The decline in public investment: “social dominance” or too-rigid fiscal rules?

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ABSTRACT
Public investment in advanced economies is at historical lows, following a declining trend since the 1980s. Two main hypotheses have been posed to explain this evolution: (i) the ‘social dominance hypothesis’, whereby increased public social spending has been displacing investment from government’s budgets, despite the upward trend witnessed in tax burdens and debt; (ii) fiscal rules’ frameworks, that would have forced governments to reduce investment in their quest for compliance. In this paper, we jointly test the validity of these two duelling explanations using two empirical approaches (panel data models; local projections) for a sample of advanced economies comprising data for the past six decades. We find that both factors are relevant to explain the observed downward trend in investment, with social spending acting as a structural driver, whereas fiscal rules contributed mainly when applied in fiscal consolidation episodes.

I. Introduction

The prolonged situation of low interest rates and low economic growth has spurred a debate on the need to revisit the role of fiscal policies (see e.g. Blanchard 2019). Advocates of a more active role of fiscal policy tend to focus on the need to revitalize government spending items that stimulate long-term growth, particularly, public investment. Moreover, the drastic economic downturn linked to COVID-19 and the substantial fiscal reaction has reinforced this point forcefully (see IMF 2020). Government investment programmes could be particularly effective at the current juncture, as monetary authorities are less likely to react by tightening policies when policy rates are at or close to the effective lower bound. At the same time, the expectation that low interest rates will be sustained for a long period anticipates persistent low borrowing costs for governments. Beyond fiscal stabilization arguments, the emergence of new investment needs such as those derived from digitalization or climate change would reinforce the call for an enhanced investor role of the government. One example of how this discussion is pervading to the policy debate is European Union’s ‘Next Generation EU’ fiscal package, that comprises many of these elements in a medium-term perspective (see European Council 2020).

Thus, there is a stark contrast between the fact that public investment in many advanced economies is at historical lows and the consensus in the literature that finds a beneficial economic impact of effective government investment on productive capacity, economic efficiency and long-term growth. Indeed, government investment has been constantly declining as a fraction of output in most advanced economies over the past decades and stands currently at a five-decade low. This feature is shared with a broad set of emerging market economies despite their much lower public capital stocks.

The literature has emphasized several factors that contribute to explain the secular decline in public investment in advanced economies (see De Haan, et al. 1996; Oxley and Martin 1991; Ardanaz et al. 2021; Castro, et al., 2017; Cepparulo and Mourre, 2020). Firstly, the supply of public capital depends on the level of development of countries, being lower at higher levels of development. Once countries have built a quality infrastructure, less
public times investment is needed. However, in more recent times new needs requiring more public investment have appeared, such as those related to intangible capital, the digitalization of the economy and the need to mitigate risks associated with climate change. Secondly, some authors suggest that the decline reflects the shrinking importance of the public sector in advanced economies, as a consequence of the privatization of companies in the telecommunications and energy sectors, as well as of railways and airports. Nevertheless, Mehrotra and Vällilä (2006) find that privatizations are unlikely to account for the continuous fall in investment. Another, related, argument is that public investment might be undertaken through Public Private Partnerships (PPP). However, the literature argues that the emergence of PPP’s is a rather recent phenomenon and represents a small proportion of global infrastructure investment that offers only very limited explanatory power for the decline of public investment (Engel et al., 2020).1

Beyond the latter considerations, two recent strands of the literature provide plausible rationalizations for the issue at hand, namely the so-called ‘social dominance’ hypothesis and the one that rests on the incidence of fiscal policy frameworks. The former stresses the role that some secular factors (like ageing populations or globalization), linked to current expenditure trends, may be at play (see Schuknecht and Zemanek, 2021). Indeed, social expenditures in advanced economies have shown an unabated upward trend in the past four decades, tripling its weight in output, with a potential to having been crowding out other outlays from the budget, in particular investment, despite the parallel upward trends witnessed in tax burdens and government debts. This can be rationalized from a political economy perspective as the outcome of the pressure from a growing number of more aged voters who tend to discount future payoffs more heavily than working-age individuals so that public goods that improve long-term growth are seen as relatively less important in the short-run (see Jöger and Schmidt 2016).

