Joint External Debt Hub.

Currently the EU's fiscal rules are procyclical because they either do not consider the phase of the business cycle (nominal deficit rule) or are unable to correctly identify it in real time and (structural balance rule), and hence, they fail to require a fiscal tightening in an economic upturn (Bilbiie et al. 2021, Kuusi and Puonti 2021). The timing of fiscal consolidation is crucial for growth since the economy is more vulnerable to slipping into recession when growth is low (Blanchard and Leigh 2013). For fiscal consolidation to be less harmful for growth, rules need to be designed so that debt reduction, or the creation of buffers takes place in an upturn. Given that countries can be at different phases of a business cycle and their speed of recovery can differ (European Fiscal Board, 2020), country-specific speed of adjustment is warranted. This would suggest a country-specific rate of debt reduction based on economic growth, rather than based on the amount of debt.

Further support for country-specific pace of fiscal adjustment is provided by Gomez-Puig and Sosvilla-Rivero (2017) whose empirical findings indicate that the impact of fiscal adjustment on economic growth differs across the countries of the euro area. The negative effect of debt increase is found to be larger than that of debt reduction in all EMU countries but the difference between the two is the smallest in Finland. On average, one percentage point increase in the debt ratios is found to reduce real GDP per capita by 0.35 percentage points, and that of debt decrease by 0.16. To further mitigate the detrimental effect of debt reduction, the authors recommend structural reforms in connection with fiscal consolidation.

From a practical point of view, a differentiation of the adjustment path towards the debt target can be more easily implemented than the differentiation of the debt target itself. The reason being that it could be introduced in the EU framework by amending secondary legislation, while changing the debt target requires a change of the Treaty (European Fiscal Board 2021), which some countries, including Finland, oppose.

In the short term, the size of the adjustment needs to balance with the effects on aggregate demand (Elmeskov and Sutherland 2012), which are less detrimental when private demand is strong (Blanchard and Leigh 2013), and when monetary policy is accommodative (Elmeskov and Sutherland 2012). Past consolidation episodes in the EU have been characterized by significant cuts in public investment (Darvas and Wolff 2021, European Fiscal Board 2021), hampering future growth prospects. This has spurred the question of whether the EU's fiscal rules can be designed so to avoid cutting productive investment, for example by excluding public investment from the rules.

While this would introduce more flexibility in the framework potentially benefitting public investment, Picarelli et al. (2019) point out the difficulty of designing a rule that would contemporaneously mitigate the moral hazard problem, whereby countries increase their debt levels in normal times by labelling unproductive public expenditure as productive public investment. A recent example of a debate on what constitutes public investment is the discussion sparked by the Finnish government's 'one-off future-oriented investments' launched in the program of Prime Minister Sanna Marin's government in 2019.<sup>7</sup> Furthermore, the evidence provided by Bacchiocchi et al. (2011) suggests that EU countries have been constrained in their investment decisions more by the need to ensure debt sustainability than by the rules of the Stability and Growth Pact. They find evidence of governments cutting expenditure on both investment and education at high levels of public debt, independently of EU membership, over the period 1990-2008.

The difficulty of defining public investment also relates to the suggestion of a 'green golden rule' to exclude green public investment from the EU's fiscal rules. In addition to being difficult to define, the impact of green investment on growth is uncertain, leading Darvas and Wolff (2021) not to recommend a general relaxation of the fiscal rules. The introduction of a 'green golden rule' could still be a way to make sure that this specific expenditure category is not cut in connection with fiscal consolidation (Darvas and Wolff 2021).

As examples of consolidation instruments that are friendly to economic growth, Elmeskov and Sutherland (2012) suggest to reform transfer systems, raise the efficiency of public services, eliminate certain tax expenditure and

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<sup>7</sup> <https://valtioneuvosto.fi/en/marin/government-programme/one-off-future-oriented-investments>

to collect additional revenues from less distortionary tax bases. As to the composition of fiscal consolidations (tax hikes vs. spending cuts), Alesina et al. (2015) document that tax-based adjustments have been followed by more prolonged and deeper recessions than spending-based adjustments on average. The difference in the output effects of the two types of adjustments is mainly due to the response of private investment and business confidence. Their results also hint that output costs are lower when the adjustment is permanent rather than transitory. Similarly, Ostry et al. (2015) claim that paying down the debt with higher taxation would additionally reduce growth prospects because of the distortionary effects of taxation. In countries with ample fiscal space and no imminent debt sustainability concerns a growth friendly alternative would be allowing the debt ratio to decline through economic growth (Ostry et al. 2015).

