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Assessing the fiscal-monetary policy mix in the euro area

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Abstract

This paper attempts to gauge the effects of various fiscal and monetary policy rules on macroeconomic outcomes in the euro area. It consists of two major parts – a historical assessment and an assessment based on an extended scenario until 2030 – and it builds on the ECB-BASE – a semistructural model for the euro area. The historical analysis (until end-2019, 'pre-pandemic') demonstrates that a consistently countercyclical fiscal policy could have created a fiscal buffer in good economic times and it would have been able to eliminate a large portion of the second downturn in the euro area. In turn, the post-pandemic simulations until 2030 reveal that certain combinations of policy rules can be particularly powerful in reaching favourable macroeconomic outcomes (i.e. recovering pandemic output losses and bringing inflation close to the ECB target). These consist of expansionary-for-longer fiscal policy, which maintains support for longer than usually prescribed, and lower-for-longer monetary policy, which keeps the rates lower for longer than stipulated by a standard reaction function of a central bank. Moreover, we demonstrate that in the current macroeconomic situation, fiscal and monetary policies reinforce each other and mutually create space for each other. This provides a strong case for coordination of the two policies in this situation.

JEL classification: E32, E62, E63

Keywords: Model simulations, Fiscal rules, Monetary policy rules, Joint analysis of fiscal and monetary policy

Non-technical Summary

Fiscal and monetary policy in the euro area exhibited distinct behaviours in the past, especially amid the euro area sovereign debt crisis when fiscal policy was overall not supportive to growth (i.e. procyclical). Against this background, this paper attempts to gauge the effects of various fiscal and monetary policy rules, irrespective of the existing institutional arrangements, on macroeconomic outcomes under different monetary policy rules. The analysis is conducted through the lens of counterfactual scenarios using the ECB-BASE model, which is a semi-structural macroeconomic model of the euro area.

In the model simulations we consider the two following subsamples: the historical pre-pandemic period up to 2019Q4 and the post-pandemic projection period up to 2030. For the historical period we mostly investigate whether different fiscal policy behaviour – more aligned with the monetary policy reaction – would have been able to improve stabilisation of the euro area economy compared to the realised trajectories. We also carefully look how the efficiency and the cost of the alternative fiscal policy arrangements depend on the reaction of the central bank. Turning to the post-pandemic horizon, we note that this period is associated with great macroeconomic challenges such as low natural interest rate and high government debt. Taking into account this environment, we attempt to identify constellations of the two policies that would facilitate a strong performance of the euro area economy going forward.

According to the model simulations for the historical period, consistently countercyclical fiscal policy significantly improves macroeconomic outcomes. In particular, it creates a buffer in good pre-crisis times and, subsequently, eliminates a large portion of the second downturn associated with the euro area sovereign debt crisis. Moreover, it noticeably reduces the negative inflation gap in recent years. While these benefits are attainable at a manageable cost, as judged by the debt-to-GDP ratio, they are also conditional on monetary accommodation. Also importantly, the positive outcomes can only be achieved if the alternative fiscal policy is implementable in the euro area in real time – an aspect we do not assess in the paper.

Regarding the post-pandemic period, our analysis indicates that the combination of expansionary-for-longer fiscal policy and low-for-longer monetary policy has a chance to significantly improve macroeconomic prospects. We define expansionary-for-longer fiscal policy as a policy that is ex-

traordinarily cautious to ensure that a recovery is well in place and, as such, it maintains fiscal support for longer and beyond the closure of the output gap. Low-for-longer monetary policy, in turn, is defined as a policy that keeps the rates lower for longer compared to what would be suggested by the standard reaction function of a central bank. Concretely, this policy constellation could recover around 50% of the accumulated output losses that materialised amid the pandemic and bring inflation into the territory close to the ECB target. While admittedly, this policy course would require a considerable fiscal expansion and it would lead to a non-negligible increase in government debt the euro area debt-to-GDP ratio would remain still on non-increasing path around 100%, for most policy mixes.

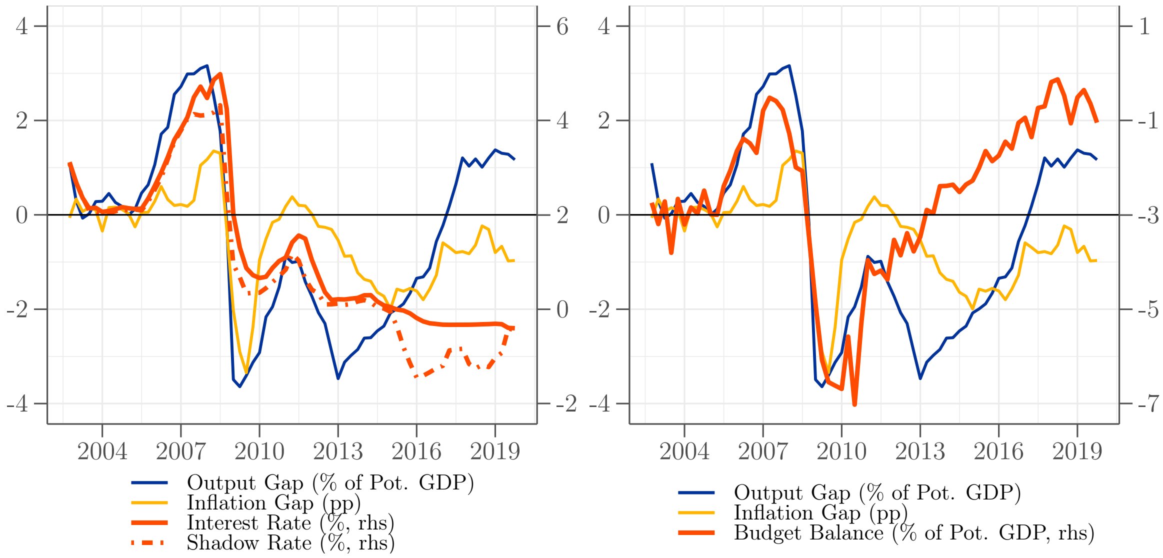
Our analysis also indicates, that at the current juncture fiscal and monetary policy reinforce each other, pointing to complementarities between the two policies. Fiscal policy stimulates output and inflation more under the low-for-longer monetary policy rule than under the standard Taylor rule. In the same vein, the ability of monetary policy to positively influence macroeconomic conditions is greater when fiscal policy is expansionary-for-longer rather than when fiscal policy behaves as it did in the past. Another important finding of the model simulations is that both policies create mutual space for each other. Fiscal policy alleviates the ELB constraint faced by monetary policy, thereby empowering the central bank. On the other hand, monetary policy limits the cost of fiscal policy by preserving favourable financing conditions, hence it positively influences the fiscal space. This provides a strong case for coordination between the two policies at the current juncture.

The stochastic simulations considering uncertainty confirm the findings of the deterministic simulations. Moreover, these simulations assess the stabilisation properties of fiscal and monetary policy in an optimistic growth scenario and a pessimistic growth scenario.

1 Introduction

The conduct of fiscal and monetary policy has changed notably in the EMU period. Until the great financial crisis (GFC) the aggregate variables representing the overall stance of policies (as depicted by the euro area aggregate government budget balance and the ECB's short-term interest rate) co-moved with the business cycle (see Figure 1, co-movement with the output gap and the inflation gap). In addition, in the wake of the GFC both policies strongly reacted to the downturn in a countercyclical fashion. Afterwards, however, a notable divergence between fiscal and monetary policy emerged. While the latter, with the exception of a short tightening episode in 2011, kept on progressing with an accommodative stance the former was tightening. In essence, fiscal and monetary policy in the euro area reacted to the second downturn into opposite directions, with fiscal policy exhibiting a procyclical stance.

Figure 1: Policy reaction over the business cycle in the euro area



Sources: Eurosystem and European Commission.

Notes: The inflation gap is calculated as the deviation to the 2% target value. The shadow rate is calculated according to the methodology of Lemke and Vladu (2017). The potential GDP for the calculation of the output gap and the budget balance-to-GDP ratio comes from the European Commission (Spring 2021 Economic Forecast) given that the ECB does not publish potential GDP estimates.

The prevailing policy mix in the euro area since the formation of the EMU relied on monetary policy as the main macroeconomic stabilisation tool. Fiscal policy instead was supposed to primarily focus on ensuring debt sustainability and addressing country idiosyncratic shocks mostly by letting automatic stabilisers operate freely. While the adequacy of this paradigm was largely unchallenged during the great moderation period, the crisis episodes (i.e. the GFC and the COVID crisis) gave rise to calls for a reassessment. Addressing these demands requires thorough analysis verifying to which extent the policy mix in place was supportive to the achievement of the policy targets and whether potential adjustments to the policy arrangements could improve the economic outcomes in the future.

A remarkable shift in the view on the role of fiscal policy in macroeconomic stabilisation has materialised already in the aftermath of the GFC. In the policy realm a huge 'multiplier debate' erupted in 2011 on the effectiveness of fiscal policy after Olivier Blanchard – in his role as chief economist of the International Monetary Fund – had emphasised that fiscal consolidations may be self-defeating. The literature rediscovering the role of fiscal policies in macroeconomic stabilisation, which simply burgeoned since then, pointed out mostly two key points (see Ramey (2019) for a comprehensive literature survey). First, it underlined that at the lower bound fiscal policy is more effective than usual (see, e.g. Eggertsson (2011) and Christiano et al. (2011)). Second, it made clear that fiscal policy might be indispensable for monetary policy to avoid persistent shortfalls of inflation from its objective at the lower bound (see, e.g. Schmidt (2013) and Corsetti et al. (2019)). Our paper aims to contribute to this strand of literature by conducting an empirical exercise for the euro area. While many of the existing studies make use of parsimonious models to highlight key mechanisms at play our paper aims to conduct the analysis in a realistic data-driven environment that is closely linked to the prevailing macroeconomic conditions in the euro area (i.e. interest rates at the ELB, subdued inflation staying persistently below the target and elevated government debt levels).

This paper attempts to illustrate – through the means of counterfactual scenarios – the implications of different fiscal and monetary policy behaviours, captured by rules, for macroeconomic outcomes.[1] To this end, we consider the historical pre-pandemic period up to 2019Q4 and a post-pandemic projection period up to 2030. For the historical period we mostly investigate whether fiscal policy that avoids procyclicality reduces cyclical fluctuations. As far as the forward-looking period is concerned, we attempt to identify constellations of policy rules that ensure favourable macroeconomic outcomes (i.e. no negative output gap and no sizeable inflation shortfalls).

According to the model simulations, consistently countercyclical fiscal policy creates a buffer in the good pre-GFC times and, subsequently, it has the potential to eliminate a large portion of the second downturn associated with the euro area sovereign debt crisis. Moreover, it reduces the

[1] Fiscal and monetary policy interact in multiple ways. Bassetto and Sargent (2020) emphasise that the separation between the fiscal and monetary authority tends to be blurred. We maintain a clear separation of monetary and fiscal authorities and analyse the interactions via the policy rules only.

negative inflation gap in recent years without bringing large cost in terms of government debt. These benefits are conditional on full monetary accommodation.

Regarding the post-pandemic period, our analysis indicate that the combination of an expansionary-for-longer fiscal policy (i.e. a policy that maintains fiscal support longer beyond the closure of the standard output gap) and a low-for-longer monetary policy (i.e. a policy that keeps the rates low for longer compared to a standard Taylor rule) has a chance to significantly improve macroeconomic prospects. Concretely, this policy constellation recovers around 50% of the accumulated output losses that materialised amid the pandemic and brings inflation into the territory close to the ECB target. Reaching such outcomes requires a moderate increase in government debt. Our analysis also indicates that at the current juncture fiscal and monetary policy reinforce each other and mutually create space for each other. This provides a strong case for the coordination between the two policies currently.

We conduct our analysis in a rich macroeconomic environment and our findings illustrate how conclusions of the academic literature on fiscal policy and its interactions with monetary policy can be brought closer to policy-making. Most notably, we show that when the interest rate policy is constrained – until 2024 in our case – fiscal policy becomes an effective tool at the disposal of policy-makers. While it is necessarily associated with budgetary costs, those are significantly alleviated by material benefits to both real and nominal developments. This helps to reduce the tension between the stabilisation needs and fiscal space when debt-to-GDP ratios are high (approaching 100% for the euro area aggregate in the next years). Moreover and similarly to the literature findings, our exercise shows that expansionary fiscal policy could support monetary policy. In particular, with supportive fiscal policy, it would be easier to address the inflation shortfalls persisting in the euro area rather than with monetary policy tools alone.