Meanwhile, the ‘fiscal rules’ hypothesis focuses on the role too-rigid fiscal rule frameworks exerts by reducing policy-maker’s choices, in particular at times of fiscal stress, when public investment tends to be overburdened compared to other budgetary items that are more difficult to adjust for political, economic or social motives (see Ardanaz et al. 2021). In this regard, while the introduction of fiscal rules has been instrumental in bringing healthier public finances by lowering fiscal deficits (Debrun et al. 2008),2 their success to cope with the traditional pro-cyclical bias of fiscal policy is mixed. In the case of public investment, the pro-cyclical behaviour tends to be induced by fiscal consolidation episodes relying disproportionately on capital expenditures (Lane 2003; Gavin and Perotti 1997; Gali and Perotti 2003; Breunig and Busemeyer 2012).3 In this context, the evidence on the role of fiscal rules to affect the composition of government budgets in the medium-run is mixed. Mehrotra and Vällilä (2006) do not unveil any systematic role, while Ardanaz et al. (2021) and Tkacevs (2020) find that their effects depend on the level of intended protection for investment embedded in the fiscal framework. Finally, European Commission (2017) find that stronger fiscal rules mitigate the broadly found results of the literature that high public debt impinges negatively on public investment.

In this paper, we use a panel of 22 OECD countries to test jointly both sets of explanatory factors over a long period of time (1960 to 2015), and show that both stories are key to understanding public investment dynamics in advanced economies over

1According to the IMF Investment and Capital Stock Dataset (IMF 2019), the stock of PPP’s amounts to less than 5% of GDP in almost all advanced economies, and, for these economies, investment using PPP’s is lower than 0.1% of GDP. However, it could also be the case that public investment is implemented through public or quasi-public corporations outside of the perimeter of the general government. Given that data for this type of investment is scarce, we cannot ascertain if this factor can account for the decrease witnessed in general government investment.

2This result holds even after taking into account the endogeneity of the adoption of a fiscal rule (Caselli and Reynaud 2018), as countries with a longer tradition of fiscal discipline might be prone to introduce fiscal rules.

3The reduction seems to be more intense when public debt is high, in spending-based fiscal consolidations episodes, in the low phase of the economic cycle, and after debt and stock market crises Bamba, Combes, and Minea (2019). The reasons behind this relate to the fact that cuts in public investment are politically more acceptable than cuts in social expenditure (see Ardanaz and Izquierdo 2017). Nonetheless, fiscal adjustment tends to hinge less on public investment in countries with flexible fiscal rule frameworks (i.e. those that include mechanisms to accommodate unexpected or cyclical shocks, like cyclically-adjusted fiscal targets), when compared to countries with rigid fiscal rules or no rules Ardanaz et al. (2021). In addition, other papers emphasize the relevance of other dimensions of the design of rules, like their type (expenditure rules versus balanced budget rules) or their simplicity (Blanchard and Giavazzi 2004; Debrun et al. 2008; Ayuso-i Casals et al. 2009; Bova, Carcenac, and Guerguil 2014; Guerguil, Mandon, and Tapsoba 2017; Alberola et al. 2018).
the past five decades. This is a significant novelty compared to the extant literature, where both set of factors are typically analysed in isolation. We find that there is crowding-out of public investment by social spending, given that social expenditure growth is strongly correlated with future negative growth in public investment. We also find that fiscal rules, even when they incorporate flexibility clauses, tend to impinge negatively on public investment through their effect on fiscal consolidation episodes. These results are robust under alternative specifications and a number of robustness checks.

The rest of the paper is organized as follows. In Section 2 we provide stylized facts on the trends in social expenditure, public investment, and the world-wide adoption of fiscal rules’s frameworks. In turn, in section 3 and 4 we present, respectively,
the dataset and models used for the empirical exercise. Then in Section 5 we discuss the main results of our study. Finally, in Section 6 we provide concluding remarks and policy implications.

