# DO EU FISCAL RULES SUPPORT OR HINDER COUNTER-CYCLICAL FISCAL POLICY?

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**ABSTRACT**

Rather than stabilising aggregate demand, discretionary fiscal policy tends to amplify cyclical fluctuations of output. The commonly accepted reasons are political economy and uncertainty surrounding output gap estimates. In the EU, the pro-cyclical nature of discretionary fiscal policy has also been associated with the commonly agreed fiscal rules, which, for some observers, unduly limit the scope for stabilising output. Using panel data covering close to 50 EU and non-EU countries, we provide evidence that the uncertainty around output gap estimates is not a convincing explanation for pro-cyclical policies. Discretionary measures remain ill-timed even when politically more meaningful indicators of the cycle such as the unemployment rate or economic confidence are used. We also show that deviations from fiscal rules and the accumulation of government debt foster pro-cyclical fiscal policy. Lawmakers can run discretionary fiscal policy measures based on political economy or other considerations up to a point. Once debt grows too high, they are forced to implement fiscal consolidation measures regardless of the cycle. More generally, there is no fiscal rule that, if consistently ignored, safeguards the opportunity to stabilise output with discretionary fiscal policy measures. Complying with or mimicking fiscal rules that are designed to keep a steady course in the face of cyclical fluctuation is conducive to counter-cyclical fiscal policy making.

**KEYWORDS:** fiscal policy, fiscal rules, fiscal stabilisation, counter-cyclical policy, dynamic panel models

**JEL CODES:** C23, E61, E62, H30, H60

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## 1 Introduction

The EU fiscal framework is an institutional safeguard against cross-border spillovers of national fiscal policies in the economic and monetary union. The commonly agreed rules and institutions are primarily meant to ensure the long-term sustainability of public finances so as to protect the autonomy and effectiveness of centralised monetary policy making. In theory, aiming for the long-term sustainability of public finances in line with the rules should be consistent with the stabilisation of output in the short term. Governments build buffers in economic good times so as to use them during economic bad times. However, there is ample evidence that discretionary fiscal policy at the national level does not follow the intended or ideal path. On the contrary, fiscal policymaking is often affected by a deficit bias which leads to an accumulation of high government debt imposing clear limits within the rules to stabilise cyclical fluctuations of output: pro- or at best a-cyclical fiscal policies are the result.

Our paper expands on the existing empirical literature by investigating the drivers of pro-cyclical fiscal policies with a particular focus on the EU. The key question underlying our paper is whether the tendency to run pro-cyclical fiscal policies arises in spite or because of the constraints imposed by the EU rules.

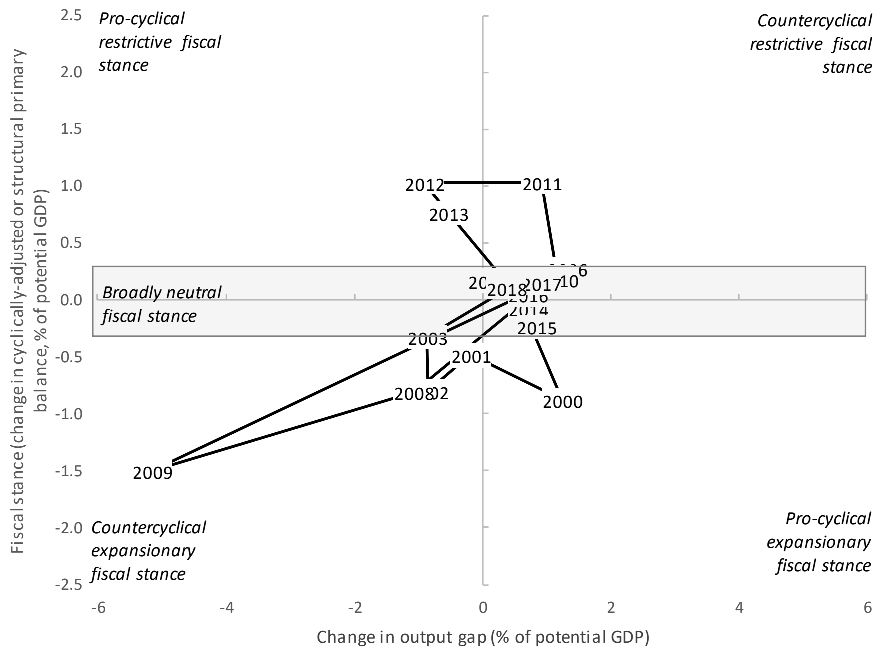
When the EU fiscal framework was designed in the 1990s, the primary objective was indeed to ensure the long-term sustainability of public finances, period. Fiscal stabilisation may still have been possible within the rules, but was not meant to play a major role. To critics of the Stability and Growth Pact, the declared preference for sustainability was and still is the 'original sin' of the original design imposing painful pro-cyclical retrenchments in economic downturns. By contrast, supporters of the Pact argue that pro-fiscal policy is simply the result of not following the commonly agreed rules, notably of not taking advantage of economic good times so as to have the fiscal space to lean against the wind in bad times.

Starting in 2005, successive reforms of the Stability and Growth Pact – legislative reforms as well as far-reaching re-interpretations of existing laws – have given more prominence to the objective of short-term fiscal stabilisation. The original system, which targeted headline deficits, was gradually replaced by one that focuses on delivering structural fiscal efforts, which can be modulated in function of cyclical conditions, and allows for structural reforms and government investment.

In spite of the increased flexibility of the Pact, many observers still consider the framework as too tight and biased towards sustainability, imposing clear limits to an effective stabilisation of output in the short term. This conclusion is generally substantiated by the well-known graphical juxtaposition of cyclical conditions on the one hand and the orientation of discretionary fiscal policy on the other; see Figure 1. Since the late 1990s, when the SGP entered into force, there has effectively been only one clear cut episode of counter-cyclical fiscal policy, the European Economic Recovery Plan of 2009. The rest was either overtly pro-cyclical or remained within the margins of what is commonly considered as broadly neutral.

Our empirical analysis starts by confirming the tendency towards running pro- or a-cyclical discretionary fiscal policy in both the EU and beyond, but extends the existing literature in a number of important directions. First, we show that the failure to deliver counter-cyclical fiscal policies is not necessarily due to the often cited uncertainty surrounding real-time output gap estimates, the conventional measurement of economic slack. We evaluate the stabilisation properties of fiscal policy using politically more meaningful measures, notably the change in the unemployment rate and of the OECD Composite Leading Indicator. The use of alternative cyclical indicators is motivated by the assumptions that fiscal policy makers do not base their decisions on an abstract, non-observable concept such as the output gap, but on more tangible measures, measures that can be understood by and are meaningful to voters. Second, we complement conventional fiscal reaction functions with non-linear elements and run dedicated logit regressions which allow for a more direct and immediate investigation of what determines pro-cyclical fiscal policies in the EU and possibly beyond. Third, compared to existing studies we add information on Member States' compliance with the different fiscal rules defined by the SGP: the nominal deficit rule, the debt rule, the structural balance rule and the expenditure benchmark. This addition allows us to discriminate between two competing views whereby pro-cyclicality either results from the constraints imposed by fiscal rules or from deviating from the rules.

**Figure 1:** The fiscal stance in the EU, 1999-2018




*Note*: Until 2003, the fiscal stance is measured by the change in the cyclically-adjusted primary balance. It is corrected for the proceeds from the sale of mobile phone licences in 2000-2001 but not for other possible one-offs.

Our findings do not corroborate earlier studies, which attribute the pro- or a-cyclical nature of discretionary fiscal policy to the difficulty of measuring the output gap in real time (Cimadomo, 2012). Estimates based on the two alternative cyclical indicators, which are available to policymakers in real time and not subject to major revisions, also lead to the same conclusion of pro-cyclicality in both the EU and beyond. Hence, pro-cyclicality is first and foremost a political economy problem. Our second main finding is that pro-cyclicality seems to be an issue when debt is very high and fiscal rules are not followed. As a result, the main issue is not how fiscal policy reacts to cyclical conditions but how the trade-off between stabilisation and sustainability unfolds at the national level. In the presence of very high debt, and barring help from the central level of macroeconomic policy making, sustainability takes over and fiscal policy runs out of options to lean against the wind.

The remainder of this paper is organised as follows. Section 2 reviews the theoretical and empirical literature on the fiscal response to the economic cycle and the role of fiscal rules and institutions in this regard. Section 3 describes our data set and the methodology. Section 4 presents our empirical findings on pro-cyclicality. Section 5 investigates the determinants of pro-cyclicality, including the impact of the SGP and its adjustments, and summarises robustness tests. Section 6 concludes.

## 2 Literature review

Numerous empirical studies have found that fiscal policy tends to be pro-cyclical, i.e. expansionary in good times and restrictive in bad times. A strong pro-cyclical bias was observed first in Latin America (Gavin and Perotti, 1997) and then more generally in developing economies (Talvi and Végh, 2000), while fiscal policy in advanced economies was found to be less pro-cyclical, or a-cyclical (Lane, 2003; Kaminsky et al., 2004), with pro-cyclicality more pronounced in good times (OECD, 2003; Manasse, 2006).

Several factors were put forward to explain pro-cyclicality in developing countries. The first one was the lack of access to international credit markets, forcing countries to repay debt in bad times rather than borrowing (Gavin and Perotti, 1997; Kaminsky et al., 2004). Political economy considerations mattered too, such as corruption (Alesina and Tabellini, 2005) and governments' strategy to run pro-cyclical tax cuts in good times rather than build up surpluses that would expose them to pressure to increase public spending (Talvi and Végh, 2005). Manasse (2006) noted, however, that fiscal policy might also appear more pro-cyclical in developing economies just because negative shocks are larger there than in advanced economies.

In advanced economies, other factors are at play. A first set of explanations refers to policymakers' lack of information and the uncertainty surrounding discretionary decisions. Some of the difficulties are due to technical reasons. It is difficult to anticipate correctly the cyclical position or even to identify it in real time, especially in good times, and more generally fiscal decisions are exposed to forecast errors at large (Cimadomo, 2012). Moreover, model failures can result in wrong estimates of potential growth. Finally, there may be errors of judgement on top of uncertainty. This can lead for instance to mistaking temporary factors for structural factors (OECD, 2003) or failing to internalise accurately the spillover effects from policies in other countries. Policymakers also tend to forget that due to policy lags, a measure that was intended to be counter-cyclical can turn out to be pro-cyclical by the time it has been adopted, implemented and it has an effective impact on the real economy.

Moving to political economy considerations, a second set of explanations relates to the deficit bias of policymakers, that is, the tendency to run deficits regardless of prevailing cyclical conditions. The most prominent of these factors is the common pool problem or the 'voracity effect' of multiple special interest groups (Lane, 2003). In the same vein, a high degree of political dispersion and fragmentation makes it more difficult to contain expenditure (Alesina and Perotti, 1995; Talvi and Vegh, 2000; Hallerberg et al., 2004; Beetsma et al., 2009). Short-sightedness and political competition are also a source of deficit bias, with incumbents increasing spending ahead of elections to attract voters or to accumulate debt and reduce the room for manoeuvre of future governments. Moreover, Larch et al. (2019) showed that pro-cyclicality in good times can be explained by the policymakers' preference to magnanimously help with tax cuts and expenditure increases in bad times but to stay away from unpopular tax increases and expenditure cuts during expansions. Structural characteristics of the economy also play a role.

Pro-cyclicality in bad times has drivers of its own, as it counteracts the usual deficit bias. Fiscal tightening in downturns is not only politically difficult to implement, it is also less likely in the presence of expenditure rigidities: the public payroll, for instance, is usually a large component of primary government expenditure and it is hardly flexible, as argued in OECD (2003). The same study found that for OECD countries in 1980-2002, the fiscal stance was predominantly counter-cyclical in bad times, unless sustainability problems and high public debt reduced the scope for counter-cyclical response. Pro-cyclical fiscal contractions thus appear to be imposed on policymakers as they hit a fundamental constraint, namely the long-term sustainability of public finances.

Although fairly easy to formulate in theory, it is difficult to define the limits of the intertemporal budget constraint of government in practice. Besides the theoretical insight that fiscal policy cannot follow a Ponzi scheme, that is, indefinitely raise new debt beyond the payment of interest on existing debt, there is no commonly accepted definition of what is considered to be a sustainable path of fiscal policy. Hence, lawmakers may be in a position to run pro-cyclical fiscal policies in bad times without creating buffers in good times for quite a while. At some point, however, lenders can review their assessment and ask much higher interest rates or cut access to debt financing altogether.

To date, almost all countries have some kind of fiscal rules which aim to keep fiscal policy on a sustainable path. Depending on their design and implementation, such rules may allow more or less room for the short-term stabilisation of output. Debrun et al. (2008) refer to a survey conducted by the European Commission in 2006, which reported that fiscal experts often perceive nominal forms of numerical fiscal rules (i.e. budget balance rules and debt rules, as opposed to expenditure or revenue rules) as a source of pro-cyclicality. Darvas et al. (2018) argue that the sizeable fiscal contraction during the global financial crisis was generated by the EU fiscal rules. However, they note that this is the flipside of countries not abiding by the rules (or the rules not being sufficiently binding) in good times. Pro-cyclicality in bad times could be avoided if it did not take place in good times; this is the actual chicken-and-egg problem, and the crux of it is to prevent pro-cyclical fiscal expansions.

Assessing pro-cyclicality in general and isolating the impact of fiscal rules in particular faces several challenges. Golinelli and Momigliano (2009) survey the empirical literature on the cyclicality of fiscal policies between the entry into force of the Maastricht Treaty in 1993 and 2008. They show the importance of modelling choices, especially with regard to the choice of the dependent and explanatory variables and the use of real-time or ex post data. These choices have remained crucial in subsequent studies. Some authors choose the primary balance as the dependent fiscal variable for practical reasons because it is observable (Golinelli and Momigliano, 2006; Checherita-Westphal and Žďárek, 2017) but the use of the cyclically-adjusted primary balance is predominant as a measurement of discretionary fiscal policy, sometimes coupled with an analysis of automatic stabilisers to assess the total impact of fiscal policy. Among the explanatory variables, the predominant indicator of cyclical conditions is the output gap in level or in change, while some analyses are based on real GDP growth rate or deviation from trend growth (e.g. Debrun and Kapoor, 2010). Orphanides and van Norden (2002) warned that real-time estimates of the output gap are subject to sizeable revisions ex post and are therefore not a reliable indicator of cyclical conditions. In line with this, using real-time or ex post data can make a difference: fiscal policy is usually found to have been a-cyclical or pro-cyclical on the basis of ex post data, while real-time data can show less pro-cyclicality or even counter-cyclicality (Golinelli and Momigliano, 2006; Cimadomo, 2012). However, this finding was not confirmed in a more recent study that finds pro-cyclicality in both cases (European Commission, 2018). An additional challenge is how to account for the impact of fiscal rules. Some studies identify fiscal rules with certain periods and start the analysis when the rule is in place, or cut the sample into several periods as in OECD (2003). Some papers use dummies (Debrun et al., 2008); some use an index such as the IMF's fiscal rules strength index in Caselli and Reynaud (2019); some choose to group countries depending on their status under the SGP (European Commission, 2018) and some perform more elaborate simulations of existing rules (Reuter, 2015; Golinelli and Momigliano, 2006). The moment at which the budget is considered also matters: Beetsma et al. (2009) distinguish between the planning phase and the implementation phase and find in the implementation phase a systematic shortfall from the planned budgetary adjustment, moreover increasing with the planning horizon. For similar reasons, Caselli and Reynaud (2019) flag a weakness of the IMF's fiscal rules strength index, namely that the index only focuses on the design of fiscal rules, not their implementation.