Due to the richness of the model specification and the close link to the data, our analysis provides a higher degree of realism in comparison to existing studies. Notwithstanding this, the modelling exercise involves several limitations, which should have a bearing on the interpretation of the simulation results. First, the euro area is modelled as a whole, thereby missing country heterogeneity and other national aspects. This is particularly important because a desirable policy, even if identified, may not be easily implementable given the incomplete setup of the fiscal architecture of the EMU.

Moreover, it is virtually impossible at the aggregate level to reflect fiscal sustainability concerns of the monetary union as these are driven by single member states. Second, the conducted exercise is specific to the periods under consideration. For a general ranking of the policy rules, the analysis should be re-conducted with stochastic simulations around the balanced growth path. Third, the model does not feature sovereign default and it is therefore not suitable for sovereign stress analysis. High debt-to-GDP ratios could increase the probability of sovereign stress in euro area Member States, with a bearing on the cost of refinancing. Fourth, the model is not equipped with a regime switching to passive monetary policy and active fiscal policy and, as such, is not suitable for studying fiscal dominance. Finally, the lack of model consistent expectations implies that agents in the economy are not behaving in a Ricardian way. This could lead to an overestimation on the efficacy of fiscal policy for macroeconomic stabilisation, which is discussed in one of the subsections. In a related vein, monetary policy cannot rely on the anticipation channel, dampening the efficacy of monetary policy tools.

The paper is structured as follows. Section 2 describes the model, with a focus on fiscal and monetary policy rules. Section 3 and 4 contain the historical assessment and the post-pandemic assessment respectively. Section 5 briefly concludes.

2 Model set-up & specification of the policy rules

The ECB-BASE is a semi-structural macroeconomic model of the euro area, developed for the use in the macroeconomic projections, as well as for policy simulations (see Angelini et al. (2019) for a model description). The model features a developed financial block with elaborate monetary policy channels. Also, the model is characterised by a rich representation of the general government, which provides for a meaningful role of fiscal policy.

The applied version of the model embeds backward-looking expectations, which tilts the power from monetary policy to fiscal policy compared to a DSGE model with forward-looking expectations. Backward-looking expectations result in the absence of Ricardian equivalence.[2] In this context, economic agents do not internalise any future consolidation needs resulting from a fiscal

[2] In the situation of economic stress, like during the current COVID crisis, weakening the Ricardian equivalence may be justified on the grounds that the share of liquidity constrained households is higher than usually.

stimulus. Accounting for any anticipated future consolidation would weaken its effects.[3] Similarly, financial market participants in the model are insensitive to any announced information on the future developments in interest rates, or other monetary policy measures known in advance. This eliminates the power of forward guidance that is present in DSGE models and weakens the potency of monetary policy make-up rules, which largely work through anticipation channels (see Hebden et al. (2020) for the analysis of the effects of expectations on monetary policy make-up rules).

The quantitative responses of the ECB-BASE model to macroeconomic shocks are assessed in Angelini et al. (2019) by benchmarking the model results against comparable models, including semi-structural and DSGE models. One further reference for assessment can be found in the 'Basic Model Elasticities' (BMEs). These BMEs are developed by the National Banks of the Eurosystem and are used regularly in the forecast exercises. They condense the views of modellers and forecasters in the Eurosystem on the propagation of macroeconomic shocks.[4] To address a potential criticism that the model gives too much power to fiscal policy and too little potency to monetary policy we cross-check the effects fiscal and monetary policy shocks with the BMEs as well. It turns out that government spending multipliers are broadly consistent with those embedded in the BMEs and the effects of monetary policy are greater than according to the BMEs.[5] Based on this benchmarking against reference models, we conclude that the power of the two policies is balanced.

One of the major advantages of the ECB-BASE model is its close link to the current conjunctural developments. The model is firmly anchored not only in the historical data but also in the Eurosystem projections. In particular, the baseline of the post-pandemic exercise reflects recent macroeconomic projections.[6] As such, the model takes a comprehensive account of the current

[3] The standard RBC/ NK model features infinitely-lived households, whose consumption decisions at any point in time are based on an intertemporal budget constraint. Ceteris paribus, an increase in government spending lowers the present value of after-tax income, thus generating a negative wealth effect that induces a cut in consumption. In this context, standard macroeconomic models feature strong Ricardian effects, which are sometimes at odds with empirical findings (e.g. Blanchard and Perotti (2002)). Against this background, a vast amount of studies established models, where the Ricardian effects are weakened (see, for instance, Gali et al. (2007), which added rule-of-thumb households).

[4] The BMEs have been developed in the context of the Eurosystem projections and they summarise the effects of changes in assumptions (including fiscal and financial assumptions) on macroeconomic variables. They can be interpreted as a simplified version of the macroeconomic models used by National Central Banks for economic projections. As such, they constitute a benchmark for the assessment of fiscal and monetary policy in a macro model. ECB (2016) provides details on BMEs and their application in the projections.

[5] The comparison of policy effects cannot be shown in this paper on account of the fact that the BME elasticities are not made available to the public.

[6] The baseline of the post-pandemic horizon exercise presented in the paper is broadly in line with the December

environment with low interest rates, inflation persistently staying well below the target and large negative output gaps amid the COVID crisis.

2.1 Baseline specification of fiscal and monetary policy

With a view to comprehensively reflecting government accounts, fiscal policy in the ECB-BASE involves multiple instruments. This applies to both the revenue and spending side of the budget. Single instruments are in most of the cases modelled with Error Correction Mechanism (ECM) equations appended with the output gap and deviations of the debt ratio from its target. These two terms represent the stabilisation and sustainability components of fiscal policy.

In the context of this paper, the three following spending categories are used as primary fiscal instruments: government transfers, purchases and investment.[7] The choice is motivated by the observation that the changes in outlays within these items observed in the past were sufficiently large to influence the evolution of the output gap. This stands in contrast to, for instance, government compensation which exhibits exceptionally stable dynamics in the data (see Figure A.1 in Appendix). Moreover, all the three selected categories involve some characteristics of discretionary spending. Given this we the three fiscal instruments as suitable for macroeconomic stabilisation purposes.

Specifically, the spending instruments considered in this paper evolve in line with Eq. 1. The formula stipulates that actual spending (g_t) converges towards its trend and, in addition, responds to cyclical fluctuations as well as to deviations of the debt-to-GDP ratio from its target.

$$\Delta g_t = \alpha \left(g_{t-1} - g_{t-1}^T\right) + \delta \Delta g_t^T + \sum_{k=1}^{2} \rho_k \Delta g_{t-k} + \gamma_Y \hat{Y}_t + \gamma_B \left(\frac{B_t}{\bar{Y}_t P_t} - \bar{b}\right) + \varepsilon_t^G \tag{1}$$

where g_t is log of actual spending, g_t^T is log of trend spending, $\hat{Y}_t$ is the real output gap, $\frac{B_t}{\bar{Y}_t P_t}$ is the debt ratio to nominal output, $\bar{b}$ is the debt-to-GDP ratio target and ε_t^G is the residual term.[8]

2020 macroeconomic projection (see ECB (2020) for the results), to the extent that macroeconomic variables are made available to the public. The estimates of potential GDP, which are crucial for the analysis and which are not published by the ECB, come from the European Commission's Economic Forecast (Spring 2021).

[7] To avoid complexity, we limit our investigation of fiscal rules to the spending side of the budget. In general, government expenditures are characterised by a higher output multiplier compared to taxes as it affects output more directly. In this context, government spending may be seen as more suitable for output stabilisation than taxes.

[8] Fiscal rules in the ECB-BASE are broadly consistent with those in DSGE models with elaborate fiscal policy (see, for instance, Coenen et al. (2013)). In addition, the inclusion of trend and lags in the equation ensures a good data fit.

The coefficients entailed in the spending rules are estimated, summarising the average behaviour of fiscal policy over the entire sample. This also applies to the coefficient on the output gap, which represents the cyclicality of fiscal policy. Given the contrasting nature of the euro area fiscal policy (i.e. countercyclical amid the GFC and procyclical thereafter) the estimated coefficients turn out to be very small (see Table A.1 for exact values). This points to little reaction of fiscal policy to the cycle on average embedded in the baseline fiscal rules.

Turning to monetary policy, the short-term interest rate follows a standard Taylor rule that accounts for the ELB. The rule builds upon an empirical version of Taylor (1999), describing the interest rate setting outside the constrained area.

$$R_t = \max \left[0.85 R_{t-1} + 0.15 \left(r^* + \bar{\pi}_t + \hat{Y}_t + (\bar{\pi}_t - \pi^*)\right), -0.5\right] + \varepsilon_t^R \tag{2}$$

where R_t denotes the nominal short term interest rate, r^* is the equilibrium real interest rate, $\bar{\pi}_t$ is the average annual inflation rate, π^* denotes the 2% target, and $\hat{Y}_t$ is the output gap.[9] The effective lower bound is imposed at -50 basis points.

In addition to the standard interest rate rule, the effects of non-standard policies, in particular asset purchases, are approximated via interest rate add-ons on short-term expectations and long-term rates. This constitutes an indirect approach to account for the non-negligible effects of APP and PEPP on the risk premium and on expectations. To this end, the paper takes as given the existing estimates of the effect of quantitative easing on the yield curve (see Eser et al. (2019)). In order to include these effects into the simulation a simple rule is specified. This rule defines the add-ons as a function of the inflation gap, that is only activated if interest rates are in negative territory (see Eq. 3 and 4).

$$R_t^{add,ST} = 0.99 R_t^{add,ST} + \mathbb{1}\left[R_t \leq 0\right] 0.01 \left(\bar{\pi}_t - \pi^*\right) + \varepsilon_t^{R^{add,ST}} \tag{3}$$

$$R_t^{add,LT} = 0.95 R_t^{add,LT} + \mathbb{1}\left[R_t \leq 0\right] 0.05 \left(\bar{\pi}_t - \pi^*\right) + \varepsilon_t^{R^{add,LT}} \tag{4}$$

[9] We base the values for the past unobserved natural rate in the euro area on Holston et al. (2017). Going forward we assume that the value remains around zero as indicated by some of the estimates in Brand et al. (2018).

Subsequently, these values are used to adjust the term premium of the long-term rates and VAR-based expectation formation through the short-term rate. By incorporating into the analysis the data on long-term interest rates, forward guidance is partly reflected in the baseline.[10]

The analysis in this paper is based on the model under VAR expectations.[11] VAR expectations assume only limited knowledge of the joint dynamics of the variables and they correspond to the same restricted information set used in the estimation of the model. Specifically, the VARs share a core set of macro variables: the policy rate, the GDP deflator, and the output gap. This design can be interpreted as a limited form of rational expectations. The system of the core VAR variables is augmented by the specific variable for which expectations are being formed. We label this form as backward looking expectations because the information set for forming expectations is containing only contemporaneous and past variables.

More precisely the setup of the VAR used for forming the expectations is:

$$\Delta z_t = \Lambda^0(z_{t-1} - z^*_{t-1}) + \sum_{k=1}^{K} \Lambda^k \Delta z_{t-k} \tag{5}$$

where z_t is a vector of variables containing inflation, the level of the interest rate and the output gap, Λ^0 is a matrix containing coefficients that control how the variables respond to the deviation of the lagged level from the long-term attractors, Λ^k are matrices that collect autoregressive coefficients for K lags. There are two different cases how expectations enter into the model. For the price and wage equations the expectations of the $t+h$-quarter variable is based on rolling the VAR forward. For variables inside the PAC specification, the VAR defines the information set to map into the desired level of the target variable.[12]

[10] Backward-looking expectations of the model do not allow for analysing the effects of forward guidance in a commensurate way.

[11] Similarly to the FRB/US model, the ECB-BASE can technically allow for two alternative ways of forming the expectations of different agents. Specifically, expectations can be either based on projections from an estimated small-scale auxiliary VAR model (i.e. VAR or limited information expectations) or consistent with a full knowledge of the dynamics of the model (i.e model-consistent or rational expectations). The latter case assumes that agents are fully rational and their expectations are based on the solution of the model under the assumption that also the expected variables follow the internal logic of the model. Rational expectations are sometimes criticised as being overly optimistic on the assumption that agents have a complete understanding of the economy and base their expectation on this understanding.

[12] Angelini et al. (2019) contains an in-depth description of the expectation formation process in the ECB-BASE.