## Conclusions

The fiscal cost of public debt is currently very low in Finland. Economics literature suggests that, even in the absence of fiscal costs, public debt may have welfare effects in an economy that is not over-accumulating capital like Finland today.

The key to raising future national income and potential output is higher national saving and productive investment. Deficits can boost the economy in the short run by increasing aggregate demand because they *reduce* national saving. In the long run, deficits can reduce economic growth for the same reason – via reduced saving and slower capital accumulation.

High public debt creates expectations about future tax increases and a climate of uncertainty, reducing incentives to save and invest. By being informative about its fiscal plans the government can anchor expectations and create a stable investment climate.

The relationship between debt and growth is complex and depends on country-specific characteristics that may change over time, providing support for country-specific debt-limits or rates of debt reduction.

According to the risk-management view to public debt, by reducing debt today, the government prepares for unanticipated events that would require significant public borrowing in the future. By reducing the debt burden, the government can contain the distortionary effect of taxation required to service the debt. Reducing debt in an economic upturn, when private demand is strong and when monetary policy is accommodative, results in fiscal policy that is optimal both in the short and long run, minimizing the potentially harmful effect of fiscal consolidation on economic growth. Policies and structural reforms boosting economic growth allow the debt ratio to decline through economic growth, reducing the need for fiscal consolidation.

## References

- Afonso, A., & Jalles, J. T. (2013). Growth and productivity: The role of government debt. *International Review of Economics & Finance*, 25, 384-407.
- Aghion, P., & Kharroubi, E. (2009). Macro Policy and Industry Growth: The Effect of Counter-Cyclical Fiscal Policy. *European Economy*, 1, 179.
- Aguiar, M., Amador, M., Farhi, E., & Gopinath, G. (2013). *Crisis and commitment: Inflation credibility and the vulnerability to sovereign debt crises*. No. w19516. National Bureau of Economic Research.
- Ahlborn, M., & Schweickert, R. (2018). Public debt and economic growth—Economic systems matter. *International Economics and Economic Policy*, 15(2), 373-403.
- Aizenman, J., Kletzer, K., & Pinto, B. (2007). Economic growth with constraints on tax revenues and public debt: Implications for fiscal policy and cross-country differences No. w12750. National Bureau of Economic Research.
- Alesina, A., Favero, C., & Giavazzi, F. (2015). The output effect of fiscal consolidation plans. *Journal of International Economics*, 96, 19-42.
- Altavilla, C., Pagano, M., & Simonelli, S. (2017). Bank exposures and sovereign stress transmission. *Review of Finance*, 21(6), 2103-2139.
- Barro, R. J. (1996). Reflections on Ricardian equivalence. NBER Working Paper, (w5502).
- Baum, A., Checherita-Westphal, C., & Rother, P. (2013). Debt and growth: New evidence for the euro area. *Journal of international money and finance*, 32, 809-821.
- Becker, B., & Ivashina, V. (2018). Financial repression in the European sovereign debt crisis. *Review of Finance*, 22(1), 83-115.
- Blanchard, O. J. (1985). Debt, deficits, and finite horizons. *Journal of political economy*, 93(2), 223-247.
- Blanchard, O. (2019). Public debt and low interest rates. *American Economic Review*, 109(4), 1197-1229.
- Blanchard, O., & Cottarelli C. (2010), "Ten Commandments for Fiscal Adjustment in Advanced Economies", IMFdirect, June 24.
- Blanchard, O., & Leigh, D. (2013). Fiscal consolidation: At what speed? VoxEU.org, 3.
- Boskin, M. J. (2020, May). Are Large Deficits and Debt Dangerous? In *AEA Papers and Proceedings* (Vol. 110, pp. 145-48).
- Broner, F., Erce, A., Martin, A., & Ventura, J. (2014). Sovereign debt markets in turbulent times: Creditor discrimination and crowding-out effects. *Journal of Monetary Economics*, 61, 114-142.
- Cecchetti, S., Mohanty, M. and Zampolli F. (2011). The real effects of debt. BIS Working Papers No. 352.
- Cerra, V., Panizza, U., & Saxena, S. C. (2013). International evidence on recovery from recessions. *Contemporary Economic Policy*, 31(2), 424-439.
- Chatterjee, S. (2013). Debt overhang: why recovery from a financial crisis can be slow. *Business Review*, (Q2), 1-9.
- Checherita-Westphal, C., & Rother, P. (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. *European economic review*, 56(7), 1392-1405.
- Chudik, A., Mohaddes, K., Pesaran, M. H., & Raissi, M. (2017). Is there a debt-threshold effect on output growth? *Review of Economics and Statistics*, 99(1), 135-150.
- Clements, B., Bhattacharya, R., & Nguyen, T. Q. (2003). External debt, public investment, and growth in low-income countries. IMF Working paper 03/249.
- Cochrane, J. H. (2011). Understanding policy in the great recession: Some unpleasant fiscal arithmetic. *European Economic Review*, 55(1), 2-30.

