CESifo WORKING PAPERS

8659
2020

October 2020

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Martin Larch, Eloïse Orseau, Wouter van der Wielan

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
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CESifo *Working Paper No. 8659*

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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. 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 40 EU and non-EU countries, we provide evidence that the volatility of output gap estimates is not a convincing explanation for pro-cyclical policies. With the exception of very large shocks, discretionary measures remain ill-timed from a stabilisation perspective even when observable and politically more meaningful indicators of the cycle 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 considerations up to a point. Once debt grows too high, the leeway to stabilise output with discretionary fiscal policy measures fades. Complying with fiscal rules that limit the increase in government debt or keep a steady course in the face of cyclical fluctuation is conducive to counter-cyclical fiscal policy making.

JEL-Codes: C230, E610, E620, H300, H620.

Keywords: fiscal policy, fiscal rules, fiscal stabilisation, counter-cyclical policy, dynamic panel models.

Martin Larch
Secretariat of the European Fiscal Board
Rue de la Loi 200
Belgium - 1049 Brussels
Martin.Larch@ec.europa.eu

Eloïse Orseau
Secretariat of the European Fiscal Board
Rue de la Loi 200
Belgium - 1049 Brussels
Eloise.Orseau@ec.europa.eu

Wouter van der Wielen
European Commission's Joint Research
Centre, Fiscal Policy Analysis Unit
Calle Inca Garcilaso 3
Spain - 41092 Seville
Wouter.van-der-Wielen@ec.europa.eu

While accepting full responsibility for any mistakes, the authors gratefully acknowledge helpful comments by Salvador Barrios, Roel Beetsma, Massimo Bordignon, Christian Keuschnigg, George Kopits, Ludger Schuknecht and Jeromin Zettelmeyer. The paper also benefited from discussions with the participants of the 2nd CESifo-EconPol Europe Workshop on Public Policy Evaluation and Optimal Policy Design and the conference organised by the European Fiscal Board in cooperation with CEPR and the ACES. The views expressed are those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission or the European Fiscal Board. Declarations of interest: none.

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 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. However, there is ample evidence that discretionary fiscal policy at the national level does not follow the intended or ideal path. On the contrary, many countries have accumulated high levels of government debt and their discretionary fiscal policies tend to amplify rather than dampen cyclical fluctuations of output.

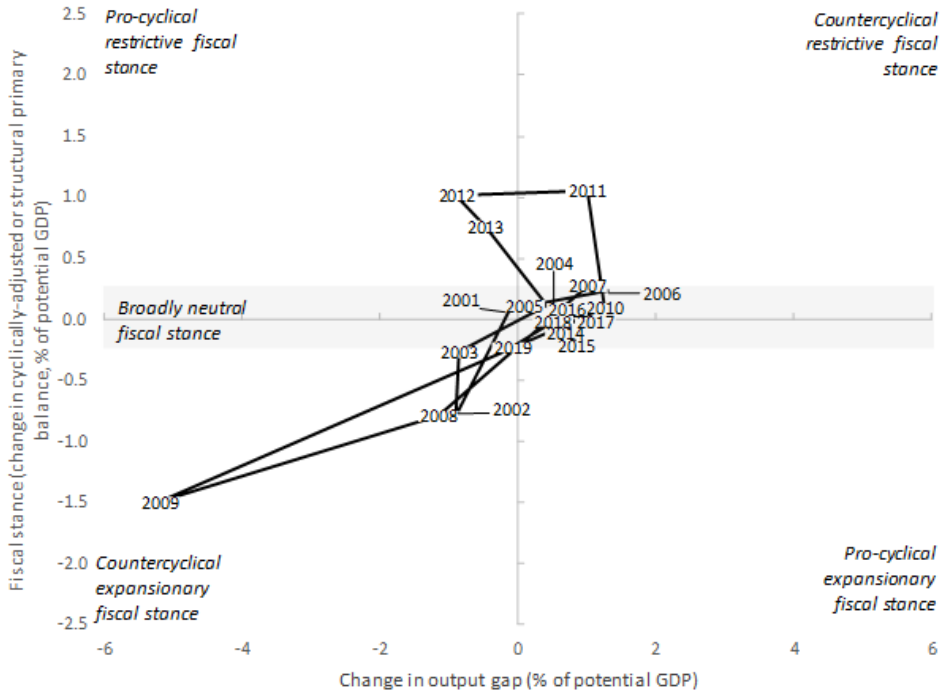
Our paper expands on the existing literature by investigating the drivers of pro-cyclical fiscal policies with a particular, although not exclusive focus on the EU. The key question underlying our paper is whether the tendency to run pro-cyclical fiscal policies arises in spite or because of the constraints imposed by the EU rules. The role of government debt as an indicator of sustainability concerns is of particular interest. We apply a methodology which allows for a direct analysis of the determinants of pro-cyclical fiscal policy and their interactions. We also draw on a novel database assessing numerical compliance with EU fiscal rules.

When the EU fiscal framework was designed in the 1990s, the commonly agreed rules asked member states to attain sound medium-term budgetary positions subject to limits on the government deficit and debt. In practice, however, stabilisation did not play much of a role mostly because member states used the 3% of GDP reference value as a target rather than a threshold. Critics of the Stability and Growth Pact (SGP), identified a revealed preference for sustainability in the initial design, which, in their view, imposed painful pro-cyclical retrenchments in economic downturns. By contrast, supporters of the Pact argue that pro-cyclical fiscal policy was simply the result of ignoring the commonly agreed rules, notably attain sound underlying positions so as to have the fiscal space in bad times.

Starting in 2005, successive reforms of the SGP – 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 have effectively been only two clear cut episodes of counter-cyclical fiscal policy, the European Economic Recovery Plan of 2009 and the fiscal response to the Covid-19 pandemic. The rest was either overtly pro-cyclical or remained within the margins of what is commonly considered as broadly neutral.

Figure 1: The fiscal stance in the EU, 2001-2019



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 analysis starts by confirming the tendency towards running pro- or a-cyclical discretionary fiscal policy in both the EU and beyond. Exceptions are very large negative shocks, such as the post-2007 global financial and economic crisis or the recent Covid-19 pandemic, that produce an unequivocal sense of urgency. We extend the existing literature in a number of important directions. First, our sample is broader and longer than most earlier studies and, hence, offers a more stable basis for interpreting result. Second, we show that the failure to deliver counter-cyclical fiscal policies is not due to the often cited volatility of real-time output gap estimates, the conventional measurement of economic slack. Pro-cyclicality is confirmed when alternative and, in our view, more tangible indicators of the business cycle are used. Consequently, pro-cyclicality is first and foremost a political economy rather than a measurement issue. Third, we complement conventional fiscal reaction functions with non-linear elements and run dedicated logit regressions which provide direct insight into what determines pro-cyclical fiscal policies. While conventional methods merely highlight the average discretionary fiscal response to cyclical swings, our paper sheds light on both the frequency of pro-cyclical fiscal policy interventions and their drivers, including in particular the level of government debt. Fourth, 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.

We find that pro-cyclicality tends to be an issue when debt is very high and/or fiscal rules are not followed. In fact, the stock of government debt signals successive deviations from

commonly agreed rules. In the presence of very high debt, and barring help from a super-ordinated level of macroeconomic policymaking, sustainability concerns can trump stabilisation needs. Compliance with EU fiscal rules reduces the likelihood of running pro-cyclical policies.

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, 2005), 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 Végh, 2005; 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.

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 may be proven wrong in hindsight, but good intentions should be vindicated if ex-post estimates of the output gap are replaced by those available at the time fiscal policy decisions are taken. Golinelli and Momigliano (2006), and more recently the European Commission (2018) and Gootjes and de Haan (2020), tested the notion that fiscal policy makers have no choice but to rely on real-time output gap estimates in the planning phase. However, their results do not corroborate their prior: the real-time output gaps still turn out to be negatively correlated or uncorrelated with the discretionary fiscal impulse, while controlling for other factors.

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 endogeneity, 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]

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. Fatás and Mihov (2010) and Bénétrix and Lane (2013) find support for the Maastricht Treaty being associated with more counter-cyclical policies. 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. Similarly, Bergman and Hutchison (2015) build an index to measure the strength of fiscal rules and interact it with the World Bank's efficiency of government bureaucracy index; they find that, while government efficiency alone is not sufficient to reduce pro-cyclicality, the combination of fiscal rules and sufficiently high government efficiency provides an environment that fosters counter-cyclical policies. Gootjes and de Haan (2020) confirm the role of government efficiency and fiscal rules but do not find evidence of complementarity.