The empirical literature generally associates fiscal rules with stronger fiscal discipline, although with some restrictions. Stronger fiscal rules and institutions are associated with a lower deficit bias (Manasse, 2006; Beetsma et al., 2009; Marneffe et al., 2011; Badinger and Reuter, 2017; Burret and Feld, 2018) but several studies argue that the sense of causality between rules and outcomes is debatable (Debrun et al., 2008; Heinemann et al., 2018; Caselli et al., 2018). After correcting for endogenity, Caselli and Reynaud (2019) find that fiscal rules do not have a significant impact on fiscal performance unless they are well designed. Golinelli and Momigliano (2006) only find a statistically significant impact of EU fiscal rules for countries subject to an excessive deficit procedure. Reuter (2015) finds that, even in years of non-compliance, fiscal rules have an impact on the trend of fiscal aggregates as policymakers steer them towards their numerical limit or target ([1]).

([1]) Similarly, Escolano et al. (2012) find no systematic impact of subnational fiscal rules in Europe. This seems in accordance with the belief that regional deficits are more likely the consequence of inadequate financing schemes than a deficit bias (see e.g. Goodspeed, 2002).

The empirical findings regarding the impact of fiscal rules on pro-cyclicality depend on the type of rule. Early studies on the EU fiscal rules did not find evidence for a pro-cyclical impact during downturns but acknowledged that there had not been many cases of recession during the period under consideration (OECD, 2003; Galí and Perotti, 2003). Debrun et al. (2008) associated budget balance rules and debt rules with higher-procyclicality unless they were corrected for the cycle or defined over the medium term, while expenditure and revenue rules were rather found to play in the opposite sense. Holm-Hadulla et al. (2012) provided evidence that expenditure rules can mitigate the pro-cyclical reaction of government spending to surprises in the output gap. Nerlich and Reuter (2015) note the need to distinguish between countries with or without fiscal space, as countries with large fiscal space do not have to consolidate during downturns; based on this distinction, they find that at least some fiscal rules may actually reduce pro-cyclicality.

As regards economic stabilisation, several studies find that limiting the scope for discretionary counter-cyclical fiscal policies does not necessarily increase output volatility. Fatás and Mihov (2006) show that by constraining discretionary fiscal policy, fiscal rules in US states also reduce policy volatility and thus the fiscal source of business cycle volatility. Badinger and Reuter (2017) come to the similar conclusion that countries with more stringent fiscal rules are negatively related to output volatility and that this happens indirectly, with fiscal rules reducing the volatility of fiscal policy.

# 3 Data and methodology

The most common way to assess the stabilisation properties of discretionary fiscal policy is to estimate fiscal reaction functions. Pioneered by Bohn (1998, 2005), fiscal reaction functions are reduced form relations capturing the behaviour of a government that aims at stabilising output while respecting the intertemporal budget constraint. In their basic form, fiscal reaction functions assume a linear and continuous trade-off between short-term fluctuations of output and the level of government debt, i.e. high government debt weighs on the stabilisation objective of fiscal policy.

This paper adds a number of new elements to the literature by focusing on the determinants of the stabilisation properties of discretionary fiscal policy. First, in addition to the change in the output gap, we consider two alternative measurements of cyclical conditions: the change in the unemployment rate and the change (in the yearly average) of the OECD composite leading indicator. These two indicators have two major advantages over the output gap: they are not revised ex post and they are conceivably closer to the information that policymakers have in mind when considering discretionary fiscal stabilisation.

Second, we investigate drivers of pro or counter-cyclical fiscal policy by (i) introducing non-linearities in the conventional fiscal reaction function approach, and (ii) estimating dedicated logit models. The conventional fiscal reaction function approach essentially tells us whether discretionary fiscal measures are on average smoothing or exacerbating cyclical fluctuations of output. They do not tell us why. To get an idea of what drives the pro-cyclical or counter-cyclical stance, the linear model can be extended with terms that interact the cycle with other variables of interest. Such interaction terms can provide an indication of whether and to what extent the stabilisation properties of discretionary fiscal policy are influenced by factors such as the level of government debt, the presence and design of fiscal rules etc. An alternative and more direct way of investigating the drivers of pro- or counter-cyclical policies is to use binary logit models. The observed combinations of output gap estimates and discretionary fiscal policy are mapped into a dummy, which then is regressed on variables that can be assumed to have an influence on the general orientation of fiscal policy.

Third, we use a number of indicators capturing the evolution of the EU fiscal rules over time, as well as a detailed database of compliance with the four different fiscal rules defined by the Stability and Growth Pact, notably the 3% of GDP reference value for the budget deficit, the debt reduction benchmark, the structural budget balance rule and the expenditure benchmark (see Table 7 in Annex 1 for a more detailed presentation). We use them to examine a possible nexus between the design of fiscal rules and the stabilisation properties of discretionary fiscal policy.

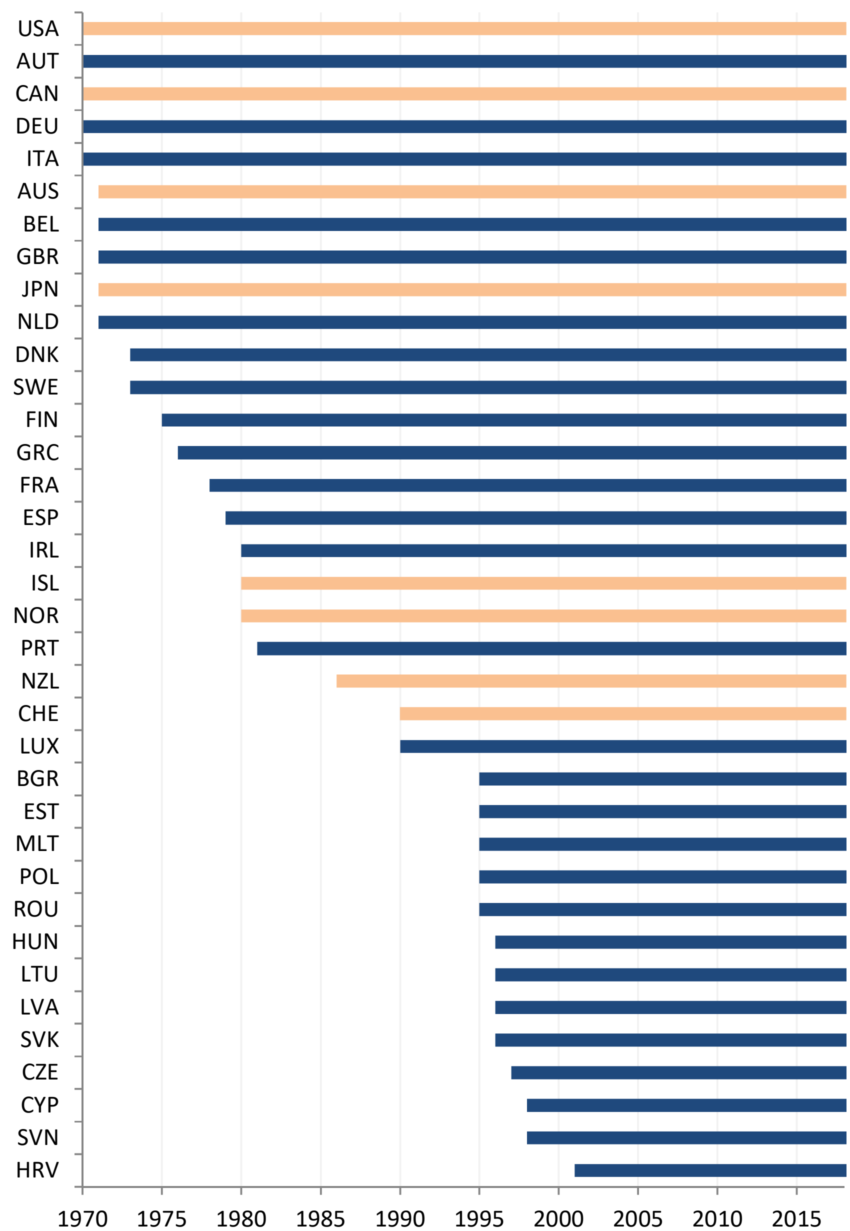
Our dataset covers 47 developed countries. In addition to the 28 EU Member States, it includes Australia, Canada, Chile, Iceland, Israel, Japan, New Zealand, Norway, Mexico, South Korea, Switzerland, Turkey, the USA, Hong Kong, Macao, Puerto Rico, San Marino, Singapore and Taiwan. The time dimension varies considerably across countries. For the most advanced economies, it goes back to the late 1960s, while it only starts in the early 1990s or later for EU countries that joined the Union in 2004 or after.

The main fiscal variables are taken from several sources, most notably the Commission AMECO database, the IMF World Economic Outlook (October 2018), the IMF Global Debt Database and the OECD balance of payments database. Control variables were extracted from a variety of sources, including the European Commission's Fiscal rules database, the IMF Fiscal Rule Database, the Comparative Political Data Set, the Chicago Board Options Exchange online repository, the IMF Monitoring of Fund Arrangements database, Duval et al. (2018), Laeven & Valencia (2013, 2018) and the EPU webpage of Baker, Bloom & Davis.

In the baseline specifications, typically 36 countries remained due to data availability. Figure 2 below, for example, plots the availability of the cyclically-adjusted primary balance. The longest available time series is for the USA and starts in 1967. The shortest available times series are typically for Croatia, e.g. with reliable and consistent series starting only in 2001. Overall, this results in an unbalanced panel, but with data from 1980 or earlier for about half the countries.

The definitions of the self-constructed dummies used throughout the project are documented in Annex 1. The annex also lists the occurrences of the different crisis dummies used as controls.

**Figure 2:** Availability of the cyclically-adjusted primary balance series, by country



# 4 The conventional fiscal reaction function approach: is fiscal policy pro- or counter-cyclical?

In order to analyse the stabilisation properties of discretionary fiscal policy, we follow the conventional fiscal reaction function approach pioneered by Bohn (1998). We estimate the following specification with annual data:

$$\Delta capb_{i,t} = \beta_1 \Delta cabp_{i,t-1} + \beta_2 cycle_{i,t} + \beta_3 X_{i,t-1} + \theta_t + \delta_i + u_{i,t} \qquad (1)$$

where the dependent variable measuring the discretionary fiscal impulse ($\Delta capb_{i,t}$) is the change in the cyclically-adjusted primary budget balance as a percentage of GDP. $cycle_{i,t}$ is our main explanatory variable of interest, to which we add a vector of controls and dummies ($X_{i,t-1}$), most importantly government debt in % of GDP. Finally, there are time ($\theta_t$) and country ($\delta_i$) fixed effects and a country-year specific error term ($u_{i,t}$).

The most commonly used measure of the economic cycle is the output gap, i.e. the difference between actual and potential GDP. A positive (negative) change in the output gap is interpreted as an improvement (deterioration) of cyclical conditions. Although conceptually sound and convincing, the output gap comes with an important practical downside: it is unobservable and surrounded by a significant degree of uncertainty. Estimates available in real time can and do differ markedly from those revealed after the fact, once estimates have stabilised. Darvas (2015) and Darvas & Simon (2015) shows that in the context of the EU fiscal surveillance framework, revisions are large enough to make discretionary stabilisation vain.

As indicated in our review of the literature, most studies using ex-post output gaps in the conventional fiscal reaction framework find a negative coefficient indicating a pro-cyclical orientation of discretionary fiscal policy. This is also the case with our regressions: the estimated coefficient of the revealed change in the output gap is negative across alternative estimation techniques; see Table 1 for the full sample and Table 2 for the EU ([2]). Notable exceptions are large macro-financial dislocations or systemic crises as defined by Leaven and Valencia (2013, 2018): they tend to be associated with an important deterioration of the underlying budget balance. This is because the government decides either to actively intervene in response to the unwinding of external or domestic imbalances, and/or to defend a given level of discretionary expenditure in the face of large losses of output and, in turn, government revenues. In other words, in the event of really large negative shocks, stabilising the economy trumps other considerations. A particularly prominent case in point is the 2008-2009 crisis in the EU which led to the European Economic Recovery Plan mentioned in the introduction. The estimated coefficient of the respective dummy in Table 2 is negative across all specifications and estimation techniques, although not always statistically significant.

Golinelli and Momigliano (2006), and more recently the European Commission (2018) tested the notion that policy makers have no choice but to rely on real-time output gap estimates when deciding about whether to run contractionary or expansionary fiscal policy measures. Hence, they may be proven wrong with the benefit of hindsight, but their good intention should be vindicated if ex-post estimates of the output gap are replaced by those available at the time fiscal policy decisions are actually taken. However, their results do not corroborate their priors: the cycle still turns out to be negatively correlated with the measure of the discretionary fiscal impulse, while controlling for other factors.

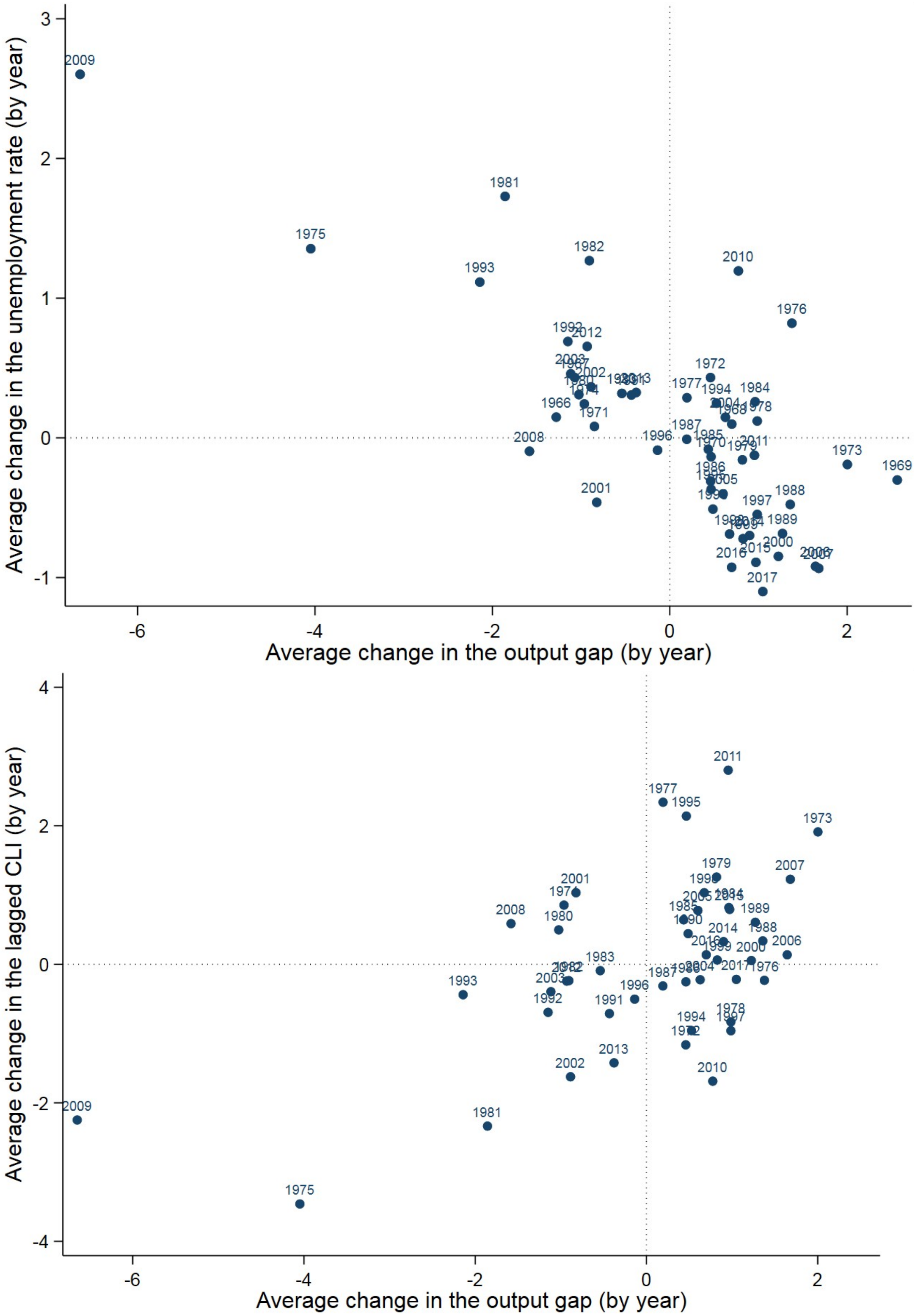
[2] The ordinary fixed-effects least squares estimator may suffer from Nickell-bias in a dynamic setting (Nickell, 1981) especially in panels with a large number of cross-sections compared to the time dimension. The LSDV estimator, nonetheless, offers a bias-corrected alternative (LSDVC) via the method proposed by Bruno (2005). The inclusion of a contemporaneous measure of the cycle in our baseline model poses a potential endogeneity problem. The issue cannot be dealt with directly by the LSDVC estimator. Therefore, we additionally report results for the two-stage least squares (2SLS) extension of the fixed-effects estimator. In contrast to the LSDVC estimator, the 2SLS estimator is not designed for dynamic panels. Nevertheless, the instrumenting it offers is valued, especially since the Nickell bias disappears for panels with a large time and cross section dimension like ours. Alternatively, the generalized method of moments instrumental variable estimators by Blundell and Bond (1998) is used to control for both issues at the same time. As for the 2SLS estimations, the instruments included in the GMM specifications are the lags of the lagged dependent variable and the cyclical variable of interest.