- Cochrane, J.H. (2021),  $r < g$ . Essay delivered at the February 19, 2021, NBER Economic Fluctuations and Growth conference. <https://www.johnhcochrane.com/research-all/rvsg>
- Codogno, L., Favero, C., & Missale, A. (2003). Yield spreads on EMU government bonds. *Economic Policy*, 18(37), 503-532.
- Cohen, D. (1993). Low Investment and Large LDC Debt in the 1980's. *The American Economic Review*, 437-449.
- De Grauwe P. (2021). *Euro Area fiscal policies and capacity in post-pandemic times*. In-depth analysis requested by the ECON committee. European Parliament.
- Darvas, Z. and G. Wolff (2021) A green fiscal pact: climate investment in times of budget consolidation, *Policy Contribution 18/2021*, Bruegel
- Diamond, P. A. (1965). National debt in a neoclassical growth model. *The American Economic Review*, 55(5), 1126-1150.
- Donayre, L., & Taivan, A. (2017). Causality between Public Debt and Real Growth in the OECD: A Country-by-country Analysis. *Economic Papers: A journal of applied economics and policy*, 36(2), 156-170.
- Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. *Journal of international Economics*, 97(1), 45-58.
- Égert, B. (2015). Public debt, economic growth and nonlinear effects: Myth or reality? *Journal of Macroeconomics*, 43, 226-238.
- Elmeskov, J., & Sutherland, D. (2012). Post-crisis debt overhang: growth implications across countries. *Available at SSRN 1997093*.
- European Commission (2021). Debt sustainability monitor. European Commission institutional paper 143, February 2021.
- European Fiscal Board (2020). European Fiscal Board Annual Report 2020.
- Fiedler S., Gern K\_j., Stolzenburd U. (2020) Blurred boundaries between monetary and fiscal policy, European Parliament Monetary Dialogue Papers, November 2020
- Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., & Qureshi, M. S. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *The Economic Journal*, 123(566), F4-F30.
- Gómez-Puig, M., & Sosvilla-Rivero, S. (2015). The causal relationship between debt and growth in EMU countries. *Journal of Policy Modeling*, 37(6), 974-989.
- Gómez-Puig, M., & Sosvilla-Rivero, S. (2017). Heterogeneity in the debt-growth nexus: Evidence from EMU countries. *International Review of Economics & Finance*, 51, 470-486.
- Jacobs, J., Ogawa, K., Sterken, E., & Tokutsu, I. (2020). Public Debt, Economic Growth and the Real Interest Rate: A Panel VAR Approach to EU and OECD Countries. *Applied Economics*, 52(12), 1377-1394.
- Jordà, Ò., Schularick, M., & Taylor, A. M. (2014). Private credit and public debt in financial crises. *FRBSF Economic Letter*, 7, 1-4.
- Jordà, Ò., Singh, S. R., & Taylor, A. M. (2020). The long-run effects of monetary policy. No. w26666. National Bureau of Economic Research.
- Kangasharju, A., Ali-Yrkkö J., Koski H., Kuusi T. (2021). Competition, Ageing and Lack of Investment, ETLA Report No 119.
- Kourtellos, A., Stengos, T., & Tan, C. M. (2013). The effect of public debt on growth in multiple regimes. *Journal of Macroeconomics*, 38, 35-43.
- Krugman, P. (1988). Financing vs. forgiving a debt overhang. *Journal of development Economics*, 29(3), 253-268.
- Kumar, M. S. & Woo, J., & (2015). Public debt and growth. *Economica*, 82(328), 705-739.