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 – the business cycle – and the level of government debt, i.e. high government debt weighs on the stabilisation objective of fiscal policy.

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

[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).

interpreted as an improvement (deterioration) of cyclical conditions. Although conceptually sound and convincing, the output gap comes with important practical downsides: it is unobservable and subject to significant revisions as new information becomes available. As a result, estimates available in real time differ markedly from those revealed after the fact, once estimates have stabilised. Darvas (2015) and Darvas and Simon (2015) shows that in the context of the EU fiscal surveillance framework, revisions are large enough to make discretionary stabilisation vain.

Our paper adds a number of new elements to the literature. First, on top of the change in the output gap, we consider three alternative measurements of cyclical conditions: the change (in the yearly average) of the unemployment rate, the change in industrial production index and the change of the OECD composite leading indicator. These three indicators have two major advantages over the output gap: they are (i) observable and not or much less revised ex post; and (ii) closer to the information that policymakers have in mind when considering discretionary fiscal stabilisation.

And indeed, why should policymakers who need to garner political support in government and parliament – something that costs political capital – want to predicate their decisions on measures that are notoriously unreliable? It would arguably make more sense to focus on indicators that are (i) observable and more readily available; and (ii) of more direct relevance and concern to their constituency. We test three potential candidates of such politically more meaningful indicators: the change in the rate of unemployment, the change in the index of industrial production and the change in the OECD leading economic indicator.

Our test is not meant to clarify which indicator is a better gauge of the business cycle; they all have their strengths and weaknesses. Rather, it is a pragmatic way to check whether fiscal policy makers use other, less abstract and less volatile measures of the cycle to systematically motivate discretionary fiscal policy decisions. Unemployment may lag most measures of the output gap, but it is the manifestation of the business cycle that most significantly affects people and households including the way they vote. This is confirmed by the political science literature (e.g. Carlsen, 2000; Wright, 2012; Martins and Veiga, 2013; Vlandas and Halikiopoulou, 2019). Moreover, in the early days of aggregate demand management, US policy makers focused on the difference between actual and full employment (Brown, 1956).

In most advanced economies, industry (comprising manufacturing, mining and quarrying) represents only part of the total economy. However, industrial production is still a very good predictor of where the economy as a whole is heading. In our sample, the change of industrial production has the highest correlation coefficient with the change of the output gap (0.93).[2] Industrial production figures are also made available in a very timely fashion, shortly after the end of the reporting period and are a key input to the first estimates of quarterly real GDP numbers.

[2] The change in the unemployment rate and the composite leading indicator are also strongly correlated (-0.75 and 0.55, resp.), however seem to encompass a somewhat different information set regarding the cycle.

The rationale for using the OECD composite leading indicator is less evident from the political economy perspective. We mainly include it as a kind of additional check assuming that policymakers could use a deterioration as a signal justifying expansionary measures while improvements could motivate discretionary consolidation.

The second new element in our analysis consists in taking a more careful look at the determinants of discretionary fiscal policy. 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 merely reveals the partial correlation between discretionary fiscal measures and cyclical fluctuations of output. It does not tell us why or how frequent pro-cyclical episodes are. 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 insightful 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 discretionary fiscal policy.

Third, we use a novel and comprehensive database assessing numerical compliance with the four fiscal rules of the SGP, 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 10 in Annex 1 for a more detailed presentation). Unlike many earlier studies that use synthetic indices capturing the quality of fiscal rules, however defined, our database allows us to examine whether following EU rules impacts the stabilisation properties of discretionary fiscal policy.

Last but not least, our dataset is large compared to earlier studies. It encompasses a substantial number (around 40) of middle to high-income countries. In addition to the 27 EU Member States, plus the UK, 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 as far back as the late 1960s, while it starts in the early 1990s or later for EU countries that joined the Union in 2004 or after. Overall, our sample is the maximum set of developed countries available, therefore exogenous to the questions addressed by our analysis.

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 and Valencia (2013, 2018) and the EPU webpage of Baker, Bloom & Davis.

Due to data availability, our baseline specifications typically include 36 countries. The longest available time series are of the USA, the shortest of Croatia. Overall, we rely on an unbalanced panel, 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.

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 per cent of GDP. Finally, there are time (θ_t) and country (δ_i) fixed effects and a country-year specific error term ($u_{i,t}$).

We report result for equation (1) based on three estimators. 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 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. For instance, an improvement in the cyclically-adjusted primary budget balance, the dependent variable, makes it easier to comply with the fiscal rules. We therefore also 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.[3]

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, with coefficients ranging between -0.2 and -0.4, i.e. on average the cyclically adjusted primary balance fell (and the deficit rose) as a share of GDP by roughly one third of a percentage point

[3] Notwithstanding their common use, lagged variables are no perfect replacement for the textbook instrument.

for a one percent improvement of the output gap.[4] This is consistent with earlier findings using revealed changes in the output gap (e.g. Cimadomo, 2012; Eyraud et al., 2017; Gootjes and de Haan, 2020). Alternative estimation techniques confirm pro-cyclicality in our sample; see Table 1 for the full sample and Table 2 and 3 for the EU and the non-EU, respectively. 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. Governments decide either to actively intervene in response to the unwinding of external or domestic imbalances, and/or to defend a given level of discretionary government expenditure in the face of large losses of output and, in turn, government revenues. In other words, in the event of very large negative shocks, stabilising the economy trumps other considerations. Particularly prominent cases in point are the 2008-2009 crisis in the EU, which led to the European Economic Recovery Plan, and the deep recession triggered by the Covid-10 pandemic. The estimated coefficient of the respective dummy in Table 2 is negative across all specifications and estimation techniques, although not always statistically significant.

Somewhat surprisingly, or maybe not, our estimation results do not support our priors in relation to the alternative indicators of the business cycle. In the full sample of EU and non-EU countries, growing unemployment or declining industrial production are on average associated with fiscal tightening and vice versa[5]; 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.[6]

Of note, the estimated coefficients for all cyclical indicators are significantly larger in the subsample of EU Member States (Table 2) than in the full and non-EU sample (Table 1 and 3). Although important, this result does not indicate that pro-cyclical fiscal policy episodes are more frequent in EU than in non-EU countries. In Section 5.2 we will actually show that the frequency is virtually the same across the two groups of countries.

The difference is due to two possibly interrelated factors. First, it can be an indication of a higher degree of fiscal activism in the EU: for a given change of the output gap policy makers enact on average higher discretionary measures. Second, the difference can reflect the, on average, larger size of government in the EU; in the face of permanent economic shocks, lawmakers keep established levels of discretionary expenditure just to find out in time that GDP ratios have shifted permanently (Larch and Salto, 2005).

[4] The reported effect sizes are robust to specification checks based on possible permutations of the control variables in the baseline specification and the institutional dummies (SGP, the 2005 SGP reform and the Six Pack), as suggested by e.g. Brodeur et al. (2020). Distributional plots of the specification checks of the baseline for each of the four cyclical indicators and each of the three estimators are included in the Annex.

[5] With the absolute coefficients for the output gap being double those of the unemployment rate, the coefficients on the change in the output gap and the change in the unemployment rate appear to be broadly in line with common estimates for their relationship according to Okun's law.

[6] Since the Composite Leading Indicator comprises a forward-looking concept, i.e. capturing current expectations about the cycle at a future point in time, we opted to use its lag in order to maintain consistency with the other cyclical indicators tested. Specifically, by using the lag of the leading indicator, the information encompassed by the variable pertains to the same timeframe as the other cyclical variables, facilitating comparison across specifications. Estimating our baseline specifications with the contemporaneous value of the leading indicator instead, does not affect our main conclusions.

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 policymakers to intervene in one way or another; the European Economic Recovery Plan mentioned above is a case in point. More importantly, our results are not consistent with the notion that pro-cyclicality is the unintended consequence of volatility in the measurement of cyclical conditions in real time. Even if policymakers were 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 may 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.[7]

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, 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.

[7] 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.

