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## Private Investment and Public Investment: Total Rates of Return and Global Balances in the OECD

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## Private Investment and Public Investment: Total Rates of Return and Global Balances in the OECD

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# Private Investment and Public Investment: Total Rates of Return and Global Balances in the OECD

## Abstract

We assess the relevance of macro rates of return on time-varying fiscal and external sustainability. First, we compute the total public and private macroeconomic rates of return for 16 OECD countries from 1980 to 2022. We find that there is a positive impact of higher investment returns on stimulating higher aggregate demand, therefore resulting in higher tax revenues, which in turn lead to greater fiscal sustainability and more external sustainability by lowering the need for foreign capital and imports of goods and services. Accordingly, we demonstrate that macroeconomic rates of return of both public and private investment positively contribute to fiscal sustainability and that public sector investment also displays the same positive effect on external sustainability.

JEL-Codes: E220, F410, H540, H610.

Keywords: macroeconomic rates of return, fiscal sustainability, external sustainability, time-varying, public investment, private investment.

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## **1. Introduction**

Economic growth is central to economic analysis, with a focus on sustainable growth and improved living standards. Interactions between domestic and external agents can disrupt and cause volatile business cycles. Both exogenous and endogenous growth theories highlight capital accumulation's role, emphasizing profitability and technological progress. Oded Galor's Unified Growth Theory (2011) underscores capital accumulation's importance, linking technological progress and living standards to long-term growth. Public and external sectors are crucial in this context.

Public sector activism reduces inequality and stimulates growth by providing essential goods and services, enhancing competitiveness, and redistributing income (Alves and Coelho, 2024; North & Wallis, 1992). Fiscal policy should be sustainable, with current expenditures financed by current revenues, and public debt used for capital expenditures (Feldstein, 1985). Investment returns significantly influence fiscal policy, making fiscal sustainability analysis vital (Tamai, 2016).

International trade boosts growth but can imbalance external accounts if demand for foreign goods rises, reducing domestic investment capacity (Lewer & den Berg, 2003; Singh, 2010; Huchet-Bourdon et al., 2017; Makin & Narayan, 2011).

We analyze the impact of macroeconomic rates of return on private and public investment using Afonso & St. Aubyn's (2009) expanding window approach. Fiscal and external sustainability are assessed through time-varying analyses, based on government revenues and expenditures, and export-import reactions. Our study hypothesizes that higher macroeconomic returns increase aggregate income and government revenues, enhancing short-term fiscal sustainability (Garcia-Macia, 2023). Increased returns also boost external competitiveness, reducing capital needs for domestic investments.

Our contributions include a novel database of macroeconomic rates of return for 16 OECD countries and an evaluation of their impact on fiscal and external sustainability. Findings show that public investment returns generally exceed private sector returns. External sustainability coefficients are higher than fiscal ones, indicating stable external accounts despite rising government debt. Public investment returns positively affect external sustainability, while both public and private investment returns correlate positively with fiscal sustainability.

The paper is organized as follows: Section 2 reviews related literature; Section 3 outlines the theoretical framework; Section 4 describes data and methodology; Section 5 discusses empirical results; Section 6 concludes with policy implications.

## **2. Literature Review**

### ***2.1. Macroeconomic Rates of Return***

The economic literature highlights a crowding-in effect between public and private investment, indicating that public investment positively impacts private gross fixed capital formation (Dreger & Reimers, 2016; São Marcos & Vale, 2022; Carvelli, 2023). The crowding-in/out effects depend on private sector leverage, financial liquidity constraints, and employment efficiency, with higher labour inefficiency or financial constraints leading to stronger crowding-in effects (Espinoza et al., 2024).

Macroeconomic rates of return on public and private investment are less studied. Pereira (2000) pioneered this area, using Aschauer's contributions to compute public capital stock-output elasticity (Aschauer 1989a, 1989b). Pereira found public investment rates of return ranging from 3.4% to 16.1% for various infrastructures, concluding a crowding-in effect on the private sector.

Pina and St. Aubyn (2005, 2006) expanded Pereira's approach using a Vector Autoregressive (VAR) model to compute impulse-response functions (IRFs) and derive macroeconomic rates of return from the marginal productivity of public and private capital. They found that investment in human and private capital in Portugal from 1960 to 2001 had higher returns than public investment, with public investment crowding-in private capital but being crowded-out by human capital shocks.

Afonso & St. Aubyn (2009, 2010, 2018) further researched partial and total public and private macroeconomic rates of return for OECD economies. They found that the crowding-in effect of private investment on public gross fixed capital formation is more pronounced than the reverse. Public investment rates of return were generally higher than private sector returns. However, private investment returns decreased after the 2008 Global Financial Crisis.

### ***2.2. External and Fiscal Sustainability***

The subject of external sustainability has been extensively discussed in both theoretical and empirical literature (Milesi-Ferretti and Razin, 1996; Arnone et al., 2005). Afonso et

al. (2019) identify three main branches: i) assessment of trade balance, current account balance, and external debt dynamics using panel data and time-series econometrics; ii) analysis of economic determinants of external debt growth; iii) study of the effects of external debt trajectories on the domestic economy. Home (1991) demonstrates that conditional projections on external imbalance trajectories can achieve long-run sustainability.

Studies on current account sustainability, such as Brissimis (2012), analyze Greek current account dynamics, concluding that post-1999, Greece's external sector was unsustainable due to decreased private savings and low investment. Bajo-Rubio et al. (2014) find current account sustainability in Austria, Canada, Italy, and New Zealand, but not in other advanced economies. Camarero et al. (2015) highlight the role of net foreign assets in EMU members' external sustainability, finding similar results to Brissimis (2012) and Bajo-Rubio et al. (2014).

Regarding external debt sustainability, Kraay and Nehru (2006) emphasize debt burden, institutional factors, and adverse shocks as key determinants. Gourinchas and Rey (2007) examine net foreign assets and exchange rate effects on external debt dynamics, using a debt-to-assets ratio and a Non-linear Model Predictive Control approach. Semmler and Tahri (2017) illustrate Germany's external sustainability, while Navarro and Sapena (2020) use a VAR estimation to assess external debt sustainability in advanced and emerging economies.

Fiscal sustainability literature includes backward and forward-looking approaches to ensure the intertemporal budget constraint (Debrun et al., 2019). The backward-looking approach assesses fiscal solvency through stationarity and cointegration between government revenues and expenditures, and fiscal reaction functions (Hakkio and Rush, 1991; Afonso, 2005). Afonso and Rault (2010) find fiscal sustainability in some EU-15 subperiods. Bohn (1998, 2007) argues that fiscal solvency is ensured if the primary balance reacts positively to past debt increases, despite the absence of cointegration.

Fiscal fatigue occurs when governments cannot maintain the pace of primary balance increases relative to debt growth, reducing fiscal space (Gosh et al., 2013; Checherita-Westphal and Václav, 2017). Afonso et al. (2021) highlight the importance of the interest rate-growth rate differential on fiscal solvency. Institutional effects on fiscal responsiveness are significant, with Euro-area economies showing reduced budget balance responsiveness post-Maastricht Treaty (Golpe et al., 2023; Weichenrieder and

Zimmer, 2014). Fiscal rules based on expenditure behaviour influence fiscal sustainability (Afonso and Jalles, 2017a). Lee et al. (2018) find that fiscal sustainability is not observed in southern and peripheral Euro-area economies. Short-term fiscal consolidations can ensure long-term sustainability (Aldama and Creel, 2019).

Time-varying fiscal reaction function coefficients offer insights into fiscal responsiveness dynamics. Core Euro-area economies have shown more sustainable fiscal trajectories, with the 2008 GFC negatively impacting fiscal sustainability. Higher government debt maturity, central bank-held debt, and capital market liquidity are associated with greater fiscal sustainability (Afonso and Jalles, 2017a; 2017b). Saadaoui et al. (2022) find that Sweden, the UK, and the US have demonstrated fiscal sustainability since the 21st century, unlike Canada, Italy, and Portugal.

### 3. Theoretical framework and empirical strategy

Let us assume that a given economy is described by a traditional Cobb-Douglas production function, displaying constant returns of scale, whose inputs are private,  $K_P$ , and public capital,  $K_G$ , and labour,  $L$ :

$$Y = K_P^\alpha K_G^\gamma L_t^{1-\alpha-\gamma} \quad (1)$$

where,  $\alpha$ ,  $\gamma$  and  $1 - \alpha - \gamma$  represent the output elasticities to private and public capital and labour, accordingly. From this expression we can derive the marginal productivity of private and public capital:

$$MPK_P = \frac{\partial Y}{\partial K_P} = \alpha K_P^{\alpha-1} K_G^\gamma L^{1-\alpha-\gamma} = \alpha \frac{Y}{K_P}, \quad (2)$$

$$MPK_G = \frac{\partial Y}{\partial K_G} = \gamma K_P^\alpha K_G^{\gamma-1} L^{1-\alpha-\gamma} = \gamma \frac{Y}{K_G}. \quad (3)$$

In order to empirically compute output elasticities for private and public investment,  $\alpha$  and  $\gamma$ , respectively, we follow Afonso and St. Aubyn (2010). Therefore, we estimate a VAR as follows:

$$X_t = c + \sum_{i=1}^p A_i X_{t-i} + \varepsilon_t \quad (4)$$



where  $X_t$  is the  $(5 \times 1)$  vector containing the five ordered endogenous variables, namely are the logarithmic growth rates of real public investment,  $K_G$ , real private investment,  $K_P$ , real output,  $Y$ , real taxes,  $Tax$ , and real interest rates,  $R$ , given by  $X_t \equiv [\Delta \log K_{G,t} \ \Delta \log K_{P,t} \ \Delta \log Y_t \ \Delta \log Tax_t \ \Delta \log R_t]'$ ,  $c$  is the constant term vector,  $A$  is the estimated autoregressive coefficients' matrix and  $\varepsilon_t$  is the error term vector. Lastly,  $p$  is the optimal lag length determined by AIC and BIC criteria. In our VAR model, public investment is prioritized, meaning changes in public investment can immediately affect other factors. This setup implies that private investment responds instantly to public investment but not to shocks in subsequent variables. Private economic agents incorporate fiscal authority's investment plans into their strategies, impacting aggregate income. The real interest rate, being the most endogenous variable, is assumed to be unaffected by other variables' shocks within the same period but responds simultaneously to shocks in the remaining variables.

For every variable in (4), orthogonal shocks,  $\eta$ , can be identified by imposing a set of constraints. These orthogonal innovations can then be computed via the random disturbances:

$$\eta_t \equiv B\varepsilon_t \quad (5)$$

$$\varepsilon_t \sim \mathcal{N}(0, \Sigma). \quad (6)$$

One can calculate  $\Sigma = Cov(\varepsilon)$  by estimating Equation (4). Therefore, we obtain  $Cov(\eta) = I$ , where  $I = (5 \times 5)$  is the identity matrix, and we may write with the orthogonal limitations and an appropriate normalisation:

$$Cov(\eta_t) = Cov(B\varepsilon_t) = BCov(\varepsilon_t)B', I = BCov(\varepsilon_t)B'. \quad (7)$$

Given that  $B$  is a square  $(n \times n)$  matrix, with dimension five in our example, there are 25 parameters in  $B$  that need to be determined. Only 15 parameters can be derived from (4) using orthogonality, consisting of five variances and ten covariances. To fully identify the model, ten additional constraints are needed. These constraints are obtained by applying a Cholesky decomposition to the covariance matrix of the residuals, requiring

all elements above the primary diagonal to be zero. This ensures exact system identification.

After that, we can derive  $B^{-1}$  to obtain a lower triangular structure,

$$B^{-1} = D = \begin{bmatrix} d_{11} & 0 & 0 & 0 & 0 \\ d_{21} & d_{22} & 0 & 0 & 0 \\ d_{31} & d_{31} & d_{33} & 0 & 0 \\ d_{41} & d_{42} & d_{43} & d_{44} & 0 \\ d_{51} & d_{52} & d_{53} & d_{54} & d_{55} \end{bmatrix} \quad (8)$$

enabling the residuals  $\varepsilon_t$  to be expressed as a function of the orthogonal shocks in every variable:

$$\varepsilon_t = D\eta_t. \quad (9)$$

Consequently, resorting to the VAR approach and the correspondent impulse response functions (IRF), we then compute the abovementioned output to private and public elasticities,  $\alpha$  and  $\gamma$ , respectively. Therefore, recalling the marginal productivities of private and public investments from Equations (2) and (3), we can derive the following macroeconomic rates of return of private and public investments, considering a 20-year investment lifetime:

$$MPK_p = (1 + r_p)^{20} \Leftrightarrow r_p = (MPK_p)^{\frac{1}{20}} - 1 \quad (10)$$

$$MPK_G = (1 + r_G)^{20} \Leftrightarrow r_G = (MPK_G)^{\frac{1}{20}} - 1 \quad (11)$$

where  $MPK_p \equiv \frac{\Delta Y}{\Delta K_p} = \varepsilon_{K_p} \frac{Y}{K_p} = \alpha \frac{Y}{K_p}$ , and  $MPK_G \equiv \frac{\Delta Y}{\Delta K_G} = \varepsilon_{K_G} \frac{Y}{K_G} = \gamma \frac{Y}{K_G}$ . These macroeconomic rates of return are termed partial because they do not account for crowding-in/out effects. For example, public investment can crowd-in private investment, and vice-versa, depending on factors such as interest rates and fiscal stance.