And indeed, why should policy makers who need to garner political support in government and parliament want to predicate their decisions on measures of the cycle that are notoriously unreliable? It would arguably make more sense for them to focus on indicators that are (i) observable; and (ii) of more direct relevance and concern to their constituency. We test two potential candidates of such politically more meaningful indicators of cyclical conditions: the change in the rate of unemployment and the change in the OECD leading economic indicator.

The motivation for the former should be fairly obvious: unemployment is a condition that directly and significantly affects people and arguably the way they vote in the ballot box: growing unemployment should increase dissatisfaction with the incumbent government while falling unemployment may increase the willingness to accept fiscal consolidation. The rationale for using a composite leading indicator is less evident from the political economy perspective. We mainly included it as a kind of robustness check assuming that policy makers could use a deterioration as an observable signal justifying expansionary measures while improvements could motivate discretionary consolidation.

As one may expect, the two alternative indicators are correlated with the latest available vintage of the estimated changes in the output gap; see Figure 3. There are, however, quite a few cases, that is country-years, where the change of the unemployment rate or of the leading economic indicator give a different signal about the cyclical conditions in terms of both size and sign.

**Figure 3:** Changes in the output gap vs. alternative cyclical indicators (yearly averages, EU only)




Source: European Commission, OECD.

Somewhat surprisingly, or maybe not, our estimation results do not support our priors. Growing unemployment is on average associated with fiscal tightening and vice versa ([3]); this finding is robust across alternative specifications and estimation techniques. While not statistically significant, deteriorations of the economic outlook as reflected by a drop in the OECD's Composite Leading Indicator are also found to go hand in hand with fiscal tightening ([4]).

Of note, the estimated coefficients for all three cyclical indicators are significantly larger in the subsample of EU Member States (Table 2) than in the full sample (Table 1). For example, while the cyclically-adjusted primary balance (as a percentage of GDP) worsened by one third of a percent as the output gap increased by one percent in the full sample, this impact increases to almost half of a percent in the EU subsample. The difference can be explained by two factors. First, it could be an indication of a higher degree of fiscal activism in the EU. Second, the difference is likely to reflect the, on average, larger size of government in the EU; in the face of economic shocks, lawmakers do not immediately adjust established levels of discretionary expenditure and finance the shortfall of revenues by raising debt (see Larch and Salto, 2005).

Overall, our results are consistent with the established finding that discretionary fiscal policy tends to be pro-cyclical. Of note, large systemic crises are the exception to the rule where the severity of the situation forces policy makers to intervene in one way or another; the European Economic Recovery Plan mentioned above is case in point. More importantly, our results are not consistent with the notion that pro-cyclicality is the unintended consequence of uncertainty with respect to cyclical conditions. Even if policy makers are assumed to target observable and politically more meaningful measures of the cycle or economic conditions, the results still corroborate the conclusion that discretionary fiscal policies do not mitigate temporary fluctuations of output; they actually magnify them.

Consequently, discretionary fiscal policy interventions seem to be driven by objectives other than stabilisation: ensuring sustainable public finances and political economy motives play a prominent role. In line with earlier studies, we find the debt-to-GDP ratio to have a positive impact on the evolution of the cyclically-adjusted primary balance, implying that, on average, countries improve their underlying fiscal balance as they get more indebted regardless of cyclical conditions. Among the controls we include in our regressions, the results for the debt ratio are by far the most robust and statistically most significant ([5]).

The role of debt as indicator of sustainability is reinforced by the dummies capturing EU financial assistance programmes. The respective coefficients turn out to be highly significant and are associated with an improvement of the fiscal position. Most EU assistance programmes were launched to address the unwinding of major macro-financial imbalances that lead to a dangerous increase of the government debt ratio typically during a sharp economic downturn.

Our controls capturing political economy factors also confirm prior expectations. The elections dummy, the number of changes in government in a given year and the age dependency ratio all come with a negative coefficient. This confirms the well-documented proclivity of lawmakers to buy the support of voters with spending increases and tax cuts or,

([3]) The coefficients on the change in the output gap and the change in the unemployment rate appear to be in line with common estimates for their relationship according to Okun's law.

([4]) Since the Composite Leading Indicator comprises a forward-looking concept, such as the expectations about the cycle, we opted to use its lag in order to maintain consistency with the other cyclical indicators tested.

([5]) Following Bohn (1998, 2005) a positive and significant debt coefficient is a sufficient condition to ensure that the government's inter-temporal budget constraint is satisfied.

in the case of the dependency ratio, to shy away from reforms that would upset important or growing constituencies.

We also tested a variety of other controls, but they were found to be either insignificant or too sparse in observations to draw conclusive results. Hence, they were left out from the baseline results reported below. For example, we tested for the impact of financial stress indicator as measured by the VIX and VXO volatility indices made available by the Chicago Board Options Exchange, for labour and product market reforms using dummies of the IMF database by Duval et al., 2018. Similarly, including the European Commission's fiscal rule index (available for EU Member States as of 1990) yielded an insignificant coefficient, confirming the more recent beliefs (see e.g. Heinemann et al., 2018) that the original estimates showing significance of this index are most likely biased due to – among other things – endogeneity.

Finally, we also ran regressions for different subsamples, namely 1980-1998, 1999-2004, 2005-2011, 2012-2017. The results are reported in Annex 2, for each of the three cyclical indicators. The estimation results suggest that the pro-cyclicality of discretionary fiscal policy has increased over time, with the exception of 1999-2004 when it was broadly a-cyclical.

**Table 1:** Baseline specifications (full sample, 1971-2017) – Pro-cyclicality found for all three measures of the cycle

| Dependent variable: Δ Cyclically-adjusted primary balance | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Estimator** | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Lagged dep. var.** | Δ Cyclically-adjusted primary balance (t-1) | -0.165*** | -0.0934 | -0.0867 | -0.165*** | 0.0430 | -0.0811* | -0.132*** | 0.157 | -0.0572 |
| | | (0.0299) | (0.106) | (0.0574) | (0.0292) | (0.0946) | (0.0452) | (0.0339) | (0.125) | (0.0540) |
| **Economic cycle indicator** | Δ Output gap (t) | -0.242*** | -0.506*** | -0.284 | | | | | | |
| | | (0.0341) | (0.133) | (0.177) | | | | | | |
| | Δ Unemployment rate (t) | | | | 0.161*** | 0.202* | -0.0678 | | | |
| | | | | | (0.0538) | (0.111) | (0.147) | | | |
| | Δ OECD Composite Leading Indicator (t-1) (yearly average) | | | | | | | -0.0924 | -0.229 | -0.413 |
| | | | | | | | | (0.0618) | (0.154) | (0.341) |
| **Std. control** | Public debt-to-GDP (t-1) | 0.0182*** | 0.0285*** | 0.00449*** | 0.0218*** | 0.0230*** | 0.00517*** | 0.0212*** | 0.0215*** | 0.00552*** |
| | | (0.00437) | (0.00582) | (0.00145) | (0.00423) | (0.00518) | (0.00172) | (0.00517) | (0.00571) | (0.00151) |
| **Political controls** | Election year dummy (t) | -0.446*** | -0.351** | -0.440*** | -0.333*** | -0.261* | -0.345** | -0.315** | -0.270* | -0.296* |
| | | (0.129) | (0.138) | (0.147) | (0.127) | (0.146) | (0.147) | (0.142) | (0.153) | (0.147) |
| | Number of changes in government (t-1) | -0.140 | -0.0976 | -0.133* | -0.112 | -0.0650 | -0.111 | -0.0389 | -0.0270 | -0.0489 |
| | | (0.0965) | (0.108) | (0.0765) | (0.101) | (0.114) | (0.0795) | (0.112) | (0.124) | (0.0897) |
| | Age dependency ratio (t-1) | -0.168** | -0.269*** | -0.0321** | -0.190*** | -0.192*** | -0.0289** | -0.196*** | -0.203** | -0.0249 |
| | | (0.0662) | (0.0816) | (0.0151) | (0.0639) | (0.0737) | (0.0136) | (0.0724) | (0.0804) | (0.0158) |
| **Crisis controls** | Systemic crisis dummy (t-1) | -0.985*** | -0.887** | -1.020** | -0.446 | -0.484 | -0.216 | -0.931** | -0.818* | -1.048* |
| | | (0.351) | (0.391) | (0.455) | (0.371) | (0.429) | (0.600) | (0.407) | (0.462) | (0.564) |
| | EU programme dummy (t-1) | 1.314*** | 0.712 | 1.186*** | 1.143*** | 0.404 | 1.130*** | 1.212** | -0.214 | 1.159* |
| | | (0.405) | (0.521) | (0.428) | (0.443) | (0.554) | (0.384) | (0.555) | (0.786) | (0.679) |
| | Time FE: Wald-test, p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | Goodness-of-fit | 0.178 | 0.146 | 0.207 | 0.119 | 0.086 | 0.139 | 0.129 | 0.088 | 0.141 |
| | Nº of observations | 982 | 885 | 982 | 1064 | 961 | 1064 | 875 | 794 | 875 |
| | Nº of countries | 33 | 33 | 33 | 35 | 35 | 35 | 27 | 27 | 27 |
| | Nº of instruments | | 68 | 64 | | 68 | 64 | | 65 | 63 |

*Notes*: Pro-cyclicality is indicated by a negative sign for the coefficient of the change in the output gap and Composite Leading Indicator (CLI). For the change in the unemployment rate, a positive sign indicates pro-cyclicality. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalised by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM is the generalised method of moments estimator developed by Blundell and Bond (1998). The instruments included are the lags of the dependent variable, the cyclical variable and the lagged current account. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 2:** Baseline specifications (EU, 1972-2017) – Pro-cyclicality found for all three measures of the cycle

| Dependent variable: Δ Cyclically-adjusted primary balance | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Estimator** | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Lagged dep. var.** | Δ Cyclically-adjusted primary balance (t-1) | -0.181*** | -0.222* | -0.127* | -0.173*** | 0.109 | -0.0749 | -0.160*** | 0.152 | -0.0968 |
| | | (0.0408) | (0.126) | (0.0727) | (0.0419) | (0.147) | (0.0628) | (0.0459) | (0.150) | (0.0603) |
| **Economic cycle indicator** | Δ Output gap (t) | -0.373*** | -0.698*** | -0.634*** | | | | | | |
| | | (0.0521) | (0.161) | (0.198) | | | | | | |
| | Δ Unemployment rate (t) | | | | 0.262*** | 0.177 | 0.00753 | | | |
| | | | | | (0.0744) | (0.148) | (0.188) | | | |
| | Δ OECD Composite Leading Indicator (t-1) (yearly average) | | | | | | | -0.230** | -0.401* | -0.726 |
| | | | | | | | | (0.104) | (0.237) | (0.509) |
| **Std. control** | Public debt-to-GDP (t-1) | 0.0242*** | 0.0315*** | 0.00606* | 0.0212*** | 0.0186** | 0.00506** | 0.0220*** | 0.0210** | 0.00611** |
| | | (0.00669) | (0.00763) | (0.00295) | (0.00697) | (0.00758) | (0.00233) | (0.00732) | (0.00813) | (0.00220) |
| **Political controls** | Election year dummy (t) | -0.291* | -0.234 | -0.249 | -0.333* | -0.314 | -0.351* | -0.250 | -0.193 | -0.246 |
| | | (0.175) | (0.187) | (0.226) | (0.182) | (0.196) | (0.194) | (0.201) | (0.222) | (0.220) |
| | Number of changes in government (t-1) | -0.0551 | -0.110 | -0.0756 | -0.0487 | -0.0560 | -0.0829 | -0.00187 | -0.0187 | 0.00444 |
| | | (0.124) | (0.139) | (0.109) | (0.128) | (0.147) | (0.102) | (0.153) | (0.173) | (0.110) |
| | Age dependency ratio (t-1) | -0.139 | -0.236** | -0.0245 | -0.0726 | -0.0851 | -0.00687 | -0.127 | -0.164 | 0.00379 |
| | | (0.111) | (0.118) | (0.0289) | (0.115) | (0.118) | (0.0255) | (0.121) | (0.136) | (0.0266) |
| **Crisis controls** | Systemic crisis dummy (t-1) | -0.423 | -0.00437 | -0.284 | -0.833 | -0.728 | -0.752 | -1.060 | -0.940 | -1.442 |
| | | (0.574) | (0.617) | (0.744) | (0.592) | (0.623) | (0.835) | (0.746) | (0.787) | (1.257) |
| | EU programme dummy (t-1) | 1.163** | 0.990 | 1.087* | 1.256** | 0.245 | 1.171** | 1.270* | -0.260 | 1.333 |
| | | (0.486) | (0.627) | (0.601) | (0.504) | (0.710) | (0.477) | (0.668) | (0.946) | (0.815) |
| | Time FE: Wald-test, p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 |
| | Goodness-of-fit | 0.213 | 0.194 | 0.240 | 0.174 | 0.129 | 0.194 | 0.183 | 0.122 | 0.177 |
| | Nº of observations | 635 | 608 | 635 | 635 | 608 | 635 | 545 | 515 | 545 |
| | Nº of countries | 27 | 27 | 27 | 27 | 27 | 27 | 20 | 20 | 20 |
| | Nº of instruments | | 65 | 63 | | 65 | 63 | | 65 | 63 |

*Notes*: Pro-cyclicality is indicated by a negative sign for the coefficient of the change in the output gap and CLI. For the change in the unemployment rate, a positive sign indicates pro-cyclicality. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalised by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM is the generalised method of moments estimator developed by Blundell and Bond (1998). The instruments included are the lags of the dependent variable, the cyclical variable and the lagged current account. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

# 5 What are the determinants of pro-cyclical fiscal policy?

## 5.1 Adding interaction terms to the conventional fiscal reaction function

Equation (1) assumes a linear relationship between the cycle and discretionary fiscal policy. One way to examine possible drivers of pro-cyclical fiscal policy is to assume that the degree with which policy makers react to the cycle is not linear but depends on other factors. To that end we add interaction terms to equation (1):

Equation (2)

$$\Delta capb_{i,t} = \beta_1 \Delta cabp_{i,t-1} + \beta_2 cycle_{i,t} + \beta_3 F_{i,t} + \underbrace{\beta_4 (cycle_{i,t} F_{i,t})}_{\text{interaction term}} + \beta_5 X_{i,t-1} + \theta_t + \delta_i + u_{i,t}$$

The extended specification includes the factor $F_{i,t}$ which is taken to interact with the cyclical indicator $cycle_{i,t}$. A positive (negative) coefficient $\beta_4$ means that factor $F_{i,t}$ amplifies (dampens) the effect of the cycle on discretionary fiscal policy. If the interacting factor $F_{i,t}$ is a simple dummy, the interaction term takes the form a slope dummy, i.e. the coefficient of the cyclical indicator increases or decreases by $\beta_4$ when the dummy is equal to 1 and remains unchanged at $\beta_2$ when the dummy takes the value 0.