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lagged dep. var.	Δ Cyclically-adjusted primary balance (t-1)	-0.165***	-0.0934	-0.0867	-0.165***	0.0430	-0.0811*	-0.165***	-0.0204	-0.0734	-0.132***	0.157	-0.0572
		(0.0299)	(0.106)	(0.0574)	(0.0292)	(0.0946)	(0.0452)	(0.0329)	(0.0900)	(0.0528)	(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 Industrial production (t)							-0.0750***	-0.0933	-0.0579			
								(0.0183)	(0.0649)	(0.0961)			
	Δ OECD Composite Leading Indicator (t-1)										-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***	0.0245***	0.0263***	0.00489**	0.0212***	0.0215***	0.00552***
		(0.00437)	(0.00582)	(0.00145)	(0.00423)	(0.00518)	(0.00172)	(0.00489)	(0.00548)	(0.00206)	(0.00517)	(0.00571)	(0.00151)
Political controls	Election year dummy (t)	-0.446***	-0.351**	-0.440***	-0.333***	-0.261*	-0.345**	-0.364***	-0.338**	-0.347**	-0.315**	-0.270*	-0.296*
		(0.129)	(0.138)	(0.147)	(0.127)	(0.146)	(0.147)	(0.134)	(0.145)	(0.144)	(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	-0.126	-0.111	-0.110	-0.0389	-0.0270	-0.0489
		(0.0965)	(0.108)	(0.0765)	(0.101)	(0.114)	(0.0795)	(0.103)	(0.117)	(0.0786)	(0.112)	(0.124)	(0.0897)
	Age dependency ratio (t-1)	-0.168**	-0.269***	-0.0321**	-0.190***	-0.192***	-0.0289**	-0.228***	-0.240***	-0.0333*	-0.196***	-0.203**	-0.0249
		(0.0662)	(0.0816)	(0.0151)	(0.0639)	(0.0737)	(0.0136)	(0.0694)	(0.0793)	(0.0171)	(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	-0.777**	-0.723	-0.756	-0.931**	-0.818*	-1.048*
		(0.351)	(0.391)	(0.455)	(0.371)	(0.429)	(0.600)	(0.372)	(0.449)	(0.725)	(0.407)	(0.462)	(0.564)
	EU programme dummy (t-1)	1.314***	0.712	1.186***	1.143***	0.404	1.130***	1.273***	0.763	1.180**	1.212**	-0.214	1.159*
		(0.405)	(0.521)	(0.428)	(0.443)	(0.554)	(0.384)	(0.455)	(0.571)	(0.489)	(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	0.000	0.000	0.000
	Goodness-of-fit	0.178	0.146	0.207	0.119	0.086	0.139	0.114	0.095	0.159	0.129	0.088	0.141
	Nº of observations	982	885	982	1064	961	1064	1032	929	1032	875	794	875
	Nº of countries	33	33	33	35	35	35	35	35	35	27	27	27
	Nº of instruments		68	64		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, composite leading indicator (CLI) and industrial production. 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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lagged dep. var.	Δ Cyclically-adjusted primary balance (t-1)	-0.181***	-0.222*	-0.127*	-0.173***	0.109	-0.0749	-0.175***	-0.150	-0.0962	-0.160***	0.152	-0.0968
		(0.0408)	(0.126)	(0.0727)	(0.0419)	(0.147)	(0.0628)	(0.0437)	(0.147)	(0.0734)	(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 Industrial production (t)							-0.103***	-0.377***	-0.231**			
								(0.0283)	(0.0833)	(0.0939)			
	Δ OECD Composite Leading Indicator (t-1)										-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**	0.0213***	0.0260***	0.00267	0.0220***	0.0210**	0.00611**
		(0.00669)	(0.00763)	(0.00295)	(0.00697)	(0.00758)	(0.00233)	(0.00694)	(0.00799)	(0.00278)	(0.00732)	(0.00813)	(0.00220)
Political controls	Election year dummy (t)	-0.291*	-0.234	-0.249	-0.333*	-0.314	-0.351*	-0.359**	-0.366*	-0.323	-0.250	-0.193	-0.246
		(0.175)	(0.187)	(0.226)	(0.182)	(0.196)	(0.194)	(0.166)	(0.205)	(0.204)	(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	-0.0712	-0.184	-0.0457	-0.00187	-0.0187	0.00444
		(0.124)	(0.139)	(0.109)	(0.128)	(0.147)	(0.102)	(0.125)	(0.156)	(0.0915)	(0.153)	(0.173)	(0.110)
	Age dependency ratio (t-1)	-0.139	-0.236**	-0.0245	-0.0726	-0.0851	-0.00687	-0.117	-0.283**	-0.0536	-0.127	-0.164	0.00379
		(0.111)	(0.118)	(0.0289)	(0.115)	(0.118)	(0.0255)	(0.118)	(0.132)	(0.0522)	(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	-1.121*	-1.713**	-1.915*	-1.060	-0.940	-1.442
		(0.574)	(0.617)	(0.744)	(0.592)	(0.623)	(0.835)	(0.586)	(0.687)	(0.938)	(0.746)	(0.787)	(1.257)
	EU programme dummy (t-1)	1.163**	0.990	1.087*	1.256**	0.245	1.171**	1.471***	1.627**	1.616***	1.270*	-0.260	1.333
		(0.486)	(0.627)	(0.601)	(0.504)	(0.710)	(0.477)	(0.525)	(0.779)	(0.558)	(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	0.000	0.000	0.000	0.002	0.000
	Goodness-of-fit	0.213	0.194	0.240	0.174	0.129	0.194	0.174	0.117	0.178	0.183	0.122	0.177
	Nº of observations	635	608	635	635	608	635	635	608	635	545	515	545
	Nº of countries	27	27	27	27	27	27	27	27	27	20	20	20
	Nº of instruments		65	63		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, composite leading indicator (CLI) and industrial production. 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 3: Baseline specifications (non-EU, 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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lagged dep. var.	Δ Cyclically-adjusted primary balance (t-1)	-0.143***	-0.262	-0.0795	-0.181***	-0.0392	-0.124**	-0.143***	-0.170	-0.0305	-0.103*	0.0427	-0.0384
		(0.0549)	(0.159)	(0.112)	(0.0483)	(0.135)	(0.0532)	(0.0532)	(0.118)	(0.0685)	(0.0582)	(0.166)	(0.113)
Economic cycle indicator	Δ Output gap (t)	-0.104**	-0.298	-0.331									
		(0.0449)	(0.230)	(0.211)									
	Δ Unemployment rate (t)				-0.0277	0.0823	-0.421						
					(0.0925)	(0.288)	(0.277)						
	Δ Industrial production (t)							-0.0224	0.378***	0.261*			
								(0.0327)	(0.135)	(0.148)			
	Δ OECD Composite Leading Indicator (t-1)										0.0340	0.0476	-0.228
											(0.0692)	(0.162)	(0.362)
Std. control	Public debt-to-GDP (t-1)	0.0209***	0.0333***	0.00254	0.0307***	0.0373***	0.00519**	0.0335***	0.0395***	0.00654**	0.0207***	0.0225***	0.00464***
		(0.00735)	(0.00931)	(0.00193)	(0.00761)	(0.00862)	(0.00239)	(0.00724)	(0.0107)	(0.00252)	(0.00626)	(0.00729)	(0.00147)
Political controls	Election year dummy (t)	-0.522***	-0.386**	-0.551***	-0.250	-0.0719	-0.312	-0.273	-0.191	-0.232	-0.339**	-0.287	-0.304*
		(0.163)	(0.185)	(0.192)	(0.181)	(0.227)	(0.229)	(0.193)	(0.282)	(0.245)	(0.173)	(0.186)	(0.167)
	Number of changes in government (t-1)	-0.290**	-0.0563	-0.225	-0.258	-0.0710	-0.243	-0.258	0.0869	-0.0945	-0.146	-0.0913	-0.155
		(0.140)	(0.164)	(0.137)	(0.168)	(0.207)	(0.163)	(0.170)	(0.267)	(0.145)	(0.152)	(0.164)	(0.181)
	Age dependency ratio (t-1)	-0.227**	-0.335***	-0.0465	-0.343***	-0.390***	-0.0637**	-0.366***	-0.403***	-0.0321	-0.217**	-0.222**	-0.0450
		(0.0989)	(0.117)	(0.0274)	(0.106)	(0.115)	(0.0293)	(0.100)	(0.141)	(0.0306)	(0.0846)	(0.0937)	(0.0298)
Crisis controls	Systemic crisis dummy (t-1)	-1.085**	-1.677***	-1.561**	0.351	0.521	0.909	-0.0227	0.188	0.127	-1.273**	-1.113**	-1.229*
		(0.517)	(0.550)	(0.625)	(0.493)	(0.669)	(0.922)	(0.598)	(0.825)	(1.230)	(0.510)	(0.523)	(0.642)
	EU programme dummy (t-1)												
	Time FE: Wald-test, p-value	0.000	0.006	0.000	0.000	0.045	0.000	0.000	0.370	0.000	0.000	0.035	0.000
	Goodness-of-fit	0.188	0.178	0.231	0.114	0.102	0.142	0.111	0.077	0.099	0.189	0.197	0.232
	Nº of observations	347	277	347	429	353	429	397	321	397	330	279	330
	Nº of countries	24	22	24	26	24	26	26	22	26	17	16	17
	Nº of instruments		67	62		67	62		67	62		64	61

Notes: Pro-cyclicality is indicated by a negative sign for the coefficient of the change in the output gap, composite leading indicator (CLI) and industrial production. 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.