Consequently, we can derive the macroeconomic rate of return of total investment caused by a shock to private ( $MPK_{Total,K_P}$ ) or to public investment ( $MPK_{Total,K_G}$ ) as follows<sup>2</sup>:

$$MPK_{Total,K_P} = (1 + r_{Total,K_P})^{20} \Leftrightarrow r_{Total,K_P} = (MPK_{Total,K_P})^{\frac{1}{20}} - 1 \quad (12)$$

$$MPK_{Total,K_G} = (1 + r_{Total,K_G})^{20} \Leftrightarrow r_{Total,K_G} = (MPK_{Total,K_G})^{\frac{1}{20}} - 1 \quad (13)$$

and

$$MPK_{Total} = \frac{\Delta Y}{\Delta K_P + \Delta K_G} = \frac{1}{MPK_P^{-1} + MPK_G^{-1}}. \quad (14)$$

On the other hand, GDP can be computed resorting to the income approach, i.e., by summing all the yields that production factors generate (the macroeconomic rates of return for the different investment types – private,  $r_P$ , and public,  $r_G$  – or total,  $r$  – and wages,  $w$ , in what concerns to the labour input) and the stock of each input in the economy, i.e., capital (private and public) and labour:

$$Y = r \cdot K + w \cdot L = r_P \cdot K_P + r_G \cdot K_G + w \cdot L. \quad (15)$$

Additionally, GDP can also be derived from the expenditure approach:

$$Y = C + G + I + X - M. \quad (16)$$

Furthermore, we can assume that exports,  $X$ , and fiscal revenues,  $R$ , are a fraction of imports,  $M$ , and of government expenditures,  $G$ , respectively, as follows:

$$X = \beta_{Ext} \cdot M \quad (17)$$

$$R = \beta_{Fis} \cdot G \leftrightarrow G = R \cdot \beta_{Fis}^{-1}. \quad (18)$$

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<sup>2</sup> The subscript  $K_P$  and  $K_G$  in  $r_{Total}$  is to highlight the fact that the total rate of return is derived from a shock on private or public investment, respectively.

Replacing (17) and (18) in (16), we reach to the following GDP expression:

$$Y = C + R \cdot \beta_{Fis}^{-1} + I + \beta_{Ext} \cdot M - M \Leftrightarrow Y = C + R \cdot \beta_{Fis}^{-1} + I + \beta_{Ext} \cdot (1 - M). \quad (19)$$

Hence, by equalising GDP obtained from the expenditure (equation (19)) and income (equation (15)) approaches, we can write the following expression:

$$C + R \cdot \beta_{Fis}^{-1} + I + \beta_{Ext} \cdot (1 - M) = r_P \cdot K_P + r_G \cdot K_G + w \cdot L. \quad (20)$$

Therefore, we can conclude that fiscal and external sustainability can be a function of both partial (if not considering crowding-in/out feedback effects of private investment on public investment and vice-versa) and total (if crowding-in/out effects are taken into account) private and public macroeconomic rates of return, that is,  $\beta_{Ext} = f(r)$  and  $\beta_{Fis} = f(r)$ .

Lastly, it is important to mention that we also analyse both fiscal and external sustainability and macroeconomic rates of return in a time-varying way. Consequently, the VAR is computed in a rolling-window setup to obtain the different output-to-investment elasticities in a rolling-window approach, while external and fiscal sustainability are computed using Schlicht's (2021) method as:

$$X_t = \alpha_{Ext,t} + \beta_{Ext,t} \cdot M_t + \varepsilon_{Ext,t} \quad (21)$$

$$R_t = \alpha_{Fis,t} + \beta_{Fis,t} \cdot G_t + \varepsilon_{Fis,t} \quad (22)$$

where  $\alpha$ ,  $\beta_{Ext,t}$ ,  $\beta_{Fis,t}$  and  $\varepsilon_t$  are the time-varying constant term, external sustainability measure, fiscal sustainability measure and error-term, correspondingly. According to Schlicht's (2021) approach, the time-varying external and fiscal sustainability coefficients are assumed to behave randomly and registering small adjustments over time as:

$$\beta_t = \beta_{t-1} + v_t, \quad (23)$$

where  $v \sim \mathcal{N}(0, r^2)$ .

After computing the (partial and total) macroeconomic rates of returns of private and public investment and the time-varying external and fiscal sustainability, we analyse the macroeconomic rates effect on both external and fiscal as follow:

$$\beta_{i,t,s} = \alpha_{0,i,t} + \alpha_1 \cdot r_{i,t,z} + \alpha_n \cdot X_{i,t,n} + \psi_i + \eta_t + \varepsilon_{i,t} \quad (24)$$

where  $\beta_s$  represents the sustainability coefficient  $s$ -type,  $s = \{\beta_{i,t,Ext}; \beta_{i,t,Fis}\}$ ,  $r_z$  is the macroeconomic rate of return  $z = \{r_{IPub,Partial}; r_{IPub,Total}; r_{IPriv,Partial}; r_{IPriv,Total}\}$ .  $X_n$  are the control variables used, detailed in the data section (section 4), while  $\psi$  and  $\eta$  are the country  $i$  and time  $t$  specific effects, and  $\varepsilon$  represents the error term. We estimate Equation (24) in a panel data framework employing Panel Ordinary Least Squares-Fixed Effects (OLS-FE) and Weighted Least Squares-Fixed Effects (WLS-FE), weighted by the inverse of standard deviations. Lastly, standard errors are robust to heteroskedasticity and serial correlation.

#### 4. Data and stylized facts

Our analysis comprises a set of 16 OECD countries, namely Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden, United Kingdom, United States, for the period of 1980-2022<sup>3</sup>.

Our data originates from various sources. For the dataset used in the VAR to compute macroeconomic rates of return, we rely on the AMECO database. For real public ( $K_G$ ) and private investment ( $K_P$ ), we use public sector gross fixed capital formation at current prices (series 1.0.0.0.UIGG) and private sector gross fixed capital formation at current prices (series 1.0.0.0.UIGP), respectively, adjusting for the gross fixed capital formation price deflator (series 3.1.0.0.PIGT) to obtain real investment values. For nominal output ( $Y$ ), we use gross domestic product at current prices (series 1.0.0.0.UVGD), and for nominal taxes ( $Tax$ ), we sum taxes on imports and production (series 1.0.0.0.UTVG), taxes on income and wealth (series 1.0.0.0.UTYG), and social security contributions (series 1.0.0.0.UTSG). We convert nominal GDP and taxes to real values using the GDP deflator (series 3.1.0.0.PVGD). For real interest rates, we use long-term nominal interest

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<sup>3</sup> We use data from 1960 until 2022 to compute the expanding-window VAR, but for the second stage analysis the analysis is focused just on the period from 1980 to 2022.

rates (series 1.1.0.0.ILN) and the national consumer price index (3.0.0.0.ZCPIN). We compute the VAR in an expanding-window setup to obtain time-varying public and private macroeconomic rates of return from 1960-1980, 1960-1981, 1960-1982, ..., 1960-2022.

To compute the time-varying fiscal and external sustainability coefficients, we use Mauro et al. (2015) for total revenues and expenditures, both as a percentage of GDP, and for exports and imports of goods and services as a percentage of GDP. The data were sourced from the World Bank's World Development Indicators (WDI).

Tables 1 and 2 present the summary statistics and correlation matrix for each data block, i.e., variables used in the expanding-window VAR and Schlicht's (2021) time-varying sustainability coefficients. Notably, there is a high correlation between (real) public and private investment and between these investments and tax revenues, indicating a potential positive impact of investment and government revenues. Additionally, panel B's correlation matrix shows high correlation levels between government revenues and expenditures, as well as exports and imports, suggesting fiscal and external sustainability during the analysed period. In sum, there appears to be a relationship between fiscal sustainability and public and private investment, and potentially between investment and external sustainability.

**Table 1. Descriptive Statistics**

<b>Panel A – Variables used in the expanding-window VAR</b>					
Variable	Mean	Std. Dev.	Min.	Max.	Obs.
<i>Real GDP</i>	6.741	2.066	3.070	13.226	1008
<i>Real Public Investment</i>	3.465	2.178	-0.413	10.373	938
<i>Real Private Investment</i>	5.098	2.131	1.560	11.768	938
<i>Inflation</i>	4.735	4.888	-4.478	31.017	992
<i>Real Interest Rates</i>	2.232	3.095	-12.659	20.688	911
<i>Real Tax Revenues</i>	5.732	2.102	1.407	12.132	929

Notes: Except for inflation and real interest rates, which are expressed as percentages, all other variables are in natural logarithms. Authors' calculations.

**Panel B – Variables used in the Schlicht's (2021) time-varying sustainability coefficients**

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
<i>Revenues</i>	42.760	8.834	13.790	58.770	688
<i>Expenditures</i>	46.400	8.412	16.340	69.400	688
<i>Exports</i>	37.060	22.152	6.988	137.090	687
<i>Imports</i>	35.900	18.522	6.809	124.490	687

Notes: All variables are expressed as a percentage of GDP. Authors' calculations.

**Table 2. Correlation Matrix**

<b>Panel A – Variables used in the expanding-window VAR</b>						
Variables	(1)	(2)	(3)	(4)	(5)	(6)

(1) <i>Real GDP</i>	1.000					
(2) <i>Real Public Investment</i>	0.990	1.000				
(3) <i>Real Private Investment</i>	0.996	0.988	1.000			
(4) <i>Inflation</i>	-0.239	-0.239	-0.244	1.000		
(5) <i>Real Interest Rates</i>	-0.087	-0.089	-0.116	-0.394	1.000	
(6) <i>Real Tax Revenues</i>	0.992	0.983	0.986	-0.289	-0.071	1.000

Notes: Authors' calculations.

**Panel B – Variables used in the Schlicht's (2021) time-varying sustainability coefficients**

Variables	(1)	(2)	(3)	(4)
(1) <i>Revenues</i>	1			
(2) <i>Expenditures</i>	0.892	1		
(3) <i>Exports</i>	0.277	0.195	1	
(4) <i>Imports</i>	0.268	0.213	0.976	1

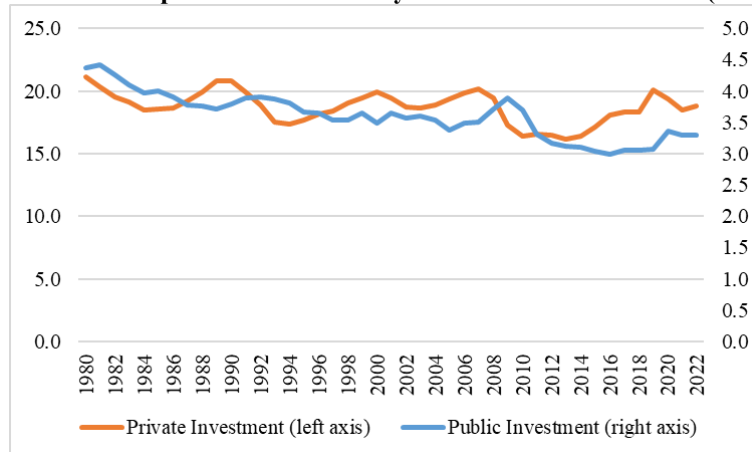
Notes: Authors' calculations.

In the second step of our analysis, we incorporated several control variables. For the relationship between the four macroeconomic rates of return and external sustainability, we included the economy's *openness* (sum of exports and imports as a percentage of GDP) from the WDI. From IMF's World Economic Outlook (WEO), we used the *output gap* (difference between actual GDP and potential GDP), a *savings deficit* indicator (gross savings minus total investment) and the *current* account balance, both as a percentage of GDP.

For fiscal sustainability, we considered *public assets* (difference between gross and net government debt as a percentage of GDP), the primary budget balance (*pbb*) (as a percentage of GDP), and the output gap, all sourced from the WEO. We also included the interest rate-growth rate *differential* (difference between the real long-term interest rate and the real growth rate) from Mauro et al. (2015).

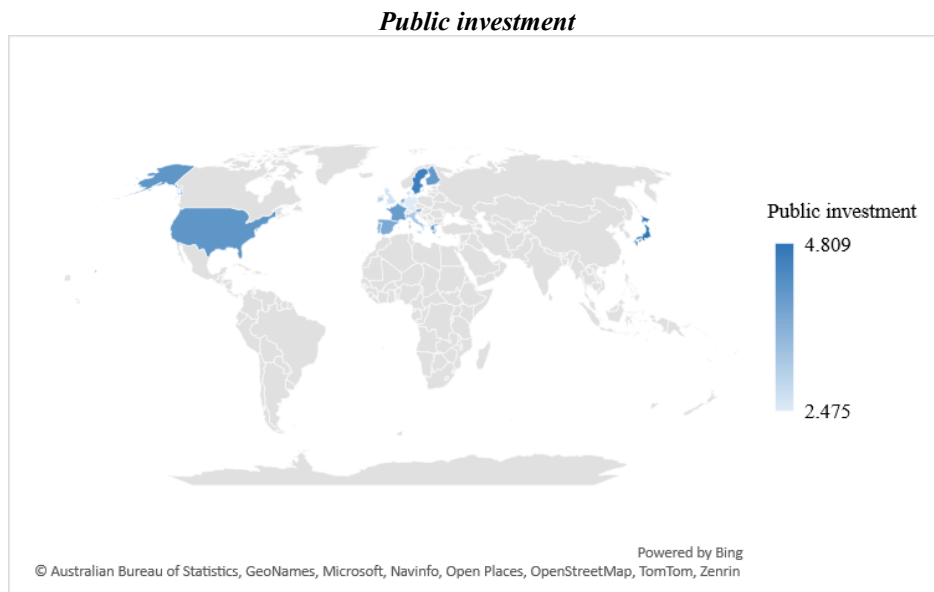
Examining historical trends, public investment has slightly decreased from nearly 4.5% to 3.5% of GDP over 42 years. Conversely, the private investment-to-GDP ratio averages more than four times the public investment ratio but is more volatile, with significant declines during crises. Economies exhibit diverse patterns in public and private investment (Figure 2). Specifically, Germany, the United Kingdom, and Belgium have the lowest average public investment ratios, each below 3% during the 1980-2022 period. In contrast, Japan (4.8%), the United States (4.2%), and Finland (4.1%) lead in average public investment. Regarding private investment, the United Kingdom (15.8%), Greece (16.1%), and Denmark (17.3%) have the lowest average private investment-to-GDP ratios. Conversely, Japan (23.4%), Austria (20.9%), and Ireland (20.7%) have the highest average private investment ratios from 1980 to 2022.