Starting from the baseline specification reported in Tables 1 and 2, we estimate the aforementioned interaction model adding one factor of interest at a time. For completeness, we do so for all three cyclical indicators, although in our view the change of the unemployment rate is the more relevant one. Table 3 summarises the key findings in qualitative terms for the full sample of countries with a focus on $\beta_4$, the estimated coefficient of the interaction term. The detailed estimation results are reported in Annex 4.

Some of the tested factors do influence the stabilisation property of fiscal policy. For example, we find some evidence that discretionary fiscal policy becomes more pro-cyclical when cyclical conditions improve. This result confirms earlier findings according to which policy makers are less inclined to withdraw fiscal support to aggregate demand when times get better. The obvious consequence of such a pattern is that government debt tends to increase over time as governments fail to build up the buffers necessary to stabilise output during downturns.

Linked to the previous point, there is also some evidence that high debt ratios impair the stabilisation function of discretionary fiscal policy. We tested a number of dummies for different debt levels and found that the degree of pro-cyclicality increases in countries where debt exceeds 90% of GDP. The estimated coefficients are statistically significant when using the change in the unemployment rate as cyclical indicator. The implied behaviour of government is more realistic than the one of the linear form in Section 3. As long as government debt remains below a certain threshold, it has little baring on discretionary fiscal policy decisions; policy makers can focus on their political priorities with little restriction. By contrast, for higher debt levels, sustainability concerns kick in at some point and start weighing on budgetary policies. While the exact threshold is likely to vary from country to country including in function of the economic governance framework, it is safe to assume that the scrutiny of markets will increase for high or very high government debt levels and force policy makers to consider policies to contain new debt or reduce the prevailing debt-to-GDP ratio. Stabilisation of output and other objectives will then take a back seat.

We also tested the impact of fiscal rules using a proxy variable of the IMF that captures the presence of a medium-term objective for the government budget, in particular medium-term spending ceilings. The result is encouraging and in line with expectations: if discretionary fiscal policy is guided by rules that aim to achieve a given expenditure path over the cycle, it will on average support a more counter-cyclical stance.

**Table 3:** Drivers of pro-cyclicality by cyclical indicator and estimation method (full sample)

Blue (red): the marginal effect of the interacting factors supports counter- (pro-) cyclical fiscal policy.

| | Cyclical indicator | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Δ Output gap (t) | | | Δ Unemployment rate (t) | | | Δ CLI (t-1) | | |
| | *Interaction* / ***Estimator*** | *LSDVC* | *2SLS* | *GMM* | *LSDVC* | *2SLS* | *GMM* | *LSDVC* | *2SLS* | *GMM* |
| Dummies | Sign of the output gap | | * | | | | | | | |
| | Sign of the change in the output gap | | *** | | ** | | * | | | |
| | High debt (90%) | | | | * | * | | | | |
| | Systemic crisis | *** | *** | | ** | ** | | | | |
| Index | Labour market reform | | ** | | ** | | ** | | ** | |
| | Product market reform | | | | ** | * | ** | | ** | |
| Rule | Medium-term spending rule dummy | | | | * | | | | | |

*Notes:* (1) LSDVC: bias-corrected least-squares dummy variable estimator. 2SLS: two-stage least squares fixed-effects. GMM: generalised method of moments. (2) ***: significant at the 1% level. **: significant at the 5% level. *: significant at the 10% level.

To examine a number of EU specific factors, we estimate the fiscal reaction function with interaction terms for EU countries only. In particular, we investigate the possible role played by the EU fiscal framework and its evolution over time. To that end, we resort to the following set of indicators:

- The fiscal rules index of the European Commission, capturing different dimensions such as the statutory base of the rule, the body in charge of monitoring compliance with the rule, the body in charge of enforcement of the rule, and the enforcement mechanisms relating to the rule;
- A set of dummy variables characterising different stages of the EU fiscal framework: the implementation of the Stability and Growth Pact from 1999 onwards, the first major reform of the Pact in 2005, the six-pack reform in 2012, as well as a dummy for the country-specific periods in the run-up to EU Membership;
- Measures of economic compliance constructed by the European Fiscal Board (2019). The variables encompass the four main rules of the Stability and Growth Pact, i.e. the deficit, debt, structural balance and spending targets. A negative value indicates the degree of non-compliance in percent of GDP.

Like for the full sample, we start from the baseline specification (see Table 3) and add interaction terms for each of the factors of interest at a time. Table 4 summarises the results. The estimated $\beta_4$ coefficients indicate that both the SGP and its 2005 reform led to stronger than average pro-cyclicality. The results for the inception of the SGP are statistically significant for all of the cyclical measures considered and for two of the three for the 2005 reform. The findings for the six-pack dummy point into a different direction, but are generally statistically insignificant, possibly due to the relatively limited number of observations given the short time period under consideration.

**Table 4:** Drivers of pro-cyclicality by cyclical indicator and estimation method (EU only)

Blue (red): the marginal effect of the interacting factors supports counter- (pro-) cyclical fiscal policy.

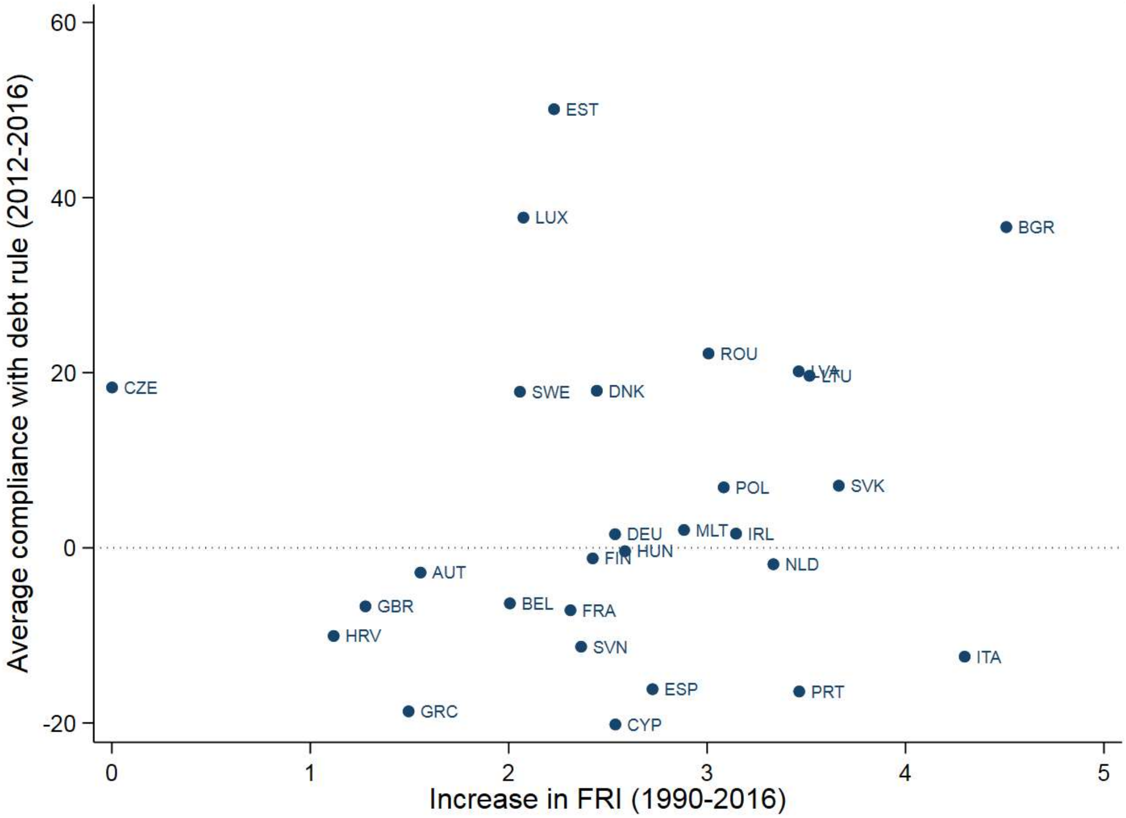
| | | Cyclical indicator | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Δ Output gap (t) | | | Δ Unemployment rate (t) | | | Δ CLI (t-1) | | |
| | ***Interaction*** / ***Estimator*** | *LSDVC* | *2SLS* | *GMM* | *LSDVC* | *2SLS* | *GMM* | *LSDVC* | *2SLS* | *GMM* |
| Dummies | Sign of the output gap | | * | | | | | | | |
| | Sign of the change in the output gap | | *** | | | | | | | |
| | High debt (90%) | | | | ** | ** | | | | |
| | Systemic crisis | *** | *** | | ** | * | | | | |
| Index | Labour market reform | | ** | | | | | | ** | |
| | Product market reform | | | | | | | * | ** | |
| Institution dummies | SGP | | ** | | | ** | | | * | |
| | SGP 2005 reform | | ** | | | * | | | | |
| | Six Pack | | * | | | | | | | |
| Fiscal rules | Fiscal rule index | | | | | | | *** | *** | * |
| | Medium-term spending rule dummy | | | | | | | | | |
| Compliance (deviation if <0) | Deficit rule | | | | | | | *** | *** | |
| | Debt rule | ** | | | | | | *** | *** | |
| | Structural balance target | | | | | | * | ** | ** | |
| | Spending benchmark | | | | | | | | | |

*Notes:* (1) LSDVC: bias-corrected least-squares dummy variable estimator. 2SLS: two-stage least squares fixed-effects. GMM: generalised method of moments. (2) ***: significant at the 1% level. **: significant at the 5% level. *: significant at the 10% level.

Evidently, time dummies are a fairly unsophisticated way to capture the impact of a complex fiscal framework such as the Stability and Growth Pact, and in particular its impact on the stabilisation properties of discretionary fiscal policies. Many different aspects are at play, such as the design and coverage of the rules, their enforcement, and the type of national arrangements that have been put in place to complement the commonly agreed EU fiscal rules with the objective to increase ownership.

It turns out that controlling for the quality of the fiscal rules does not improve results with respect to stabilisation. Interacting the cycle with the quality index in the fiscal reaction function actually suggests that EU countries with higher quality rules in place typically portray more than average pro-cyclicality. Hence, improvements in the design of rules or frameworks may not support key objectives of discretionary fiscal policy, such as stabilisation, if they are not followed. Compliance plays a crucial role. Figure 4 provides a graphic illustration: the increase in the strength of fiscal rules (as measured by the fiscal rules index of the European Commission) is not correlated with better compliance.

**Figure 4:** Total increase in fiscal rule strength (FRI) vs. average compliance with debt rule since Six Pack

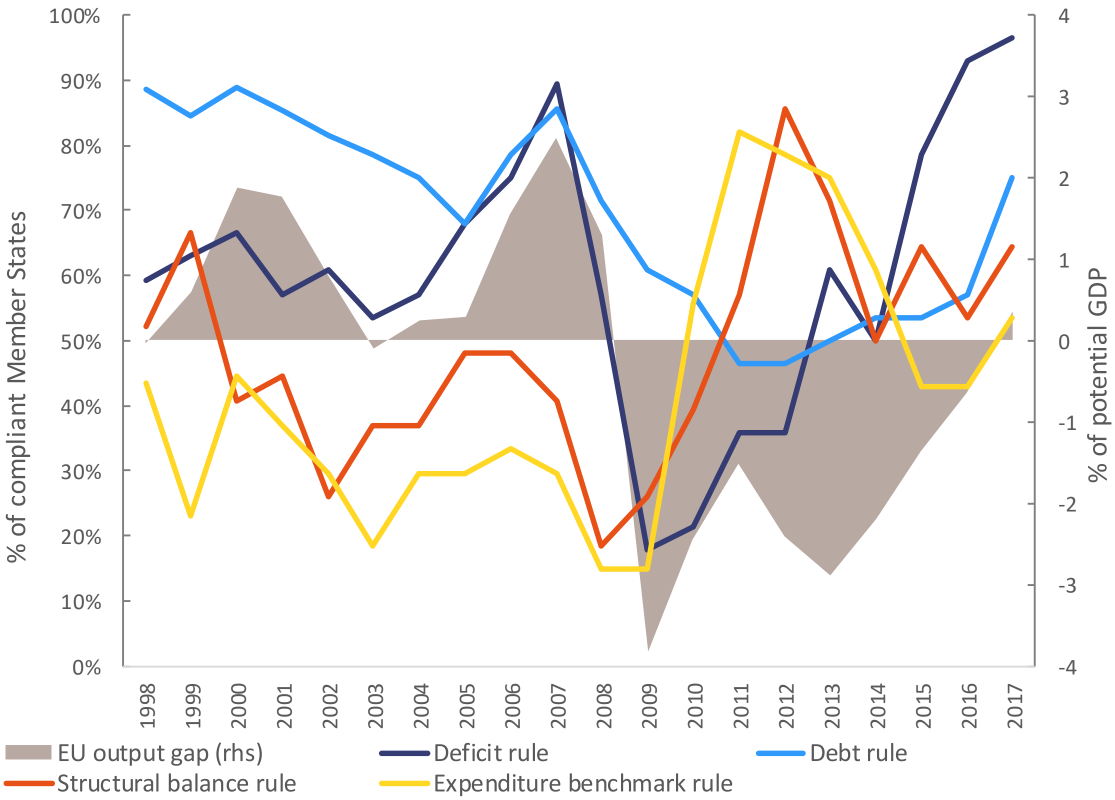



Source: European Fiscal Board, European Commission

To test our prior, we make use of the series of economic compliance mentioned above. Although some of the rules, such as the debt reduction and the expenditure benchmark, were introduced only in 2011, our series indicates whether fiscal policy would have been compliant or not and to what degree. Although hypothetical from an institutional perspective, such information is still useful for our purposes as it allows us to investigate the possible nexus between a given fiscal performance and the stabilisation properties of discretionary fiscal policy. Figure 4 offers a first interesting insight: it shows that improvements in the quality of fiscal rules do not go along with improvements in compliance.

Moreover, our estimation results provide some evidence that compliance with the various rules of the Stability and Growth Pact tends to moderate the tendency to run pro-cyclical fiscal policies in the EU. Most of the estimated coefficients of the interaction terms have the right sign although few are statistically significant. The notion that compliance fosters stabilisation should not come as a complete surprise: in the long run, only governments that build buffers in good times have the fiscal space to run fiscal expansions during downturns. Figure 5 provides a first visual illustration of the point. In the years preceding the Great Recession, few EU Member States ran fiscal policies consistent with the expenditure benchmark, or the required structural budget balance, while favourable economic conditions made compliance with the deficit and debt rule fairly easy. As a result, a sharp pro-cyclical correction became necessary after 2007, as shown by the significant increase in compliance with the expenditure and structural balance rule.