2.2 Alternative fiscal policy and monetary policy rules

We define the rule with the estimated coefficients as the baseline, which turns out to be broadly neutral (i.e. acyclical) to the cycle. A first counterfactual rule is then defined as a rule that decisively reacts to real economic developments in a countercyclical fashion. Such a rule has its natural limit, once the real output gap closure is achieved. After deep recessions with lasting inflation shortfalls, it might still be warranted to keep fiscal stimulus in place. To address this limitation we introduce further rules based on an augmented output gap, which deviates from the standard gap only when the policy rate hits the ZLB. We label rules of this type as expansionary-for-longer fiscal policy because they provide fiscal support for longer, beyond the point when the output gap closes. Such fiscal policy rules constitute an analogy to low-for-longer monetary policy rules, which provide monetary support beyond what is suggested by a standard Taylor rule.

The exact specification of the countercyclical fiscal rules is as follows (see Eq. 6).

$$\Delta g_t = \alpha \left(g_{t-1} - g_{t-1}^T \right) + \delta \Delta g_t^T + \sum_{k=1}^{2} \rho_k \Delta g_{t-k} + \gamma_Y \hat{Y}_t + \gamma_B \left(\frac{B_t}{\bar{Y}_t P_t} - \bar{b} \right) + \varepsilon_t^G \tag{6}$$

where $\gamma_Y << 0$. In fact, what makes the countercyclical fiscal rule distinct from an estimated fiscal rule (see Eq. 1) is the size of the coefficient on the output gap, which in the case of the latter is close to zero.[13]

The first approach to implement expansionary-for-longer fiscal policy is based on the substitution of the real output gap by the nominal output gap – the nominal approach. This means that the real output gap is augmented by a price gap, computed as cumulative inflation deviations over time. The second approach relies on augmenting the standard output gap with past negative output gaps – the real approach. This implies that policy-makers rather than being concerned only about closing the contemporanous output gap attempt to also compensate additionally for past output shortfalls.[14]

There are multiple reasons for fiscal policy to consider not only the real but also the nominal

[13]Given the complexity of the spending rules the interpretation of γ_Y may not be straight-forward. The value used in the analysis for government purchases is equal to -0.1 which is a value that ensures a sizeable, albeit still plausible, fiscal expansion (see Figure 13 for the exact amounts of additional expenditure associated with various scenarios). The coefficient values for other instruments (i.e. social transfers and government investment) are rescaled accordingly so that a fiscal expansion is evenly distributed across the three instruments used in the analysis.

[14]This might be considered in cases where protracted shortfalls lead to hysteresis or scarring effects which are not fully reflected in the level of the output gap.

developments in policy setting. First, nominal income, and not only real income, is a relevant variable perceived by economic agents, thereby constituting the basis for their business decision making. Second, it is nominal income that is relevant for debt sustainability – one of the main concerns for a fiscal authority. Third, the price dynamics embedded in the nominal concept may improve the understanding of the current state of the business cycle given material uncertainty about the unobservable real output gap (see for example Jarociński and Lenza (2018)). Finally, a fiscal authority responding only to real developments and the monetary authority reacting solely to price dynamics may result in the divergence of policy courses. The aim to coordinate, will necessarily involve policy rules based on similar variables (i.e. see, for instance, Bianchi et al. (2020) suggesting a common strategy for fiscal and monetary policy in the current environment).

Importantly, such a formulation does not call for any shift of responsibility between monetary and fiscal authorities. With policy rates at the ELB monetary policy may not be able to ensure adequate dynamics on the nominal side. In such a situation fiscal policy, supported by favourable financing conditions, remains an effective macroeconomic tool. In a situation characterised by a closed output gap and still subdued price dynamics, nominal output gap targeting on the fiscal side could contribute to excess demand and higher prices simultanously. It would deliver some make-up for the large output losses experienced in the euro area both during the great recession and amid the COVID crisis.

Turning to the real approach, expansionary-for-longer fiscal policy can also be achieved by considering past negative real output gaps when the interest rate is at the ZLB. This specification can be mostly motivated by the desire to recover at least some of the significant output losses that materialised during severe crises (e.g. amid the GFC or the COVID crisis). Our model baseline indicates that cumulative output losses with respect to potential GDP are reaching around 15% of GDP, which is undeniably a sizeable figure (see Figure 5). The case for recovering past output losses is particularly strong in the presence of hysteresis effects, which stipulates that grave output shortfalls affect potential GDP.[15] In such an environment, a period of excess demand could help to address some of these adverse effects, thereby preserving potential capacity of the economy. This

[15] Permanent damage to a potential output following a cyclical recession can materialise through a number of channels such as labour force, capital stock and productivity. Cerra et al. (2020) contains a review of the related literature.

may be the case currently when the COVID crisis brings massive disruptions to economic activity.[16]

Formally, the expansionary-for-longer fiscal rules can be described by the following equation

$$\Delta g_t = \alpha \left(g_{t-1} - g_{t-1}^T \right) + \delta \Delta g_t^T + \sum_{k=1}^{2} \rho_k \Delta g_{t-k} + \gamma_Y \hat{Y}_t^{aug,i} + \gamma_B \left(\frac{B_t}{\bar{Y}_t P_t} - \bar{b} \right) + \varepsilon_t^G \tag{7}$$

where $\gamma_Y << 0$ remains like in the countercyclical fiscal rules. The specification of $\hat{Y}_t^{aug,i}$ depends on whether we consider the nominal ($i = nom$; see Eq. 8) or the real ($i = real$; see Eq. 9) approach. It is crucial to emphasise that the augmenting terms, which cumulate the inflation deviations in the case of $\hat{P}_t$ or output shortfalls in the case of $\hat{Y}_t^{add}$ embed a memory loss (see the details on Appendix Section B). Varying the degree of it is useful to demonstrate how expansionary-for-longer fiscal policy gains strength in macroeconomic stabilisation.[17]

$$\hat{Y}_t^{aug,nom} = \hat{Y}_t + \mathbb{1}\left[R_t \leq 0\right] \hat{P}_t \tag{8}$$

$$\hat{Y}_t^{aug,real} = \hat{Y}_t + \mathbb{1}\left[R_t \leq 0\right] \hat{Y}_t^{add} \tag{9}$$

Turning to monetary policy, the paper considers three alternative policy rules which embed various degrees of monetary accommodation. These rules stipulate average inflation targeting with an averaging windows of different length. As such, the rules take into account the accumulated inflation deviations over the corresponding time windows. Given the persisting negative inflation deviations, the rules imply additional monetary accommodation (i.e. keeping rates low for longer) compared to the standard Taylor rule at the current juncture.[18] For this reason, we label the regimes implied by these alternative rules as low-for-longer monetary policy.

Concretely, the rules feature inflation gaps based on 2-year, 3-year and 4-year averaging windows. The specification of the rules is consistent with the study by Arias et al. (2020) prepared for the

[16] IMF (2021) points to significant scarring effects to global output in the medium term as a result of the pandemic.

[17] Without any memory loss the price gap becomes very large given the persistent inflation shortfalls in recent years. The large size makes the gap hardly usable as an indicator in a policy rule.

[18] The readiness of a policy-maker to cool the economy because of a realised inflation overshooting may be different from the readiness to stimulate the economy because of realised inflation shortfalls. To reflect this, some studies, like Arias et al. (2020), consider asymmetric average inflation rules, where the make-up strategy only applies to past inflation shortfalls. In our analysis this is the case even with the symmetric rules because the inflation have been recording negative deviations in the data.

discussion of the Federal Reserve's review of monetary policy strategy.[19] Formally the rule for a T-year average inflation targeting follows Eq. 10 with $\bar{\pi}_t^{(T-year)}$ being the T-year average inflation.

$$R_t = \max\left[0.85R_{t-1} + 0.15\left(r^* + \bar{\pi}_t + \hat{Y}_t + T\left(\bar{\pi}_t^{(T-year)} - \pi^*\right)\right), -0.5\right] + \varepsilon_t^R \tag{10}$$

2.3 Criteria for assessing the rules

Having specified fiscal and monetary policy rules for the analysis it is equally important to lay out criteria used for their assessment. By contrast to many papers in the academic literature, we do not attempt to identify optimal rules for fiscal and monetary policy (see Benigno and Woodford (2003)) for a single economy and Kirsanova et al. (2007) for a monetary union as examples of studies). Instead, we consider rules that are commonly accepted in the policy-making world and extend them along several dimensions as explained in Subsection 2.2. The modifications are motivated by the desire to improve realised or projected macroeconomic outcomes, such as high output volatility or persisting inflation shortfalls.

In contrast to the existing literature based on parsimonious theoretical models, we do not assess the rules with a single welfare-based loss function (see the derivation for a simple NK model in Gali (2015)). ECB-BASE is not rigorously micro-founded and consequently, does not feature an explicit welfare measure. Specifying a loss function in this context would necessarily require additional assumptions, such as weighting the typical loss function variables.[20]

We focus, instead, on a set of variables that are relevant to policy-makers and will allow them to judge the rules with a cost-benefit approach. In line with the chosen policy rules, we use output gap and inflation. In addition to this we analyse the policy variables themselves and variables that are informative about the cost of stabilisation. For monetary policy, these are the short-term interest rate and the ZLB duration. For fiscal policy, these are the budget balance-to-GDP ratio and the government debt-to-GDP ratio. To condense the findings of the simulations we do not only offer graphical presentation of the above mentioned variables but also summarise them in heat maps for

[19] The average inflation targeting rules in Arias et al. (2020) rely on 4-year and 8-year averaging windows. We consider shorter horizons for the sake of realism.

[20] Hauptmeier and Kamps (2020), for instance, in their assessment of selected fiscal rules assume that a fiscal authority follows a quadratic loss function consisting of the output gap and government debt-to-GDP deviations. The aggregation of the two terms requires choosing υ parameter (where $0 < \upsilon < 1$), which represents the preference of a fiscal authority to stabilise the business cycle relative to debt sustainability.

the post-pandemic scenario (see Figure 11, 12 and 13.)

3 Historical perspective

The analysis of fiscal policy in this section is based on counterfactual scenarios conducted around the historical sample from 2003 to 2019. Through the lens of the ECB-BASE model we attempt to illustrate how various fiscal policies affect the business cycle under two different configurations of monetary policy.[21] The first set of simulations assumes that monetary policy does not react to any changes brought by the alteration of the fiscal rules and remains the same as observed in the data. In the second step, the monetary policy reaction becomes endogenous with the central bank following a standard Taylor rule. Eventually, by turning to stochastic simulations we generalise the illustration by considering uncertainty. The analysis remains agnostic on whether the fiscal policy implied by the considered fiscal rules was implementable given past financial and political conditions.

3.1 Fiscal rules with *exogenous* monetary policy

According to the model simulations, the alternative fiscal rules substantially smooth the real output gap and slightly reduce the inflation gap without causing a surge in the government debt. A systematically countercyclical policy (see Figure 2, Countercyclical rule) reduces the output gap fluctuations significantly. Initially, the spending retrenchment imposed by the rule during the good pre-crisis times dampens the positive output gap noticeably. Afterwards, a supportive fiscal policy that sharply reacts to the downturns facilitates the post-GFC recovery and alleviates the gravity of the second downturn. While the inflation benefits are non-negligible during the post-GFC period, the inflation rate still remains far from the target for an extended period of time given the large size of the recorded shortfalls.