**Figure 1. Public and private investment dynamics from 1980 to 2022 (% of GDP).**



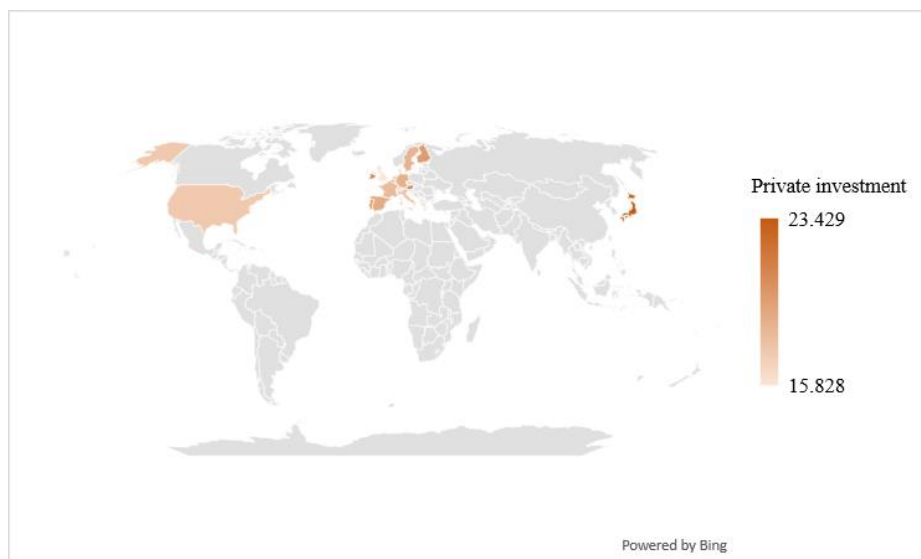
Notes: Authors' calculations.

**Figure 2. Average public and private investment by country from 1980 to 2022 (% of GDP).**



*Private investment*





Notes: Authors' calculations.

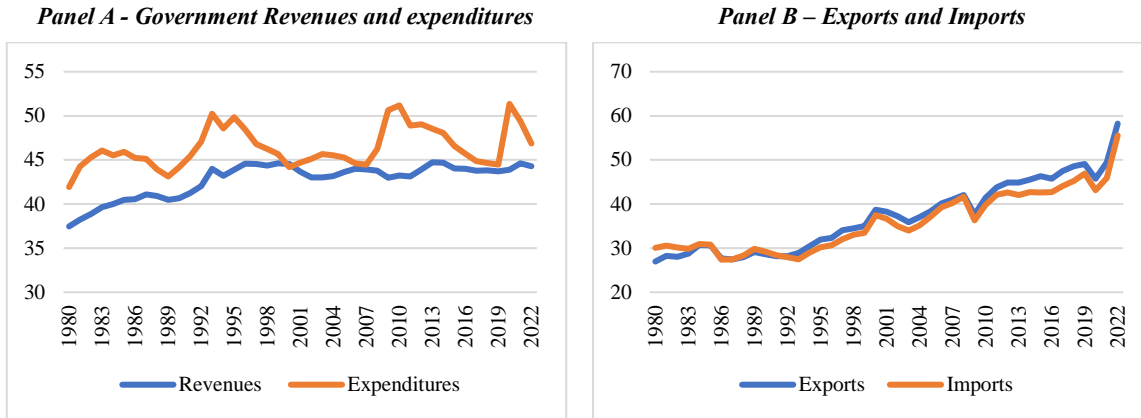
Analysing government revenue and expenditure patterns (Figure 3, Panel A), we observe a co-movement, with average values of 42.7% of GDP for revenues and 46.4% for expenditures. The gap between revenues and expenditures shows a diminishing trend, enhancing fiscal sustainability. However, fiscal imbalances increase during crises, such as the 2008 GFC and the COVID-19 crisis. In contrast, exports and imports exhibit a strong correlation, with an upward trend becoming more pronounced post-COVID-19 (Panel B).

Government revenue and expenditure patterns, along with export and import trends, show varied country-specific trends (Figure 4). Denmark has the highest government burden, with spending at 54.5% of GDP and revenues at 54.8%. Japan has the lowest, with revenues and expenditures at 30.4% and 34.8% of GDP.

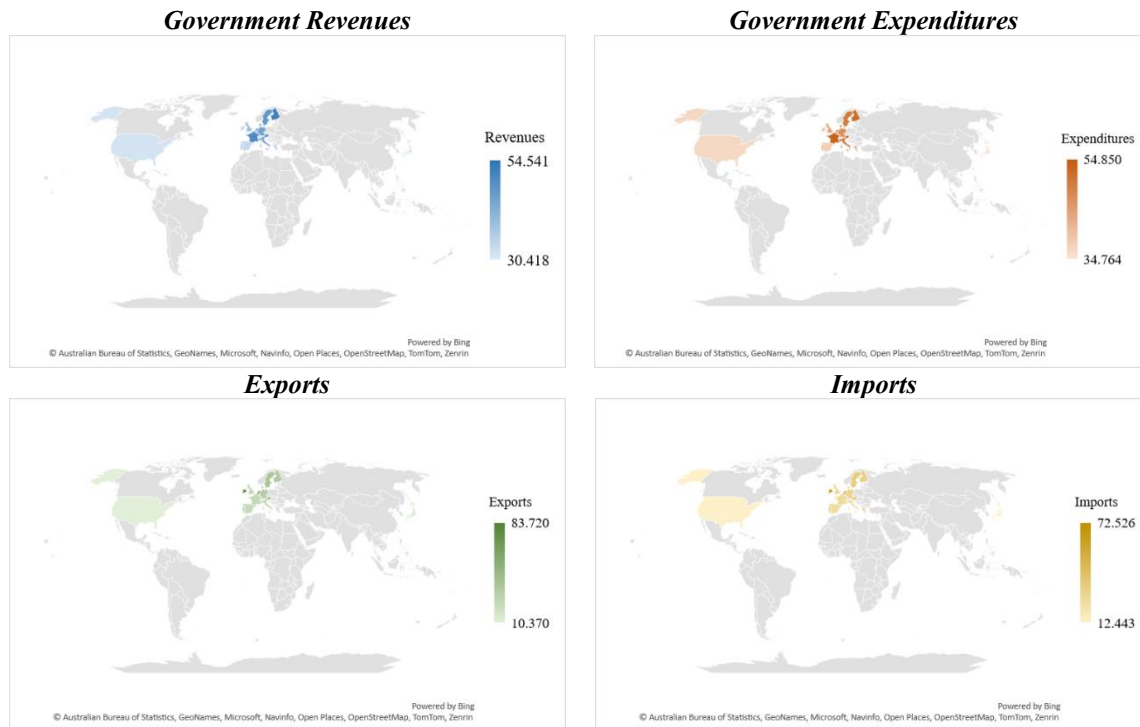
Ireland and Belgium are the most open economies, with openness degrees of 156% and 123% of GDP. Ireland's exports-to-GDP ratio averaged 83.7% from 1980 to 2022, consistently exceeding GDP since 2010. The United States and Japan have average exports-to-GDP ratios around 25%. Japan usually has an external surplus, while the United States has had an external imbalance since 1980.

Summary statistics of public and private investment, public sector revenues and expenditures, and average export and import values per country are in the Appendix (Table A1).

**Figure 3. Government revenues and expenditures (Panel A), exports and imports of goods and services (Panel B) from 1980 to 2022 (% of GDP).**



**Figure 4. Average government revenues, expenditures, exports and imports by country from 1980 to 2022 (% of GDP).**



## 5. Empirical analysis

### 5.1. Public and private investment macroeconomic rates of return

We computed macroeconomic rates of return for private and public investment using an expanding-window approach for 16 countries from 1980 to 2022. Negative marginal

productivities in Belgium and Sweden prevented calculating public investment returns, assuming a 20-year investment lifespan.

Table 3 shows that public investment generally yields higher macroeconomic returns than private investment, except in Finland, Italy, the Netherlands, the UK, and the US, where private investment has higher returns. This is expected due to higher investment levels leading to lower marginal productivity. Given that private investment's GDP share is over five times that of public investment (Figure 1), higher returns for public investment are anticipated.

For illustration, we compare four economies with the highest GDP in 2022 (AMECO). Figure 5 shows that public investment returns are more volatile than private investment returns, influenced by political cycles and public finance constraints, despite some links to automatic stabilizers. Private investment is more tied to economic fundamentals like growth, real interest rates, and inflation.

Public investment rates show higher variability, with a coefficient of variation 50% greater than private investment. This is due to public investment's counter-cyclical role, acting as a lag variable, while private investment reflects future business cycle conditions anticipated by private sector managers.

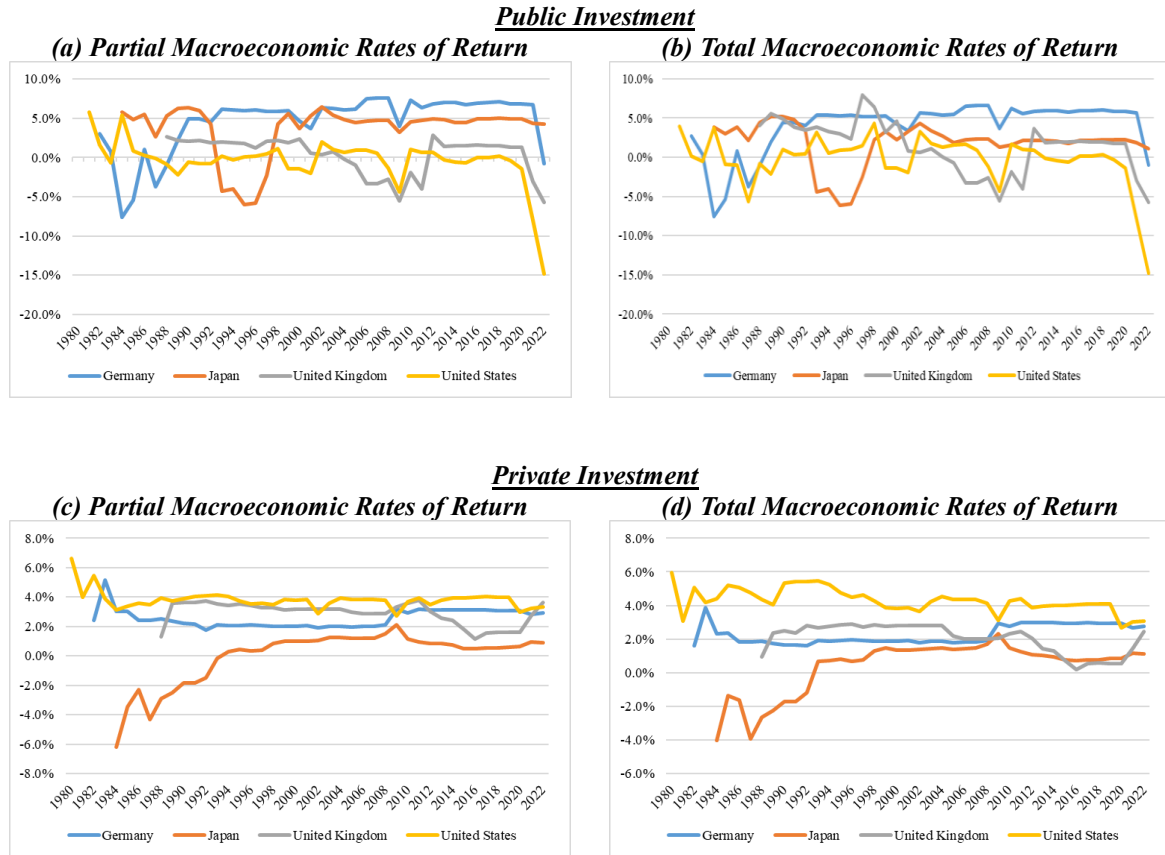
Table A2 in the Appendix provides detailed macroeconomic rates of return for public and private investment for each country.

**Table 3. Average Public and Private Partial and Total Macroeconomic Rates of Return by country.**

	Public Investment		Private Investment	
	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>
<i>Austria</i>	2.215%	1.094%	1.134%	0.634%
<i>Belgium</i>	n.a.	n.a.	-0.889%	-0.704%
<i>Denmark</i>	0.682%	0.431%	-0.553%	-0.778%
<i>Finland</i>	0.347%	0.016%	0.768%	0.859%
<i>France</i>	0.872%	3.101%	2.426%	2.028%
<i>Germany</i>	4.587%	3.914%	2.561%	2.272%
<i>Greece</i>	1.803%	1.050%	-1.090%	-0.485%
<i>Ireland</i>	2.661%	3.278%	0.770%	-0.283%
<i>Italy</i>	-5.028%	-4.871%	2.553%	1.809%
<i>Japan</i>	3.671%	1.790%	-0.025%	0.360%
<i>Netherlands</i>	-1.595%	-1.319%	2.161%	1.928%
<i>Portugal</i>	5.881%	3.638%	2.135%	1.914%
<i>Spain</i>	3.190%	1.898%	1.758%	1.543%
<i>Sweden</i>	n.a.	n.a.	-0.338%	-0.311%
<i>United Kingdom</i>	0.333%	1.369%	2.897%	2.036%
<i>United States</i>	-0.442%	-0.269%	3.811%	4.306%

Notes: "n.a." indicates non-availability due to negative marginal productivity of capital, making it impossible to compute annual average growth rates. Authors' calculations.

**Figure 5. Macroeconomic Rates or Return for Public and Private investment for selected countries from 1980 to 2022.**



Notes: Authors' calculations.

## 5.2. Fiscal and External Sustainability Coefficients

Before estimating the fiscal and external sustainability coefficients, we conducted panel unit root tests for each time series and panel cointegration tests between revenues and expenditures, and exports and imports. These results are in Tables A3 and A4 in the Appendix. After confirming the necessary econometric requirements, including cointegration relationships indicating long-run fiscal sustainability and balanced external accounts, we estimated Equations (21) and (22) using Schlicht's (2021) approach. Table 4 presents the average time-varying fiscal and external sustainability coefficients for each country. Detailed results for each country and year are in Tables A5 and A6 in the Appendix.