**Figure 5:** Compliance with EU fiscal rules and output gap developments




Source: European Fiscal Board, European Commission

## 5.2 Logit models

In light of the results derived from the extended fiscal reaction function we looked at an alternative and more direct way to assess the drivers of pro-cyclical fiscal policy, notably logit models. As dependent variable we use a binary indicator equal to one for pro-cyclical country-year episodes and zero otherwise. A pro-cyclical country-year episode is defined as an observation where either the cyclically adjusted primary balance increased by more than 0.25% of GDP when the change of the output gap was negative or where the cyclically adjusted primary balance decreased by more than 0.25% of GDP when the change of the output gap was positive. [7]

The results are reported in Table 5 ([8]). Due to the non-linearity of the logit model, the estimated coefficients do not represent the marginal effect on the probability to run pro-cyclical fiscal policy ([9]). Nevertheless, the sign of the estimated coefficients has a straightforward meaning: positive (negative) coefficients indicate a higher (lower) likelihood of pro-cyclical fiscal policy.

(7) We tested variations of this definition for instance by including cases within the band of +/- 0.25% of GDP as pro-cyclical event. The estimation results turn out to be largely robust especially as regards the role played by (non)-compliance with the EU fiscal rules.

(8) The country-specific panel effects seem of insignificant importance in the binary classification models. The Hausman test does not reject the null hypothesis that the unobserved individual level effects are uncorrelated with the other covariates. Hence, random effects are favoured over fixed effects. Moreover, random effects estimation results show that the panel-level variance component is unimportant, supporting the use of the equal-correlation models (using a generalized estimating equation estimator), as reported below.

(9) To facilitate interpretation and comparison, the estimated coefficients can be exponentiated, i.e. looking at $e^{\beta}$ instead of β. The exponentiated coefficients can be interpreted as follows: for a one unit increase in explanatory variable, the odds of pro-cyclical fiscal policy (versus counter-cyclical policy) increase by a factor of β.

Interestingly, and in line with the results of the reaction function discussed above, the effect of the government debt ratio it not linear. The likelihood of a pro-cyclical fiscal stance increases exponentially with the debt to GDP ratio. The effect is significant for the EU sample. We interpret this as a sign that high debt levels limit the leeway for counter-cyclical fiscal interventions.

The stage of economic development and the volatility of growth also seem to play a significant role. Countries with a higher level of per capita GDP or a higher variance of nominal GDP growth are more likely to run pro-cyclical fiscal policies. This finding is not surprising. A higher volatility of economic activity, which is often associated with catching up countries, makes budgetary planning and implementation more difficult.

Not surprising is also the finding that higher average nominal growth tends to raise the probability of pro-cyclical fiscal policy making. It is a reflection of the (in)famous statement of the former Irish finance minister Charles McCreevy made sometime in the early 2000s: “When I have it, I spend it”. Higher government revenues from higher economic growth typically give rise to the temptation to implement measures that benefit specific constituencies or improve a government’s approval among voters more generally. The effect of interest rates seems to go into a similar direction: lower (higher) rates improve (deteriorate) a country’s fiscal space, which tends to be used in a way that does not take into account cyclical conditions. Recent experience in the euro area would be a case in point. In several countries the budgetary benefits of lower interest spending have been used to finance higher spending in a phase of economic recovery.

We also tested the importance of institutional determinants for the likelihood of pro-cyclical fiscal policy. The results are reported in specification (3) of Table 5, which includes dummies capturing different stages of the EU fiscal framework. None of the estimated coefficients turn out to be significant and only some of the algebraic signs support an intuitive interpretation. The positive coefficient of the run-up-to-EU/euro dummy is in line with expectations. Several countries implemented a series of adjustments to qualify for the EU/euro membership regardless of cyclical conditions. The SGP dummy has a negative sign suggesting that on average the commonly agreed fiscal rules may have dampened the tendency to run pro-cyclical policies. In contrast, the dummies capturing the 2005 and 2011 reforms of the SGP point into the opposite direction, although the respective reforms introduced elements that were specifically meant to curb pro-cyclical behaviour. This result echoes the pattern mentioned in relation to Figure 5: During the boom preceding the post-2007 crisis, many Member States did not follow policies supportive of a counter-cyclical stance and, as a result, accumulated very large levels of debt during the crisis. This left them with little to no space for discretionary fiscal stabilisation even if the reformed rules would have allowed for it.

The role of compliance with the EU fiscal rules is examined in Table 6 and Table 7. We first transform the numerical compliance variables into dummies where 1 stands for a positive value (compliance) and 0 for a negative value (non-compliance) and add them to the standard controls of the logit model (Table 6). We find clear evidence that compliance reduces the likelihood of running pro-cyclical policies in the EU including when the debt benchmark is not respected. Particularly encouraging are the statistically significant results for the expenditure and the structural balance rules, as both rules are specifically designed to help governments keep public finances on a stable and sustainable path across the cycle. They define a course of action that allows law markers to take advantage of good economic times, and to use buffers when aggregate demand goes south. The results are also reassuring because they are derived from measures of economic compliance that capture actual behaviour, including in times when the SGP did not yet foresee the respective rules, i.e. before the structural budget balance rule was introduced in 2005 and the expenditure benchmark in 2011. Hence, responsible fiscal behaviour is not only a matter of finding the optimal design of rules. The interplay between ownership, discipline and enforcement which determine compliance, also play an important role.

**Table 5:** Determinants of the likelihood of pro-cyclical fiscal policy - Logit estimates (baseline)

| | | **Full** | **EU only** | **Full** |
|---|---|---|---|---|
| | | (1) | (2) | (3) |
| Standard controls | Output gap (t) | 0.0818* | 0.0180 | 0.0864* |
| | | (0.0488) | (0.0578) | (0.0480) |
| | Public debt-to-GDP squared (t) | 0.0000124 | 0.0000760*** | 0.0000157 |
| | | (0.0000164) | (0.0000243) | (0.0000171) |
| | 5y average real GDP per capita (t) | 0.0000430 | 0.00108** | 0.0000389 |
| | | (0.000248) | (0.000533) | (0.000261) |
| | 5y average nominal GDP growth (t) | 0.0341 | 0.163*** | 0.0385 |
| | | (0.0332) | (0.0437) | (0.0347) |
| | 5y variance of real GDP (t) | 0.0132** | 0.0134** | 0.0124** |
| | | (0.00526) | (0.00593) | (0.00521) |
| | Interest rate (t-1) | -0.0715 | -0.200*** | -0.0715 |
| | | (0.0447) | (0.0520) | (0.0475) |
| | Systemic crisis dummy (t) | 0.948** | 1.530* | 0.984** |
| | | (0.467) | (0.784) | (0.486) |
| | EU programme dummy (t) | 0.646 | 0.474 | 0.597 |
| | | (0.549) | (0.652) | (0.548) |
| | Election dummy (t) | 0.264* | 0.434** | 0.263* |
| | | (0.153) | (0.199) | (0.152) |
| | Large country dummy (t) | | 0.370 | |
| | | | (0.243) | |
| Institutional dummies | Run up to euro dummy (t) | | | 0.177 |
| | | | | (0.450) |
| | SGP dummy (t) | | | -0.0895 |
| | | | | (0.367) |
| | SGP 2005 reform dummy (t) | | | 0.105 |
| | | | | (0.681) |
| | 6P onwards dummy (t) | | | 0.548 |
| | | | | (0.597) |
| | Time FE: Wald-test, p-value | 0.000 | 0.000 | 0.000 |
| | Goodness-of-fit | 0.104 | 0.150 | 0.108 |
| | N° of observations | 824 | 575 | 824 |
| | N° of countries | 33 | 27 | 33 |

*Notes*: The dependent variable is the binary indicator equal to one for pro-cyclical country-year observations. Positive (negative) coefficients indicate a higher (lower) likelihood of pro-cyclical fiscal policy. Logit is the equal-correlation logistic model estimated using a generalised estimating equation estimator. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. The squared correlation coefficient between the actual and predicted values of the dependent variables is reported as a measure of the goodness-of-fit.

**Table 6:** Determinants of the likelihood of pro-cyclical fiscal policy - Logit estimates (non-compliance I)

| | | EU only | EU only | EU only | EU only |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| Standard controls | Output gap (t) | -0.0373 | -0.0486 | -0.0466 | -0.0371 |
| | | (0.0583) | (0.0659) | (0.0623) | (0.0704) |
| | Public debt-to-GDP squared (t) | 0.000103*** | 0.000104*** | 0.000106*** | |
| | | (0.0000294) | (0.0000290) | (0.0000285) | |
| | 5y average real GDP per capita (t) | 0.00120** | 0.00130** | 0.00129** | 0.00102** |
| | | (0.000535) | (0.000525) | (0.000526) | (0.000518) |
| | 5y average nominal GDP growth (t) | 0.182*** | 0.167*** | 0.172*** | 0.134*** |
| | | (0.0449) | (0.0478) | (0.0448) | (0.0460) |
| | 5y variance of real GDP (t) | 0.0158** | 0.0160** | 0.0168** | 0.0120* |
| | | (0.00685) | (0.00691) | (0.00685) | (0.00657) |
| | Interest rate (t-1) | -0.342*** | -0.343*** | -0.340*** | -0.237** |
| | | (0.0954) | (0.112) | (0.106) | (0.102) |
| | Systemic crisis dummy (t) | 1.417* | 1.369* | 1.339* | 1.177 |
| | | (0.816) | (0.817) | (0.806) | (0.788) |
| | EU programme dummy (t) | 0.515 | 0.730 | 0.702 | 0.832 |
| | | (0.732) | (0.803) | (0.817) | (0.829) |
| | Election dummy (t) | 0.320 | 0.319 | 0.301 | 0.338 |
| | | (0.208) | (0.223) | (0.212) | (0.213) |
| | Large country dummy (t) | 0.308 | 0.246 | 0.243 | 0.292 |
| | | (0.228) | (0.266) | (0.268) | (0.270) |
| Fiscal rule non-compliance dummies | Deficit compliance dummy (t) | -0.293 | | | |
| | | (0.279) | | | |
| | Spending compliance dummy (t) | | -0.639** | | |
| | | | (0.288) | | |
| | Struct. bal. compliance dummy (t) | | | -0.766** | |
| | | | | (0.303) | |
| | Debt compliance dummy (t) | | | | -0.657** |
| | | | | | (0.307) |
| | Time FE: Wald-test, p-value | 0.000 | 0.000 | 0.000 | 0.000 |
| | Goodness-of-fit | 0.174 | 0.187 | 0.198 | 0.162 |
| | Nº of observations | 449 | 419 | 419 | 419 |
| | Nº of countries | 27 | 27 | 27 | 27 |

*Notes*: The dependent variable is the binary indicator equal to one for pro-cyclical country-year observations. Positive (negative) coefficients indicate a higher (lower) likelihood of pro-cyclical fiscal policy. Logit is the equal-correlation logistic model estimated using a generalised estimating equation estimator. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. The squared correlation coefficient between the actual and predicted values of the dependent variables is reported as a measure of the goodness-of-fit.

**Table 7:** Determinants of the likelihood of pro-cyclical fiscal policy - Logit estimates (non-compliance II)

| | | EU only | EU only | EU only | EU only |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| Standard controls | Output gap (t) | -0.0389 | -0.0700 | -0.0625 | -0.0475 |
| | | (0.0578) | (0.0688) | (0.0707) | (0.0660) |
| | Public debt-to-GDP squared (t) | 0.0000946*** | 0.000131*** | 0.000120*** | |
| | | (0.0000314) | (0.0000351) | (0.0000316) | |
| | 5y average real GDP per capita (t) | 0.00114** | 0.00110** | 0.00115** | 0.00107** |
| | | (0.000539) | (0.000523) | (0.000534) | (0.000534) |
| | 5y average nominal GDP growth (t) | 0.172*** | 0.183*** | 0.179*** | 0.154*** |
| | | (0.0393) | (0.0483) | (0.0502) | (0.0469) |
| | 5y variance of real GDP (t) | 0.0142** | 0.0148** | 0.0139* | 0.0138** |
| | | (0.00662) | (0.00688) | (0.00733) | (0.00588) |
| | Interest rate (t-1) | -0.352*** | -0.313*** | -0.317*** | -0.266** |
| | | (0.0962) | (0.105) | (0.104) | (0.104) |
| | Systemic crisis dummy (t) | 1.392* | 1.260* | 1.476* | 1.351* |
| | | (0.805) | (0.752) | (0.797) | (0.792) |
| | EU programme dummy (t) | 0.493 | 0.688 | 0.531 | 0.462 |
| | | (0.706) | (0.836) | (0.808) | (0.835) |
| | Election dummy (t) | 0.299 | 0.327 | 0.339 | 0.333 |
| | | (0.205) | (0.218) | (0.222) | (0.212) |
| Fiscal rule non-compliance | Deficit compliance (t) | -0.0756* | | | |
| | | (0.0386) | | | |
| | Deficit compliance squared (t) | -0.00170 | | | |
| | | (0.00201) | | | |
| | Spending compliance (t) | | -0.0285 | | |
| | | | (0.104) | | |
| | Spending compliance squared (t) | | -0.0480** | | |
| | | | (0.0225) | | |
| | Structural balance compliance (t) | | | -0.0478 | |
| | | | | (0.0995) | |
| | Structural balance compl. squared (t) | | | -0.0387 | |
| | | | | (0.0247) | |
| | Debt compliance (t) | | | | -0.0288** |
| | | | | | (0.0147) |
| | Debt compliance squared (t) | | | | 0.000418* |
| | | | | | (0.000237) |
| | Time FE: Wald-test, p-value | 0.000 | 0.000 | 0.000 | 0.000 |
| | Goodness-of-fit | 0.175 | 0.180 | 0.180 | 0.164 |
| | Nº of observations | 449 | 419 | 419 | 419 |
| | Nº of countries | 27 | 27 | 27 | 27 |

*Notes*: The dependent variable is the binary indicator equal to one for pro-cyclical country-year observations. Positive (negative) coefficients indicate a higher (lower) likelihood of pro-cyclical fiscal policy. Logit is the equal-correlation logistic model estimated using a generalised estimating equation estimator. Standard errors are noted in parentheses: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The squared correlation coefficient between the actual and predicted values of the dependent variables is reported as a measure of the goodness-of-fit.

The role of compliance is confirmed in Table 7 where, instead of dummies, we use the numerical values of the four main rules of the SGP. As a reminder, a negative (positive) value of the compliance variable signals a shortfall from (overachievement compared to) the requirements of the rule. The estimated coefficients indicate that compliance dampens the incidence of pro-cyclical policies. In our specification we also included a quadratic term with the expectation that the impact of non-compliance may not be linear. After all, a small shortfall may still be compatible with counter-cyclical policies while a larger one may imply stricter limits on fiscal stabilisation especially in the presence of high government debt. The estimation results provide support for this view, especially as regards the debt rule. Over the observed range of (non)compliance with the debt rule, the estimated quadratic form amounts to an impact on the probability to run a pro-cyclical policy that is fairly flat for compliant countries, but rises quickly for countries that deviate significantly from the debt benchmark.

## 6 Conclusions

We have analysed the stabilisation properties of fiscal policy and their main drivers. Our empirical analysis uses panel data covering 47 EU and non-EU countries up to 2017, with observations starting at the earliest in the 1960s, and in the 1980s-1990s for most countries.