II. Two relevant trends

The upward trend in social spending

Figure 1 illustrates how the simple correlation between public investment and social expenditure has switched from positive to seemingly negative between the decade of the 1960 and the 2000s. Over that period of time total public expenditures as a share of GDP have increased drastically in industrialized economies, showing a declining weight of investment and a remarkable expansion of social expenditures, whose share in terms of GDP tripled in the period (see upper panel of Figure 2) fuelled by the expansion of the welfare state together with increasing costs of services and an ageing population, which demanded higher-quality health services and a more generous pension system (see Figure 3). The increase in public spending came hand-in-hand with an expansion of the tax burden needed to finance it. Nonetheless, the surge in government revenues was not enough over the whole period to cater for the increased expenditures, leading to a significant build-up of government debt (see lower panels of Figure 2). The latter put pressure on governments, in particular at times of economic distress, making it more likely for the government budget constraint to bite during crisis times.

The long run decline of public investment goes back to the maximum levels observed in the 1960s-1970s and is visible, with some dating differences, not only for advanced economies but also in some emerging ones. In the case of the EU, public investment recorded a significant fall during the 1970s and the 1980s before stabilizing in the 1990s. After increasing slightly in the pre-financial-crisis years, reflecting a gradual increase in Greece, Ireland, Spain, Portugal and in the countries that joined the EU between 2004 and 2007, public investment...
reached a ratio of 3% of GDP, below the pre-crisis median. In the case of the US, the public investment ratio has followed a similar pattern. As a result, it stands now at a historical low of 3% of GDP.

**The generalization of fiscal rules’ frameworks**

Over the past decades, governments have tried to reign on public finances through the progressive adoption of fiscal rules’ frameworks. While in the 1960s and 1970s only a handful of advanced economies had fiscal rules in place, its prevalence increased markedly in the early 1990s (see Figure 4), in particular in Europe, as a consequence of the adoption of the Maastricht Treaty. Subsequent reforms tried to find the right balance between enforcing fiscal discipline while preserving flexibility in the design of budgetary policies. The so-called ‘second-generation’ fiscal rules expanded the flexibility provisions putting cyclically adjusted budget balance at the centre of fiscal frameworks (to correct for the consequences of the cycle on public finances), introducing new escape clauses, the introduction of ‘golden rules’ i.e. fiscal rules that provide flexibility to spend in public investment by not accounting for it in the calculation of total expenditures, or other specific provisions (Barbiero and Darvas 2014). Thus, flexible rules have become more common around the world (see lower panel of Figure 4).

**III. Dataset**

We build up a panel database for the period 1960–2015 for twenty-two OECD developed countries, fourteen from the European Union.

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There are strong arguments about how these rules should be financed: as future generations will benefit from current investment expenditure given its impact on long term growth, they should be financed with debt and not by taxes paid by current generations (Blanchard and Giavazzi 2004; Balassone and Franco 2000).
investment. Meanwhile, the last one may have two possible effects on investment (see Kamiguchi and Tamai 2019; Picarelli, Vanlaer, and Marneffe 2019). On the one hand, public debt is a source of public financing, enabling governments to carry out large financing projects. On the other hand, when the debt level is significant, governments may reduce investment at times of fiscal stress. We also use as controls the stock of capital, a fiscal consolidation dummy, defined as in Alesina and Ardagna (2013) (a fiscal consolidation occurs if the cyclically adjusted primary balance-to-GDP ratio improves in two consecutive years and the cumulative improvement is at least two percentage points of GDP), and a profitability measure (defined as the difference between the long term interest rate and GDP growth).

**IV. Econometric model**

Our model on the determinants of public investment is the following:

\[
\Delta \text{inv}_{it} = \alpha + \beta_{Fiscal\text{rule}_{it}} \sum_{s=1}^{3} \beta_{soexp,s} \Delta soexp_{it-s} + \beta_{X} X_{it} + \mu_{i} + \epsilon_{it}
\]

(1)

where, subscript \(i\) and subscript \(t\) refer to the country and year, respectively, \(\Delta \text{inv}_{it}\) stands for the change in public investment over GDP, \(Fiscal\text{rule}_{it}\) for fiscal rules-related variables, \(\Delta soexp_{it}\) is the change in social expenditure-to-GDP ratio, and \(X_{it}\) is a matrix with the control variables,\(^7\) and \(\mu_{i}\) denotes country fixed effects.\(^8\)

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\(^1\)The dataset used on flexibility clauses covers only the period 1985–2015, but given that it contains information on the existence of fiscal rules prior to 1985, we extend the dummies for our whole period of analysis. The only two countries having fiscal rules before 1985 are Germany and Japan. For both countries they date back to the 1960s and contained flexibility clauses since their inception.