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 the change in the output gap. They suggest that pro-cyclicality of discretionary fiscal policy has on average increased over time, with the exception of 1999-2004 when it was broadly a-cyclical. The increase over time is visible in both the EU and non-EU part of our sample. The results for the alternative cyclical indicators support the same qualitative conclusions.

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 policymakers react to the cycle is not linear but depends on other factors. To that end, we add interaction terms to equation (1):

$$\Delta capb_{i,t} = \beta_1 \Delta cabp_{i,t-1} + \beta_2 cycle_{i,t} + \beta_3 F_{i,t} + \underbrace{\beta_4 (cycle_{i,t} F_{i,t})}_{\text{interaction term}} + \beta_5 X_{i,t-1} + \theta_t + \delta_i + u_{i,t} \quad (2)$$

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 β_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 β_4 when the dummy is equal to 1 and remains unchanged at β_2 when the dummy takes the value 0.

Starting from the baseline specification reported in Tables 1 through 3, we estimate the aforementioned interaction model adding one factor of interest at a time. We do so for two of the four cyclical indicators, the change in the output gap and the unemployment rate. Table 4 summarises the key findings in qualitative terms for the full sample of countries with a focus on β_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 policymakers 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 some evidence 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; policymakers can focus on their political priorities with little restriction. By contrast, for higher debt levels, sustainability concerns seem to kick in 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 policymakers 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.

Similar to Gootjes and de Haan (2020), 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 results, although not statistically significant, are 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 or less pro-cyclical stance.

Table 4: 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)		
	Estimator / ***Interaction***	*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 of national arrangements such as the statutory base of the rules, the role of independent fiscal councils, the frequency and type of monitoring, the room for revising fiscal targets and the nature of corrections mechanisms;

- A set of dummy variables characterising different stages of the EU fiscal framework: the implementation of the SGP from 1999 onwards, the first major reform of the Pact in 2005, the six-pack reform of 2011, as well as a dummy for country-specific periods in the run-up to EU/€ membership;
- Measures of numerical compliance as defined in Larch and Santacroce (2020). The variables encompass the four main rules of the SGP, 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 2) and add interaction terms for each of the factors of interest at a time. Table 5 summarises the results. The sign of the estimated β_4-coefficients suggest that both the SGP and its 2005 reform exacerbated average pro-cyclicality, while the estimates for the six-pack dummy point into a different direction. However, statistical significance at conventional levels of confidence is patchy.

Table 5: 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)		
	Estimator / ***Interaction***	*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 SGP, 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.

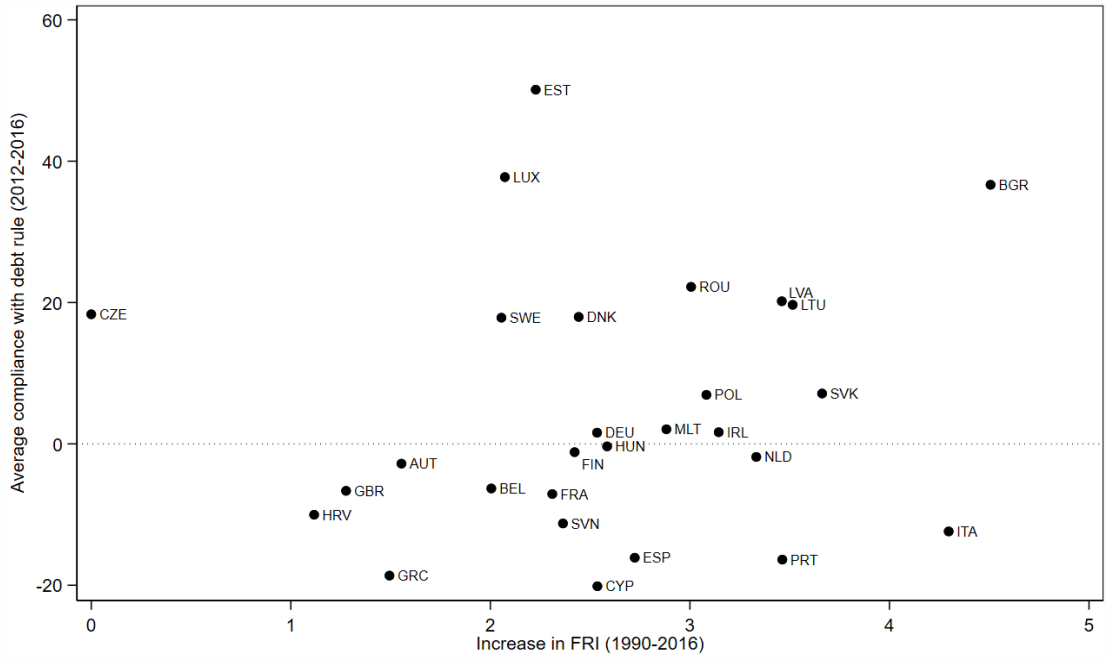
It turns out that controlling for the quality of the fiscal rules does not improve results with respect to stabilisation. Interacting the cycle with the quality index in the fiscal reaction function seems to suggest EU countries with higher quality rules, i.e. a higher fiscal rules index, portray on average a stronger pro-cyclical reaction. 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 appears to play an important role. Figure 2 provides a graphic illustration: the increase in the fiscal rules index of the European Commission is not correlated with better compliance. This is due to two reasons: First, although national arrangements are meant to complement EU fiscal rules, there can be discrepancies or inconsistencies. Second, the fiscal rule index of the European Commission measures how complete national rules are relative to some desirable design features. Hence, a given score can be compatible with very different degrees of numerical constraints imposed by rules.

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 with the 2011 reform of the Pact, our series indicates whether fiscal policy would have been compliant or not and to what extent. Although hypothetical, 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. Hence, Figure 2 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 first tentative evidence that compliance with the rules of the SGP 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, should have the fiscal space to run fiscal expansions during downturns. Figure 3 and Figure 4 provide a first visual illustration of the point. Figure 4 shows a clear positive correlation between compliance with EU rules and debt dynamics: Staying within the perimeters of the rules targeting budgetary aggregates goes along with a lower increase in government debt and, hence, preserves the leeway for stabilisation during downturns. Figure 3 provides the historical context. 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. The first phase of the same pattern emerged in the recovery from the euro area sovereign debt crisis, especially in 2018 and 2019. While the cycle automatically improved compliance with the

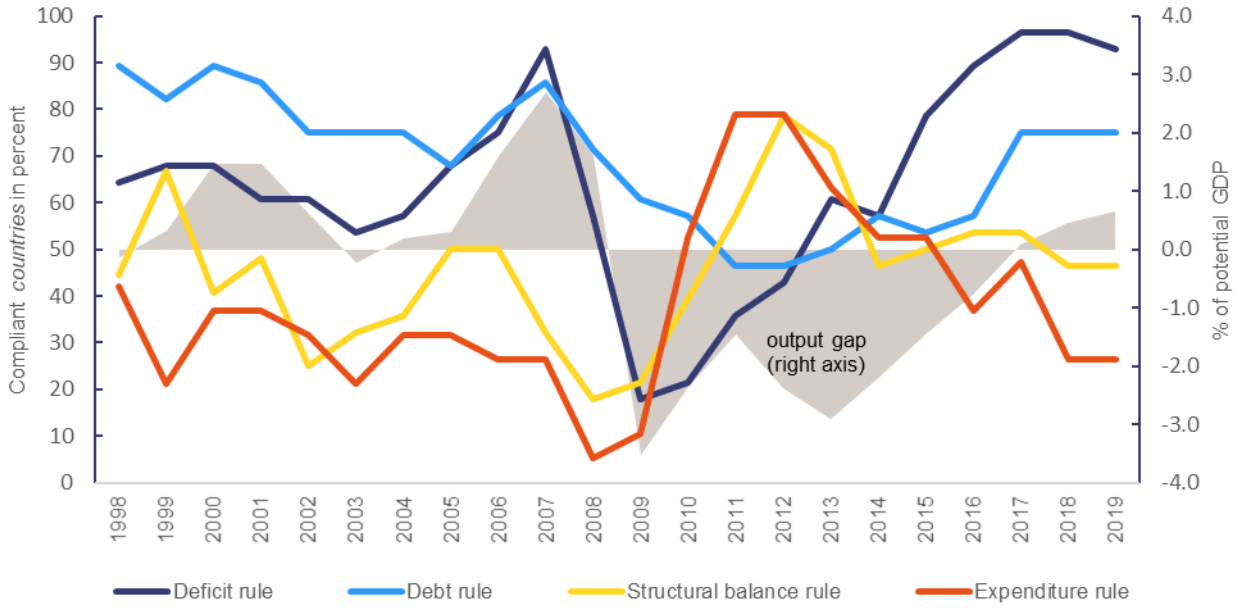
deficit and the debt rule, giving the false impression that the budgetary situation was strengthening, attention to rules cutting through the cycle declined.