In line with existing studies, we find that discretionary fiscal policies tend to be pro-cyclical, but we add several findings to the literature. First, while real-time output gap estimates are notoriously subject to revisions, the uncertainty around them cannot serve as a credible explanation for pro-cyclicality. We show that alternative cyclical indicators that are observable in real time and politically more meaningful also point to ill-timed discretionary fiscal stabilisation. This suggests that pro-cyclicality is first and foremost a matter of political economy.

Second, we stress the crucial role of sustainability concerns, which, if they become important, trump the stabilisation objective. By complementing a standard fiscal reaction function with non-linear elements and running logit regressions, we show that the trade-off between stabilisation and sustainability is not dealt with in the same manner for all levels of debt. When debt exceeds a certain threshold, sustainability takes over all other policy objectives and it becomes impossible for fiscal policy to lean against the wind in downturns. Pro-cyclicality in bad times is the flipside of pro-cyclicality in good times and the failure to build fiscal buffers. The years preceding and following the post-2007 crisis are a clear case.

Third, we show that the design of fiscal rules matters, but not as much as compliance with them. Fiscal rules based on nominal aggregates such as the headline budget balance and the debt-to-GDP ratio have the deserved reputation of not taking into account the automatic impact of the economic cycle. The run-up to the post-2007 crisis was a case in point, when several countries respecting the nominal deficit and the debt rule found themselves in dire straits with no leeway to lean against the wind. While enhancing the EU fiscal framework with a structural balance rule and an expenditure rule has certainly been an improvement in terms of quality of the rules, compliance has not improved. No matter how refined rules can be, they are of no help for counter-cyclicality if they are not binding: fiscal policy is only able to stabilise the economy if sustainability is preserved in the long run.

In practice, the sustainability of public finances is not a well-defined and unique condition applying across countries. It also depends on the economic governance framework – for instance, whether the central bank is independent, how credibly governments can be forced to correct slippery fiscal trends, and what budgetary instruments are available to stabilise the economy in addition to national budgets. In the euro area, governance is characterised by a number of idiosyncrasies. First, monetary policy is centralised and has a clear and unequivocal mandate to keep inflation below but close to 2% over the medium term. Second, fiscal policy is decentralised, albeit subject to commonly agreed rules whose implementation is ultimately decided by the EU Member States themselves. And third, there is no central fiscal capacity, which implies that national budgets are directly exposed in case of major shocks. Compared to a fully-fledged monetary union, such an arrangement can arguably impose stricter sustainability conditions and, in turn, a tighter trade-off with fiscal stabilisation. However, even if it existed, a central fiscal capacity would not address the political economy motives driving pro-cyclical fiscal policies; it would only relax, although not completely eliminate, sustainability constraints at the level of individual Member States.

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**Annexes**

**Annex 1. Descriptives**

| Variable | Description | Source |
|---|---|---|
| EU Financial Assistance Programme dummy | 1 for HUN from 2008 to 2010<br>LVA from 2008 to 2012<br>ROU from 2009 to 2011 (0.5 for 2012-2015)<br>GRC from 2010 to 2018<br>IRL from 2011 to 2013<br>PRT from 2011 to 2014<br>ESP from 2012 to 2014<br>CYP from 2013 to 2016 | Self-constructed |
| Run-up to EU/€ dummy | 1 for AUT, BEL, FIN, FRA, DEU, IRL, ITA, LUX, NLD, ESP and PRT from 1993 to 1998<br>GRC from 1998 to 2000<br>SVN from 2004 to 2006<br>CYP and MLT from 2005 to 2007<br>SVK from 2006 to 2008<br>EST from 2008 to 2011<br>LVA from 2011 to 2013<br>LTU from 2012 to 2014 | |
| SGP dummy | 1 for EU Members as of 1999 | |
| SGP 2005 revision dummy | 1 for EU Members as of 2005 | |
| Six Pack reform dummy | 1 for EU Members as of 2012 | |
| Sovereign debt crisis dummy | 1 for POL (1981), ROU (1982), BGR (1990), GRC (2012), CYP (2013), TUR (1978), MEX (1982), CHL (1983) | Laeven & Valencia |
| Systemic banking crisis dummy | 1 for AUT (2008), BEL (2008), BGR (1996, 2008), CHE (2008), CHL (1976, 1981), CYP (2011), CZE (1996), DEU (2008), DNK (2008), ESP (1977, 2008), EST (1992), FIN (1991), FRA (2008), GBR (2007), HRV (1998), HUN (1991, 2008), IRL (2008), ISL (2008), ISR (1983), ITA (2008), JPN (1997), KOR (1997), LTU (1995), LUX (2008), LVA (1995, 2008), MEX (1981, 1994), NLD (2008), NOR (1991), POL (1992), PRT (2008), ROU (1998), SVK (1998), SVN (1992, 2008), SWE (1991, 2008), TUR (1982, 2000), USA (1988, 2007) | |

| | | |
|---|---|---|
| Currency crisis dummy | 1 for BGR (1996), CHL (1972, 1982), ESP (1983), EST (1992), FIN (1993), GRC (1983), ISL (1975, 1989, 2008), ISR (1975, 1980, 1985), ITA (1981), KOR (1998), LTU (1992), LVA (1992), MEX (1977, 1982, 1995), NZL (1984), PRT (1983), ROU (1996), SWE (1993), TUR (1978, 1984, 1991, 1996, 2001) | |
| Systemic crisis dummy | 1 if sovereign debt crisis dummy, systemic banking crisis dummy or currency crisis dummy equal to one | Combination of the three previous crisis dummies |
| Labour market reform dummies | for each country, the reform variable in each area takes value 0 in non-reform years, 1 in liberalizing reform years, and -1 in tightening reform years | Duval et al. |
| Product market reform dummies | | |

**Table 8:** Definition of variables measuring compliance and deviation from the four fiscal rules

| | Description of the rule | Numerical values (<0 if non-compliant) | Dummy (0 = compliant, 1 = non-compliant) | Notes on assumptions and recalculations |
|---|---|---|---|---|
| **Deficit rule** | The general government budget deficit may not exceed the Treaty reference value of 3% of GDP. | Difference between the headline budget balance and -3% of GDP. | Dummy = 1 if the headline budget balance is lower than -3% of GDP for at least two consecutive years,<br>0 otherwise. | A country remains compliant if the excess is temporary, i.e. if the deficit exceeds 3% of GDP for only one year. Although the SGP adds that the condition that the deficit must remain close to 3% of GDP, our simulated rule treats all temporary excesses equally, as there is no official quantification of "close to 3%" and the observed cases of one-year excesses well above 3% of GDP are rare. |
| **Debt rule** | The general government gross debt may not exceed the Treaty reference value of 60% of GDP unless it is being reduced at a sufficient pace, namely by 1/20 of the distance to 60% per year on average over the past 3 years. | If debt < 60% of GDP, difference between 60% and actual debt;<br>if debt > 60%, difference between the debt level corresponding to a reduction at a sufficient pace over the past 3 years (backward-looking debt benchmark) and actual debt. | Dummy = 1 if debt is higher than both 60% and the backward-looking debt benchmark,<br>0 otherwise. | For simplicity, the simulated rule focuses on the backward-looking debt benchmark and disregards the forward-looking criterion and the cyclically-adjusted criterion of the existing EU fiscal framework. |
| **Structural balance rule** | Until the MTO is achieved, the structural balance must improve by 0.5% of GDP per year or by the remaining distance to the MTO if smaller than 0.5%. If the country is above its MTO, the structural balance may not deviate below the MTO. | Difference between the change in the structural balance and the required structural effort. | Dummy = 1 if not at MTO and the structural fiscal effort is lower than required,<br>0 otherwise. | Until 2003, we use the change in the cyclically-adjusted primary balance. It is corrected for the proceeds from the sale of mobile phone licences in 2000-2001 but not for other possible one-offs. |
| **Expenditure rule** | The growth of net primary expenditure may not exceed the 10-year average of nominal potential output growth plus a country-specific convergence margin (where net primary expenditure = primary expenditure net of discretionary revenue measures and one-offs, and with investment smoothed over 4 years). | Difference between net primary expenditure and the 10-year average of nominal potential output growth plus a country-specific convergence margin. | Dummy = 1 if the growth of net primary expenditure exceeds the 10-year average of nominal potential output growth + the country-specific convergence margin,<br>0 otherwise. | Unlike the expenditure benchmark in the existing EU fiscal framework, our simulated rule does not net out from expenditure the cyclical component of unemployment benefits nor government expenditure on EU programmes that is fully matched by EU funds revenue. |

## Annex 2. Subsamples

**Table 9:** Baseline specification Δ output gap (Full sample) - Time splits

| **Dependent variable:** Δ Cyclically-adjusted primary balance | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Time Period** | **1980-1998** | | **1999-2004** | | **2005-2011** | | **2012-2017** | |
| | **Estimator** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Lag. Dep.** | Δ Cyclically-adjusted primary balance (t-1) | -0.0972* | -0.0982 | -0.0590 | -0.274* | -0.237*** | -0.187 | -0.0982 | 0.0283 |
| | | (0.0553) | (0.139) | (0.0991) | (0.144) | (0.0824) | (0.161) | (0.0947) | (0.132) |
| **Cycl ind.** | Δ Output gap (t) | -0.189*** | -0.289 | -0.0885 | 0.128 | -0.409*** | -0.508*** | -0.704*** | -0.787** |
| | | (0.0552) | (0.195) | (0.141) | (0.331) | (0.0886) | (0.134) | (0.224) | (0.302) |
| **Stan. Cont.** | Public debt-to-GDP (t-1) | 0.0453*** | 0.0499*** | -0.00870 | -0.0356 | 0.0688** | 0.103*** | -0.0300 | -0.0173 |
| | | (0.00925) | (0.0122) | (0.0343) | (0.0313) | (0.0341) | (0.0273) | (0.0607) | (0.0543) |
| **Political controls** | Election year dummy (t-1) | -0.721*** | -0.762*** | -0.617* | -0.582** | -0.125 | -0.0297 | -0.554 | -0.600 |
| | | (0.179) | (0.196) | (0.325) | (0.265) | (0.442) | (0.341) | (0.378) | (0.413) |
| | Number of changes in government (t-1) | -0.161 | -0.132 | 0.0188 | -0.00186 | -0.0762 | 0.00200 | -0.0519 | -0.192 |
| | | (0.141) | (0.162) | (0.251) | (0.221) | (0.345) | (0.276) | (0.257) | (0.307) |
| | Age dependency ratio (t-1) | -0.527*** | -0.629*** | -0.309 | -0.0178 | -0.0646 | -0.139 | 1.719 | 2.040** |
| | | (0.152) | (0.195) | (0.568) | (0.418) | (0.864) | (0.552) | (1.200) | (1.022) |
| **Crisis controls** | Systemic crisis dummy (t-1) | -1.288*** | -1.573*** | -0.585 | | 0.252 | 0.111 | -4.868*** | -4.124** |
| | | (0.463) | (0.536) | (0.468) | | (0.924) | (0.748) | (1.746) | (1.645) |
| | EU programme dummy (t-1) | | | | | 1.516 | 0.593 | 2.976** | 2.463 |
| | | | | | | (1.347) | (1.275) | (1.333) | (1.526) |
| | Time FE: Wald-test, p-value | 0.000 | 0.001 | 0.170 | 0.297 | 0.000 | 0.001 | 0.009 | 0.077 |
| | Goodness-of-fit | 0.077 | 0.072 | 0.056 | 0.049 | 0.098 | 0.062 | 0.003 | 0.001 |
| | Nº of observations | 351 | 319 | 167 | 169 | 198 | 230 | 95 | 128 |
| | Nº of countries | 29 | 20 | 34 | 32 | 33 | 33 | 33 | 33 |
| | Nº of instruments | | 42 | | 29 | | 30 | | 28 |

*Notes*: Pro-cyclicality is indicated by a negative sign for the coefficient of the change in the output gap. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM is the generalized method of moments estimator developed by Blundell and Bond (1998). The instruments included are the lags of the dependent variable, the cyclical variable, and the lagged current account. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 10:** Baseline specification Δ unemployment rate (Full sample) - Time splits

| **Dependent variable:** Δ Cyclically-adjusted primary balance | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Time Period** | **1980-1998** | | **1999-2004** | | **2005-2011** | | **2012-2017** | |
| | **Estimator** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Lag. Dep.** | Δ Cyclically-adjusted primary balance (t-1) | -0.114** | 0.0299 | -0.0524 | -0.222 | -0.199** | -0.267** | -0.174*** | -0.0555 |
| | | (0.0574) | (0.162) | (0.0942) | (0.145) | (0.0817) | (0.119) | (0.0666) | (0.133) |
| **Cycl ind.** | Δ Unemployment rate (t) | -0.0887 | -0.352 | -0.0768 | 0.0926 | 0.449** | 0.772*** | 1.096*** | 1.458*** |
| | | (0.0958) | (0.215) | (0.150) | (0.191) | (0.183) | (0.240) | (0.248) | (0.402) |
| **Stan. Cont.** | Public debt-to-GDP (t-1) | 0.0457*** | 0.0400*** | -0.00703 | -0.0266 | 0.105*** | 0.130*** | 0.0364 | 0.0641 |
| | | (0.0102) | (0.0111) | (0.0317) | (0.0235) | (0.0325) | (0.0254) | (0.0546) | (0.0559) |
| **Political controls** | Election year dummy (t-1) | -0.566*** | -0.618*** | -0.495 | -0.463* | -0.0725 | -0.00387 | -0.317 | -0.329 |
| | | (0.179) | (0.196) | (0.310) | (0.246) | (0.509) | (0.396) | (0.317) | (0.400) |
| | Number of changes in government (t-1) | -0.135 | 0.0104 | 0.0307 | 0.00833 | 0.0339 | 0.112 | -0.0787 | -0.213 |
| | | (0.137) | (0.165) | (0.244) | (0.211) | (0.382) | (0.319) | (0.245) | (0.296) |
| | Age dependency ratio (t-1) | -0.500*** | -0.459*** | -0.483 | -0.0355 | 0.354 | 0.591 | 1.524 | 1.824* |
| | | (0.171) | (0.172) | (0.557) | (0.416) | (1.029) | (0.652) | (0.985) | (0.966) |
| **Crisis controls** | Systemic crisis dummy (t-1) | -0.544 | -0.604 | -0.264 | | 0.606 | 0.547 | -3.916** | -2.755 |
| | | (0.461) | (0.556) | (0.423) | | (1.013) | (0.872) | (1.544) | (1.678) |
| | EU programme dummy (t-1) | | | | | 0.956 | 0.235 | 2.966** | 2.843* |
| | | | | | | (1.558) | (1.337) | (1.157) | (1.434) |
| | Time FE: Wald-test, p-value | 0.000 | 0.008 | 0.031 | 0.006 | 0.081 | 0.004 | 0.002 | 0.064 |
| | Goodness-of-fit | 0.047 | 0.052 | 0.032 | 0.067 | 0.040 | 0.037 | 0.007 | 0.005 |
| | Nº of observations | 383 | 353 | 177 | 181 | 210 | 244 | 100 | 135 |
| | Nº of countries | 31 | 23 | 36 | 34 | 35 | 35 | 35 | 35 |
| | Nº of instruments | | 42 | | 29 | | 30 | | 28 |