**Table 4. Average Time-Varying Fiscal and External Sustainability Coefficients by country.**

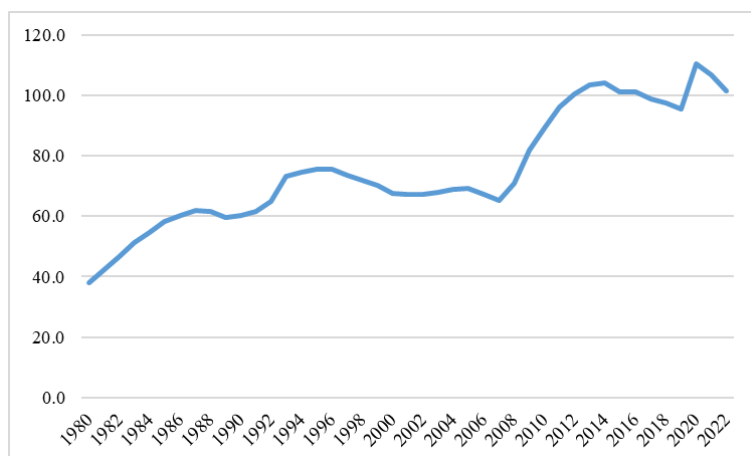
	<i>External</i>	<i>Fiscal</i>
<i>Austria</i>	0.930	0.141
<i>Belgium</i>	0.865	0.140
<i>Denmark</i>	0.862	0.272

<i>Finland</i>	0.985	0.184
<i>France</i>	0.813	0.122
<i>Germany</i>	0.864	-0.001
<i>Greece</i>	0.740	0.350
<i>Ireland</i>	0.537	0.263
<i>Italy</i>	0.685	0.237
<i>Japan</i>	0.665	-0.100
<i>Netherlands</i>	1.053	0.140
<i>Portugal</i>	0.657	0.140
<i>Spain</i>	0.701	0.740
<i>Sweden</i>	0.974	0.727
<i>United Kingdom</i>	0.716	0.122
<i>United States</i>	0.571	-0.091

Notes: Authors' calculations.

The results show an average external sustainability coefficient of approximately 0.8, significantly higher than the fiscal sustainability coefficient of 0.2. This suggests that external accounts are closer to a long-run balanced trajectory compared to fiscal sustainability. This is expected, given the increasing trend of government debt as a percentage of GDP, as shown in Figure 6.

**Figure 6. Average Government Debt-to-GDP ratio for the country's sample from 1980 to 2022.**



Notes: Authors' calculations based on Mauro et al. (2015).

### ***5.3. MRR effects on external and fiscal sustainability***

#### ***5.3.1. External Sustainability***

In this subsection, we assess the impacts of four different macroeconomic rates of return on time-varying external sustainability. The results, presented in Tables 5 to 8, use both OLS (columns (1) to (6)) and WLS (columns (7) to (12)) econometric techniques with fixed effects to address heterogeneity between countries and over time.

The results indicate that macroeconomic rates of return on public investment, whether partial or total, positively impact external sustainability. In contrast, private sector returns have a non-significant impact. This non-significance can be attributed to two opposing forces: higher private investment returns attract foreign direct investment, increasing capital inflows and potentially unbalancing external accounts, while also reducing the need for domestic financing, thus balancing the need for external financing. Public sector investment, being government-decided and not fully linked to the business cycle, shows a positive impact on external sustainability.

Control variables show expected signs: higher trade openness or current account balance enhances external sustainability, while a higher output gap negatively impacts it by increasing disposable income and imports, thus affecting the import-export balance. Increased investment decisions beyond domestic financing capacity lead to reliance on foreign savings, causing capital inflows and jeopardizing external sustainability.

**Table 5. The impact of partial macroeconomic rates of return of public investment on time-varying external sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$r_{IPub,Partial}$	0.430*** (0.127)	0.328** (0.131)	0.338*** (0.125)	0.323*** (0.109)	0.450*** (0.104)	0.267** (0.104)	0.473*** (0.125)	0.386*** (0.128)	0.409*** (0.125)	0.364*** (0.106)	0.481*** (0.105)	0.331*** (0.106)
<i>openness</i>		0.003*** (0.001)				0.002*** (0.001)		0.003*** (0.001)				0.001** (0.001)
<i>outputgap</i>			-0.010*** (0.002)			-0.008*** (0.001)			-0.009*** (0.002)			-0.007*** (0.001)
<i>savings deficit</i>				-0.017*** (0.002)		-0.008** (0.003)				-0.017*** (0.002)		-0.009*** (0.003)
<i>current</i>					0.017*** (0.002)	0.008** (0.003)					0.017*** (0.001)	0.007** (0.003)
<i>Constant</i>	0.553*** (0.071)	0.515*** (0.058)	0.530*** (0.077)	0.625*** (0.036)	0.615*** (0.022)	0.574*** (0.030)	0.516*** (0.068)	0.492*** (0.055)	0.490*** (0.073)	0.609*** (0.033)	0.604*** (0.022)	0.570*** (0.029)
Obs.	382	382	381	382	382	381	382	382	381	382	382	381
$R^2$	0.822	0.836	0.838	0.900	0.904	0.915	0.839	0.850	0.851	0.915	0.916	0.924

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

**Table 6. The impact of total macroeconomic rates of return of public investment on time-varying external sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$r_{IPub,Total}$	0.368*** (0.131)	0.256* (0.135)	0.304** (0.124)	0.307*** (0.110)	0.412*** (0.106)	0.247** (0.100)	0.401*** (0.130)	0.304** (0.135)	0.366*** (0.126)	0.340*** (0.108)	0.436*** (0.109)	0.307*** (0.105)
<i>openness</i>		0.003*** (0.001)				0.002*** (0.001)		0.003*** (0.001)				0.001** (0.001)
<i>outputgap</i>			-0.010*** (0.002)			-0.008*** (0.001)			-0.010*** (0.002)			-0.007*** (0.001)
<i>savings deficit</i>				-0.017*** (0.002)		-0.008** (0.003)				-0.018*** (0.002)		-0.010*** (0.003)
<i>current</i>					0.017*** (0.002)	0.007** (0.003)					0.017*** (0.002)	0.006* (0.003)
<i>Constant</i>	0.560*** (0.074)	0.521*** (0.060)	0.534*** (0.079)	0.630*** (0.037)	0.622*** (0.024)	0.578*** (0.032)	0.522*** (0.070)	0.498*** (0.057)	0.495*** (0.075)	0.614*** (0.034)	0.610*** (0.023)	0.573*** (0.031)
Obs.	382	382	381	382	382	381	382	382	381	382	382	381
$R^2$	0.820	0.835	0.837	0.899	0.903	0.915	0.837	0.848	0.850	0.914	0.915	0.924

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

**Table 7. The impact of partial macroeconomic rates of return of private investment on time-varying external sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$r_{IPriv,Partial}$	-0.270 (0.816)	0.232 (0.522)	-0.861 (0.770)	0.202 (0.586)	0.232 (0.576)	0.114 (0.314)	-0.294 (0.706)	0.428 (0.602)	-0.754 (0.672)	0.014 (0.515)	0.030 (0.489)	0.259 (0.395)
<i>openness</i>		0.004*** (0.000)				0.004*** (0.000)		0.004*** (0.000)				0.003*** (0.000)
<i>outputgap</i>			-0.013*** (0.002)			-0.011*** (0.001)			-0.012*** (0.002)			-0.010*** (0.001)
<i>savings deficit</i>				-0.016*** (0.002)		-0.011*** (0.003)				-0.016*** (0.002)		-0.012*** (0.003)
<i>current</i>					0.015*** (0.002)	0.003 (0.003)					0.015*** (0.002)	0.002 (0.003)
<i>Constant</i>	0.567*** (0.064)	0.478*** (0.049)	0.571*** (0.062)	0.609*** (0.042)	0.603*** (0.037)	0.526*** (0.028)	0.544*** (0.061)	0.467*** (0.050)	0.541*** (0.062)	0.608*** (0.038)	0.605*** (0.033)	0.528*** (0.029)
Obs.	593	593	592	593	593	592	593	593	592	593	593	592
$R^2$	0.778	0.844	0.801	0.843	0.842	0.916	0.797	0.835	0.815	0.868	0.866	0.913

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

**Table 8. The impact of total macroeconomic rates of return of private investment on time-varying external sustainability.**

	OLS						WLS					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$r_{IPriv,Total}$	-0.021 (0.877)	-0.058 (0.480)	-0.365 (0.870)	0.401 (0.610)	0.488 (0.607)	0.021 (0.290)	-0.108 (0.748)	0.286 (0.572)	-0.372 (0.743)	0.143 (0.510)	0.212 (0.493)	0.257 (0.365)
<i>openness</i>		0.004*** (0.000)				0.004*** (0.000)		0.004*** (0.000)				0.003*** (0.000)
<i>outputgap</i>			-0.012*** (0.002)			-0.011*** (0.001)			-0.011*** (0.001)			-0.011*** (0.001)
<i>savings deficit</i>				-0.016*** (0.002)		-0.011*** (0.003)				-0.016*** (0.002)		-0.012*** (0.003)
<i>current</i>					0.016*** (0.002)	0.003 (0.003)					0.015*** (0.002)	0.002 (0.003)
<i>Constant</i>	0.556*** (0.067)	0.491*** (0.048)	0.550*** (0.065)	0.600*** (0.045)	0.592*** (0.040)	0.530*** (0.027)	0.536*** (0.063)	0.474*** (0.050)	0.525*** (0.065)	0.602*** (0.039)	0.596*** (0.034)	0.528*** (0.029)
Obs.	593	593	592	593	593	592	593	593	592	593	593	592
$R^2$	0.778	0.844	0.800	0.843	0.842	0.916	0.797	0.835	0.814	0.868	0.866	0.913

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

### 5.3.2. Fiscal Sustainability

In this subsection, we analyse the impact of macroeconomic rates of return on fiscal sustainability. The results in Tables 9 to 12 (OLS results in columns (1) to (6) and WLS results in columns (7) to (12)) indicate that public investment rates of return generally have a positive impact on fiscal sustainability, despite some negative coefficients when including government assets. Private investment rates of return also positively contribute to fiscal solvency, as higher returns generate additional aggregate income and tax revenues, ensuring higher fiscal sustainability for the same level of government expenditures.

Negative coefficients for public investment rates of return can be attributed to the fact that public investment is not exogenously decided by the government and is less linked to the business cycle. Public investment can act as a countercyclical measure, potentially deteriorating fiscal solvency. Additionally, the share of public investment is lower than private investment, and despite positive returns, the net effect can be negative due to government spending on capital formation.

Control variables show that a higher share of government assets increases the government's capacity to fulfil financial obligations. Public assets significantly impact interest rates and debt management. Improvements in the primary budget balance and the interest rate-growth rate differential positively influence fiscal sustainability. Although a higher differential may require increased revenues or reduced expenditures, this result aligns with findings in Afonso et al. (2024). The output gap indicates countercyclical government behavior, supporting long-term fiscal sustainability.



**Table 9. The impact of partial macroeconomic rates of return of public investment on time-varying fiscal sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$r_{IPub,Partial}$	0.122* (0.069)	-0.393*** (0.084)	0.104 (0.070)	0.077 (0.068)	0.129* (0.069)	-0.394*** (0.084)	0.148** (0.066)	-0.352*** (0.085)	0.140** (0.070)	0.110* (0.066)	0.160** (0.067)	-0.363*** (0.088)
<i>public_assets</i>		0.002*** (0.000)				0.002*** (0.000)		0.002*** (0.000)				0.002*** (0.000)
<i>pbb</i>			0.009*** (0.001)			0.009*** (0.001)			0.009*** (0.001)			0.010*** (0.001)
<i>differential</i>				0.003** (0.001)		0.003** (0.001)				0.002* (0.001)		0.003** (0.001)
<i>outputgap</i>					-0.001 (0.001)	0.004*** (0.002)					0.000 (0.001)	0.005*** (0.002)
<i>Constant</i>	-0.107*** (0.008)	-0.154*** (0.013)	-0.135*** (0.013)	-0.105*** (0.008)	-0.107*** (0.008)	-0.136*** (0.012)	-0.107*** (0.008)	-0.156*** (0.013)	-0.135*** (0.014)	-0.106*** (0.008)	-0.107*** (0.008)	-0.134*** (0.012)
<i>Obs.</i>	383	319	346	383	382	318	383	319	346	383	382	318
<i>R</i> <sup>2</sup>	0.970	0.979	0.977	0.971	0.971	0.985	0.972	0.980	0.978	0.973	0.972	0.985

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

**Table 10. The impact of total macroeconomic rates of return of public investment on time-varying fiscal sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$r_{IPub,Total}$	0.094 (0.070)	-0.379*** (0.080)	0.055 (0.070)	0.056 (0.068)	0.099 (0.069)	-0.408*** (0.079)	1.531*** (0.543)	1.561*** (0.482)	2.311*** (0.449)	1.351** (0.524)	1.476*** (0.568)	2.000*** (0.422)
<i>public_assets</i>		0.002*** (0.000)				0.002*** (0.000)		0.001*** (0.000)				0.001*** (0.000)
<i>pbb</i>			0.009*** (0.001)			0.010*** (0.001)			0.006*** (0.002)			0.007*** (0.002)
<i>differential</i>				0.003*** (0.001)		0.003** (0.001)				0.004*** (0.001)		0.004*** (0.001)
<i>outputgap</i>					-0.001 (0.001)	0.005*** (0.002)					-0.002 (0.002)	0.001 (0.002)
<i>Constant</i>	-0.105*** (0.008)	-0.152*** (0.013)	-0.133*** (0.013)	-0.104*** (0.008)	-0.105*** (0.008)	-0.131*** (0.012)	-0.226*** (0.037)	-0.262*** (0.030)	-0.343*** (0.017)	-0.202*** (0.033)	-0.223*** (0.037)	-0.254*** (0.027)
<i>Obs.</i>	383	319	346	383	382	318	596	493	540	596	595	490
<i>R</i> <sup>2</sup>	0.970	0.979	0.977	0.971	0.970	0.985	0.943	0.964	0.962	0.945	0.944	0.971