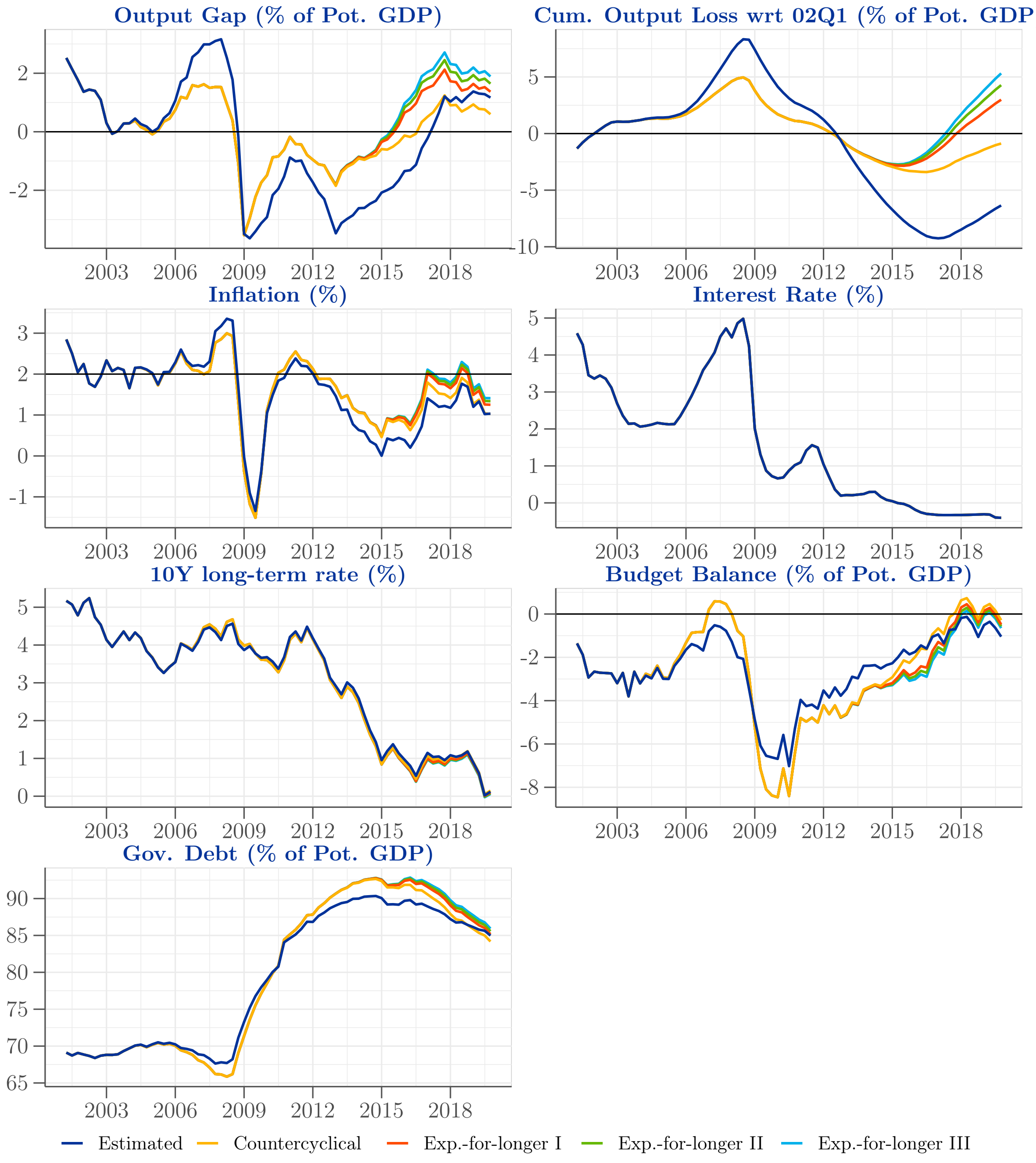
Scenarios with expansionary-for-longer fiscal rules (see Figure 2, Expansionary-for-longer I, II, III rules) bring additional stimulating effects. The countercyclical fiscal rule that reacts to the standard output gap stops providing support with the output gap closure in late 2016. This is the moment when the expansionary-for-longer fiscal policy starts making a sizeable difference providing

[21] One crucial assumption underlying the simulations is that all shocks/ residuals in the model remain unchanged compared to those associated with the realised data.

support beyond the output gap closure. Fiscal policy under these rules constitutes an option to further diminish the accumulated output losses amid the two crisis episodes or to support inflation dynamics. This, however, requires a prolongation of the fiscal stimulus well beyond the sovereign debt crisis, which is associated with a considerable overheating of the economy in recent years. In fact, the implementation of the expansionary-for-longer rules more than overcompensates for the accumulated output losses towards the end of the sample with inflation still not being firmly on target.

Judging by the evolution of the debt-to-GDP ratio in the various scenarios, sizeable benefits of expansionary-for-longer fiscal policy come at only limited cost under the assumption of full monetary accommodation. Increases in debt as a share of potential GDP associated with the alternative fiscal policies are small. The investigated fiscal rules first lead to savings prior to the GFC, thereby building a small fiscal buffer. Afterwards, supportive fiscal policies, even the expansionary-for-longer versions, yield substantial benefits to both real and nominal sides, which significantly alleviates the cost of the increased expenditures. With policy rates being unresponsive, monetary policy keeps the servicing cost of the sovereigns debt low. It also provides an additional accommodation, in the sense of keeping rates unchanged against the background of higher output and inflation. The findings of the simulations heavily rely on the assumption that policy-makers know in real time the current estimates of the output gap and are able to adjust policies accordingly. Given the extent of the revisions to the output gap, accurate fiscal policy fine-tuning is very difficult in practice.

Figure 2: Historical counterfactual simulations of various fiscal rules with exogenous monetary policy



Sources: ECB-BASE simulations.

Notes: "Estimated" fiscal rule reproduces the observed data. The expansionary-for-longer fiscal rules presented in the context of the historical exercise are formulated on the basis of the nominal approach. Rules bringing equivalent outcomes can be devised following the real approach (see the demonstration for the post-pandemic horizon, Subsection 4.2).

3.2 Fiscal rules with *endogenous* monetary policy

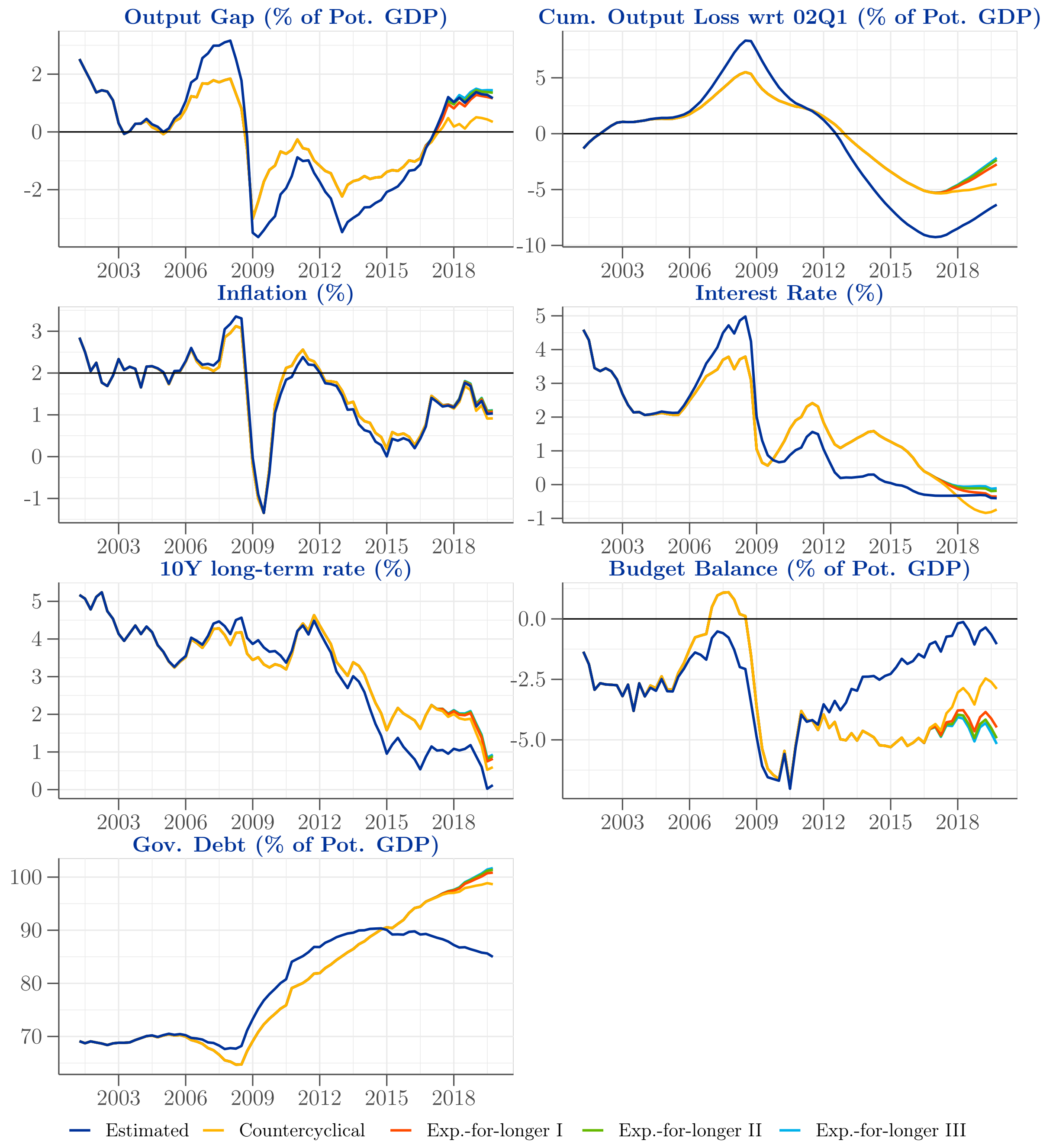
The sizeable macroeconomic effects of fiscal policy in Subsection 3.1 are conditional on fully accommodative monetary policy. The assumption of exogenous monetary policy implies that the central bank undertakes the same measures as observed in the past irrespective of inflation and output gap outcomes. Relaxing this assumption, namely that the central bank reacts to more positive macroeconomic outcomes brought by an alternative fiscal policy (for instance, by following a Taylor rule) may be seen as more realistic and it changes the picture materially.

The simulations indicate that for the efficacy of fiscal rules full accommodation of monetary policy is crucial. In a configuration with endogenous monetary policy, the central bank responds to the macroeconomic developments according to the Taylor rule. Prior to the GFC, the policy rate in the simulations remains below the baseline. Subsequently, given the improved economic conditions, the rate is above baseline and remains there also during the second downturn. The monetary policy reaction has substantial consequences for the efficacy of the investigated fiscal rules in our simulations. More concretely, the extent to which fiscal policy reduces output gap fluctuations is more limited compared to the case with full monetary accommodation (see Figure 3). None of the fiscal rules eliminates the crisis-related accumulated output losses at the end of the simulation horizon. Moreover, virtually no gains from the alternative fiscal policy rules are visible for inflation.

With fiscal support in place the monetary policy rate reaches the ELB significantly later than in the data (i.e. in late 2017 rather than in mid-2015). In this context, the alternative fiscal rules create ample room for monetary policy. The expansionary-for-longer fiscal rules start making a difference only during the last part of the simulation period. This is because the activation of the augmented gap is conditional on the central bank being at the ZLB (see the explanations in Subsection 2.2). In this context, there are no substantial changes to government expenditure and no material implications for economic outcomes compared to the countercyclical rule.

Endogenous monetary policy also affects the size of fiscal cost of the alternative fiscal rules. Prior to the crisis, interest rates are lower than observed in the data, therefore contributing to the build-up of a fiscal buffer. Following the GFC this tendency is reverting, however. The less accommodative stance of monetary policy gradually increases the servicing cost of government debt. This, together with additional expenditure and limited macroeconomic benefits, brings the debt-to-GDP ratio to levels noticeably exceeding the observed values.

Figure 3: Historical counterfactual simulations of various fiscal rules with endogenous monetary policy following a standard Taylor rule



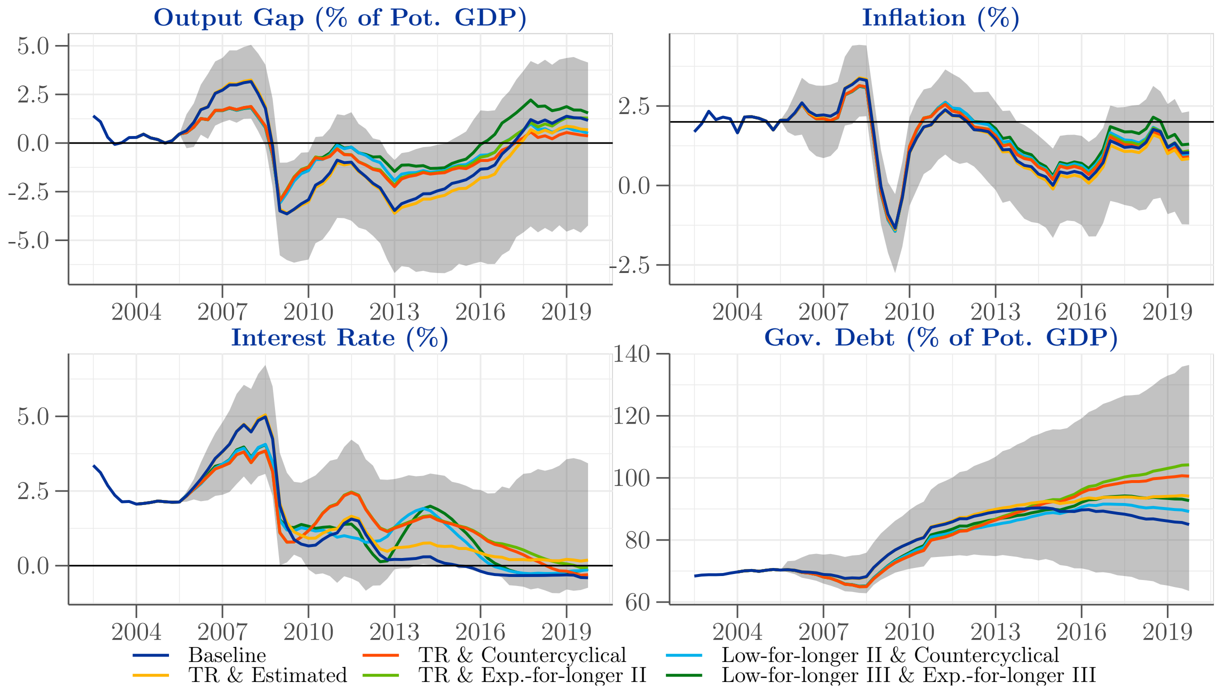
Sources: ECB-BASE simulations.