\(^2\)Strength is defined by four criteria: sectoral coverage (general, central or regional government), existence of enforcement mechanisms, legal basis and the existence of supporting procedures. The scores of these four criteria are first standardized to range between 0 and 1 and then added. We take the higher score between national and supranational rules. Moreover, if a country has different types of rules (revenue or expenditure rules, debt rules, or budget balance rules) they are added to the overall index to reflect a more complete fiscal rules framework. As a result, the composite Fiscal Rules Strength index varies between 0 and 4 (e.g. the maximum value could be reached by a country with these 4 types of rules, each of them scoring 1 in the 4 criteria considered). In addition, calculate a composite index of flexibility of these rules taking into account if each rule has a flexible feature in its fiscal framework, such as a cyclically-adjusted target, a clause protecting investment expenditure (or ‘golden rule’) or a well-defined escape clause, therefore this index will take values between 0 and 3. We can only calculate this index for the post-1985 period due to data limitations.

\(^3\)We performed tests to rule out the existence of multicollinearity obtaining relative small variable inflation factor (VIF), all below 10 with the exception of capital stock that reaches a VIF of 12.5.

\(^4\)In some specifications we also included time effects dummies, as robustness check. The main results are not affected. Although time dummies might correct for any remaining unobserved common time variation, we account for cyclical variations by means of our economic controls.
The model is estimated in first differences, as the non-stationary nature of the data might otherwise lead to spurious results. Our estimation strategy is based on a fixed effects panel data model, given the structure of our panel. Judson and Owen (1999) finds that for a panel with a small N and a time span T of 30 periods or more, the most suitable estimation strategy is the Least Squared Dummy Variable method (LSDV). Moreover, one of the main concerns in the construction of this kind of models is the appearance of the Nickell bias that may arise when the number of groups is small and the lag of the dependent variable is included. Nevertheless, in Nickell (1981) the possible bias affecting an OLS estimation of a panel data model with individual fixed effects is significantly reduced when considering a large time dimension of the panel. Thus, for our panel the bias is expected to be extremely small. We actually estimate the model both including and excluding the lag of the dependent variable, obtaining very similar results, and therefore we decided to include as our main specification the one excluding the lag. In addition, we follow Driscoll and Kray (1998) in our main specification: relying on large T asymptotics, they demonstrate that the standard non-parametric time series covariance matrix estimator can be modified such that it is robust to very general forms of cross-sectional as well as temporal dependence. Besides, for the sake of robustness, we estimate the main specification under the biased-corrected Least Square Dummy Variable (LSDVC) developed by Bruno (2005a, 2005b), obtaining similar results. We also use the Generalized Method of Moments (GMM) in order to account for the endogeneity between public investment and social expenditure by using additional lags of the variables as instruments for their first differences. More concretely, we follow the Anderson and Hsiao (1982) estimator, which only includes one instrument for each endogenous variable, thus preventing an increase of the number of reduced form coefficients from growing with the number of years.

We do not control for the potential endogeneity of the variables capturing the incidence of fiscal rules, for several reasons. First, in our sample there is a majority of European countries, and thus outside (i.e. EU-wide) pressure to adopt fiscal rules’ frameworks has been a dominant force, easing off endogeneity concerns. Second, the more common and state-of-the-art way to control for endogeneity, following Caselli and Reynaud (2018) rests in the construction of an instrument based on geographical proximity, exploiting wide sets of advanced and emerging market economies, while in our case the focus on OECD economies and the high weight of European countries limits its usefulness, also taking into account that the implementation dates of fiscal rules are highly correlated.9