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

**Table 11. The impact of partial macroeconomic rates of return of private investment on time-varying fiscal sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
$r_{IPriv,Partial}$	1.885*** (0.548)	1.625*** (0.486)	2.566*** (0.427)	1.667*** (0.530)	1.787*** (0.571)	2.253*** (0.392)	1.531*** (0.543)	1.561*** (0.482)	2.311*** (0.449)	1.351** (0.524)	1.476*** (0.568)	2.000*** (0.422)
<i>public_assets</i>		0.001*** (0.000)				0.001*** (0.000)		0.001*** (0.000)				0.001*** (0.000)
<i>pbb</i>			0.008*** (0.002)			0.008*** (0.002)			0.006*** (0.002)			0.007*** (0.002)
<i>differential</i>				0.005*** (0.001)		0.004** (0.001)				0.004*** (0.001)		0.004*** (0.001)
<i>outputgap</i>					-0.004** (0.002)	-0.001 (0.002)					-0.002 (0.002)	0.001 (0.002)
<i>Constant</i>	-0.245*** (0.036)	-0.262*** (0.031)	-0.350*** (0.016)	-0.217*** (0.032)	-0.242*** (0.035)	-0.266*** (0.027)	-0.226*** (0.037)	-0.262*** (0.030)	-0.343*** (0.017)	-0.202*** (0.033)	-0.223*** (0.037)	-0.254*** (0.027)
<i>Obs.</i>	596	493	540	596	595	490	596	493	540	596	595	490
<i>R</i> <sup>2</sup>	0.936	0.959	0.958	0.940	0.938	0.968	0.943	0.964	0.962	0.945	0.944	0.971

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

**Table 12. The impact of total macroeconomic rates of return of private investment on time-varying fiscal sustainability.**

	<i>OLS</i>						<i>WLS</i>					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
$\tau_{Priv.Total}$	1.473** (0.658)	1.596*** (0.539)	2.563*** (0.476)	1.372** (0.609)	1.402** (0.676)	2.269*** (0.435)	1.086* (0.641)	1.578*** (0.521)	2.325*** (0.493)	1.009* (0.597)	1.031 (0.661)	2.046*** (0.453)
<i>public_assets</i>		0.001*** (0.000)				0.001*** (0.000)		0.001*** (0.000)				0.001*** (0.000)
<i>pbb</i>			0.008*** (0.002)			0.008*** (0.002)			0.006*** (0.002)			0.007*** (0.002)
<i>differential</i>				0.006*** (0.001)		0.004** (0.001)				0.005*** (0.001)		0.004*** (0.001)
<i>outputgap</i>					-0.005*** (0.002)	-0.001 (0.002)					-0.003** (0.002)	0.000 (0.002)
<i>Constant</i>	-0.227*** (0.047)	-0.271*** (0.036)	-0.376*** (0.022)	-0.203*** (0.040)	-0.226*** (0.045)	-0.282*** (0.031)	-0.206*** (0.048)	-0.273*** (0.034)	-0.367*** (0.022)	-0.187*** (0.041)	-0.204*** (0.047)	-0.270*** (0.030)
<i>Obs.</i>	596	493	540	596	595	490	596	493	540	596	595	490
<i>R</i> <sup>2</sup>	0.933	0.959	0.956	0.938	0.936	0.968	0.941	0.964	0.961	0.944	0.942	0.970

Notes: \* indicates the level of significance of 10%, \*\* a level of 5%, and \*\*\* a level of 1%. In brackets we report the robust standard errors. Obs. are the observations for each regression. The models include country and year fixed effects, which were estimated but omitted for reasons of parsimony.

## 6. Conclusions and policy implications

This study is the first to link macroeconomic rates of return on public and private investment to external and fiscal sustainability. We computed these rates using an expanding-window approach for 16 OECD countries from 1980 to 2022, distinguishing between partial and total rates. Partial rates focus on the solo impact of public or private investment, while total rates include cross-sector effects.

We also analysed the promotion of gross fixed capital formation by public and private sectors. Private investment decisions are closely tied to economic activity, whereas public investment decisions may consider political factors.

We estimated time-varying external and fiscal sustainability coefficients using Schlicht's (2021) approach. Our findings indicate that macroeconomic rates of return positively impact long-term external and fiscal sustainability, with both public and private investment contributing to fiscal sustainability.

Public authorities should stimulate both private and public investment to promote sustainable public finances. Public investment also helps reduce external imbalances, making it beneficial for both external and public accounts. Public assets, derived from the difference between gross and net government debt, play a significant role in fiscal sustainability. Effective public debt management requires attention to the financial returns, risks, and liquidity of these assets. Additionally, addressing the savings deficit is crucial for efficient allocation of public and private capital.

Future research should explore other factors influencing macroeconomic rates of return, such as political cycles, structural reforms, financial sector conditions, human capital development, and sectoral growth. This comprehensive analysis will help identify effective public policies that positively impact both external and fiscal balances.

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## Appendix

**Table A1. Summary Statistics for public and private investment, government revenues and expenditures and exports and import from 1980 to 2022 by country (% of GDP).**

	<i>Public investment</i>	<i>Private investment</i>	<i>Revenues</i>	<i>Expenditures</i>	<i>Exports</i>	<i>Imports</i>
<i>Austria</i>	3.521	20.864	49.594	52.311	43.192	42.009
<i>Belgium</i>	2.626	19.436	48.784	53.650	69.628	67.712
<i>Denmark</i>	3.064	17.345	54.541	54.850	44.763	39.732
<i>Finland</i>	4.093	19.703	52.148	51.647	34.798	32.468
<i>France</i>	4.041	18.058	49.938	53.601	25.786	25.984
<i>Germany</i>	2.475	18.68	44.947	46.890	32.870	30.504
<i>Greece</i>	4.043	16.139	36.669	43.616	22.788	30.210
<i>Ireland</i>	3.055	20.749	35.922	40.195	83.720	72.526
<i>Italy</i>	3.185	17.533	43.864	50.116	24.474	23.483
<i>Japan</i>	4.809	23.429	30.418	34.764	13.210	12.443
<i>Netherlands</i>	3.822	17.366	47.312	49.912	65.229	58.169
<i>Portugal</i>	3.734	19.841	37.793	42.697	30.807	36.750
<i>Spain</i>	3.773	18.904	33.722	37.894	25.071	25.972
<i>Sweden</i>	4.610	18.455	47.229	49.960	38.873	35.269
<i>United Kingdom</i>	2.669	15.828	39.445	43.757	26.781	27.564
<i>United States</i>	4.154	17.378	31.759	36.458	10.370	13.049

**Table A2 – Public and Private Partial and Total Macroeconomic Rates of Return by country, 1980–2022.**

	<i>Austria</i>				<i>Belgium</i>				<i>Denmark</i>				<i>Finland</i>			
	<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>	
	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>
1980	5.120%	2.691%	3.555%	2.987%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.274%	0.994%
1981	4.976%	3.055%	2.794%	1.842%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.881%	1.450%
1982	2.832%	2.098%	0.484%	-0.020%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.813%	1.357%
1983	3.306%	2.595%	0.161%	-0.281%	n.a.	n.a.	n.a.	n.a.	3.922%	3.132%	-1.115%	-1.409%	n.a.	n.a.	0.580%	1.157%
1984	3.812%	2.988%	1.409%	0.712%	n.a.	n.a.	n.a.	n.a.	1.506%	-0.624%	-0.388%	-0.634%	n.a.	n.a.	0.091%	0.637%
1985	3.909%	3.079%	1.418%	0.686%	n.a.	n.a.	n.a.	n.a.	1.579%	1.246%	-0.632%	-1.082%	n.a.	n.a.	0.170%	0.759%
1986	3.963%	3.135%	1.438%	0.724%	n.a.	n.a.	n.a.	n.a.	4.809%	4.338%	-0.797%	-0.948%	n.a.	n.a.	-0.210%	0.447%
1987	4.312%	3.377%	1.267%	0.540%	n.a.	n.a.	n.a.	n.a.	4.710%	4.273%	-1.000%	-1.261%	n.a.	n.a.	-0.159%	0.502%
1988	4.184%	3.266%	1.332%	0.620%	n.a.	n.a.	n.a.	n.a.	-1.527%	-1.618%	-0.876%	-1.138%	n.a.	n.a.	-0.276%	0.472%
1989	4.537%	3.553%	1.351%	0.643%	n.a.	n.a.	n.a.	n.a.	-2.308%	-2.362%	-1.013%	-1.271%	n.a.	n.a.	-0.250%	0.646%
1990	5.242%	3.918%	1.271%	0.587%	n.a.	n.a.	-0.697%	-0.419%	-2.551%	-2.593%	-0.970%	-1.214%	n.a.	n.a.	0.399%	0.782%
1991	5.245%	3.979%	0.972%	0.330%	n.a.	n.a.	-0.639%	-0.403%	0.033%	-0.075%	-0.739%	-1.012%	n.a.	n.a.	0.465%	0.831%
1992	5.241%	3.937%	0.990%	0.350%	n.a.	n.a.	-0.783%	-0.528%	-1.121%	-1.216%	-0.787%	-1.028%	n.a.	n.a.	0.148%	0.105%
1993	4.305%	3.229%	1.303%	0.621%	n.a.	n.a.	-0.816%	-0.597%	-7.879%	-7.888%	-0.717%	-0.957%	n.a.	n.a.	0.457%	0.278%
1994	3.419%	2.773%	1.344%	0.673%	n.a.	n.a.	-0.844%	-0.630%	-5.993%	-6.012%	-0.537%	-0.768%	n.a.	n.a.	0.668%	0.578%
1995	3.672%	2.927%	1.190%	0.534%	n.a.	n.a.	-0.824%	-0.621%	-1.888%	-1.945%	-0.628%	-0.866%	-3.596%	-3.736%	0.767%	0.680%
1996	4.097%	3.211%	1.282%	0.619%	n.a.	n.a.	-0.813%	-0.610%	-1.648%	-1.721%	-0.540%	-0.817%	-2.966%	-3.097%	0.730%	0.630%
1997	3.755%	2.125%	1.066%	0.506%	n.a.	n.a.	-0.679%	-0.492%	-0.244%	-0.349%	-0.550%	-0.817%	3.413%	2.828%	1.007%	0.768%
1998	1.257%	0.218%	0.912%	0.409%	n.a.	n.a.	-0.826%	-0.639%	-0.447%	-0.551%	-0.632%	-0.853%	2.884%	2.419%	0.787%	0.587%
1999	1.351%	0.293%	0.909%	0.415%	n.a.	n.a.	-0.835%	-0.650%	-0.538%	-0.635%	-0.581%	-0.801%	2.899%	2.434%	0.807%	0.607%
2000	1.629%	0.279%	0.829%	0.345%	n.a.	n.a.	-0.950%	-0.752%	0.655%	0.520%	-0.584%	-0.793%	1.144%	0.823%	0.823%	0.624%
2001	2.035%	0.859%	0.795%	0.338%	n.a.	n.a.	-0.891%	-0.685%	-1.129%	-1.212%	-0.587%	-0.812%	1.987%	1.585%	0.983%	0.794%
2002	1.924%	0.676%	0.805%	0.359%	n.a.	n.a.	-1.307%	-1.095%	-1.147%	-1.230%	-0.577%	-0.801%	2.040%	1.635%	1.019%	0.839%
2003	-0.427%	-0.887%	1.080%	0.606%	n.a.	n.a.	-0.948%	-0.764%	0.906%	0.711%	-0.483%	-0.711%	2.267%	1.910%	1.108%	0.967%
2004	0.635%	-0.001%	1.129%	0.654%	n.a.	n.a.	-0.855%	-0.691%	1.006%	0.805%	-0.480%	-0.713%	3.539%	3.048%	1.113%	0.980%
2005	-0.899%	-1.618%	1.139%	0.675%	n.a.	n.a.	-0.909%	-0.764%	1.034%	0.840%	-0.501%	-0.734%	3.571%	3.077%	1.104%	0.977%
2006	1.039%	-2.148%	1.087%	0.635%	n.a.	n.a.	-0.983%	-0.817%	1.801%	1.594%	-0.692%	-0.941%	2.468%	2.112%	1.125%	0.998%
2007	1.086%	-2.120%	1.096%	0.647%	n.a.	n.a.	-0.997%	-0.833%	1.802%	1.595%	-0.710%	-0.957%	2.491%	2.133%	1.126%	1.000%
2008	0.855%	-2.852%	1.037%	0.597%	n.a.	n.a.	-1.075%	-0.904%	2.352%	2.073%	-0.502%	-0.750%	2.072%	1.751%	1.141%	1.016%
2009	2.092%	-0.393%	1.531%	1.026%	n.a.	n.a.	-0.552%	-0.432%	2.782%	2.474%	-0.297%	-0.535%	0.408%	0.218%	1.469%	1.331%
2010	2.403%	-0.181%	0.898%	0.535%	n.a.	n.a.	-0.975%	-0.819%	3.161%	2.817%	-0.426%	-0.631%	-8.969%	-9.051%	0.954%	0.905%
2011	-0.530%	-0.041%	0.987%	0.631%	n.a.	n.a.	-0.893%	-0.726%	3.485%	3.113%	-0.459%	-0.659%	-9.751%	-9.812%	0.972%	0.922%
2012	0.492%	1.405%	0.934%	0.592%	n.a.	n.a.	-0.918%	-0.752%	1.799%	1.586%	-0.384%	-0.581%	n.a.	n.a.	1.004%	0.954%
2013	0.282%	1.085%	0.960%	0.625%	n.a.	n.a.	-0.843%	-0.685%	1.908%	1.690%	-0.360%	-0.544%	n.a.	n.a.	1.031%	0.980%
2014	0.050%	0.742%	0.976%	0.642%	n.a.	n.a.	-0.856%	-0.681%	1.890%	1.673%	-0.348%	-0.533%	n.a.	n.a.	1.118%	1.076%
2015	-0.318%	0.252%	1.038%	0.717%	n.a.	n.a.	-0.948%	-0.769%	1.860%	1.640%	-0.430%	-0.613%	n.a.	n.a.	1.118%	1.066%
2016	-0.579%	0.016%	0.914%	0.611%	n.a.	n.a.	-1.041%	-0.857%	1.850%	1.631%	-0.409%	-0.596%	n.a.	n.a.	1.004%	0.942%
2017	-0.784%	-0.191%	0.908%	0.613%	n.a.	n.a.	-0.993%	-0.816%	1.585%	1.384%	-0.350%	-0.518%	n.a.	n.a.	1.062%	1.000%
2018	-0.731%	-0.071%	0.884%	0.590%	n.a.	n.a.	-1.009%	-0.829%	1.592%	1.381%	-0.372%	-0.540%	n.a.	n.a.	1.056%	0.991%
2019	-0.961%	-0.357%	0.691%	0.409%	n.a.	n.a.	-1.094%	-0.907%	1.651%	1.444%	-0.393%	-0.557%	n.a.	n.a.	1.055%	0.989%
2020	-0.945%	-0.339%	0.689%	0.408%	n.a.	n.a.	-0.706%	-0.546%	1.638%	1.431%	-0.399%	-0.563%	n.a.	n.a.	1.060%	0.995%
2021	3.999%	-2.778%	0.994%	0.768%	n.a.	n.a.	-0.944%	-0.777%	2.417%	2.147%	0.066%	-0.061%	n.a.	n.a.	1.211%	1.157%
2022	4.349%	-0.753%	0.932%	0.758%	n.a.	n.a.	-0.896%	-0.729%	1.963%	1.737%	0.042%	-0.086%	n.a.	n.a.	1.217%	1.160%

Notes: Public Inv. And Private Inv. denote public and private investment, respectively. “n.a.” stands for non-available since the marginal productivity of capital is negative, therefore, it is not possible to compute the annual average growth rates.