Notes: "Estimated" fiscal rule reproduces the observed data. The expansionary-for-longer fiscal rules presented in the context of the historical exercise are formulated on the basis of the nominal approach. Rules bringing equivalent outcomes can be devised following the real approach (see the demonstration for the post-pandemic horizon, Subsection 4.2).

The deterministic simulation presented hitherto evaluate the policy mix in a ceteris paribus environment assuming that all shocks and residuals remain at the values identified by inverting the baseline model. One way to evaluate the robustness of the results is to conduct stochastic simulations. By drawing from model residuals and repeating the simulations multiple times the analysis incorporates the effects of uncertainty and possible model misspecifications.[22] The depicted means of the stochastic distributions under the counterfactual policy experiments show a picture consistent with the counterfactual scenarios described above (see Figure 4; more details on stochastic simulations, including the occurrences of risk events, is given in Section 4). The differences between stochastic means across various scenarios very much resemble those of the deterministic simulations. The property that the means of the stochastic simulations are situated below the deterministic simulation is due to existence of the ELB. For those paths, where the interest rate is constrained by the ELB, particularly negative paths for output and inflation are more frequently observed. This induces a negative bias in the distribution of output and inflation. Non-standard monetary policy dampens the negative outcomes but it cannot fully compensate for the lack of the interest rate instrument during ELB episodes. In this environment, alternative fiscal rules improve the outcomes significantly when it comes to the output gap (see Figure 4, the difference between the blue/ yellow lines and the other lines) and inflation.

[22]The residuals of the equations capture the part of the observed variables that cannot be explained by the structure of the equations.

Figure 4: Stochastic simulations of various fiscal and monetary policy rules



Sources: ECB-BASE simulations.

Notes: The confidence bands are based on stochastic simulations with the baseline policy rules. The bands are based on 2.5% and 97.5% percentiles. The alternative rules are presented by the mean of the stochastic simulations to maintain readability.

4 Post-pandemic perspective

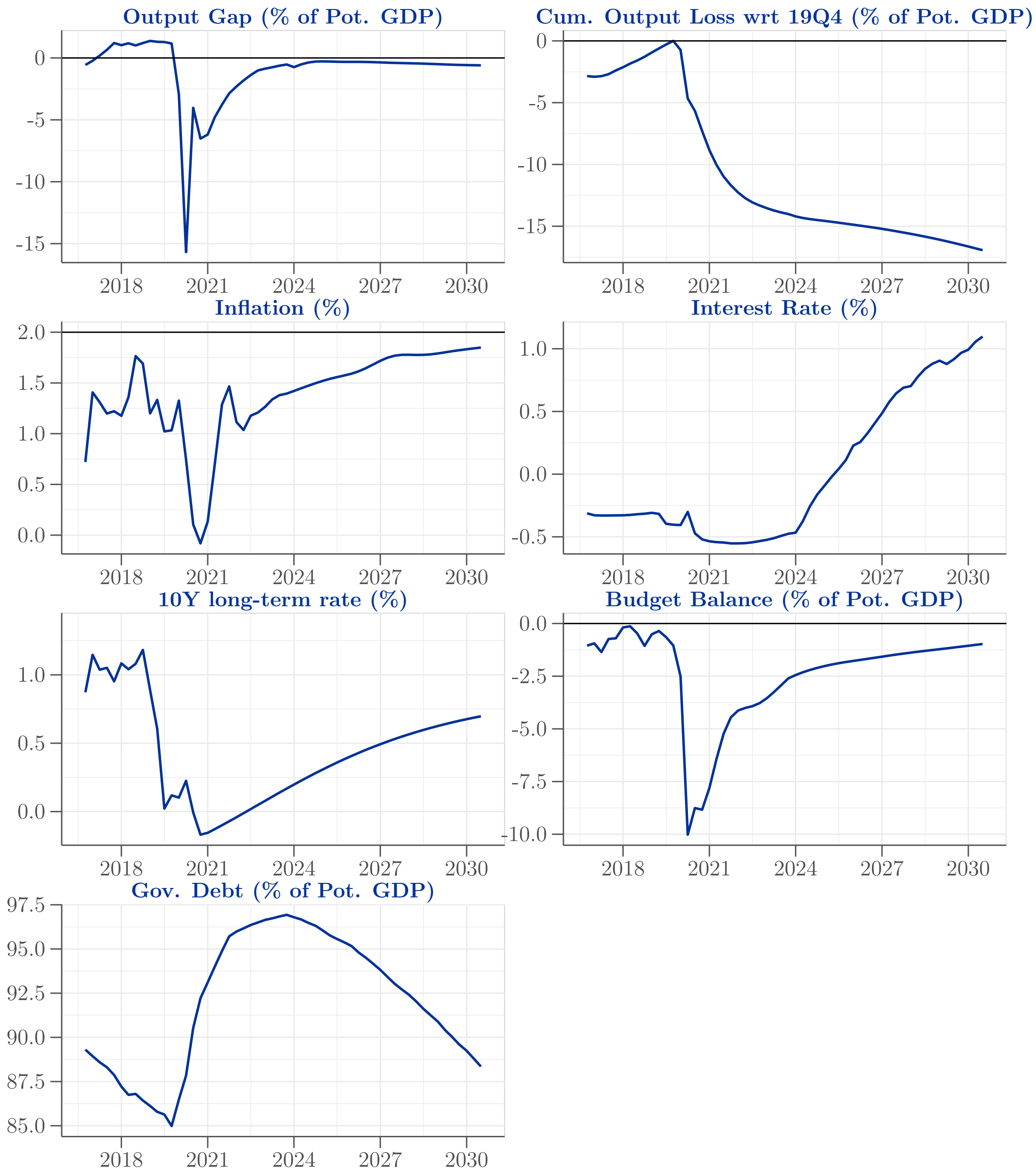
By conducting simulations over an extended horizon until 2030, we investigate how different configurations of fiscal and monetary policy affect the expected medium-term macroeconomic outlook. The starting point for the exercise is the construction of a reference baseline with fiscal and monetary policy rules that are consistent with the existing institutional arrangements and the dynamics observed in the past (i.e. the estimated fiscal rules and the Taylor rule specified in Subsection 2.1). Subsequently, we vary the rules (for both fiscal and monetary policy) and assess how their different combinations perform relative to the baseline.

The reference baseline is broadly consistent with the Eurosystem projections (the December 2020 exercise, see ECB (2020) for the results). We complement the set of projected variables published by the ECB, which does not include the potential output, with the potential output of the European Commission. The projected variables are reproduced by the model until the end of their forecast horizon (i.e. end-2023 for the Eurosystem and end-2022 for the European Commission). Afterwards the figures are model-based.

To construct post-2023 baseline we use information contained in the model residuals. Rather than imposing zero residuals in the calculations the residual in-sample information is considered. Specifically, it is assumed that residuals consist of a systematic and idiosyncratic component. The former is derived from an auxiliary state space model and used for the post-2023 simulation (the appendix of Angelini et al. (2019) contains a description of the methodology). This approach greatly improves the realism of the medium-term baseline compared to the approach based on zero residuals.

In the baseline the output gap is nearly closed already within the Eurosystem forecast horizon and remains close to zero thereafter (see Figure 5). The narrowing of the inflation gap with respect to the 2% target occurs at significantly lower speed in comparison to the closure of the output gap. The short-term interest rate remains at the ELB until the end of the Eurosystem forecast horizon and then lifts off following the Taylor rule. Public finances normalise gradually, following the grave consequences of the COVID crisis. Specifically, the budget balance-to-GDP ratio converges towards a balanced position and the debt-to-GDP ratio starts falling, albeit from an elevated level.

Figure 5: Medium-term reference baseline



Sources: ECB-BASE simulations.

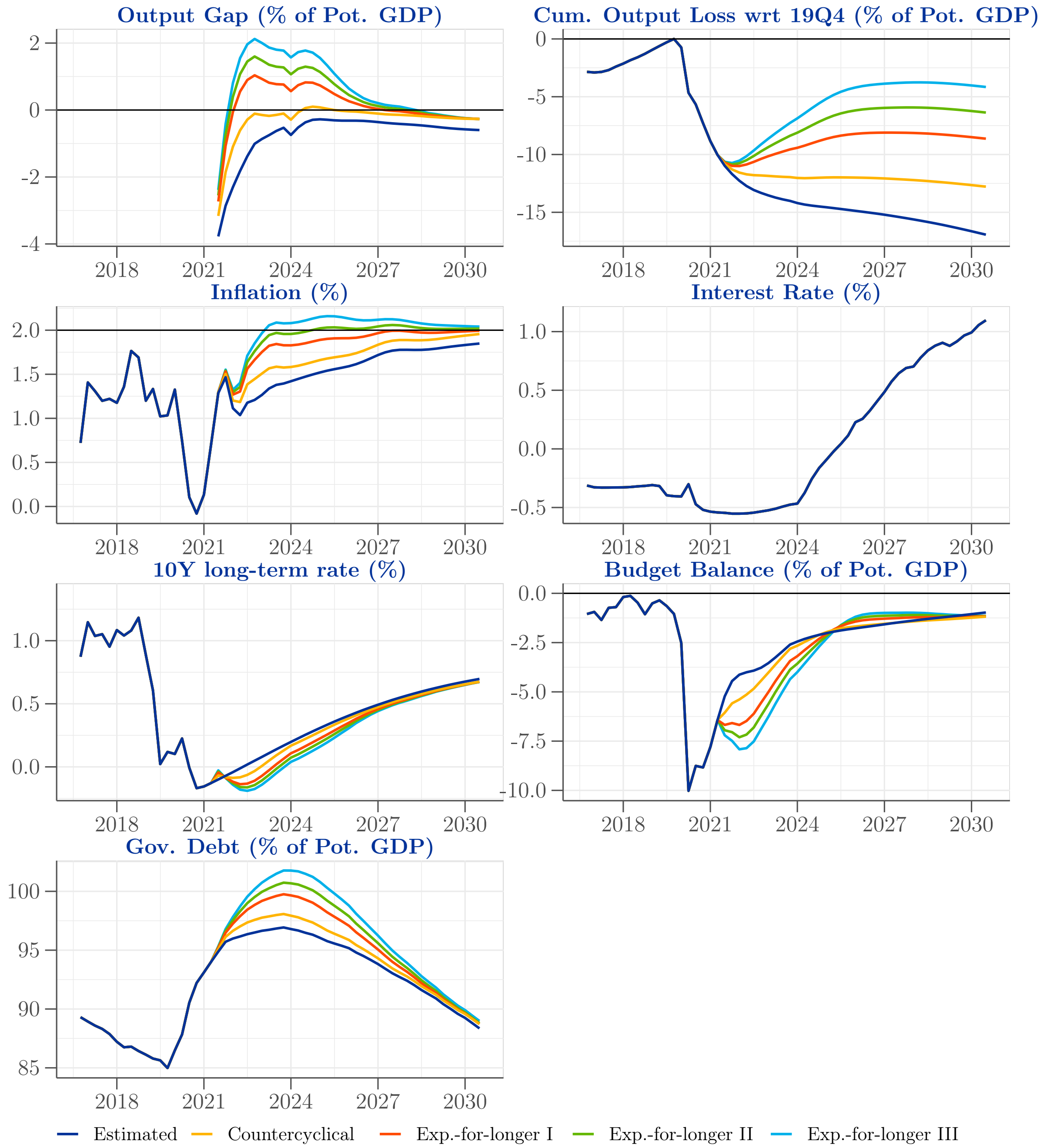
Notes: The baseline presented above is broadly consistent with the Eurosystem projections for the variables that are made available to the public (see ECB (2020)). The output gap, which is not published, is based on the potential output of the European Commission (Spring 2021 Economic Forecast). In the post-forecast period the figures are model-based.