*Notes*: : Pro-cyclicality is indicated by a positive sign for the coefficient of the change in the unemployment rate. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM is the generalized method of moments estimator developed by Blundell and Bond (1998). The instruments included are the lags of the dependent variable, the cyclical variable, and the lagged current account. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 11:** Baseline specification Δ Composite Leading Indicator (Full sample) - Time splits

| **Dependent variable:** Δ Cyclically-adjusted primary balance | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Time Period** | **1980-1998** | | **1999-2004** | | **2005-2011** | | **2012-2017** | |
| | **Estimator** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** | **LSDVC** | **IV-2SLS** |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Lag. Dep.** | Δ Cyclically-adjusted primary balance (t-1) | -0.137** | -0.0310 | -0.137 | -0.138 | -0.255*** | 0.0240 | 0.231** | 0.341** |
| | | (0.0582) | (0.155) | (0.108) | (0.165) | (0.0922) | (0.264) | (0.112) | (0.161) |
| **Cycl ind.** | Δ OECD Composite Leading Indicator (t-1) | -0.0228 | -0.161 | -0.0839 | -0.445* | -0.223 | -0.343 | -0.210 | -0.484 |
| | (yearly average) | (0.0809) | (0.175) | (0.149) | (0.264) | (0.254) | (0.457) | (0.240) | (0.397) |
| **Stan. Cont.** | Public debt-to-GDP (t-1) | 0.0456*** | 0.0536*** | 0.000656 | -0.0165 | 0.0564 | 0.110*** | -0.0656 | -0.0575 |
| | | (0.00985) | (0.0119) | (0.0389) | (0.0291) | (0.0427) | (0.0417) | (0.0798) | (0.0721) |
| **Political controls** | Election year dummy (t-1) | -0.652*** | -0.596*** | -0.611* | -0.565** | -0.220 | -0.0117 | 0.156 | 0.00177 |
| | | (0.183) | (0.212) | (0.345) | (0.279) | (0.537) | (0.460) | (0.375) | (0.543) |
| | Number of changes in government (t-1) | -0.185 | -0.0758 | 0.143 | 0.00356 | -0.234 | -0.0394 | -0.00969 | -0.292 |
| | | (0.140) | (0.165) | (0.282) | (0.234) | (0.460) | (0.395) | (0.325) | (0.474) |
| | Age dependency ratio (t-1) | -0.555*** | -0.669*** | -0.128 | 0.0490 | -0.222 | -0.232 | 1.812 | 2.017 |
| | | (0.176) | (0.180) | (0.676) | (0.481) | (1.064) | (0.739) | (1.413) | (1.447) |
| **Crisis controls** | Systemic crisis dummy (t-1) | -1.488*** | -1.258** | -1.054** | | 0.0445 | -0.280 | | |
| | | (0.567) | (0.577) | (0.475) | | (1.057) | (0.960) | | |
| | EU programme dummy (t-1) | | | | | 1.774 | -0.812 | 3.629* | 2.671 |
| | | | | | | (2.129) | (2.245) | (1.943) | (2.293) |
| | Time FE: Wald-test, p-value | 0.000 | 0.012 | 0.160 | 0.013 | 0.239 | 0.764 | 0.082 | 0.352 |
| | Goodness-of-fit | 0.079 | 0.053 | 0.136 | 0.117 | 0.085 | 0.028 | 0.004 | 0.005 |
| | Nº of observations | 336 | 314 | 135 | 149 | 162 | 189 | 70 | 97 |
| | Nº of countries | 25 | 21 | 27 | 27 | 27 | 27 | 27 | 27 |
| | Nº of instruments | | 42 | | 29 | | 30 | | 27 |

*Notes*: Pro-cyclicality is indicated by a negative sign for the coefficient of the lagged change in the CLI. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM is the generalized method of moments estimator developed by Blundell and Bond (1998). The instruments included are the lags of the dependent variable, the cyclical variable, and the lagged current account. Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

## Annex 3. Non-linearities

**Table 12:** Non-linearities - Dummy for the sign of the output gap in *t*

| | Full sample | | | EU only | | |
|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** |
| **Δ Output gap (t)** | -0.253*** | -0.502*** | -0.279 | -0.408*** | -0.614*** | -0.794*** |
| | (0.0380) | (0.134) | (0.286) | (0.0605) | (0.146) | (0.242) |
| Positive output gap dummy | 0.122 | 0.0340 | 1.002 | 0.000545 | 0.0237 | 0.0342 |
| | (0.164) | (0.170) | (0.669) | (0.231) | (0.238) | (1.549) |
| Interaction term | 0.0191 | 0.234* | -0.328 | 0.104 | 0.268* | 1.828 |
| | (0.0691) | (0.128) | (0.791) | (0.0917) | (0.141) | (1.130) |
| Goodness-of-fit | 0.178 | 0.148 | 0.169 | 0.214 | 0.200 | 0.085 |
| **Δ Unemployment rate (t)** | 0.107* | 0.120 | -0.495 | 0.275*** | 0.159 | 0.290 |
| | (0.0635) | (0.144) | (0.447) | (0.0816) | (0.175) | (0.280) |
| Positive output gap dummy | 0.110 | 0.0303 | 4.306 | -0.166 | -0.224 | -2.841 |
| | (0.161) | (0.182) | (2.836) | (0.241) | (0.253) | (2.823) |
| Interaction term | 0.206* | 0.164 | 3.092 | -0.0944 | -0.0286 | -1.833 |
| | (0.114) | (0.174) | (2.137) | (0.162) | (0.208) | (1.459) |
| Goodness-of-fit | 0.121 | 0.085 | 0.026 | 0.176 | 0.128 | 0.077 |
| **Δ Yearly average CLI (t-1)** | -0.0635 | -0.188 | -0.244 | -0.141 | -0.292 | -0.588 |
| | (0.0742) | (0.183) | (0.702) | (0.114) | (0.273) | (0.527) |
| Positive output gap dummy | -0.0562 | -0.106 | -1.288 | -0.242 | -0.172 | -2.887 |
| | (0.164) | (0.182) | (1.271) | (0.267) | (0.271) | (1.963) |
| Interaction term | -0.0655 | -0.00116 | -0.686 | -0.218 | -0.151 | -1.063 |
| | (0.0892) | (0.158) | (1.823) | (0.149) | (0.222) | (1.789) |
| Goodness-of-fit | 0.130 | 0.091 | 0.090 | 0.189 | 0.126 | 0.106 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 13:** Non-linearities - Dummy for the sign of the change in the output gap in *t*

| | Full sample | | | EU only | | |
|---|---|---|---|---|---|---|
| | LSDVC | IV-2SLS | IV-GMM SYS | LSDVC | IV-2SLS | IV-GMM SYS |
| **Δ Output gap (t)** | -0.210*** | -1.232*** | -0.189 | -0.380*** | -1.949*** | -1.597 |
| | (0.0499) | (0.338) | (0.482) | (0.0778) | (0.424) | (1.068) |
| Positive Δ output gap dummy | 0.120 | 0.838** | 1.502 | 0.184 | 1.330*** | 1.715 |
| | (0.178) | (0.355) | (1.791) | (0.241) | (0.456) | (2.171) |
| Interaction term | -0.141 | 1.065*** | -0.913 | -0.0473 | 1.897*** | 1.759 |
| | (0.0989) | (0.398) | (0.873) | (0.151) | (0.532) | (2.043) |
| Goodness-of-fit | 0.174 | 0.136 | 0.143 | 0.214 | 0.151 | 0.138 |
| **Δ Unemployment rate (t)** | 0.0123 | -0.0355 | -2.294* | 0.227** | 0.0914 | -0.514 |
| | (0.0717) | (0.215) | (1.354) | (0.0964) | (0.261) | (0.871) |
| Positive Δ output gap dummy | -0.449*** | -0.492*** | -3.824 | -0.544*** | -0.564** | -1.133 |
| | (0.157) | (0.189) | (3.025) | (0.207) | (0.243) | (2.952) |
| Interaction term | 0.206** | 0.201 | 3.348* | -0.0316 | 0.0366 | 0.691 |
| | (0.104) | (0.231) | (1.943) | (0.157) | (0.289) | (1.133) |
| Goodness-of-fit | 0.121 | 0.085 | 0.032 | 0.178 | 0.135 | 0.145 |
| **Δ Yearly average CLI (t-1)** | -0.0373 | -0.326 | 0.772 | -0.241 | -0.526 | -0.616 |
| | (0.0864) | (0.342) | (1.272) | (0.152) | (0.482) | (1.084) |
| Positive Δ output gap dummy | -0.469*** | -0.511*** | -1.896 | -0.693*** | -0.712*** | -0.813 |
| | (0.151) | (0.184) | (1.466) | (0.246) | (0.264) | (1.431) |
| Interaction term | -0.0160 | 0.275 | -1.600 | 0.103 | 0.412 | -0.119 |
| | (0.0998) | (0.293) | (1.962) | (0.180) | (0.419) | (1.454) |
| Goodness-of-fit | 0.130 | 0.095 | 0.067 | 0.188 | 0.137 | 0.183 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 14:** Non-linearities - Dummy for debt-to-GDP ratio above 90% in *t*

| | **Full sample** | | | **EU only** | | |
|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** |
| **Δ Output gap (t)** | -0.236*** | -0.442*** | -0.331* | -0.349*** | -0.732*** | -0.503* |
| | (0.0369) | (0.155) | (0.185) | (0.0513) | (0.187) | (0.268) |
| High debt-to-GDP dummy | 0.777*** | 1.069*** | 2.458 | 1.117*** | 1.338*** | 0.311 |
| | (0.225) | (0.262) | (3.944) | (0.359) | (0.377) | (3.948) |
| Interaction term | 0.00390 | 0.0631 | -0.405 | -0.0751 | 0.150 | -1.092 |
| | (0.0679) | (0.114) | (1.022) | (0.0978) | (0.139) | (1.255) |
| Goodness-of-fit | 0.210 | 0.189 | 0.139 | 0.249 | 0.220 | 0.188 |
| **Δ Unemployment rate (t)** | 0.117* | -0.0700 | 0.0569 | 0.191** | -0.168 | 0.218 |
| | (0.0610) | (0.161) | (0.399) | (0.0864) | (0.219) | (0.304) |
| High debt-to-GDP dummy | 0.814*** | 0.857*** | -5.158 | 1.046*** | 1.425*** | -5.878* |
| | (0.235) | (0.311) | (3.439) | (0.370) | (0.467) | (3.208) |
| Interaction term | 0.243* | 0.362* | -0.994 | 0.316** | 0.509** | -0.701 |
| | (0.140) | (0.208) | (2.040) | (0.149) | (0.246) | (1.436) |
| Goodness-of-fit | 0.156 | 0.013 | 0.002 | 0.206 | 0.029 | 0.007 |
| **Δ Yearly average CLI (t-1)** | -0.0925 | -0.154 | -0.419 | -0.255** | -0.392 | -0.774* |
| | (0.0601) | (0.199) | (0.376) | (0.102) | (0.298) | (0.395) |
| High debt-to-GDP dummy | 0.797*** | 0.952*** | -4.172 | 1.199*** | 1.699*** | 2.738 |
| | (0.250) | (0.305) | (7.090) | (0.397) | (0.502) | (7.318) |
| Interaction term | 0.0495 | 0.0742 | 0.183 | 0.121 | 0.308 | 0.687 |
| | (0.105) | (0.171) | (0.986) | (0.160) | (0.232) | (1.210) |
| Goodness-of-fit | 0.167 | 0.028 | 0.010 | 0.200 | 0.041 | 0.130 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 15:** Non-linearities - Dummy for sysstemic crisis in *t*

| | Full sample | | | EU only | | |
|---|---|---|---|---|---|---|
| | LSDVC | IV-2SLS | IV-GMM SYS | LSDVC | IV-2SLS | IV-GMM SYS |
| **Δ Output gap (t)** | -0.259*** | -0.549*** | -0.267 | -0.410*** | -0.719*** | -0.562 |
| | (0.0343) | (0.144) | (0.184) | (0.0548) | (0.166) | (0.453) |
| Systemic crisis dummy | 0.513 | 0.555 | -7.001 | 0.943 | 1.295* | 23.56 |
| | (0.449) | (0.499) | (8.368) | (0.686) | (0.754) | (17.85) |
| Interaction term | 0.363*** | 0.659*** | -1.950 | 0.563*** | 0.877*** | 6.990 |
| | (0.140) | (0.217) | (3.039) | (0.204) | (0.277) | (5.479) |
| Goodness-of-fit | 0.181 | 0.151 | 0.084 | 0.216 | 0.199 | 0.048 |
| **Δ Unemployment rate (t)** | 0.202*** | 0.272** | -0.286 | 0.310*** | 0.240 | -0.119 |
| | (0.0553) | (0.124) | (0.390) | (0.0766) | (0.163) | (0.242) |
| Systemic crisis dummy | 0.196 | -0.0925 | -4.172 | 0.654 | 0.502 | 7.340 |
| | (0.450) | (0.489) | (7.919) | (0.636) | (0.695) | (6.413) |
| Interaction term | -0.448** | -0.518** | 2.660 | -0.576** | -0.530* | -0.237 |
| | (0.201) | (0.235) | (2.696) | (0.237) | (0.299) | (1.728) |
| Goodness-of-fit | 0.122 | 0.094 | 0.042 | 0.172 | 0.139 | 0.086 |
| **Δ Yearly average CLI (t-1)** | -0.0960 | -0.254 | -0.322 | -0.230** | -0.409* | -0.577 |
| | (0.0647) | (0.155) | (0.390) | (0.104) | (0.237) | (0.516) |
| Systemic crisis dummy | -0.0746 | -0.145 | 6.440 | -0.0852 | -0.241 | -0.752 |
| | (0.419) | (0.464) | (7.615) | (0.738) | (0.799) | (13.08) |
| Interaction term | 0.168 | 0.461 | -5.971 | -0.00464 | 0.162 | -7.420 |
| | (0.331) | (0.397) | (5.883) | (0.632) | (0.658) | (6.099) |
| Goodness-of-fit | 0.129 | 0.089 | 0.034 | 0.183 | 0.123 | 0.099 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 16:** Non-linearities - Index for labour market reforms (higher for liberalizing reforms)

| | Full sample | | | EU only | | |
|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** |
| **Δ Output gap (t)** | -0.210*** | -0.570** | -0.0862 | -0.405*** | -0.654* | -0.204 |
| | (0.0490) | (0.262) | (0.252) | (0.0707) | (0.390) | (0.519) |
| Labour market reform index | 0.126 | 0.0606 | 1.044 | 0.0341 | 0.0122 | 2.091* |
| | (0.112) | (0.129) | (0.884) | (0.148) | (0.161) | (0.998) |
| Interaction term | 0.0538 | 0.184** | -0.0733 | 0.159* | 0.265** | -0.136 |
| | (0.0654) | (0.0918) | (0.320) | (0.0869) | (0.128) | (0.400) |
| Goodness-of-fit | 0.184 | 0.165 | 0.181 | 0.246 | 0.227 | 0.138 |
| **Δ Unemployment rate (t)** | -0.125* | -0.0635 | -0.722** | -0.0429 | -0.117 | -0.595 |
| | (0.0761) | (0.176) | (0.341) | (0.118) | (0.224) | (0.427) |
| Labour market reform index | 0.235** | 0.233* | -0.0918 | 0.0150 | 0.0572 | 0.746 |
| | (0.115) | (0.134) | (1.063) | (0.156) | (0.179) | (1.132) |
| Interaction term | 0.168** | 0.158 | 1.101** | 0.106 | 0.0967 | 0.587 |
| | (0.0849) | (0.0968) | (0.507) | (0.114) | (0.135) | (0.340) |
| Goodness-of-fit | 0.144 | 0.122 | 0.119 | 0.218 | 0.163 | 0.185 |
| **Δ Yearly average CLI (t-1)** | -0.0565 | -0.230 | -0.201 | -0.192** | -0.448* | -0.229 |
| | (0.0598) | (0.156) | (0.446) | (0.0946) | (0.245) | (0.707) |
| Labour market reform index | 0.183 | 0.194 | 0.0487 | 0.0323 | 0.0226 | 0.127 |
| | (0.121) | (0.130) | (0.813) | (0.158) | (0.174) | (0.826) |
| Interaction term | 0.106 | 0.192** | -0.729 | 0.193 | 0.300** | -0.121 |
| | (0.0779) | (0.0946) | (0.593) | (0.133) | (0.141) | (0.905) |
| Goodness-of-fit | 0.171 | 0.137 | 0.134 | 0.242 | 0.198 | 0.264 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 17:** Non-linearities - Index for product market reforms (higher for liberalizing reforms)