**Table A2 – Public and Private Partial and Total Macroeconomic Rates of Return by country, 1980-2022 (continued).**

	<i>France</i>				<i>Germany</i>				<i>Greece</i>				<i>Ireland</i>			
	<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>	
	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>
1980	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1981	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1982	n.a.	n.a.	1.758%	1.280%	3.056%	2.722%	2.442%	1.620%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1983	n.a.	n.a.	2.184%	1.751%	0.739%	0.359%	5.150%	3.849%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1984	n.a.	n.a.	2.671%	2.331%	-7.580%	-7.563%	3.001%	2.338%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1985	n.a.	n.a.	2.779%	2.516%	-5.386%	-5.347%	3.006%	2.366%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.992%	-2.167%
1986	n.a.	n.a.	2.182%	1.817%	1.032%	0.817%	2.425%	1.815%	n.a.	n.a.	-0.061%	0.874%	n.a.	n.a.	-0.165%	-1.384%
1987	n.a.	n.a.	1.697%	1.344%	-3.698%	-3.742%	2.426%	1.812%	n.a.	n.a.	0.307%	1.584%	n.a.	n.a.	0.065%	-1.477%
1988	n.a.	n.a.	1.866%	1.311%	-0.935%	-1.060%	2.502%	1.894%	n.a.	n.a.	-3.518%	-2.587%	n.a.	n.a.	-2.448%	-5.252%
1989	n.a.	n.a.	1.585%	1.061%	2.296%	1.995%	2.375%	1.735%	n.a.	n.a.	-3.503%	-2.565%	n.a.	n.a.	-1.249%	-2.628%
1990	n.a.	n.a.	1.722%	1.315%	4.954%	4.400%	2.194%	1.659%	n.a.	n.a.	-3.495%	-2.554%	n.a.	n.a.	-0.455%	-1.923%
1991	n.a.	n.a.	1.889%	1.512%	4.969%	4.412%	2.173%	1.641%	n.a.	n.a.	-3.481%	-2.533%	n.a.	n.a.	-0.753%	-1.933%
1992	n.a.	n.a.	1.720%	1.323%	4.526%	4.057%	1.766%	1.604%	n.a.	n.a.	-3.454%	-2.493%	n.a.	n.a.	-0.834%	-1.947%
1993	n.a.	n.a.	2.233%	1.875%	6.122%	5.387%	2.096%	1.922%	n.a.	n.a.	-3.420%	-2.447%	n.a.	n.a.	-0.343%	-1.449%
1994	n.a.	n.a.	2.349%	1.919%	6.103%	5.351%	2.055%	1.887%	n.a.	n.a.	-2.299%	-1.210%	n.a.	n.a.	-0.011%	-1.077%
1995	n.a.	n.a.	2.464%	2.024%	5.970%	5.242%	2.063%	1.924%	n.a.	n.a.	-2.441%	-1.334%	n.a.	n.a.	0.935%	-0.106%
1996	n.a.	n.a.	2.583%	2.151%	6.114%	5.354%	2.096%	1.955%	n.a.	n.a.	-3.231%	-2.198%	n.a.	n.a.	1.333%	0.315%
1997	n.a.	n.a.	2.605%	2.175%	5.891%	5.183%	2.072%	1.930%	n.a.	n.a.	-0.518%	0.643%	n.a.	n.a.	2.182%	1.153%
1998	n.a.	n.a.	2.535%	2.086%	5.924%	5.219%	2.028%	1.890%	n.a.	n.a.	-2.608%	-1.842%	n.a.	n.a.	2.391%	1.437%
1999	n.a.	n.a.	2.548%	2.100%	5.972%	5.260%	2.019%	1.883%	-8.010%	-8.016%	-1.654%	-0.924%	n.a.	n.a.	2.365%	1.416%
2000	n.a.	n.a.	2.545%	2.096%	4.687%	4.211%	2.022%	1.880%	-6.763%	-6.773%	-1.296%	-0.513%	n.a.	n.a.	2.334%	1.394%
2001	n.a.	n.a.	2.553%	2.109%	3.712%	3.330%	2.059%	1.918%	-6.810%	-6.821%	-1.282%	-0.488%	n.a.	n.a.	2.517%	1.557%
2002	n.a.	n.a.	2.432%	1.959%	6.345%	5.648%	1.925%	1.765%	-12.652%	-12.653%	-1.328%	-0.637%	n.a.	n.a.	2.586%	1.553%
2003	n.a.	n.a.	2.639%	2.263%	6.294%	5.565%	2.023%	1.853%	-13.274%	-13.275%	-1.534%	-0.910%	n.a.	n.a.	2.862%	1.676%
2004	n.a.	n.a.	2.645%	2.264%	6.069%	5.371%	2.034%	1.864%	-7.746%	-7.754%	-1.583%	-0.959%	n.a.	n.a.	2.805%	1.629%
2005	n.a.	n.a.	2.674%	2.295%	6.184%	5.445%	1.965%	1.800%	-0.427%	-0.541%	-1.208%	-0.504%	n.a.	n.a.	2.719%	1.549%
2006	n.a.	n.a.	2.685%	2.294%	7.530%	6.512%	2.017%	1.841%	-0.441%	-0.556%	-1.400%	-0.685%	n.a.	n.a.	2.619%	1.459%
2007	n.a.	n.a.	2.681%	2.292%	7.588%	6.560%	2.023%	1.849%	-0.468%	-0.582%	-1.403%	-0.684%	n.a.	n.a.	2.589%	1.427%
2008	n.a.	n.a.	2.655%	2.283%	7.622%	6.591%	2.105%	1.927%	-0.498%	-0.611%	-1.917%	-1.339%	n.a.	n.a.	2.990%	1.751%
2009	n.a.	n.a.	2.169%	1.756%	3.986%	3.667%	3.166%	2.922%	1.078%	0.901%	-0.659%	-0.151%	n.a.	n.a.	3.784%	2.012%
2010	n.a.	n.a.	2.184%	1.800%	7.337%	6.247%	2.923%	2.753%	2.469%	2.123%	-0.341%	-0.149%	n.a.	n.a.	1.036%	0.114%
2011	-2.039%	-1.900%	2.331%	2.005%	6.352%	5.515%	3.155%	2.977%	6.871%	5.665%	-0.209%	-0.036%	n.a.	n.a.	0.921%	-0.073%
2012	0.812%	1.601%	2.448%	2.141%	6.825%	5.843%	3.116%	2.967%	8.742%	7.040%	0.341%	0.491%	n.a.	n.a.	1.360%	0.293%
2013	1.500%	3.282%	2.469%	2.139%	6.996%	5.946%	3.116%	2.969%	8.449%	6.896%	0.263%	0.302%	n.a.	n.a.	1.911%	0.791%
2014	2.875%	9.821%	2.614%	2.243%	7.001%	5.951%	3.107%	2.962%	8.276%	6.789%	0.428%	0.486%	n.a.	n.a.	1.801%	0.800%
2015	3.179%	9.739%	2.677%	2.274%	6.742%	5.747%	3.110%	2.959%	8.191%	6.767%	0.644%	0.704%	n.a.	n.a.	3.279%	2.295%
2016	3.381%	7.164%	2.695%	2.296%	6.929%	5.898%	3.111%	2.960%	8.296%	6.827%	0.086%	0.138%	1.577%	1.787%	2.148%	1.387%
2017	2.748%	4.419%	2.700%	2.310%	6.987%	5.917%	3.144%	2.988%	8.277%	6.854%	0.303%	0.288%	1.475%	1.673%	1.822%	1.210%
2018	2.604%	4.012%	2.710%	2.311%	7.094%	6.042%	3.082%	2.929%	8.017%	6.653%	0.477%	0.519%	1.759%	1.937%	0.797%	0.275%
2019	2.305%	4.055%	2.706%	2.279%	6.863%	5.871%	3.085%	2.932%	7.578%	6.297%	0.518%	0.744%	2.559%	3.224%	-0.395%	-0.840%
2020	2.318%	4.076%	2.701%	2.276%	6.867%	5.874%	3.085%	2.932%	7.591%	6.322%	0.585%	0.815%	2.589%	3.266%	-0.446%	-0.884%
2021	-8.086%	-8.075%	2.786%	2.468%	6.776%	5.658%	2.829%	2.692%	8.224%	6.803%	1.838%	2.159%	4.280%	5.458%	-8.798%	-8.941%
2022	-1.139%	-0.982%	3.391%	3.099%	-0.802%	-0.971%	2.916%	2.784%	8.310%	6.850%	1.743%	2.064%	4.390%	5.599%	-5.981%	-6.146%

Notes: Public Inv. And Private Inv. denote public and private investment, respectively. “n.a.” stands for non-available since the marginal productivity of capital is negative, therefore, it is not possible to compute the annual average growth rates.

**Table A2 – Public and Private Partial and Total Macroeconomic Rates of Return by country, 1980-2022 (continued).**

	<i>Italy</i>				<i>Japan</i>				<i>Netherlands</i>				<i>Portugal</i>			
	<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>	
	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>
1980	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1981	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1982	n.a.	n.a.	2.340%	1.520%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1983	n.a.	n.a.	3.039%	2.508%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1984	n.a.	n.a.	3.166%	2.591%	5.770%	3.895%	-6.206%	-4.027%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1985	n.a.	n.a.	3.171%	2.554%	4.829%	3.029%	-3.451%	-1.365%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1986	n.a.	n.a.	2.845%	2.257%	5.485%	3.867%	-2.313%	-1.612%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1987	n.a.	n.a.	2.566%	1.991%	2.612%	2.101%	-4.315%	-3.945%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1988	n.a.	n.a.	1.819%	1.350%	5.323%	4.388%	-2.909%	-2.659%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1989	n.a.	n.a.	1.939%	1.534%	6.270%	5.166%	-2.478%	-2.261%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1990	n.a.	n.a.	1.638%	1.241%	6.341%	5.134%	-1.857%	-1.707%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1991	n.a.	n.a.	1.717%	1.335%	5.974%	4.822%	-1.865%	-1.711%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1992	n.a.	n.a.	2.242%	1.798%	4.230%	3.386%	-1.494%	-1.174%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1993	n.a.	n.a.	1.179%	0.634%	-4.335%	-4.414%	-0.149%	0.659%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1994	n.a.	n.a.	2.463%	1.524%	-3.970%	-4.053%	0.304%	0.716%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1995	n.a.	n.a.	2.782%	1.858%	-6.033%	-6.106%	0.462%	0.812%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1996	n.a.	n.a.	2.744%	1.774%	-5.826%	-5.934%	0.364%	0.693%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1997	n.a.	n.a.	2.592%	1.640%	-2.274%	-2.492%	0.365%	0.778%	n.a.	n.a.	n.a.	n.a.	12.833%	10.400%	6.389%	6.051%
1998	n.a.	n.a.	2.484%	1.517%	4.271%	2.192%	0.849%	1.288%	n.a.	n.a.	n.a.	n.a.	13.955%	10.953%	4.127%	3.890%
1999	n.a.	n.a.	2.509%	1.543%	5.606%	3.324%	1.000%	1.454%	n.a.	n.a.	2.623%	2.497%	13.907%	10.925%	4.126%	3.887%
2000	n.a.	n.a.	2.583%	1.621%	3.713%	2.209%	1.020%	1.330%	n.a.	n.a.	2.771%	2.650%	11.393%	9.762%	3.369%	3.158%
2001	n.a.	n.a.	2.456%	1.494%	5.331%	3.315%	1.021%	1.344%	n.a.	n.a.	2.947%	2.812%	11.546%	9.842%	3.340%	3.091%
2002	n.a.	n.a.	2.355%	1.356%	6.479%	4.280%	1.069%	1.401%	4.686%	6.169%	3.437%	3.342%	11.424%	9.762%	2.630%	2.448%
2003	n.a.	n.a.	2.132%	1.279%	5.450%	3.342%	1.253%	1.437%	4.456%	5.841%	3.443%	3.265%	9.776%	8.469%	3.065%	2.785%
2004	n.a.	n.a.	2.125%	1.301%	4.787%	2.697%	1.268%	1.462%	-1.504%	-1.402%	3.270%	2.973%	9.690%	8.429%	2.255%	2.087%
2005	n.a.	n.a.	2.160%	1.336%	4.407%	1.834%	1.180%	1.395%	-8.361%	-8.356%	3.300%	2.997%	7.403%	6.678%	1.819%	1.660%
2006	n.a.	n.a.	2.164%	1.331%	4.671%	2.258%	1.201%	1.443%	-5.545%	-5.529%	3.401%	3.087%	4.343%	4.003%	1.685%	1.517%
2007	n.a.	n.a.	2.168%	1.337%	4.726%	2.300%	1.225%	1.465%	-5.534%	-5.518%	3.390%	3.078%	4.350%	4.011%	1.700%	1.532%
2008	n.a.	n.a.	2.207%	1.384%	4.761%	2.327%	1.499%	1.700%	-3.607%	-3.564%	2.918%	2.598%	3.852%	3.557%	1.718%	1.554%
2009	n.a.	n.a.	2.588%	1.868%	3.259%	1.244%	2.121%	2.312%	n.a.	n.a.	3.887%	3.566%	n.a.	n.a.	2.040%	1.897%
2010	n.a.	n.a.	2.683%	1.874%	4.514%	1.523%	1.172%	1.454%	n.a.	n.a.	1.746%	1.469%	-3.580%	-5.270%	0.495%	0.632%
2011	n.a.	n.a.	2.685%	1.860%	4.693%	2.136%	0.971%	1.235%	n.a.	n.a.	1.764%	1.486%	3.912%	1.835%	1.082%	0.941%
2012	-5.324%	-5.207%	2.709%	1.779%	4.914%	2.144%	0.862%	1.092%	-1.080%	-0.917%	1.909%	1.638%	3.952%	1.880%	1.139%	0.998%
2013	-3.677%	-3.283%	2.829%	2.019%	4.879%	2.180%	0.851%	1.049%	-0.736%	-0.551%	2.011%	1.724%	2.950%	-0.031%	1.282%	1.023%
2014	-3.644%	-3.311%	2.908%	2.100%	4.480%	2.026%	0.753%	0.952%	-1.118%	-0.946%	1.970%	1.674%	3.365%	1.222%	1.208%	0.959%
2015	-3.765%	-3.487%	2.944%	2.160%	4.488%	1.792%	0.502%	0.752%	-2.980%	-2.933%	1.141%	0.893%	3.147%	1.142%	1.330%	1.025%
2016	-4.136%	-3.957%	2.918%	2.141%	4.891%	2.133%	0.517%	0.743%	-0.130%	0.118%	1.116%	0.892%	2.962%	0.826%	1.358%	1.114%
2017	-4.994%	-4.899%	2.927%	2.177%	4.934%	2.167%	0.534%	0.760%	-0.201%	0.037%	0.982%	0.765%	3.036%	0.884%	1.389%	1.147%
2018	-5.499%	-5.438%	2.913%	2.179%	4.996%	2.208%	0.561%	0.787%	-0.183%	0.055%	0.971%	0.757%	2.407%	-5.496%	1.354%	1.025%
2019	-6.230%	-6.189%	2.930%	2.185%	4.934%	2.193%	0.617%	0.839%	-0.192%	0.037%	0.936%	0.728%	2.694%	-1.233%	1.378%	1.037%
2020	-6.211%	-6.170%	2.948%	2.204%	4.946%	2.207%	0.632%	0.855%	-0.183%	0.048%	0.933%	0.726%	2.724%	-1.212%	1.393%	1.053%
2021	-6.797%	-6.767%	3.204%	2.522%	4.374%	1.873%	0.956%	1.165%	-1.226%	-1.087%	0.395%	0.208%	2.429%	-0.259%	1.599%	1.268%
2022	n.a.	n.a.	3.883%	3.483%	4.276%	1.127%	0.917%	1.127%	-5.279%	-5.249%	0.593%	0.442%	2.552%	-0.124%	2.247%	1.977%