4.1 Fiscal and monetary policy rules in isolation

Before analysing combinations of the rules, we look at the effects of fiscal and monetary policy rules in isolation. This means that a change to fiscal rules and its macroeconomic consequences will be ignored by monetary policy (i.e. monetary policy is exogenous and kept at its baseline values). Similarly, when analysing monetary policy rules, we assume no reaction from the side of fiscal policy (i.e. fiscal policy exogenous). While this set-up is hardly realistic it helps to understand the economic impact of fiscal and monetary policy alone without mixing the policies and their effects.

Fiscal policy rules can significantly alter the macroeconomic outcomes compared to the baseline. In particular, a countercyclical fiscal policy stimulates output leading to a very fast output gap closure and it lifts inflation by a non-negligible margin (see Figure 6). The expansionary-for-longer fiscal rules bring inflation back to target still within the projection horizon. At the same time, they significantly reduce the cumulative output gap losses. This involves, however, a sizeable amount of additional stimulus compared to the baseline as indicated by the deterioration in the budget balance. Moreover, it also necessitates the tolerance of overheating the euro area economy (output gap reaching 2% of GDP in the coming years). While the additional stimulus does increase the debt-to-GDP ratio in a few years' time it does not raise it in the medium term in 2030.

Figure 6: Post-pandemic simulations of various fiscal policy rules in isolation.



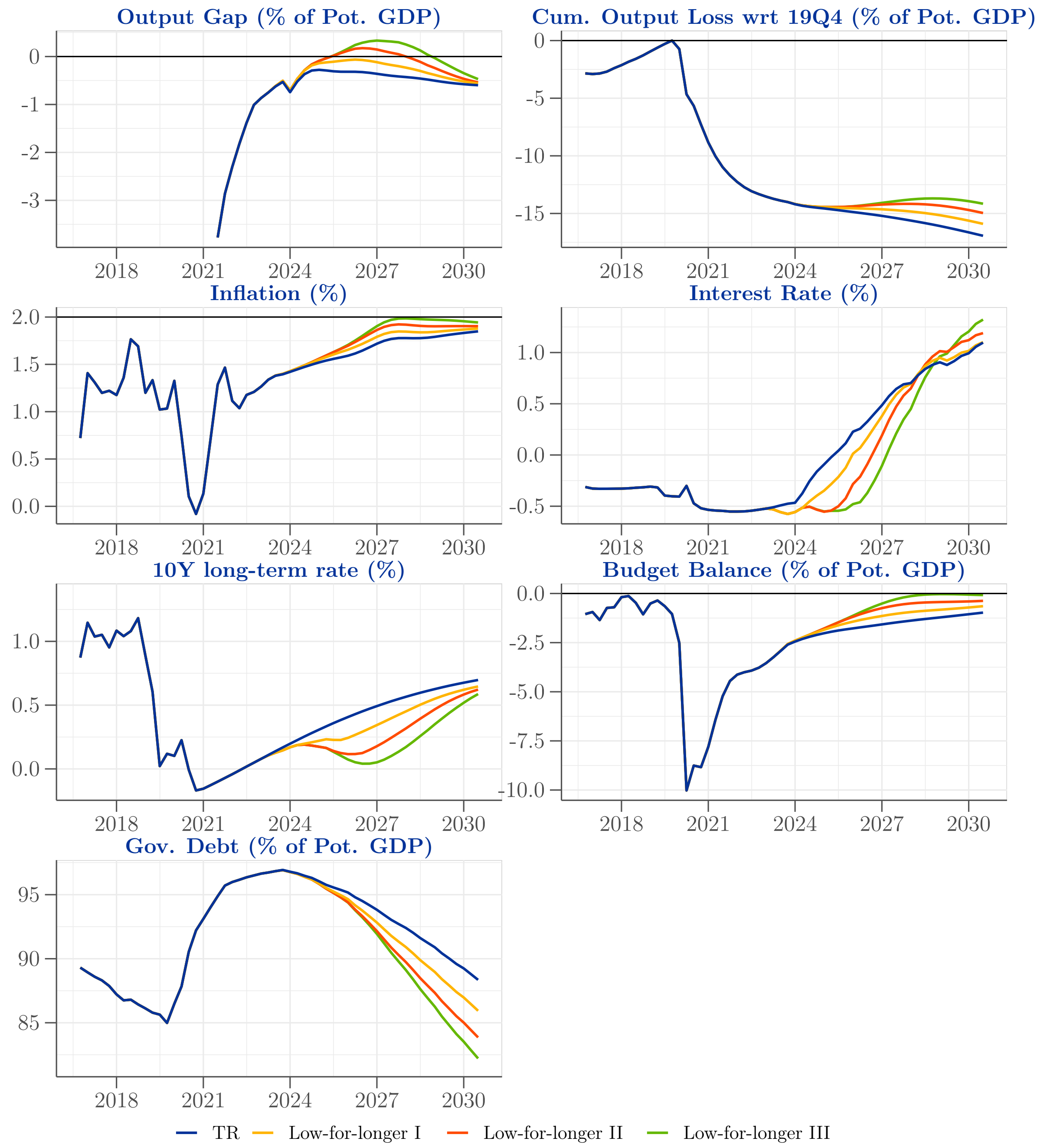
Sources: ECB-BASE simulations.

Notes: "Estimated" fiscal rule reproduces the reference baseline presented in Figure 5.

Model simulations also reveal that interest rate rules can alter the expected paths for macroeconomic variables, albeit only to a limited extend.[23] Both real output and inflation improve slightly with more accommodative monetary policy rules (see Figure 7). The reason for limited gains lies in the limited monetary policy space in the baseline. In this context, the additional rules that we consider make a relatively small difference. The short-term interest rate in the outer years is lower only by a maximum of around 0.7 percentage point. Furthermore, with backward-looking expectations in the model there is no expectation channel of monetary policy. In contrast to forward-looking models, only the realised changes in interest rates matter but not the expected path of interest rates in the future. In the simulations, the non-standard monetary policy is modelled through add-ons (see the description in Subsection 2.1) which are kept endogenous. For a complete assessment of the role of monetary policy, the impact of forward guidance would need to be included.

[23]The investigation of monetary policy rules in isolation involves shutting down the reaction of fiscal policy. This still involves an active fiscal block (i.e. no exogenisation of the entire fiscal block). In particular, changes in tax bases translate into corresponding changes in tax revenue. Moreover, all fiscal identities, including the budget balance and debt accumulation remain fully operational. In practice, shutting down the reaction of fiscal policy does not materially change the outcomes compared to the estimated fiscal rules, which embed very little reaction to the cycle (as discussed in Subsection 2.1).

Figure 7: Post-pandemic simulations of various monetary policy rules in isolation



Sources: ECB-BASE simulations.

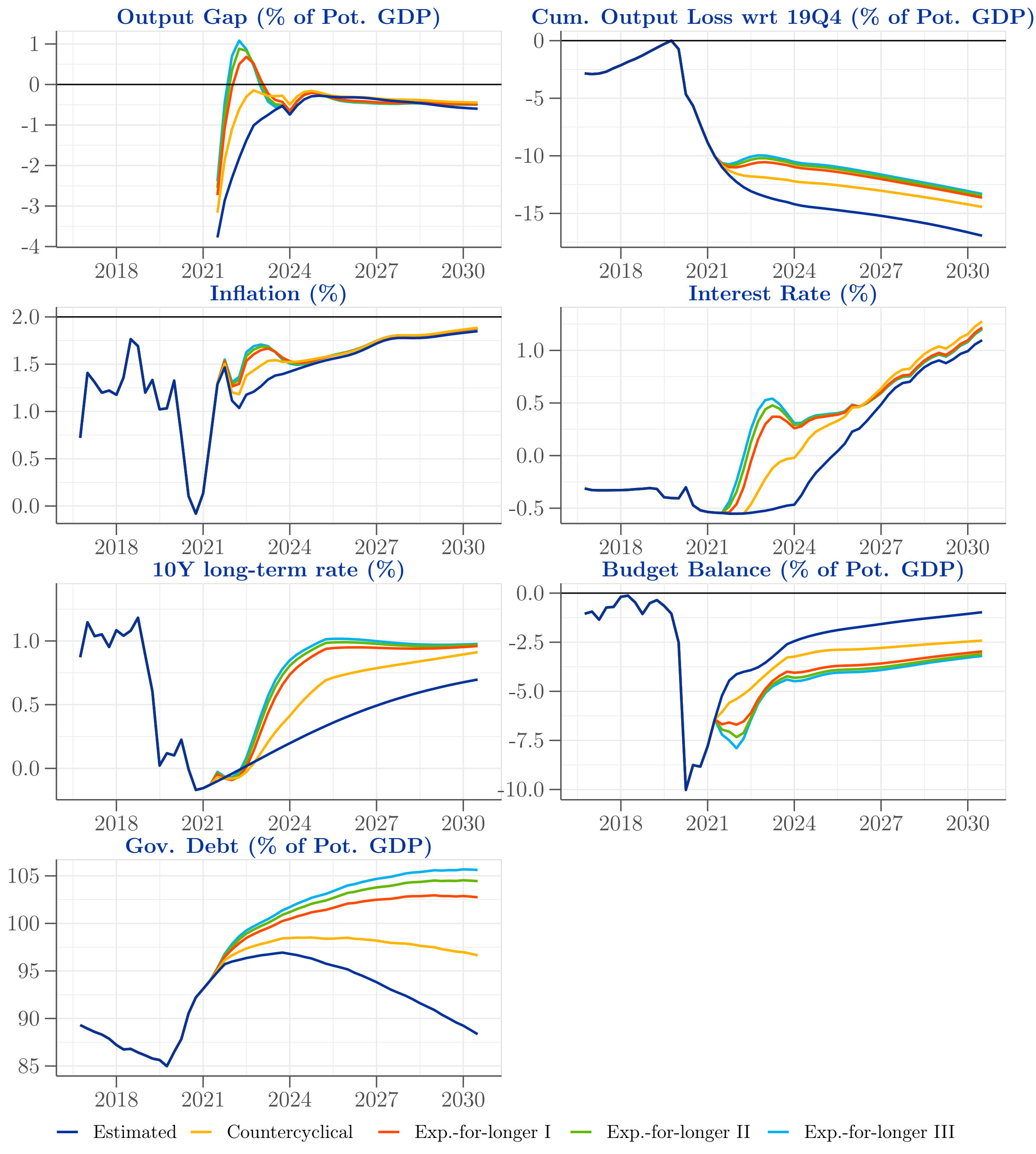
Notes: "TR" monetary rule reproduces the reference baseline presented in Figure 5.

4.2 Combinations of fiscal and monetary policy rules

To have a realistic assessment of the effectiveness of the two policies we run simulations under endogenous fiscal and monetary rules. We start with the analysis of various fiscal rules where the monetary policy reacts in a usual manner following a standard Taylor rule.

The gains from fiscal policy rules combined with a standard monetary policy reaction, that is not providing any further accommodation, are limited. While alternative fiscal rules initially provide a significant boost to real activity and to prices the effect is short-lived (see Figure 8). This is because the standard Taylor rule promptly reacts to the macroeconomic improvements. As such, the benefits of fiscal policy are eliminated by an 'uncooperative' monetary policy tightening. Furthermore, interest rate increases lead to a situation in which the governments face higher financing costs, which gradually propagate into the overall debt servicing cost. This brings detrimental consequences for the debt-to-GDP ratio and makes the fiscal policy very costly.

Figure 8: Post-pandemic simulations of various fiscal rules with endogenous monetary policy following the standard Taylor rule



Sources: ECB-BASE simulations.