Figure 2: Total increase in fiscal rule strength (FRI) vs. average compliance with debt rule since Six Pack



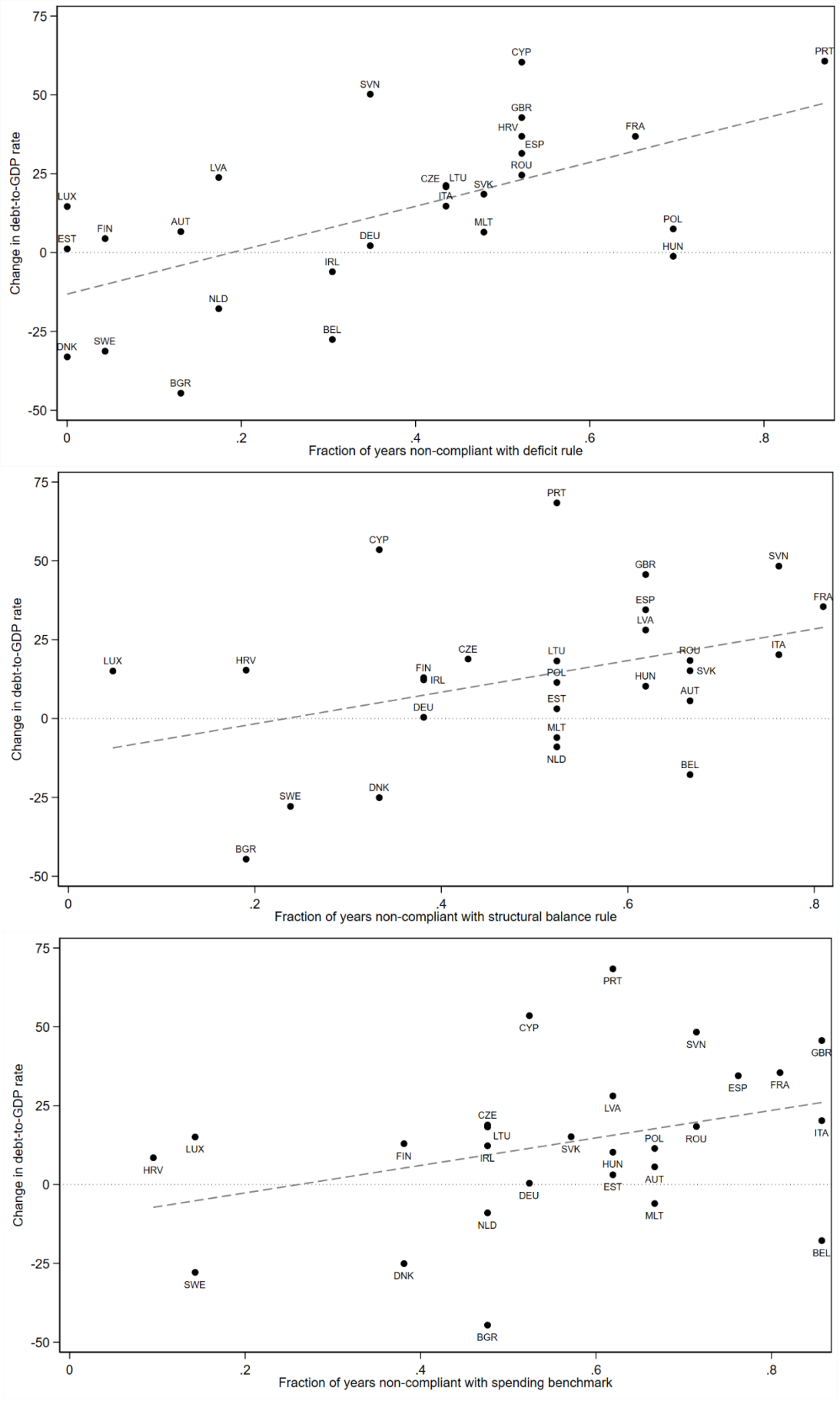
Source: European Fiscal Board, European Commission

Figure 3: Compliance with EU fiscal rules and output gap developments



Source: European Fiscal Board, European Commission

Figure 4: Non-compliance with EU fiscal rules and the accumulation of debt (1998-2018)

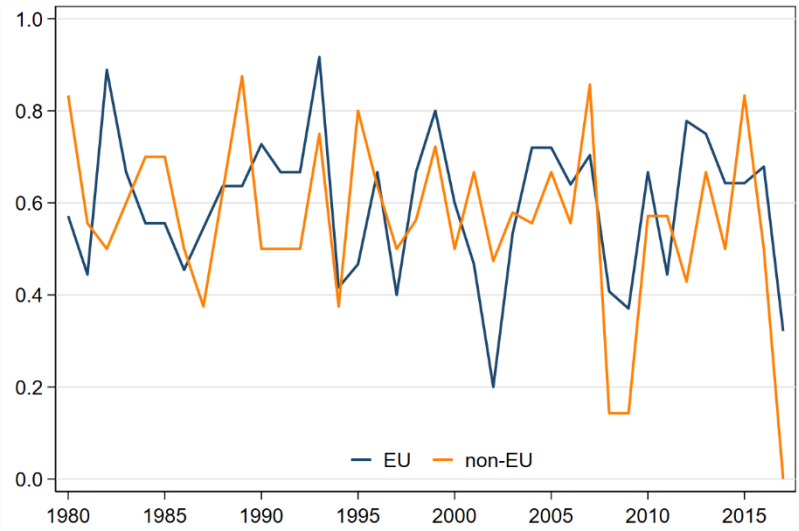


Note: The top panel (deficit compliance) covers 1996-2018. Greece was excluded since it was considered an outlier, The relation is significant at the 1% level for the deficit rule and 10% for the structural balance and spending rules, with the explained variation as high as 37% for the deficit rule.

5.2 Logit models

In light of the results derived from the extended fiscal reaction functions, we take a look at an alternative, more direct and parsimonious 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 output gap was negative or where the cyclically adjusted primary balance decreased by more than 0.25% of GDP when the output gap was positive.[8] Of note, Figure 5 shows that the tendency to run pro-cyclical fiscal policies is pervasive in both EU and non-EU countries. The average frequency is very similar: 59% in the EU and 56% in the non-EU. This means that a priori stabilising output through discretionary fiscal policy interventions is almost like tossing a coin: countries get it right close to 50% of the time only.[9]

Figure 5: Frequency of pro-cyclical fiscal policy episodes – EU versus non EU countries



Note: 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 output gap was negative or where the cyclically adjusted primary balance decreased by more than 0.25% of GDP when the output gap was positive.

The results of our logit regressions are reported in Table 6.[10] Due to the non-linearity of the logit model, the estimated coefficients do not represent the marginal effect on the probability

[8] 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. A summary of these robustness checks is included in Annex 5 of the supplementary materials.

[9] A simple analysis of variance (ANOVA) test shows that the differences between EU and non-EU countries are statistically insignificant at conventional levels of confidence (p value: 0.344).

[10] 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. Employing the more flexible partial pooling of the random effects, in their turn, results in a statistically insignificant panel-level variance component. Consequently, the use of an equal-correlation model (estimated using a generalized estimating equation estimator) is found to be the most appropriate four our data.

to run pro-cyclical fiscal policy.[11] Nevertheless, the sign of the estimated coefficients has a straightforward meaning: positive (negative) coefficients indicate a higher (lower) likelihood of pro-cyclical fiscal policy.