Finally, we also use Jordà (2005)’s local projections’ method to explore the dynamic response of investment to fiscal rule’s implementation dates (as in Ardanaz et al. 2021) and social expenditures’ shocks:

$$
\Delta inv_{it} = \alpha + \beta_{fr,h} Fiscalrule_{it} + \beta_{soexp,h} Soexp_{it-1} + \beta_{x,h} X_{it} + \mu_{i,h} + \epsilon_{it+h}
$$

(2)

where the subindex $h = [0, 7]$ represents the number of periods ahead. We estimate one regression for each value of $h$, therefore $\beta_{soexp,h}$ measures the effect of social expenditure on investment after $h$ periods and $\beta_{fr,h}$ the effect of the presence of a fiscal rule. In order to avoid possible endogeneity problems, we use lags of social expenditures as shocks. The local projection method is a more flexible alternative to VAR specifications since it does not impose the model restrictions proper of structural VARs. It delivers non-linear estimates of the explanatory variables across horizons, also allowing to control for other possible determinants, as in the previous specifications.

V. Results

The main results of our study are presented in Table 1, as regards panel estimations for the whole sample 1960–2015 and two subsamples

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9On related grounds, Alberola et al. (2018) use, for a sample of Latin American economies an external instrument defined as the number of years the current political regime has been in place. However, that strategy seems only suitable for economies with low stability in political regimes, which has not been the case in our sample of OECD countries.
(1960–1985 and 1985–2015), and Figure 5, for local projections. In addition, in tables Annex Table A2 and A3 we provide a number of robustness exercises using as reference the whole sample\(^\text{10}\) that confirm the key insights that we discuss in the next paragraphs.

Four main results are worth highlighting. First, we find evidence of crowding-out of public investment by social spending (given the negative sign of the relevant coefficients in all specifications), a phenomenon which is stronger in the second part of the sample. An increase of one percentage point in social expenditure broadly leads to a decrease of around 0.1 percentage points in investment expenditure, summing up the effects of the coefficients attached to each lag of the former.

Second, the presence of fiscal frameworks (with and without flexibility clauses) impinges negatively on government investment dynamics, a result led by the second part of the sample, which is the one in which fiscal rules’ were massively adopted by the countries in our study, even though the statistical significant of the coefficients varies across specifications.\(^\text{11}\) It is worth noting that in similar regressions that use as dependent variable social expenditure, we find that fiscal frameworks present a negative sign, thus supporting the results in the literature about the broad disciplining role of fiscal rules on government deficits, also controlling for demographic and other determinants of social spending.\(^\text{12}\)

Still in Table 1, a third key result indicates that fiscal consolidations matter for investment: at time of fiscal stress governments tend to reduce the size of this budgetary item as a fraction of output, irrespective of the presence of flexible rules (i.e. the interaction term does not show statistical significance at the usual levels). Nonetheless, we can qualify the latter result with the dynamic effects based on local projections, as shown in Figure 5. In the first two panels of the figure we plot the values of \(\beta_{q,t}\) for the fiscal

\(^\text{10}\)This is done for the sake of brevity. Results by subsample are available upon request, including a detailed discussion of the robustness results.

\(^\text{11}\)The result on flexibility contrast with Ardanaz et al. (2021), that find that the flexibility of fiscal rules has a moderating impact on investment, possibly signalling the need for the consideration of additional variables on the ex-post implementation of frameworks (de facto rules) versus the ex-ante, de jure, existence of such frameworks. This said, given that their sample include emerging economies and their time period is much shorter, we cannot discard that the difference in results is a product of the different sample selection. We should take into account, in any case, that the effect of fiscal rules on investment in our paper might be present indirectly through the negative and sizable impact fiscal rules have on social expenditure.

\(^\text{12}\)Results are available upon request.
consolidation dummies, the fiscal rules dummies and the interactions. In the panel that appears below, we plot the values of $\beta_{\text{exp},t}$. We find that the presence of flexible rules makes the fiscal consolidation less harmful for public investment (right-hand panels of Figure 5). This effect is not present in the case of social expenditure, in which the impulse responses are very similar regardless of the presence of fiscal rules (whether flexible or not), which complements the results found in Ardanaz et al. (2021).