- Kuusi, T. & Puonti P. (2021). EU's Fiscal Rules: Keep it Simple, Not Stupid! ETLA Report No 118., ETLA Economic Research.
- Laubach, T. (2009). New evidence on the interest rate effects of budget deficits and debt. *Journal of the European Economic Association*, 7(4), 858-885.
- Leeper, E. M., & Walker, T. B. (2011). Fiscal limits in advanced economies. *Economic Papers: A journal of applied economics and policy*, 30(1), 33-47.
- Mauro, P., Romeu, R., Binder, A., & Zaman, A. (2015). A modern history of fiscal prudence and profligacy. *Journal of Monetary Economics*, 76, 55-70.
- Ministry of Finance (2021). Economic Survey, Autumn 2021, Publications of the Ministry of Finance 2021:51.
- Modigliani, F. (1961). Long-run implications of alternative fiscal policies and the burden of the national debt. *The Economic Journal*, 71(284), 730-755.
- Niemann, S., Pichler, P., & Sorger, G. (2013). Public debt, discretionary policy, and inflation persistence. *Journal of Economic Dynamics and Control*, 37(6), 1097-1109.
- Ostry, M. J. D., Ghosh, M. A. R., & Espinoza, M. R. A. (2015). *When should public debt be reduced?* Washington DC: International Monetary Fund.
- Panizza, U., & Presbitero, A. F. (2014). Public debt and economic growth: is there a causal effect? *Journal of Macroeconomics*, 41, 21-41.
- Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, 74(4), 967-1012.
- Pescatori, M. A., Sandri, M. D., & Simon, J. (2014). Debt and growth: is there a magic threshold? Working Paper 14/34, International Monetary Fund, Washington D.C.
- Picarelli, M. O., Vanlaer, W., & Marneffe, W. (2019). *Does public debt produce a crowding out effect for public investment in the EU?* European Stability Mechanism Working Paper No. 36.
- Reis, R. (2021). The constraint on public debt when  $r < g$  but  $g < m$ . BIS Working Papers No 939, May 2021.
- Saint-Paul, G. (1992). Fiscal policy in an endogenous growth model. *The Quarterly Journal of Economics*, 107(4), 1243-1259.
- Salotti S., Trecroci C. (2016). The impact of Government Debt, Expenditure and Taxes on Aggregate Investment and Productivity Growth, *Economica* (2016) **83**, 356-384.
- Spencer, R. W., & Yohe, W. P. (1970). The "crowding out" of private expenditures by fiscal policy actions. *Federal Reserve Bank of St. Louis Review*, (October 1970).
- Sutherland, A. (1997). Fiscal crises and aggregate demand: can high public debt reverse the effects of fiscal policy?. *Journal of public economics*, 65(2), 147-162.
- Teles, V. K., & Mussolini, C. C. (2014). Public debt and the limits of fiscal policy to increase economic growth. *European Economic Review*, 66, 1-15.
- Woo, J. (2009). Why do more polarized countries run more procyclical fiscal policy?. *The Review of Economics and Statistics*, 91(4), 850-870.
- Yang, L., & Su, J. J. (2018). Debt and growth: Is there a constant tipping point? *Journal of International Money and Finance*, 87, 133-143.