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 of 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.[12] 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 countries fiscal space, which tends to be used in a way that does not take into account cyclical conditions. Recent experience in the euro area is 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 test the importance of institutional determinants for the likelihood of pro-cyclical fiscal policy. The results are reported in specification (3) of Table 6, which includes the dummies capturing different stage of the EU fiscal framework. None of the estimated coefficients turn out to be statistically significant and only some of the algebraic signs support an intuitive interpretation. The positive coefficient of the run-up-to-EU/€ dummy is in line with expectations. Most countries implemented a series of adjustments to qualify for the EU/€ 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 reform 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 corroborates the pattern mentioned in relation to Figure 4. In the boom period preceding the post-2007 crisis, many member states did not follow rules supportive of counter-cyclical fiscal policies and

[11] To facilitate interpretation and comparison, the estimated coefficients can be exponentiated, i.e. looking at e^{β} 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.

[12] The 5-year variance of real GDP is computed as the rolling-window sample variance over the current and four previous observations of real GDP growth.

accumulated very large levels of debt during the crisis, which left little to no room 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 7 to Table 9. 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 7). 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 lawmakers 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 numerical compliance that capture actual behaviour, including in times when the SGP did not yet foresee the respective rules, i.e. 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 also plays an important role: rules can only support fiscal discipline if they are followed, which requires some political buy-in at the country level and across member states within the Council of the European Union.

The role of compliance is confirmed in Tables 8 and 9 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. The estimation results provide some support especially as regards the debt rule. Over the observed range of (non-)compliance, 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.

Table 6: 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*	0.0178	0.0858*
		(0.0488)	(0.0583)	(0.0480)
	Public debt-to-GDP squared	0.0000118	0.0000761***	0.0000152
	(t)	(0.0000163)	(0.0000239)	(0.0000169)
	5y average real GDP per	0.0000428	0.00108**	0.0000405
	capita (t)	(0.000246)	(0.000528)	(0.000258)
	5y average nominal GDP	0.0339	0.163***	0.0385
	growth (t)	(0.0331)	(0.0439)	(0.0346)
	5y variance of real GDP (t)	0.0127**	0.0126**	0.0116**
		(0.00520)	(0.00570)	(0.00510)
	Interest rate (t-1)	-0.0714	-0.201***	-0.0709
		(0.0444)	(0.0517)	(0.0472)
	Systemic crisis dummy (t)	0.938**	1.516*	0.971**
		(0.467)	(0.782)	(0.485)
	EU Programme dummy (t)	0.641	0.453	0.585
		(0.547)	(0.638)	(0.545)
	Election dummy (t)	0.278*	0.456**	0.277*
		(0.157)	(0.203)	(0.156)
	Large country dummy (t)		0.366	
			(0.237)	
Institutional dummies	Run up to € dummy (t)			0.192
				(0.450)
	SGP dummy (t)			-0.0865
				(0.366)
	SGP 2005 reform dummy (t)			0.140
				(0.679)
	6P onwards dummy (t)			0.522
				(0.600)
	Time FE: Wald-test, p-value	0.000	0.000	0.000
	Share correctly classified	0.658	0.676	0.658
	Nº of observations	827	578	827
	Nº 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 percentage of fiscal episodes classified correctly by the model is reported as a measure of the goodness-of-fit.

Table 7: Determinants of the likelihood of pro-cyclical fiscal policy - Logit estimates, including fiscal rule compliance dummies

		EU only	EU only	EU only	EU only	EU only
		(1)	(2)	(3)	(4)	(5)
Standard controls	Output Gap (t)	0.0178	-0.0420	-0.0540	-0.0505	-0.0423
		(0.0583)	(0.0578)	(0.0642)	(0.0603)	(0.0691)
	Public debt-to-GDP squared	0.0000761***	0.000104***	0.000104***	0.000107***	
	(t)	(0.0000239)	(0.0000293)	(0.0000289)	(0.0000284)	
	5y average real GDP per	0.00108**	0.00121**	0.00131**	0.00130**	0.00103**
	capita (t)	(0.000528)	(0.000531)	(0.000521)	(0.000522)	(0.000514)
	5y average nominal GDP	0.163***	0.183***	0.168***	0.172***	0.134***
	growth (t)	(0.0439)	(0.0445)	(0.0473)	(0.0443)	(0.0458)
	5y variance of real GDP (t)	0.0126**	0.0149**	0.0152**	0.0162**	0.0111*
		(0.00570)	(0.00661)	(0.00664)	(0.00667)	(0.00631)
	Interest rate (t-1)	-0.201***	-0.348***	-0.352***	-0.348***	-0.244**
		(0.0517)	(0.0949)	(0.110)	(0.104)	(0.0995)
	Systemic crisis dummy (t)	1.516*	1.384*	1.336*	1.317	1.149
		(0.782)	(0.812)	(0.812)	(0.806)	(0.786)
	EU Programme dummy (t)	0.453	0.491	0.714	0.697	0.817
		(0.638)	(0.712)	(0.785)	(0.806)	(0.813)
	Election dummy (t)	0.456**	0.355*	0.352	0.326	0.374*
		(0.203)	(0.212)	(0.226)	(0.213)	(0.215)
	Large country dummy (t)	0.366	0.291	0.225	0.225	0.269
		(0.237)	(0.226)	(0.263)	(0.265)	(0.269)
Fiscal rule non-compliance dummies	Deficit compliance dummy (t)		-0.276			
			(0.271)			
	Spending compliance			-0.644**		
	dummy (t)			(0.288)		
	Struct. bal. compliance				-0.792***	
	dummy (t)				(0.300)	
	Debt compliance dummy (t)					-0.648**
						(0.300)
	Time FE: Wald-test, p-value	0.000	0.000	0.000	0.000	0.000
	Share correctly classified	0.676	0.701	0.696	0.703	0.703
	Nº of observations	578	451	421	421	421
	Nº of countries	27	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 percentage of fiscal episodes classified correctly by the model is reported as a measure of the goodness-of-fit.

Table 8: Determinants of the likelihood of pro-cyclical fiscal policy - Logit estimates, including numerical measures of fiscal rule compliance

		EU only	EU only	EU only	EU only	EU only
		(1)	(2)	(3)	(4)	(5)
Standard controls	Output Gap (t)	0.0136	-0.0457	-0.0576	-0.0566	-0.0431
		(0.0593)	(0.0570)	(0.0662)	(0.0672)	(0.0691)
	Public debt-to-GDP squared	0.0000682**	0.0000967***	0.000110***	0.000110***	
	(t)	(0.0000270)	(0.0000313)	(0.0000309)	(0.0000316)	
	5y average real GDP per	0.000976*	0.00116**	0.00118**	0.00119**	0.000968*
	capita (t)	(0.000531)	(0.000535)	(0.000526)	(0.000528)	(0.000528)
	5y average nominal GDP	0.149***	0.175***	0.162***	0.167***	0.153***
	growth (t)	(0.0426)	(0.0400)	(0.0441)	(0.0447)	(0.0511)
	5y variance of real GDP (t)	0.0104*	0.0131**	0.0143**	0.0139**	0.0113
		(0.00537)	(0.00641)	(0.00631)	(0.00634)	(0.00753)
	Interest rate (t-1)	-0.204***	-0.356***	-0.335***	-0.341***	-0.252**
		(0.0527)	(0.0950)	(0.105)	(0.105)	(0.102)
	Systemic crisis dummy (t)	1.488*	1.360*	1.343	1.329*	1.201
		(0.773)	(0.797)	(0.820)	(0.806)	(0.778)
	EU Programme dummy (t)	0.459	0.468	0.620	0.555	0.730
		(0.634)	(0.691)	(0.794)	(0.768)	(0.815)
	Election dummy (t)	0.448**	0.342	0.346	0.344	0.370*
		(0.197)	(0.208)	(0.219)	(0.211)	(0.216)
Deviation from fiscal rule:	Deficit compliance (t)		-0.0639*			
			(0.0332)			
	Spending compliance (t)			-0.110		
				(0.0872)		
	Structural balance compl. (t)				-0.0925	
					(0.0992)	
	Debt compliance (t)					-0.0169*
						(0.0100)
	Time FE: Wald-test, p-value	0.000	0.000	0.000	0.000	0.000
	Share correctly classified	0.673	0.701	0.703	0.708	0.694
	Nº of observations	578	451	421	421	421
	Nº of countries	27	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 percentage of fiscal episodes classified correctly by the model is reported as a measure of the goodness-of-fit.