| | Full sample | | | EU only | | |
|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** |
| **Δ Output gap (t)** | -0.177*** | -0.443 | -0.0427 | -0.314*** | -0.410 | -0.469 |
| | (0.0505) | (0.316) | (0.370) | (0.0809) | (0.362) | (0.535) |
| Product market reform index | -0.226** | -0.245** | 0.243 | -0.253* | -0.247* | 1.442* |
| | (0.0985) | (0.103) | (0.713) | (0.139) | (0.135) | (0.782) |
| Interaction term | -0.0542 | 0.0217 | -0.318 | -0.112 | -0.0859 | -0.216 |
| | (0.0547) | (0.123) | (0.426) | (0.0709) | (0.130) | (0.711) |
| Goodness-of-fit | 0.187 | 0.171 | 0.202 | 0.251 | 0.235 | 0.145 |
| **Δ Unemployment rate (t)** | -0.0167 | 0.132 | 0.192 | 0.0415 | 0.0569 | -0.161 |
| | (0.0805) | (0.196) | (0.202) | (0.120) | (0.242) | (0.433) |
| Product market reform index | -0.285*** | -0.286*** | 0.0112 | -0.318** | -0.284* | 1.026 |
| | (0.0933) | (0.107) | (2.410) | (0.144) | (0.149) | (0.766) |
| Interaction term | -0.193** | -0.223* | -1.431** | -0.134 | -0.157 | -0.512 |
| | (0.0901) | (0.122) | (0.574) | (0.124) | (0.155) | (0.631) |
| Goodness-of-fit | 0.144 | 0.120 | 0.105 | 0.228 | 0.164 | 0.127 |
| **Δ Yearly average CLI (t-1)** | -0.103 | -0.218 | -0.346 | -0.239** | -0.386 | -0.183 |
| | (0.0634) | (0.175) | (0.609) | (0.0969) | (0.255) | (0.740) |
| Product market reform index | -0.320*** | -0.318*** | 1.035 | -0.358** | -0.341** | 0.412 |
| | (0.0950) | (0.104) | (1.231) | (0.141) | (0.149) | (1.272) |
| Interaction term | 0.150** | 0.216** | -0.533 | 0.187* | 0.268** | -0.337 |
| | (0.0663) | (0.0968) | (0.892) | (0.100) | (0.130) | (1.461) |
| Goodness-of-fit | 0.176 | 0.146 | 0.069 | 0.254 | 0.202 | 0.209 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 18:** Non-linearities - Dummy for presence of a medium-term spending ceiling in *t*

| | Full sample | | | EU only | | |
|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** |
| **Δ Output gap (t)** | -0.313*** | -0.454*** | -0.627*** | -0.426*** | -0.514*** | -0.578** |
| | (0.0486) | (0.165) | (0.161) | (0.0673) | (0.179) | (0.209) |
| Medium-term spending rule | -0.0934 | -0.00674 | -0.275 | 0.289 | 0.208 | -0.439 |
| | (0.360) | (0.385) | (1.248) | (0.482) | (0.484) | (1.009) |
| Interaction term | 0.0745 | 0.138 | 0.373 | 0.0906 | 0.147 | -0.389 |
| | (0.0739) | (0.107) | (0.541) | (0.0871) | (0.106) | (0.686) |
| Goodness-of-fit | 0.143 | 0.136 | 0.212 | 0.284 | 0.267 | 0.276 |
| **Δ Unemployment rate (t)** | 0.367*** | 0.0938 | 0.283 | 0.399*** | 0.373* | 0.284 |
| | (0.0794) | (0.221) | (0.382) | (0.104) | (0.222) | (0.260) |
| Medium-term spending rule | -0.173 | -0.115 | -3.671 | 0.408 | 0.410 | 1.238 |
| | (0.436) | (0.495) | (3.089) | (0.508) | (0.505) | (1.636) |
| Interaction term | -0.308* | -0.110 | -1.334 | -0.0428 | -0.0437 | -0.0518 |
| | (0.166) | (0.238) | (1.366) | (0.182) | (0.212) | (0.922) |
| Goodness-of-fit | 0.119 | 0.059 | 0.037 | 0.222 | 0.208 | 0.211 |
| **Δ Yearly average CLI (t-1)** | -0.183* | -0.364 | -0.0810 | -0.0927 | -0.0313 | 0.0360 |
| | (0.102) | (0.250) | (0.393) | (0.193) | (0.361) | (0.623) |
| Medium-term spending rule | 0.429 | 0.299 | 0.624 | 1.053* | 0.642 | 1.313 |
| | (0.481) | (0.511) | (1.017) | (0.636) | (0.652) | (1.364) |
| Interaction term | 0.150 | 0.266 | -0.765 | 0.0442 | 0.0640 | -0.568 |
| | (0.121) | (0.173) | (0.797) | (0.160) | (0.189) | (0.991) |
| Goodness-of-fit | 0.129 | 0.093 | 0.089 | 0.205 | 0.196 | 0.177 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 19:** Non-linearities – European Commission's Fiscal Rule Index in *t* (EU only)

| | LSDVC | IV-2SLS | IV-GMM SYS |
|---|---|---|---|
| **Δ Output gap (t)** | -0.378*** | -0.720*** | -0.694** |
| | (0.0602) | (0.168) | (0.281) |
| Fiscal rule index | -0.0526 | -0.110 | 0.356 |
| | (0.205) | (0.198) | (0.855) |
| Interaction term | -0.0453 | -0.00879 | 0.0645 |
| | (0.0537) | (0.0581) | (0.233) |
| Goodness-of-fit | 0.201 | 0.182 | 0.223 |
| **Δ Unemployment rate (t)** | 0.264*** | 0.298* | 0.0313 |
| | (0.0890) | (0.162) | (0.318) |
| Fiscal rule index | 0.00249 | -0.00925 | -0.153 |
| | (0.211) | (0.201) | (0.788) |
| Interaction term | 0.0679 | 0.0476 | 0.0726 |
| | (0.0840) | (0.0881) | (0.347) |
| Goodness-of-fit | 0.173 | 0.153 | 0.194 |
| **Δ Yearly average CLI (t-1)** | -0.230* | -0.359 | -0.649 |
| | (0.136) | (0.272) | (0.629) |
| Fiscal rule index | 0.0682 | 0.0615 | 0.0961 |
| | (0.232) | (0.242) | (0.954) |
| Interaction term | -0.286*** | -0.295*** | -1.188* |
| | (0.0973) | (0.101) | (0.580) |
| Goodness-of-fit | 0.185 | 0.137 | 0.146 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 20:** Non-linearities - Institutional dummies t-1 (EU only)

| | SGP dummy | | | SGP 2005 revision dummy | | | 6P onwards dummy | | |
|---|---|---|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** | **LSDVC** | **IV-2SLS** | **IV-GMM SYS** |
| **Δ Output gap (t)** | -0.320*** | 1.760* | 2.052 | -0.373*** | 1.759* | 1.219 | -0.388*** | -0.717*** | -0.659** |
| | (0.105) | (0.939) | (2.372) | (0.0972) | (0.942) | (1.232) | (0.0549) | (0.173) | (0.239) |
| Institutional dummy | -1.157 | 0.782 | 1.288 | 2.957*** | 3.677 | 3.563* | -0.946 | -1.654 | -1.554 |
| | (1.497) | (1.361) | (2.687) | (0.845) | (2.381) | (2.056) | (0.787) | (2.802) | (1.124) |
| Interaction term | -0.0760 | -2.142** | -3.103 | -0.00701 | -2.127** | -2.151 | 0.144 | 0.506* | -0.122 |
| | (0.119) | (0.936) | (2.773) | (0.113) | (0.942) | (1.516) | (0.223) | (0.279) | (0.777) |
| Goodness-of-fit | 0.220 | 0.061 | 0.068 | 0.219 | 0.031 | 0.089 | 0.221 | 0.201 | 0.240 |
| **Δ Unemployment rate (t)** | 0.0474 | -1.589** | -0.645 | 0.110 | -0.915 | -0.0392 | 0.283*** | 0.248 | 0.158 |
| | (0.165) | (0.751) | (1.552) | (0.151) | (0.660) | (0.750) | (0.0818) | (0.168) | (0.289) |
| Institutional dummy | -1.140 | -0.802 | -1.408** | 2.517*** | 3.427* | 2.492** | 0.191 | 0.830 | -0.325 |
| | (1.519) | (0.989) | (0.611) | (0.791) | (2.037) | (1.025) | (1.011) | (2.914) | (0.975) |
| Interaction term | 0.276 | 1.903** | 0.860 | 0.210 | 1.231* | 0.110 | -0.165 | -0.185 | -0.635 |
| | (0.184) | (0.753) | (1.839) | (0.174) | (0.665) | (0.971) | (0.250) | (0.286) | (0.949) |
| Goodness-of-fit | 0.185 | 0.091 | 0.192 | 0.183 | 0.109 | 0.203 | 0.181 | 0.137 | 0.200 |
| **Δ Yearly average CLI (t-1)** | -0.266* | -0.170 | -0.692 | -0.320** | -0.308 | -0.549 | -0.228** | -0.397 | -0.480 |
| | (0.141) | (0.429) | (0.599) | (0.130) | (0.383) | (0.672) | (0.103) | (0.256) | (0.545) |
| Institutional dummy | -1.447 | -1.133 | -2.132** | 2.851*** | 0.593 | 3.736 | -2.343 | -0.432 | -5.598** |
| | (1.539) | (1.095) | (0.798) | (0.874) | (0.772) | (4.210) | (2.209) | (2.293) | (2.414) |
| Interaction term | 0.0564 | -0.00187 | 0.484 | 0.210 | 0.242 | -0.0904 | -0.205 | 0.0606 | -1.425 |
| | (0.199) | (0.455) | (1.410) | (0.201) | (0.419) | (1.554) | (0.461) | (0.548) | (1.999) |
| Goodness-of-fit | 0.190 | 0.125 | 0.196 | 0.191 | 0.126 | 0.193 | 0.189 | 0.127 | 0.187 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.

**Table 21:** Non-linearities - Numerical deviation from EU fiscal rule in *t-1* (positive = compliant, negative = non-compliant) (EU only)

| | Deficit rule | | | Debt rule | | | Structural balance target | | | Spending benchmark | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** | **LSDVC** | **IV-2SLS** | **IV-GMM** |
| **Δ Output gap (t)** | -0.367*** | -0.585*** | -0.528 | -0.577*** | -0.583*** | -0.675* | -0.436*** | -0.510*** | -0.683*** | -0.426*** | -0.496*** | -0.723** |
| | (0.0591) | (0.132) | (0.485) | (0.0867) | (0.203) | (0.344) | (0.0686) | (0.153) | (0.245) | (0.0680) | (0.158) | (0.326) |
| Degree of compliance | -0.404*** | -0.362*** | -0.317 | -0.0564** | -0.0573*** | -0.161*** | 0.0827 | -0.220 | -0.324 | -0.0485 | -0.130 | -0.0318 |
| | (0.0482) | (0.0566) | (0.241) | (0.0225) | (0.0213) | (0.0578) | (0.0986) | (0.148) | (0.536) | (0.101) | (0.113) | (0.364) |
| Interaction term | 0.00691 | 0.00916 | -0.0240 | 0.00437** | 0.00313 | -0.00202 | 0.0200 | 0.0213 | -0.0850 | 0.00776 | 0.0129 | 0.119 |
| | (0.00979) | (0.0102) | (0.266) | (0.00171) | (0.00329) | (0.0145) | (0.0261) | (0.0256) | (0.209) | (0.0181) | (0.0184) | (0.117) |
| Goodness-of-fit | 0.221 | 0.215 | 0.310 | 0.147 | 0.128 | 0.194 | 0.135 | 0.098 | 0.195 | 0.128 | 0.108 | 0.191 |
| **Δ Unemployment rate (t)** | 0.196** | 0.0956 | -0.0609 | 0.291*** | 0.225 | 0.579 | 0.381*** | 0.244 | 0.168 | 0.365*** | 0.259 | 0.106 |
| | (0.0986) | (0.176) | (0.280) | (0.106) | (0.182) | (0.543) | (0.0953) | (0.172) | (0.431) | (0.0953) | (0.166) | (0.313) |
| Degree of compliance | -0.403*** | -0.411*** | -0.468*** | -0.0600** | -0.0630*** | -0.176*** | 0.00665 | -0.422*** | -0.447 | -0.125 | -0.272** | -0.704* |
| | (0.0518) | (0.0635) | (0.151) | (0.0238) | (0.0228) | (0.0541) | (0.107) | (0.155) | (0.413) | (0.107) | (0.115) | (0.357) |
| Interaction term | -0.00315 | -0.0115 | -0.0342 | 0.00364 | 0.00511 | -0.0175 | 0.0347 | 0.00609 | -0.434* | 0.000623 | -0.0135 | -0.211 |
| | (0.0204) | (0.0240) | (0.133) | (0.00279) | (0.00338) | (0.0227) | (0.0372) | (0.0412) | (0.244) | (0.0296) | (0.0279) | (0.152) |
| Goodness-of-fit | 0.180 | 0.185 | 0.230 | 0.121 | 0.097 | 0.090 | 0.105 | 0.043 | 0.034 | 0.095 | 0.060 | 0.071 |
| **Δ Yearly average CLI (t-1)** | -0.243* | -0.623** | 0.00604 | -0.00372 | -0.221 | -0.472 | -0.333** | -0.403 | 0.307 | -0.277* | -0.363 | -0.285 |
| | (0.125) | (0.252) | (0.759) | (0.151) | (0.308) | (0.699) | (0.154) | (0.370) | (1.372) | (0.157) | (0.355) | (1.225) |
| Degree of compliance | -0.335*** | -0.310*** | -0.715 | -0.0660*** | -0.0616** | -0.189*** | -0.0132 | -0.566*** | -1.489* | -0.161 | -0.403*** | -1.234* |
| | (0.0509) | (0.0624) | (0.442) | (0.0220) | (0.0252) | (0.0547) | (0.105) | (0.195) | (0.740) | (0.126) | (0.152) | (0.653) |
| Interaction term | -0.153*** | -0.159*** | 0.150 | -0.0245*** | -0.0241*** | -0.00371 | -0.140** | -0.160** | 0.121 | -0.0253 | -0.0232 | -0.426 |
| | (0.0209) | (0.0213) | (0.256) | (0.00433) | (0.00501) | (0.0271) | (0.0646) | (0.0778) | (0.662) | (0.0604) | (0.0666) | (0.570) |
| Goodness-of-fit | 0.326 | 0.323 | 0.080 | 0.247 | 0.198 | 0.137 | 0.140 | 0.050 | 0.016 | 0.112 | 0.051 | 0.063 |

*Notes*: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM SYS is the system generalized method of moments developed by Blundell and Bond (1998). Standard errors are noted in parentheses: * p<0.10, ** p<0.05, *** p<0.01. For the LSDVC specifications, bootstrapped standard errors following the bias-corrected alternative by Bruno (2005) are reported.