Notes: Public Inv. And Private Inv. Denote public and private investment, respectively. “n.a.” stands for non-available since the marginal productivity of capital is negative, then being not possible to compute the annual average growth rates.

**Table A2 – Public and Private Partial and Total Macroeconomic Rates of Return by country, 1980-2022 (continued).**

	<i>Spain</i>				<i>Sweden</i>				<i>United Kingdom</i>				<i>United States</i>			
	<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>		<b>Public Inv.</b>		<b>Private Inv.</b>	
	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>	<i>Partial</i>	<i>Total</i>
1980	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	6.627%	5.966%
1981	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.756%	3.991%	3.995%	3.093%
1982	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1.608%	0.141%	5.464%	5.048%
1983	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.801%	-0.544%	n.a.	n.a.	n.a.	n.a.	-0.687%	-0.516%	3.872%	4.189%
1984	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.143%	0.080%	n.a.	n.a.	n.a.	n.a.	5.405%	3.789%	3.114%	4.418%
1985	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.323%	-0.355%	n.a.	n.a.	n.a.	n.a.	0.871%	-0.896%	3.397%	5.180%
1986	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.611%	-0.772%	n.a.	n.a.	n.a.	n.a.	0.260%	-0.986%	3.591%	5.078%
1987	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.740%	-0.937%	n.a.	n.a.	n.a.	n.a.	-0.074%	-5.688%	3.463%	4.742%
1988	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-0.195%	-0.383%	2.691%	4.044%	1.282%	0.938%	-0.916%	-0.777%	3.920%	4.341%
1989	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-1.839%	-2.417%	2.139%	5.581%	3.567%	2.352%	-2.226%	-2.150%	3.745%	4.043%
1990	n.a.	n.a.	0.806%	0.910%	n.a.	n.a.	-1.215%	-1.454%	2.043%	4.941%	3.658%	2.497%	-0.619%	1.016%	3.878%	5.320%
1991	n.a.	n.a.	0.888%	1.034%	n.a.	n.a.	-2.694%	-3.010%	2.149%	3.881%	3.655%	2.368%	-0.764%	0.366%	4.032%	5.442%
1992	6.288%	5.388%	1.290%	1.364%	n.a.	n.a.	-0.913%	-1.199%	1.856%	3.450%	3.752%	2.805%	-0.727%	0.470%	4.083%	5.444%
1993	8.727%	7.285%	1.606%	1.574%	n.a.	n.a.	-0.697%	-0.825%	1.969%	3.811%	3.556%	2.675%	0.171%	3.137%	4.159%	5.478%
1994	4.361%	3.740%	1.397%	1.226%	n.a.	n.a.	-0.204%	-0.079%	1.900%	3.277%	3.443%	2.758%	-0.315%	0.491%	4.058%	5.250%
1995	-2.625%	-3.585%	1.155%	1.066%	n.a.	n.a.	-0.258%	-0.131%	1.753%	3.041%	3.535%	2.848%	0.064%	0.882%	3.744%	4.740%
1996	3.236%	2.618%	1.036%	1.176%	n.a.	n.a.	-0.721%	-0.606%	1.184%	2.341%	3.450%	2.909%	0.190%	1.020%	3.557%	4.486%
1997	3.386%	2.788%	1.204%	1.192%	n.a.	n.a.	-0.580%	-0.411%	2.116%	7.981%	3.254%	2.731%	0.476%	1.440%	3.607%	4.625%
1998	3.554%	2.943%	1.219%	1.190%	n.a.	n.a.	-0.375%	-0.216%	2.177%	6.442%	3.274%	2.860%	1.098%	4.286%	3.467%	4.269%
1999	3.536%	2.926%	1.206%	1.178%	n.a.	n.a.	-0.379%	-0.248%	1.863%	3.165%	3.123%	2.769%	-1.456%	-1.380%	3.827%	3.859%
2000	3.418%	2.838%	1.160%	1.134%	n.a.	n.a.	-0.358%	-0.219%	2.390%	4.581%	3.155%	2.801%	-1.433%	-1.356%	3.797%	3.839%
2001	3.604%	3.006%	1.154%	1.142%	n.a.	n.a.	-0.410%	-0.305%	0.526%	0.850%	3.202%	2.805%	-1.980%	-1.919%	3.827%	3.882%
2002	3.337%	2.770%	1.251%	1.314%	n.a.	n.a.	-0.386%	-0.290%	0.361%	0.630%	3.190%	2.790%	2.014%	3.313%	2.882%	3.645%
2003	3.326%	2.757%	1.313%	1.316%	n.a.	n.a.	-0.313%	-0.210%	0.712%	1.103%	3.185%	2.786%	1.060%	1.789%	3.597%	4.237%
2004	3.444%	2.861%	1.300%	1.320%	n.a.	n.a.	-0.239%	-0.135%	-0.240%	0.045%	3.169%	2.791%	0.657%	1.246%	3.954%	4.535%
2005	3.411%	2.829%	1.269%	1.300%	n.a.	n.a.	-0.261%	-0.161%	-0.958%	-0.740%	2.990%	2.170%	0.932%	1.591%	3.816%	4.379%
2006	3.481%	2.887%	1.241%	1.271%	n.a.	n.a.	-0.137%	-0.052%	-3.353%	-3.286%	2.862%	1.992%	0.959%	1.624%	3.826%	4.365%
2007	3.449%	2.855%	1.214%	1.243%	n.a.	n.a.	-0.152%	-0.068%	-3.326%	-3.260%	2.865%	1.999%	0.540%	0.929%	3.831%	4.338%
2008	3.109%	2.528%	1.326%	1.158%	n.a.	n.a.	-0.140%	-0.056%	-2.741%	-2.650%	2.856%	2.006%	-1.303%	-1.178%	3.806%	4.117%
2009	3.335%	2.740%	1.478%	1.637%	n.a.	n.a.	0.067%	0.130%	-5.562%	-5.552%	3.339%	2.060%	-4.371%	-4.349%	2.701%	3.128%
2010	-1.200%	-1.465%	1.275%	1.148%	n.a.	n.a.	0.187%	0.295%	-1.948%	-1.878%	3.562%	2.340%	1.055%	1.663%	3.703%	4.277%
2011	-1.044%	-1.714%	1.611%	1.229%	n.a.	n.a.	0.099%	0.210%	-4.043%	-4.016%	3.789%	2.452%	0.646%	0.952%	3.914%	4.407%
2012	3.184%	1.589%	2.811%	2.128%	n.a.	n.a.	0.054%	0.159%	2.864%	3.699%	3.003%	2.031%	0.651%	0.912%	3.464%	3.851%
2013	2.996%	1.341%	2.943%	2.184%	n.a.	n.a.	0.006%	0.111%	1.403%	1.815%	2.546%	1.452%	-0.296%	-0.143%	3.809%	3.950%
2014	3.075%	1.405%	2.972%	2.220%	n.a.	n.a.	-0.049%	0.056%	1.503%	1.905%	2.411%	1.290%	-0.582%	-0.473%	3.920%	4.025%
2015	3.516%	1.386%	2.917%	2.222%	n.a.	n.a.	0.066%	0.168%	1.555%	1.989%	1.818%	0.722%	-0.706%	-0.601%	3.916%	4.021%
2016	3.639%	1.480%	2.871%	2.270%	n.a.	n.a.	0.043%	0.131%	1.639%	2.079%	1.169%	0.188%	-0.044%	0.098%	3.984%	4.062%
2017	3.324%	0.286%	2.818%	2.227%	n.a.	n.a.	0.027%	0.115%	1.532%	1.944%	1.558%	0.556%	-0.013%	0.129%	4.019%	4.102%
2018	3.258%	0.637%	2.811%	2.216%	n.a.	n.a.	-0.001%	0.080%	1.536%	1.938%	1.608%	0.576%	0.202%	0.362%	3.979%	4.089%
2019	3.024%	0.162%	2.839%	2.248%	n.a.	n.a.	-0.060%	0.026%	1.348%	1.719%	1.613%	0.532%	-0.430%	-0.315%	3.995%	4.090%
2020	3.050%	0.181%	2.847%	2.258%	n.a.	n.a.	-0.069%	0.016%	1.348%	1.719%	1.621%	0.538%	-1.437%	-1.403%	2.955%	2.682%
2021	3.483%	0.338%	2.206%	1.735%	n.a.	n.a.	0.480%	0.554%	-3.016%	-2.967%	2.715%	1.422%	-7.985%	-7.983%	3.246%	3.038%
2022	4.224%	1.039%	2.579%	2.105%	n.a.	n.a.	0.418%	0.492%	-5.723%	-5.710%	3.626%	2.443%	-14.825%	-14.825%	3.328%	3.067%

Notes: Public Inv. And Private Inv. denote public and private investment, respectively. “n.a.” stands for non-available since the marginal productivity of capital is negative, therefore, it is not possible to compute the annual average growth rates.

Table A3. Im-Pesaran-Shin Panel Unit Tests.

	<i>Revenues</i>	<i>Expenditures</i>	<i>Exports</i>	<i>Imports</i>
<i>Levels</i>	-0.2760	-2.662***	6.469	7.0492
<i>F.D.</i>	-14.679***	-14.888***	-12.969***	-13.098***

Notes: \*, \*\*, and \*\*\* represents the 10%, 5% and 1% levels of significance, respectively.

Table A4. Pedroni and Kao panel cointegration tests.

		<i>Revenues &amp; Expenditures</i>	<i>Exports &amp; Imports</i>
<i>Pedroni</i>	<i>Modified Phillips-Perron t</i>	-2.066**	-2.289**
	<i>Phillips-Perron t</i>	2.972***	-3.594***
	<i>Augmented Dickey-Fuller t</i>	2.909***	-2.764***
<i>Kao</i>	<i>Modified Dickey-Fuller t</i>	-4.559***	-6.229***
	<i>Dickey-Fuller t</i>	-4.033***	-4.476***
	<i>Augmented Dickey-Fuller t</i>	-4.534***	-3.172***
	<i>Unadjusted modified Dickey-Fuller t</i>	-5.921***	-10.748***
	<i>Unadjusted Dickey-Fuller t</i>	-4.480***	-5.752***

Notes: \*, \*\*, and \*\*\* represents the 10%, 5% and 1% levels of significance, respectively.

Table A5. Time-varying external sustainability coefficients, from 1980 to 2022.