Table 9: Determinants of the likelihood of pro-cyclical fiscal policy - Logit estimates, including squared numerical measures of fiscal rule compliance

		EU only	EU only	EU only	EU only	EU only
		(1)	(2)	(3)	(4)	(5)
Standard controls	Output Gap (t)	0.0136	-0.0429	-0.0753	-0.0673	-0.0521
		(0.0593)	(0.0574)	(0.0678)	(0.0698)	(0.0653)
	Public debt-to-GDP squared	0.0000682**	0.0000961***	0.000132***	0.000121***	
	(t)	(0.0000270)	(0.0000311)	(0.0000346)	(0.0000312)	
	5y average real GDP per	0.000976*	0.00116**	0.00111**	0.00116**	0.00108**
	capita (t)	(0.000531)	(0.000533)	(0.000517)	(0.000528)	(0.000528)
	5y average nominal GDP	0.149***	0.173***	0.184***	0.180***	0.154***
	growth (t)	(0.0426)	(0.0390)	(0.0477)	(0.0497)	(0.0469)
	5y variance of real GDP (t)	0.0104*	0.0135**	0.0142**	0.0132*	0.0128**
		(0.00537)	(0.00651)	(0.00671)	(0.00716)	(0.00567)
	Interest rate (t-1)	-0.204***	-0.359***	-0.319***	-0.323***	-0.272***
		(0.0527)	(0.0955)	(0.103)	(0.102)	(0.101)
	Systemic crisis dummy (t)	1.488*	1.364*	1.233	1.449*	1.315*
		(0.773)	(0.805)	(0.750)	(0.797)	(0.792)
	EU Programme dummy (t)	0.459	0.472	0.678	0.518	0.463
		(0.634)	(0.689)	(0.821)	(0.792)	(0.822)
	Election dummy (t)	0.448**	0.332	0.357	0.370*	0.371*
		(0.197)	(0.209)	(0.219)	(0.223)	(0.214)
Deviation from fiscal rule	Deficit compliance (t)		-0.0750*			
			(0.0385)			
	Deficit compl. squared (t)		-0.00184			
			(0.00202)			
	Spending compliance (t)			-0.0323		
				(0.103)		
	Spending compl. squared (t)			-0.0484**		
				(0.0222)		
	Structural balance compl. (t)				-0.0505	
					(0.0994)	
	Structural balance				-0.0387	
	Compl. squared (t)				(0.0248)	
	Debt compliance (t)					-0.0280*
						(0.0143)
	Debt compliance squared (t)					0.000400*
						(0.000233)
	Time FE: Wald-test, p-value	0.000	0.000	0.000	0.000	0.000
	Share correctly classified	0.673	0.701	0.694	0.705	0.696
	N° of observations	578	451	421	421	421
	N° of countries	27	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 percentage of fiscal episodes classified correctly by the model is reported as a measure of the goodness-of-fit.

6 Conclusions

Using panel data covering around 40 EU and non-EU countries, we have analysed the stabilisation properties of fiscal policy and their main drivers. Our empirical analysis uses data 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 in the EU and beyond, but we add several findings to the literature. First, while real-time output gap estimates are notoriously volatile and subject to revisions, their volatility cannot serve as a credible explanation for pro-cyclicality. We show that alternative cyclical indicators that are observable in real time, less prone to revisions 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, not of uncertainty.

Second, we stress the crucial role of sustainability concerns or constraints, which, if they become important, trump the stabilisation objective. 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 overtakes other policy objectives and it becomes difficult for fiscal policy to lean against the wind in downturns. Pro-cyclicality in bad times is the flipside of pro-cyclicality in good times.

Third, and very much linked to the second point, breaching not following EU fiscal rules contributes to pro-cyclicality. We provide evidence that compliance with EU rules improves the cyclical behaviour; some more than others. 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 stabilisation purposes if they are not followed and debt accumulates.

A possible path to enhance compliance could be to rebalance and strengthen the incentives to abide by the rules. In the long-standing debate on whether to rely on sticks or carrots, it could be time to put more emphasis on the latter, notably by making access to funds distributed at the EU level conditional on compliance with the fiscal rules. Sticks – i.e. the threat of financial sanctions – have thus far not proved sufficiently effective in enforcing rules through coercion. Beyond the question of sticks versus carrots, the literature (see Bergman and Hutchinson, 2015; Gootjes and de Haan, 2020; Larch and Santacroce, 2020) suggests that compliance and better fiscal behaviour are linked to better governance or efficiency. While such a link makes sense intuitively, deriving clear-cut policy conclusions is rather difficult. Good or efficient governance depends on a very wide spectrum of factors that goes well beyond the scope of this paper.

Finally, 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 de facto stricter sustainability conditions in turn, this makes the trade-off with fiscal stabilisation trickier.

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SUPPLEMENTARY MATERIALS

Annex 1. Descriptives

Variable	Description	Source
EU Financial Assistance Programme dummy	1 for HUN from 2008 to 2010 LVA from 2008 to 2012 ROU from 2009 to 2011 (0.5 for 2012-2015) GRC from 2010 to 2018 IRL from 2011 to 2013 PRT from 2011 to 2014 ESP from 2012 to 2014 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 GRC from 1998 to 2000 SVN from 2004 to 2006 CYP and MLT from 2005 to 2007 SVK from 2006 to 2008 EST from 2008 to 2011 LVA from 2011 to 2013 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 10: 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, 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; 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, 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, 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, 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

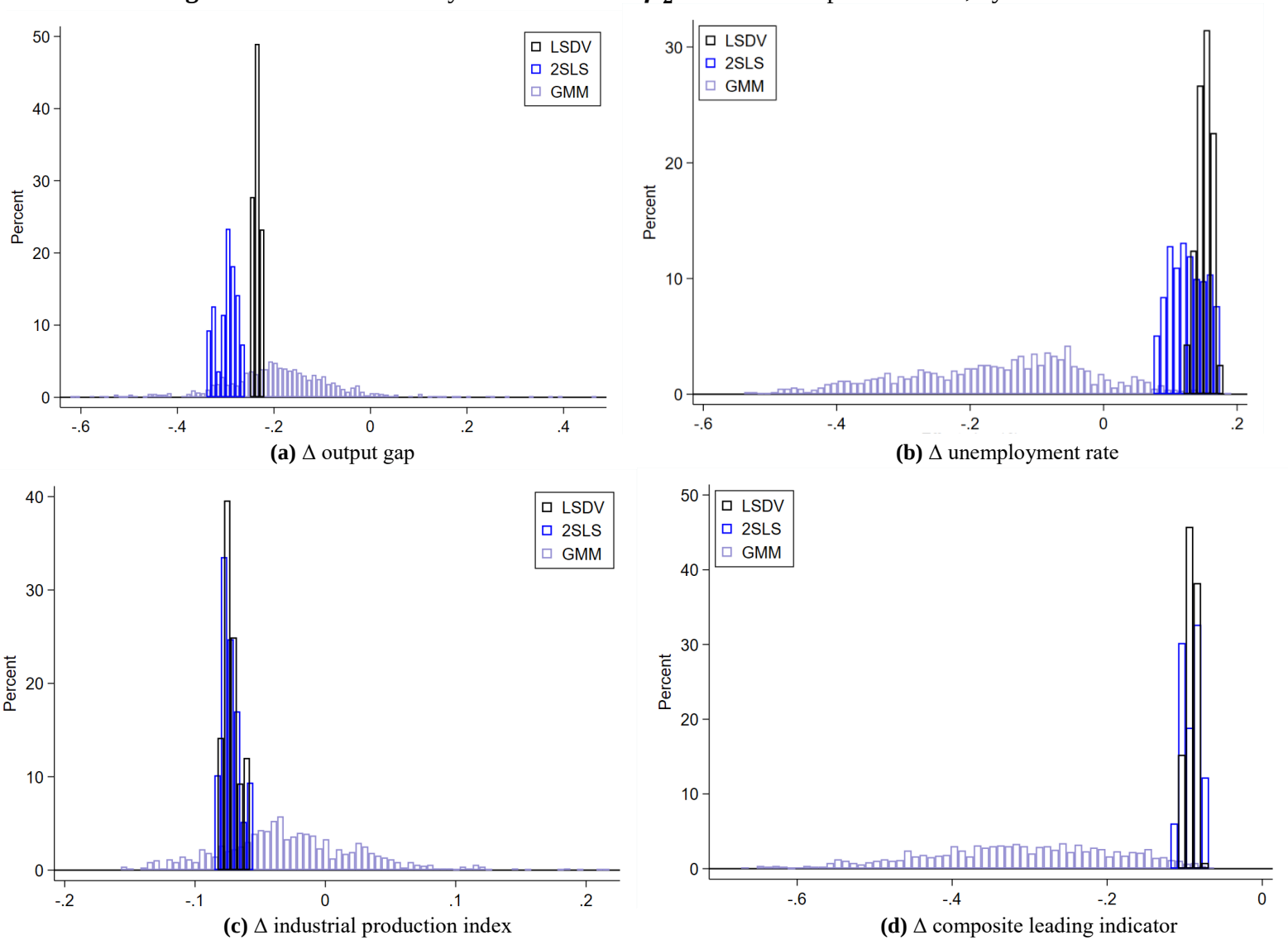
Table 11: Baseline specification Δ output gap (Full sample) - Time splits

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.