**VI. Conclusions**

In this paper we delve into the reasons for the long-standing decline in public investment expenditure. This is a long-standing empirical issue in economics. The novelty of our paper lies in the integrated approach we take. We test jointly the two main hypotheses that have been posed in the literature, and show that both ‘social dominance’ and fiscal rules (though when interacted with periods of fiscal consolidation) are relevant to understand the phenomenon at hand.

These results underline two key policy takeaways. First, the necessity of protecting public investment specifically by creating long-term investment programmes that resist economic and financial crises. This is specially important in the case of investment in R&D, climate transformation, food and health security, and broader infrastructure programmes, as a cut in investment may imperil the finalization of such programmes given their usual long-run orientation, that typically extend over periods of time well-

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13Results are available upon request.

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Figure 5. Local projections’ estimations (horizon 6 years). Dependent variable: Public investment-to-GDP ratio.
above standard electoral cycles. A number of recent studies indicate that investment needs are on the rise on these important areas, and that the energizing action of the public sector might be needed given the clear social externalities present. Second, the issue of protecting investment has to be inserted in a broader debate on the role of the public sector in the economy and its sustainable financing. Policies that do not acknowledge the rising trends in social spending and follow short-term, quick-fix policies are deemed to fail, as the government budget constraint may end up biting, thus creating the need for fiscal consolidation, but also inducing additional distortions on the private sector through potentially unsustainable tax policies and increasing levels of public debt.

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## Annex

### Table A1. Database.

| Data                        | Sources                                      | Availability                                      |
|-----------------------------|----------------------------------------------|---------------------------------------------------|
| Public investment (in % of GDP) | AMECO, IMF                                  | 1960–2018: AT BE DE ES FI FR GR IE IT NL PT DK GB SE AU CA CH JP US NZ 2 NO |
| Social Expenditure (in % of GDP) | OECD Database, IME (1965), Espuelas (2013), Carlo and Pereirinha (2010) | 1960–2018: AT BE DE ES FI FR GR IE IT NL PT DK GB SE AU CA CH JP US NZ NO |
| Public Debt (in % of GDP) | AMECO, IMF                                  | 1960–2018: ALL COUNTRIES |
| Stock of Capital (in % of GDP) | IMF (2019)                                  | 1960–2018: ALL COUNTRIES |
| Profitability               | AMECO, IMF, Jordà et al. (2019), own calculations | 1960–2018: ALL COUNTRIES (excl. LU) 1972–2018:LU |
| Real GDP growth             | IMF, OECD                                   | 1960s–2018: AT BE DE ES FI FR GR IE IT NL PT DK GB SE AU CA CH JP US NZ NO 1980–2018:LU |
| GDP per capita              | AMECO, IMF                                  | 1960–2018: AT BE DE ES FI FR GR IE IT NL PT DK GB SE AU CA CH JP US NZ NO 1970–2018: DE 1980–2018: NZ |
| Demographic variables      | OECD                                        | 1960–2018: ALL COUNTRIES |
| Averaged cabinet            | Armingeon et al. (2019)                     | 1960–2017: AT BE DE FI FR GR IE IT LU NL DK GB SE AU CA CH JP US NZ NO year 2017: PT ES |
| Fiscal Rules Dummy          | IMF (2017)                                  | 1960–2015: ALL COUNTRIES |
| Fiscal Rules Flexibility    | IMF (2017)                                  | 1985–2015: ALL COUNTRIES |

1Availability: AU (1960–2016); CA(1960–2017); JP (1960–2015).
2Availability: DK (1965–2018); AU CA (1960–2017); NZ (1960–2016).
3Availability: PT (1975); ES (1977).
Table A2. Robustness exercises: different methodological approaches.