	AUT	BEL	DNK	FIN	FRA	DEU	GRC	IRL	ITA	JPN	NLD	PRT	ESP	SWE	GBR	USA
1980																
1981	0.829	0.766	0.744	0.935	0.735	0.599	0.830	0.033	0.568	0.679	1.053	0.391	0.512	0.839	0.834	0.670
1982	0.853	0.786	0.732	0.903	0.706	0.643	0.705	0.031	0.575	0.671	1.053	0.403	0.536	0.846	0.799	0.617
1983	0.840	0.822	0.761	0.897	0.778	0.625	0.672	0.108	0.609	0.709	1.053	0.524	0.608	0.914	0.770	0.524
1984	0.856	0.836	0.751	0.979	0.805	0.652	0.699	0.215	0.595	0.790	1.053	0.643	0.731	0.953	0.757	0.459
1985	0.879	0.837	0.733	0.916	0.786	0.689	0.671	0.234	0.598	0.836	1.053	0.703	0.718	0.906	0.793	0.427
1986	0.879	0.839	0.677	0.932	0.764	0.718	0.712	0.159	0.599	0.824	1.053	0.694	0.682	0.933	0.714	0.418
1987	0.877	0.829	0.722	0.900	0.725	0.711	0.750	0.227	0.554	0.697	1.053	0.645	0.604	0.899	0.699	0.441
1988	0.874	0.848	0.774	0.864	0.745	0.716	0.703	0.284	0.532	0.610	1.053	0.593	0.556	0.888	0.604	0.530
1989	0.878	0.855	0.795	0.808	0.758	0.723	0.645	0.326	0.554	0.591	1.053	0.648	0.486	0.856	0.603	0.578
1990	0.885	0.844	0.847	0.810	0.750	0.742	0.588	0.263	0.555	0.560	1.053	0.631	0.464	0.845	0.657	0.604
1991	0.868	0.842	0.871	0.824	0.770	0.742	0.587	0.277	0.522	0.585	1.053	0.592	0.470	0.865	0.688	0.670
1992	0.855	0.848	0.888	0.915	0.805	0.725	0.623	0.331	0.530	0.623	1.053	0.563	0.489	0.874	0.683	0.667
1993	0.862	0.851	0.905	1.061	0.839	0.719	0.617	0.411	0.700	0.597	1.053	0.558	0.582	0.934	0.718	0.635
1994	0.844	0.864	0.859	1.095	0.842	0.734	0.666	0.453	0.733	0.572	1.053	0.580	0.647	0.967	0.741	0.628
1995	0.853	0.872	0.825	1.159	0.853	0.753	0.640	0.512	0.782	0.524	1.053	0.610	0.668	1.034	0.747	0.657
1996	0.853	0.864	0.853	1.135	0.866	0.773	0.623	0.523	0.806	0.500	1.053	0.594	0.712	1.037	0.750	0.659
1997	0.876	0.882	0.823	1.144	0.921	0.808	0.702	0.547	0.778	0.589	1.053	0.586	0.752	1.053	0.747	0.670
1998	0.895	0.877	0.789	1.168	0.916	0.821	0.634	0.583	0.752	0.640	1.053	0.570	0.738	1.037	0.702	0.620
1999	0.914	0.883	0.872	1.210	0.902	0.804	0.686	0.613	0.698	0.596	1.053	0.541	0.702	1.026	0.685	0.571
2000	0.939	0.882	0.906	1.189	0.878	0.818	0.686	0.657	0.702	0.617	1.053	0.552	0.700	1.017	0.696	0.542
2001	0.953	0.891	0.918	1.206	0.883	0.864	0.685	0.675	0.714	0.551	1.053	0.555	0.709	1.022	0.682	0.515
2002	0.989	0.916	0.912	1.199	0.892	0.947	0.667	0.668	0.683	0.626	1.053	0.583	0.702	1.024	0.654	0.475
2003	0.977	0.910	0.906	1.118	0.868	0.932	0.631	0.599	0.659	0.671	1.053	0.617	0.687	1.030	0.653	0.453
2004	0.980	0.906	0.879	1.103	0.855	0.982	0.711	0.590	0.673	0.730	1.053	0.594	0.650	1.063	0.649	0.455
2005	0.986	0.900	0.886	1.028	0.830	0.984	0.722	0.554	0.662	0.722	1.053	0.573	0.620	1.049	0.668	0.454
2006	0.996	0.903	0.867	1.031	0.825	0.991	0.671	0.529	0.664	0.753	1.053	0.624	0.606	1.057	0.699	0.475
2007	1.010	0.906	0.848	1.047	0.811	1.028	0.646	0.542	0.690	0.801	1.053	0.636	0.613	1.039	0.676	0.519
2008	1.010	0.870	0.867	1.016	0.800	1.009	0.652	0.566	0.674	0.733	1.053	0.606	0.630	1.028	0.704	0.547
2009	0.991	0.868	0.864	0.973	0.787	0.978	0.664	0.651	0.615	0.632	1.053	0.607	0.692	1.025	0.709	0.582
2010	0.992	0.874	0.923	0.957	0.787	0.987	0.744	0.713	0.625	0.741	1.053	0.624	0.721	1.017	0.720	0.596
2011	0.981	0.862	0.918	0.906	0.782	0.979	0.815	0.730	0.659	0.644	1.053	0.722	0.787	1.008	0.759	0.618
2012	0.980	0.863	0.912	0.888	0.803	1.009	0.865	0.724	0.738	0.596	1.053	0.816	0.849	1.008	0.749	0.632
2013	0.981	0.869	0.924	0.897	0.811	1.000	0.926	0.734	0.777	0.601	1.053	0.859	0.911	0.995	0.736	0.651
2014	0.989	0.870	0.930	0.891	0.811	1.023	0.956	0.744	0.796	0.628	1.053	0.841	0.888	0.980	0.709	0.648
2015	0.997	0.874	0.928	0.902	0.830	1.047	0.971	0.863	0.804	0.700	1.053	0.855	0.887	0.984	0.712	0.624
2016	0.999	0.874	0.923	0.883	0.828	1.042	0.959	0.757	0.810	0.735	1.053	0.862	0.916	0.966	0.713	0.619
2017	0.988	0.878	0.935	0.922	0.820	1.034	0.961	0.802	0.807	0.757	1.053	0.867	0.908	0.954	0.743	0.625
2018	0.985	0.863	0.918	0.894	0.825	1.009	0.950	0.861	0.798	0.736	1.053	0.859	0.883	0.951	0.747	0.622
2019	0.995	0.872	0.938	0.930	0.825	1.005	0.960	0.695	0.826	0.711	1.053	0.859	0.889	0.993	0.747	0.617
2020	0.989	0.882	0.922	0.919	0.771	1.002	0.810	0.801	0.820	0.676	1.053	0.778	0.827	1.001	0.782	0.556
2021	0.950	0.892	0.931	0.926	0.793	0.992	0.842	0.985	0.799	0.713	1.053	0.788	0.833	1.006	0.761	0.549
2022	0.946	0.870	1.014	0.888	0.778	0.923	0.836	0.984	0.744	0.658	1.053	0.828	0.867	0.971	0.731	

**Table A6. Time-varying fiscal sustainability coefficients, from 1980 to 2022.**

	AUT	BEL	DNK	FIN	FRA	DEU	GRC	IRL	ITA	JPN	NLD	PRT	ESP	SWE	GBR	USA
1980	0.128	0.075	0.202	0.049	0.052	0.004	0.069	0.337	0.047	-0.147	0.203	-0.179	0.525	0.460	0.167	-0.102
1981	0.137	0.077	0.192	0.076	0.058	0.003	0.025	0.324	0.041	-0.191	0.209	-0.122	0.542	0.490	0.198	-0.080
1982	0.128	0.100	0.177	0.080	0.073	0.009	0.101	0.336	0.102	-0.182	0.218	-0.073	0.501	0.481	0.218	-0.082
1983	0.124	0.102	0.207	0.088	0.086	0.002	0.124	0.352	0.141	-0.181	0.228	-0.043	0.606	0.469	0.200	-0.099
1984	0.143	0.117	0.237	0.117	0.100	0.003	0.139	0.355	0.117	-0.164	0.222	-0.056	0.610	0.513	0.196	-0.104
1985	0.154	0.120	0.263	0.148	0.106	0.005	0.127	0.339	0.111	-0.154	0.235	-0.056	0.594	0.568	0.187	-0.088
1986	0.151	0.109	0.300	0.165	0.091	-0.009	0.143	0.339	0.130	-0.154	0.218	0.001	0.634	0.600	0.180	-0.081
1987	0.146	0.117	0.311	0.159	0.104	-0.018	0.165	0.359	0.127	-0.114	0.222	-0.013	0.714	0.691	0.160	-0.062
1988	0.139	0.097	0.317	0.187	0.081	-0.027	0.115	0.393	0.147	-0.114	0.212	0.035	0.714	0.702	0.166	-0.067
1989	0.129	0.065	0.298	0.199	0.076	-0.021	0.074	0.362	0.160	-0.116	0.175	0.055	0.734	0.744	0.161	-0.059
1990	0.134	0.080	0.263	0.219	0.076	-0.040	0.127	0.363	0.180	-0.082	0.177	0.032	0.736	0.710	0.128	-0.059
1991	0.145	0.089	0.245	0.230	0.087	-0.031	0.149	0.383	0.197	-0.096	0.218	0.076	0.749	0.639	0.130	-0.056
1992	0.165	0.080	0.260	0.225	0.078	-0.008	0.161	0.388	0.235	-0.096	0.208	0.156	0.760	0.575	0.099	-0.060
1993	0.169	0.111	0.277	0.215	0.096	0.003	0.177	0.390	0.254	-0.125	0.226	0.122	0.722	0.693	0.067	-0.054
1994	0.161	0.116	0.285	0.216	0.098	0.010	0.220	0.395	0.233	-0.143	0.185	0.096	0.688	0.711	0.080	-0.045
1995	0.154	0.120	0.283	0.212	0.103	0.008	0.353	0.360	0.249	-0.138	0.132	0.125	0.719	0.721	0.090	-0.035
1996	0.167	0.135	0.292	0.226	0.131	0.013	0.375	0.373	0.258	-0.141	0.148	0.147	0.750	0.774	0.094	-0.022
1997	0.171	0.148	0.291	0.221	0.139	0.012	0.403	0.373	0.310	-0.126	0.132	0.156	0.777	0.793	0.106	-0.014
1998	0.168	0.160	0.296	0.218	0.129	0.017	0.417	0.353	0.291	-0.133	0.125	0.149	0.799	0.826	0.135	-0.004
1999	0.164	0.162	0.307	0.211	0.142	0.029	0.440	0.353	0.295	-0.138	0.137	0.169	0.836	0.821	0.148	-0.005
2000	0.158	0.156	0.301	0.236	0.132	0.022	0.481	0.359	0.284	-0.140	0.135	0.167	0.841	0.857	0.172	0.009
2001	0.164	0.166	0.291	0.213	0.129	-0.005	0.445	0.289	0.264	-0.134	0.111	0.162	0.850	0.824	0.165	-0.086
2002	0.151	0.167	0.280	0.205	0.119	-0.016	0.431	0.259	0.255	-0.160	0.089	0.190	0.858	0.775	0.121	-0.154
2003	0.143	0.187	0.282	0.191	0.112	-0.017	0.402	0.274	0.260	-0.174	0.084	0.214	0.854	0.779	0.111	-0.170
2004	0.131	0.154	0.309	0.184	0.119	-0.031	0.394	0.308	0.253	-0.159	0.092	0.222	0.862	0.800	0.127	-0.166
2005	0.120	0.152	0.339	0.189	0.136	-0.030	0.424	0.325	0.240	-0.138	0.101	0.189	0.896	0.831	0.150	-0.124
2006	0.112	0.151	0.329	0.196	0.137	-0.028	0.424	0.364	0.271	-0.111	0.128	0.205	0.923	0.832	0.168	-0.101
2007	0.114	0.138	0.314	0.196	0.124	-0.027	0.432	0.330	0.296	-0.105	0.121	0.221	0.911	0.851	0.162	-0.099
2008	0.121	0.146	0.298	0.193	0.124	-0.020	0.406	0.257	0.288	-0.109	0.139	0.217	0.765	0.825	0.184	-0.122
2009	0.121	0.123	0.276	0.174	0.103	-0.008	0.348	0.209	0.278	-0.122	0.117	0.170	0.648	0.780	0.117	-0.165
2010	0.117	0.140	0.274	0.171	0.110	-0.023	0.406	0.166	0.275	-0.134	0.115	0.199	0.679	0.787	0.123	-0.158
2011	0.122	0.174	0.262	0.187	0.139	-0.013	0.446	0.193	0.278	-0.105	0.062	0.221	0.675	0.774	0.047	-0.154
2012	0.132	0.192	0.258	0.195	0.154	-0.003	0.501	0.225	0.311	-0.085	0.066	0.234	0.661	0.764	0.047	-0.160
2013	0.141	0.208	0.270	0.205	0.172	0.000	0.539	0.239	0.317	-0.066	0.080	0.269	0.723	0.760	0.058	-0.105
2014	0.142	0.202	0.294	0.206	0.175	-0.001	0.522	0.241	0.314	-0.024	0.080	0.253	0.749	0.755	0.039	-0.104
2015	0.145	0.186	0.253	0.205	0.173	0.004	0.550	0.099	0.315	-0.003	0.067	0.259	0.760	0.780	0.042	-0.097
2016	0.132	0.177	0.245	0.204	0.172	0.011	0.604	0.096	0.301	-0.002	0.083	0.258	0.775	0.802	0.054	-0.109
2017	0.131	0.192	0.249	0.196	0.181	0.015	0.606	0.053	0.296	-0.003	0.088	0.246	0.797	0.808	0.067	-0.125
2018	0.136	0.192	0.239	0.189	0.180	0.027	0.604	0.034	0.296	0.015	0.088	0.267	0.811	0.798	0.065	-0.136
2019	0.137	0.165	0.278	0.183	0.162	0.032	0.582	0.003	0.310	0.014	0.091	0.264	0.801	0.790	0.059	-0.135
2020	0.125	0.146	0.268	0.168	0.147	0.027	0.492	-0.076	0.271	0.040	0.085	0.247	0.706	0.737	0.057	-0.095
2021	0.139	0.155	0.274	0.183	0.158	0.043	0.520	-0.073	0.286	0.067	0.080	0.283	0.758	0.777	0.086	-0.085
2022	0.140	0.156	0.207	0.183	0.175	0.041	0.574	-0.079	0.297	0.080	0.076	0.291	0.787	0.790	0.107	