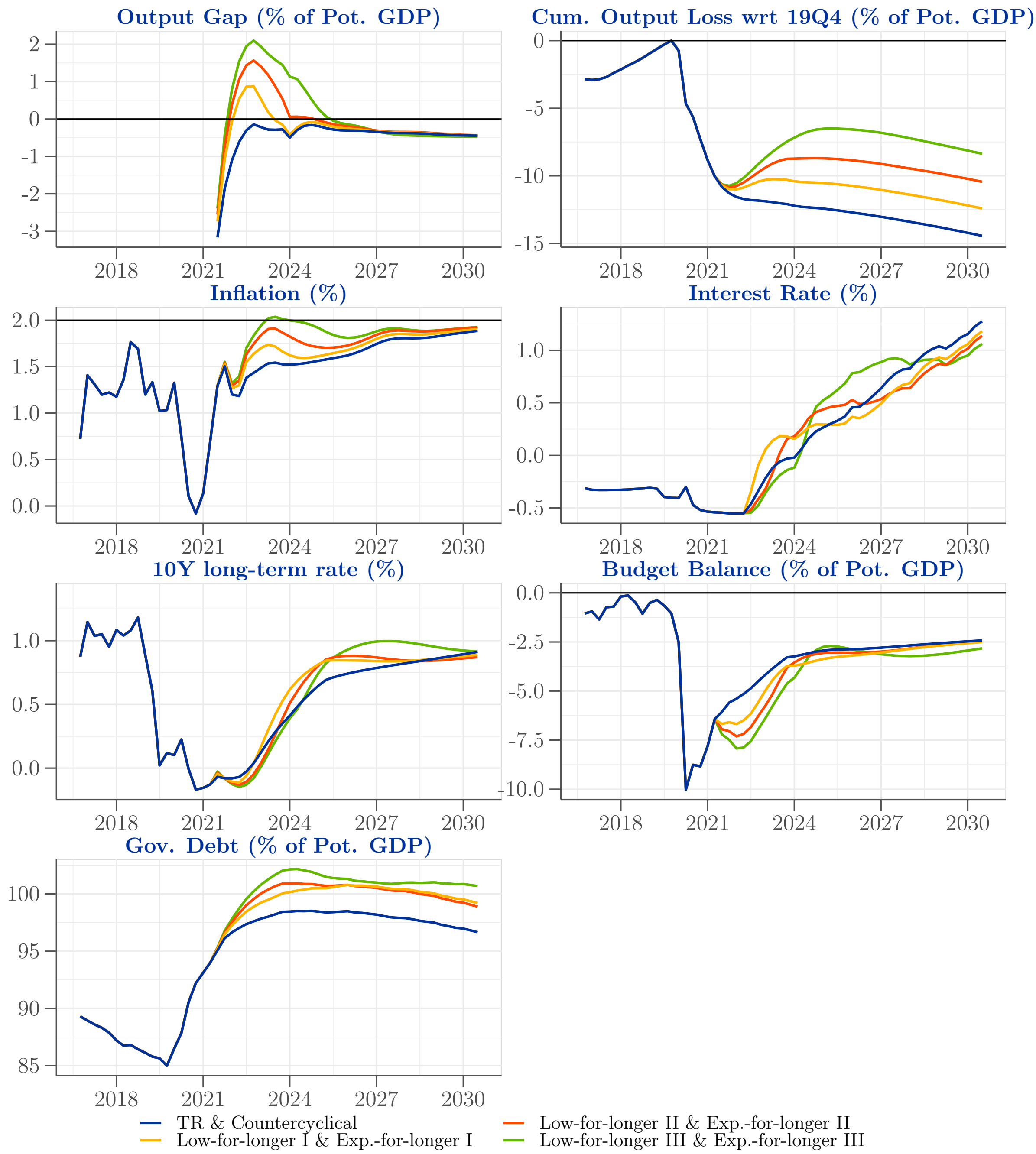
Notes: "Estimated" fiscal rule reproduces the reference baseline presented in Figure 5.

To uncap the potential of fiscal policy, more accommodative monetary policy rules are essential. With monetary policy still reacting but working in concert with fiscal policy the macroeconomic benefits are significantly more tangible.[24] Fiscal policy can provide a significant boost to output and inflation when monetary policy delivers additional accommodation in parallel (see Figure 9 and 10). In our illustration, monetary policy, in contrast to the standard Taylor rule reaction, does not fight back the benefits of fiscal policy but rather tries to create favourable conditions for it by lifting the rates only gradually. This makes the macroeconomic gains of fiscal policy sizeable and long-lasting. However, only with a considerable additional spending and significant overheating of the economy, a combination of expansionary-for-longer fiscal policy and low-for-longer monetary policy has a chance to bring inflation close to the 2% target during the simulation horizon. This scenario halves the output losses accumulated amid the COVID crisis. Also, no sharp monetary policy tightening means no abrupt increases of the financing cost for the governments. This makes the application of fiscal policy significantly less costly compared to the situation in which the central bank strictly follows the standard Taylor rule.

Both formulations of expansionary-for-longer fiscal policy (i.e nominal and real approach) bring virtually the same macroeconomic outcomes (compare Figure 9 and Figure 10). In this context, a fiscal authority does not need to choose between the two specifications. Rather it needs to make a choice how to communicate an expansionary-for-longer fiscal policy. The nominal-based specification explicitly acknowledges the role of fiscal policy in reaching the inflation target at the time when the central bank is constrained. The real-based specification emphasises the objective to recover some of the output losses. At the current juncture both aims coincide and require the same course of fiscal policy.

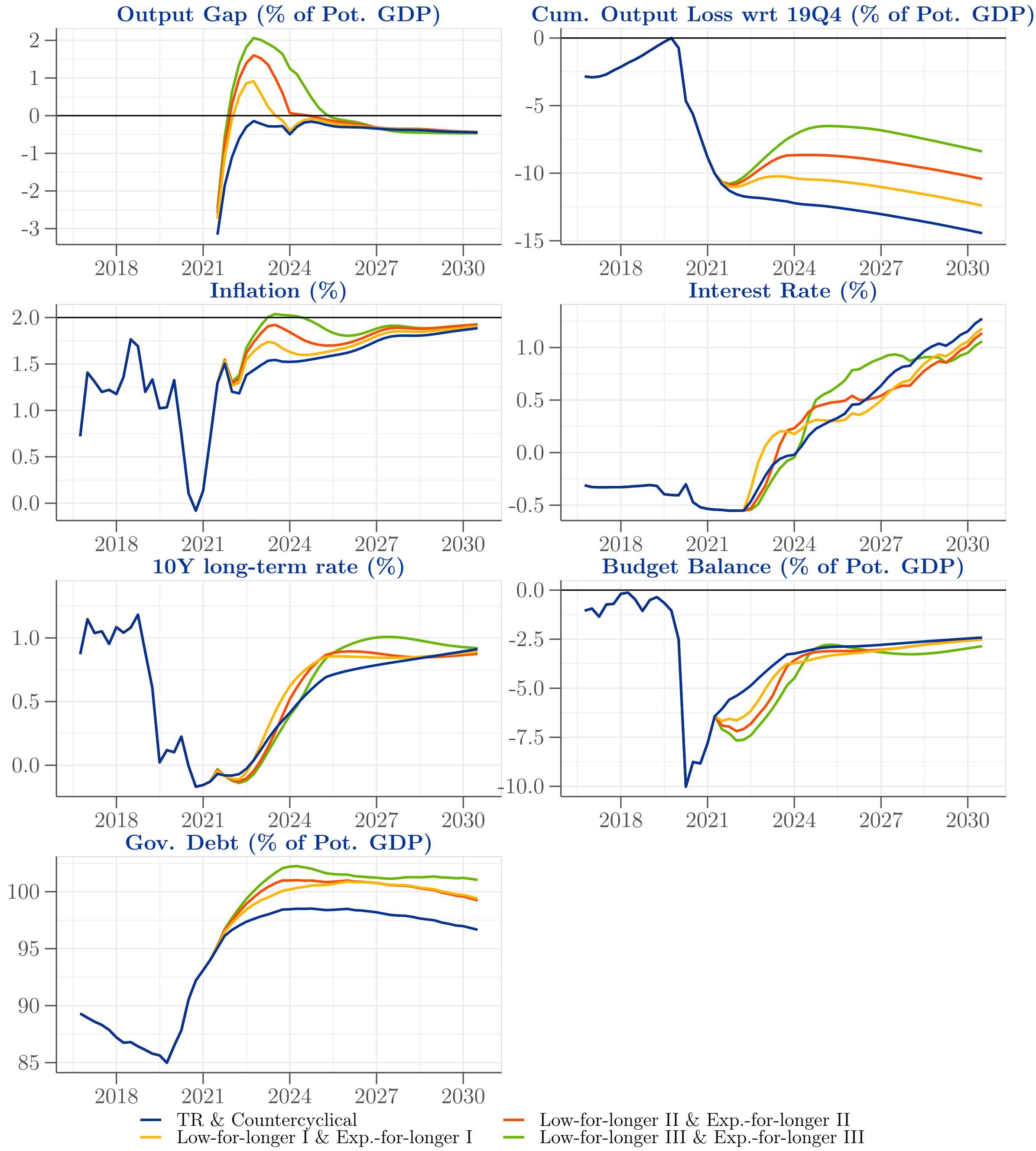
[24] The lack of any monetary policy reaction could be interpreted as a case of subordination of monetary policy to the needs of fiscal policy or fiscal dominance. In the analysis we do not consider this theoretical constellation as it remains at odds with the prevailing institutional arrangement.

Figure 9: Post-pandemic simulations of fiscal and monetary policy rules working in concert (expansionary-for-longer fiscal policy specified following the nominal approach)



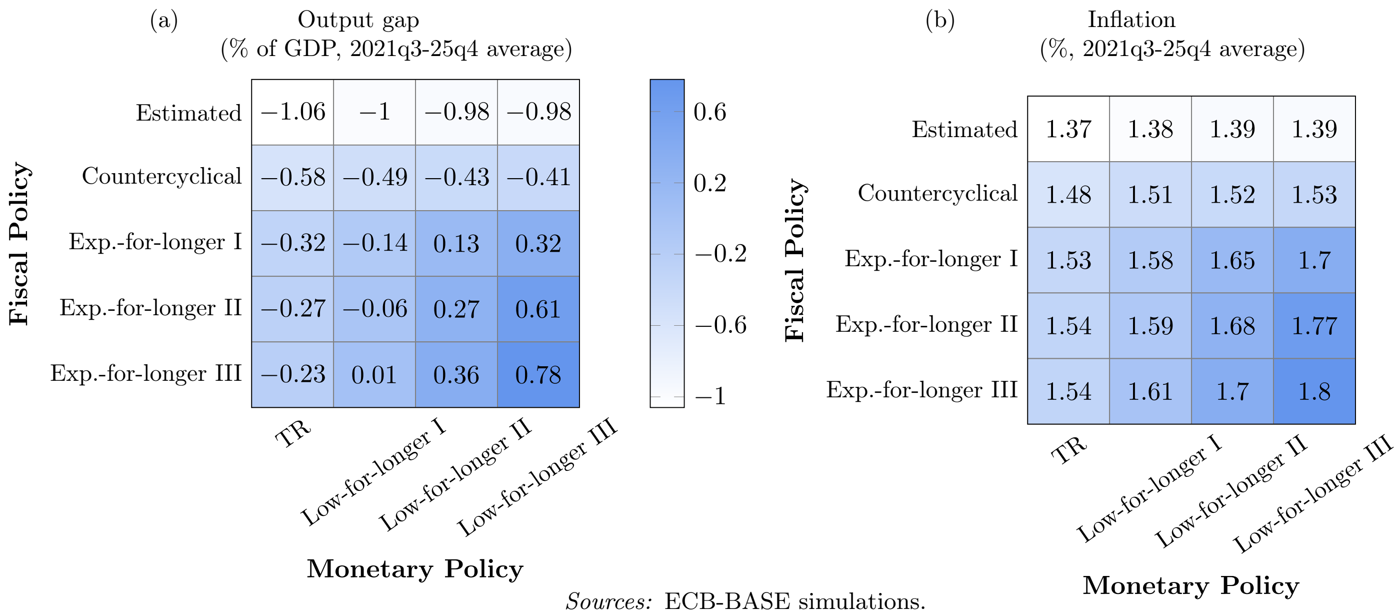
Sources: ECB-BASE simulations.

Figure 10: Post-pandemic simulations of fiscal and monetary policy combinations working in concert (expansionary-for-longer fiscal policy specified following the real approach)



Sources: ECB-BASE simulations.