Annex 3. Effect sizes

Figure 6: Distribution of cyclical coefficient $\boldsymbol{\beta_2}$ across model permutations, by estimator



(a) Δ output gap

(b) Δ unemployment rate

(c) Δ industrial production index

(d) Δ composite leading indicator

Note: The histograms portray the distribution of the effect size (β_2) of 1,023 permutations of the baseline fiscal reaction functions. The permutations include all possible combinations of the control variables in the baseline specification (cf. Table 1) and the institutional dummies (SGP, SGP 2005 reform and Six Pack) available for the full sample. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalised by Bruno (2005). 2SLS is the two-stage least squares fixed-effects estimator. GMM is the generalised method of moments estimator developed by Blundell and Bond (1998).

Annex 4. 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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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**
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

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**	**LSDVC**	**IV-2SLS**	**IV-GMM**	**LSDVC**	**IV-2SLS**	**IV-GMM**
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

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.

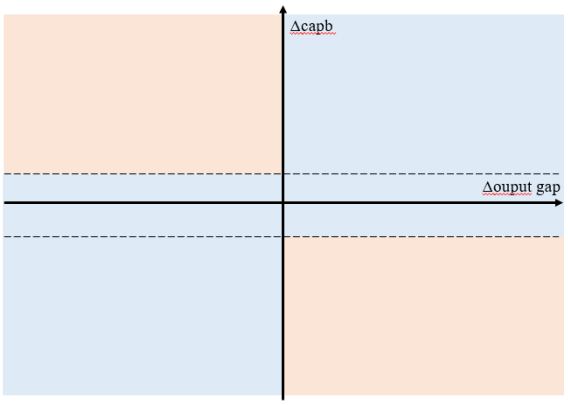
Table 21: Non-linearities - Numerical deviation from EU fiscal rule in *t-1* (positive = compliant, negative = non-compliant) (EU only)

	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

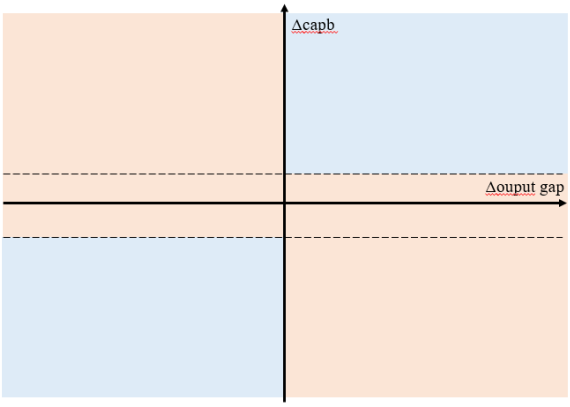
Notes: The dependent variable is the change in the cyclically adjusted primary budget balance as a percentage of GDP. LSDVC is the Nickell bias-corrected least-squares dummy variable estimator as operationalized by Bruno (2005). IV-2SLS is the two-stage least squares fixed-effects estimator. IV-GMM is 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.

Annex 5. Classification of fiscal episodes

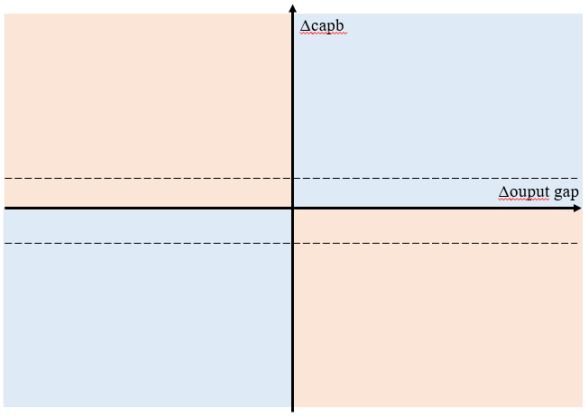
Figure 7: Classification of fiscal episodes (blue = counter-cyclical, red = pro-cyclical)



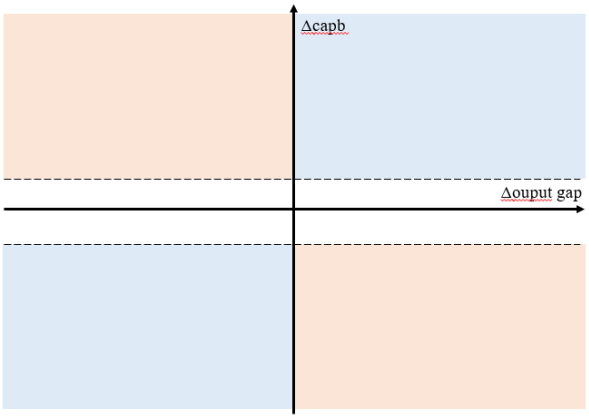
(a) Baseline



(b) Neutral band incl. in pro-cyclical



(c) 0% of GDP cut-off



(d) Neutral band excluded

Table 22: Summary of robustness checks of logit regression coefficients – by way of classification of fiscal episodes (a)-(b)

Table 6 – Institutional dummies				
	(a)	(b)	(c)	(d)
Run up to € dummy	0.192	0.032	-0.015	0.121
SGP dummy	-0.087	-0.221	-0.086	-0.145
SGP 2005 reform dummy	0.140	0.387	0.133	0.179
6P onwards dummy	0.522	-0.099	0.291	0.302
Table 7 – Compliance dummies				
	(a)	(b)	(c)	(d)
Deficit compliance dummy	-0.276	-0.470	-0.411	-0.542*
Spending compliance dummy	-0.644**	-0.393	-0.361	-0.636**
Struct. bal. compliance dummy	-0.792***	-0.436*	-0.566**	-0.707**
Debt compliance dummy	-0.648**	-1.299***	-0.774***	-1.288***
Table 8 – Numerical compliance variables				
	(a)	(b)	(c)	(d)
Deficit compliance	-0.064*	-0.107***	-0.098**	-0.112***
Spending compliance	-0.110	-0.068	-0.070	-0.134
Struct. bal. compliance	-0.093	-0.097	-0.106	-0.143
Debt compliance	-0.017*	-0.018**	-0.018*	-0.022**
Table 9 – Numerical compliance variables and their squared values				
	(a)	(b)	(c)	(d)
Deficit compliance	-0.075*	-0.113***	-0.105**	-0.125***
Deficit compliance squared	-0.0018	-0.0016	-0.0017	-0.0027
Spending compliance	-0.032	-0.028	-0.012	-0.072
Spending compliance squared	-0.0484**	-0.0229	-0.0363**	-0.0357*
Struct. bal. compliance	-0.051	-0.109	-0.092	-0.130
Struct. bal. compliance squared	-0.0387	0.0082	-0.0124	-0.0097
Debt compliance	-0.028*	-0.034***	-0.032**	-0.038**
Debt compliance squared	0.0004*	0.0006**	0.0005**	0.0005*

Note: Values represent the most relevant coefficients from the logit models in Tables (6)-(9) in the manuscript. The dependent variable is the binary indicator equal to one for pro-cyclical country-year observations, with its definition varying according to options (a)-(b) as described in the text and Figure R-1. Positive (negative) coefficients indicate a higher (lower) likelihood of pro-cyclical fiscal policy. Significance: * p<0.10, ** p<0.05, *** p<0.01. The full estimation results are reported in the tables at the end of this document.