|                        | Dependent lag | Time effect | LSDV\(^*\) | GMM\(^*\) |
|------------------------|---------------|-------------|------------|-----------|
|                        | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
| Δ Investment/GDP \(_{t-1}\) | 0.038 | 0.036 | 0.058 | 0.056 |
|                        | (0.037) | (0.038) | (0.000) | (0.000) |
| Δ Social expenditure \(_{t-1}\) | −0.028 \(^**\) | −0.027 \(^**\) | −0.018 | −0.018 | −0.027 \(^**\) | −0.026 \(^**\) | −0.115 \(^***\) | −0.125 \(^***\) |
|                        | (0.013) | (0.013) | (0.016) | (0.016) | (0.000) | (0.000) | (0.032) | (0.036) |
| Δ Social expenditure \(_{t-2}\) | −0.034 \(^***\) | −0.052 \(^***\) | −0.019 | −0.019 | −0.051 \(^***\) | −0.050 \(^***\) |
|                        | (0.017) | (0.017) | (0.016) | (0.016) | (0.000) | (0.000) |
| Δ Social expenditure \(_{t-3}\) | −0.032 \(^**\) | −0.030 \(^**\) | −0.033 \(^***\) | −0.032 \(^***\) | −0.030 \(^**\) | −0.028 \(^**\) |
|                        | (0.012) | (0.012) | (0.012) | (0.012) | (0.000) | (0.000) |
| Fiscal Cons. Alesina    | −0.057 | −0.064 | −0.024 | −0.028 | −0.059 | −0.065 | −0.186 \(^***\) | −0.170 \(^***\) |
|                        | (0.063) | (0.048) | (0.072) | (0.054) | (0.000) | (0.000) | (0.063) | (0.057) |
| Rules dummy            | −0.059 \(^*\) | 0.041 | 0.060 \(^*\) | 0.193 |
|                        | (0.031) | (0.044) | (0.000) | (0.149) |
| Fiscal Cons. Al. ×      | −0.037 | −0.061 | −0.035 | 0.049 |
|                        | (0.071) | (0.077) | (0.000) | (0.078) |
| flexibility dummy      | −0.052 | −0.018 | −0.049 | 0.126 |
|                        | (0.034) | (0.035) | (0.000) | (0.196) |
| Fiscal Cons. Al. ×      | −0.046 | −0.078 | −0.043 | 0.031 |
|                        | (0.063) | (0.066) | (0.000) | (0.073) |
| Debt \(_{t-1}\)        | −0.001 | −0.001 | −0.000 | −0.000 | −0.001 \(^*\) | −0.001 \(^*\) | −0.009 \(^*\) | −0.011 \(^*\) |
|                        | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.005) | (0.005) |
| GDPpc growth \(_{t}\)   | −0.007 \(^*\) | −0.006 \(^*\) | −0.010 \(^**\) | −0.010 \(^**\) | −0.007 \(^*\) | −0.006 \(^*\) | 0.004 | 0.002 |
|                        | (0.003) | (0.003) | (0.004) | (0.004) | (0.000) | (0.000) | (0.019) | (0.017) |
| Cycle                  | −0.006 | −0.007 | 0.014 | 0.014 | −0.010 | −0.011 | −0.041 \(^*\) | −0.043 \(^*\) |
|                        | (0.008) | (0.008) | (0.010) | (0.010) | (0.000) | (0.000) | (0.021) | (0.022) |
| Capital Stock \(_{t-1}\) | −0.004 \(^***\) | −0.004 \(^***\) | −0.004 \(^***\) | −0.004 \(^***\) | −0.004 \(^***\) | −0.004 \(^***\) | −0.007 | 0.004 |
|                        | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.010) | (0.011) |
| Ideology \(_{t-1}\)     | −0.010 | −0.012 | −0.013 | −0.013 | 0.002 | 0.000 | −0.010 | −0.017 |
|                        | (0.014) | (0.014) | (0.015) | (0.015) | (0.000) | (0.000) | (0.042) | (0.043) |
| # Observations         | 1,073 | 1,073 | 1,074 | 1,074 | 1,075 | 1,075 | 1,083 | 1,083 |
| Sargan test p-value     | 0.000 | 0.000 |
| AR(2) test p-value      | 0.042 | 0.031 |

\(^*\)Estimation strategy following Bruno (2005a, 2005b).
\(^*\)Includes GMM following the Anderson and Hsiao (1982) estimator. AR(2) test p-value refers to the p-values from Arellano and Bond (1991) test for the lack of second-order autocorrelation in the first-differenced errors; under this null hypothesis, the instruments are valid because errors in levels are not correlated. Sargan test p-value refers to the p-values from the test of overidentifying restrictions under the null that instruments are valid, i.e. moment conditions hold in the data.

\(^*, **, ***\) : significance at the 1%, 5% and 10% levels.
### Table A3. Robustness exercises: alternative definitions of variables.

|                             | Nominal growth<sup>a</sup> | Rules index<sup>b</sup> | Interactions<sup>c</sup> | Profitability<sup>d</sup> |
|-----------------------------|-----------------------------|--------------------------|---------------------------|---------------------------|
|                             | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   |
| $\Delta$ Social expenditure<sub>τ-1</sub> | 0.003 | 0.001 | −0.023 | −0.023 | −0.018 | −0.017 | −0.022<sup>*</sup> | −0.020 |
|                             | (0.033) | (0.033) | (0.020) | (0.020) | (0.017) | (0.017) | (0.013) | (0.013) |
| $\Delta$ Social expenditure<sub>τ-2</sub> | −0.042 | −0.043 | −0.074<sup>***</sup> | −0.073<sup>***</sup> | −0.050<sup>***</sup> | −0.049<sup>***</sup> | −0.054<sup>***</sup> | −0.053<sup>***</sup> |
|                             | (0.038) | (0.039) | (0.020) | (0.019) | (0.016) | (0.016) | (0.017) | (0.017) |
| $\Delta$ Social expenditure<sub>τ-3</sub> | −0.049 | −0.049 | −0.048<sup>***</sup> | −0.046<sup>***</sup> | −0.034<sup>**</sup> | −0.032<sup>**</sup> | −0.032<sup>**</sup> | −0.030<sup>**</sup> |
| Fiscal Cons. Alesina        | −0.788 | −0.650 | −0.140<sup>***</sup> | −0.105<sup>***</sup> | −0.062 | −0.070 | (0.069) | (0.051) |
|                             | (1.857) | (1.412) | (0.035) | (0.026) |          |          |          |          |
| Rules dummy                 | −0.696 | −0.047<sup>**</sup> |          |          | −0.064<sup>**</sup> |          | −0.074<sup>**</sup> |          |
|                             | (0.948) | (0.022) |          |          | (0.029) |          | (0.029) |          |
| Fiscal Cons. Al. × Rules dummy | −0.946 | 0.018  |          |          | −0.041  |          |          |          |
|                             | (2.116) | (0.018) |          |          | (0.074) |          |          |          |
| flexibility dummy           | −1.061 | −0.029<sup>*</sup> |          |          | −0.056  |          |          |          |
|                             | (1.204) | (0.016) |          |          | (0.036) |          |          |          |
| Fiscal Cons. Al. × Flexibility | −2.002 | −0.024  |          |          | −0.045  |          |          |          |
|                             | (1.918) | (0.018) |          |          | (0.062) |          |          |          |
| $\Delta$ Social exp. <sub>τ-1</sub> × Rules dummy |          | −0.002 |          |          |          |          |          |          |
|                             |          | (0.023) |          |          |          |          |          |          |
| $\Delta$ Social exp. <sub>τ-1</sub> × flexibility dummy |          | 0.000  |          |          |          |          |          |          |
|                             |          | (0.024) |          |          |          |          |          |          |
| Profitability               |          | −0.022 | −0.017  |          |          |          |          |          |
|                             |          | (0.014) | (0.013) |          |          |          |          |          |
| # Observations              | 1,067 | 1,067 | 670  | 670  | 1,075 | 1,075 | 1,017 | 1,017 |

<sup>a</sup>Public investment and Social expenditure in million euros growth rate.

<sup>b</sup>Rules dummy and flexibility in index terms.

<sup>c</sup>Includes interaction between fiscal rules and social expenditure variations.

<sup>d</sup>Includes profitability indicator.

All specifications include debt in terms of GDP, GDPpc growth, cycle, capital stock and ideology.

***, **, *: significance at the 1%, 5% and 10% levels.