Figure 11: The effects of various combinations of fiscal and monetary rules on output gap and inflation



Sources: ECB-BASE simulations.

Notes: The intersection of the estimated fiscal rule (Estimated) and the Taylor monetary policy rule (TR) corresponds to the baseline. Comparing the outcomes to the baseline is a way to assess the effectiveness of various policy constellations.

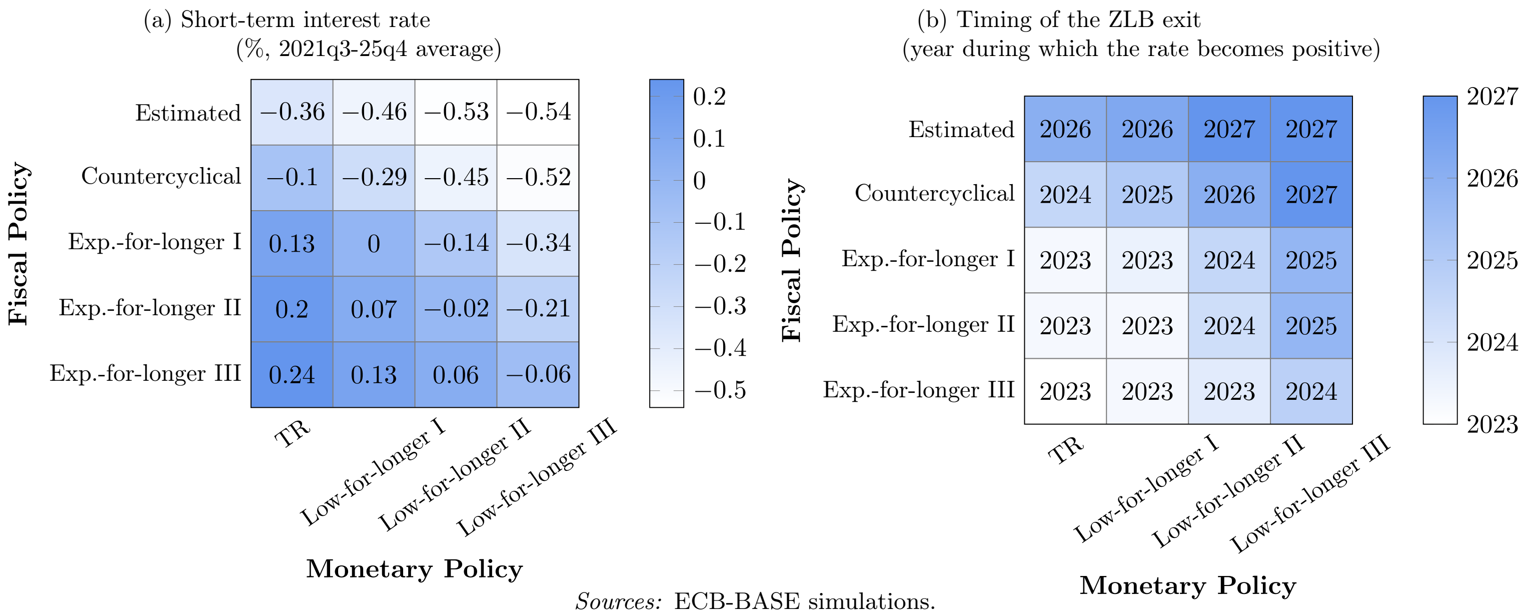
A more detailed look at all simulation scenarios reveals that monetary policy uncaps the potential of fiscal policy. The more accommodative monetary policy is, the higher are the output gains associated with fiscal rules (see Figure 11, subfigure (a), vertical gains are bigger for Expansionary-for-longer III scenario compared to TR scenario). The positive average output gap of 0.8% of GDP associated with the most favourable policies compares to -1.1% of GDP in the baseline and implies around 8% of additional output by end-2025. This addresses the large cumulative output losses that arose amid the COVID crisis. Similarly, inflation benefits most from the alternative fiscal rules under the most accommodative monetary policy arrangement (see Figure 11, subfigure (b)). Concretely, while the average inflation can benefit from the most expansionary-for-longer fiscal policy by less than 0.2 percentage points under the Taylor rule arrangement the gains exceed 0.4 percentage points under the most accommodative low-for-longer monetary policy. With this outcome the inflation reaches 1.8% on average, which is closest to the target among all constellations we consider in our analysis.

It is not only that monetary policy uncaps the potential of fiscal policy but also fiscal policy makes monetary policy more powerful. While the potency of monetary policy in the absence of expansionary-for-longer fiscal policies is relatively limited (see Figure 11, subfigures (a) and (b) horizontal gains of the first row) under the assumption of expansionary-for-longer fiscal policy monetary policy can still noticeably increase output and inflation (see Figure 11, subfigures (a) and (b), horizontal gains of the last row). This occurs because fiscal policy with its power to stimulate the economy alleviates the ELB and creates space for additional interest rate stimulus.

The model simulations suggest that the largest increases in output and inflation can be obtained when both fiscal and monetary policy work hand in hand. Looking at the heatmaps summarising the results, it becomes apparent that adjusting both policies simultaneously brings the biggest benefits (see Figure 11, subfigures (a) and (b), gains by moving along a diagonal towards the right lower corner). None of the policies on its own can perform so well. Against this background, fiscal and monetary policy reinforce each other and exhibit the properties of complementarity.

Another conclusion brought by the model simulations is that both policies mutually create space for each other. In particular, fiscal policy can alleviate some of the burden placed on monetary policy. With the expansionary-for-longer fiscal policy the interest rates are on average higher compared to the estimated fiscal rule (see Figure 12, subfigure (a)). This leads to a situation in which the central bank is able to lift the interest rate earlier than in the baseline. The exit from the undesirable ZLB environment materialises in 2023-24 rather than in 2026-27 (see Figure 12, subfigure (b)).

Figure 12: The effects of various combinations of fiscal and monetary rules on the short-term interest rate and the timing of the ZLB exit



Sources: ECB-BASE simulations.

Notes: The intersection of the estimated fiscal rule (Estimated) and the Taylor monetary policy rule (TR) corresponds to the baseline. Comparing the outcomes to the baseline is a way to assess the effectiveness of various policy constellations.

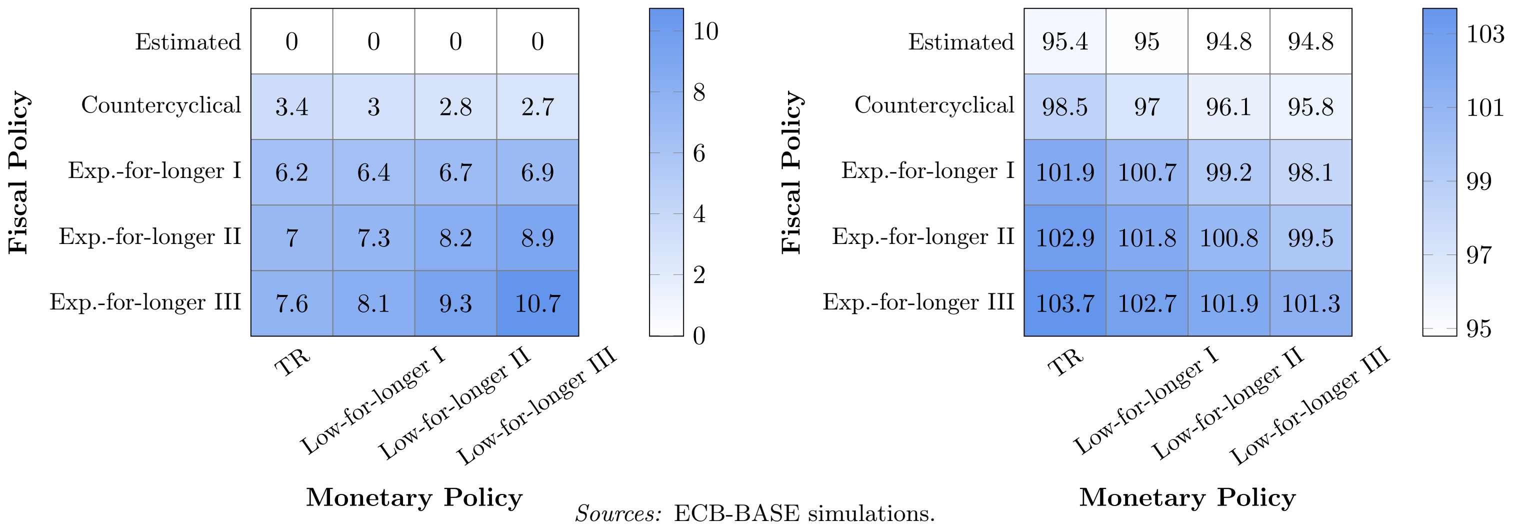
In the same vein, monetary policy creates space for fiscal policy, which takes place through two mechanisms in the model. First, accommodative monetary policy does not fight back the positive effects of fiscal stimuli and, as such, it allows the budget to benefit from the improved macroeconomic conditions. Second, by holding back interest rate increases the central back ensures favourable financing conditions for the government, thereby effectively keeping the cost of debt servicing in check. In the model simulations, the increase in debt-to-GDP ratio under the most accommodative low-for-longer monetary policy is smaller than under the Taylor rule (see Figure 13, subfigure (b)). This occurs even though the amount of additional expenditure is noticeably higher (see Figure 13, subfigure (a)).[25]

[25]The result that the fiscal expansion under the low-for-longer monetary policy is more sizeable than under the Taylor rule regime relates to the set-up of the expansionary-for-longer fiscal policy rules (see Subsection 2.2). The expansionary-for-longer fiscal rules, by definition, only make a difference if interest rates are negative. Under low-for-longer monetary policy the central banks holds back with interest rate increases, which extends the duration of the ZLB period and makes the extraordinary support embedded in the expansionary-for-longer fiscal policy activated.

Figure 13: The effects of various combinations of fiscal and monetary rules on the primary expenditure and the government debt

(a) Additional primary spending relative to the baseline (% of GDP, cumulated over 2021q3-25q4)

(b) Government debt-to-GDP ratio for analysed scenarios (%, end-2025q4)



Sources: ECB-BASE simulations.

Notes: The intersection of the estimated fiscal rule (Estimated) and the Taylor monetary policy rule (TR) corresponds to the baseline. Comparing the outcomes to the baseline is a way to assess the effectiveness of various policy constellations.

The extension of the baseline until 2030, underlying the above discussed simulations, is based on a number of assumptions and it is subject to uncertainty. The stochastic simulations allow to assess uncertainty and its effects on the baseline and on the counterfactual simulations.[26]

Stochastic simulations also allow to conduct risk analysis through the occurrence of undesirable events, from the point of view of monetary or fiscal policy. We define these events as hitting the ELB, low inflation episodes, enduring deep recessions or recording high debt-to-GDP ratios.[27] Table 1 shows the frequency of these events for the two subsamples under consideration. In both cases, the introduction of the alternative fiscal and monetary rules has an impact on the frequency of

[26] See also the description of the stochastic simulations in Section 3. The model for the stochastic simulations differs slightly from the model in the deterministic simulations. First, an ELB at -50bp is introduced also for the long-term rate to avoid negative realisations of long-term rates in the lower part of the distribution. Second, in the baseline and deterministic simulations, the asset purchases are calibrated taken into account APP and PEPP (Pandemic emergency purchase program). For the stochastic simulation the calibration was slightly reduced to tone down the effects of asset purchases for the general case without PEPP.

[27] The incidences of risk events are derived by calculating the number of simulation points inside the stochastic distribution where a certain defined event is fulfilled, and relating this number to the total number of simulation points.

occurrences of these risk events. Comparing the two subsamples shows that the number of ELB incidences under the baseline specification in the historical period is significantly lower than during the post-pandemic horizon. The differences are driven by the respective levels of interest rates in the two samples, where higher interest rate levels make ELB events less likely. While the historical sample starts from relatively high interest rates, the extended horizon is initiated at the ELB. A similar argument holds for the occurrence of high debt events, which are more likely in the second sample, because the initial debt level is already elevated. In comparison to the baseline with the estimated fiscal rules and the Taylor rule, the introduction of the countercyclical fiscal policy makes the adverse events, with the exception of high debt, less likely. The negative impact on debt is related to the fact that the lack of coordination with monetary policy makes a fiscal stimulus more costly. Once monetary policy becomes more accommodative (i.e. see low-for-longer policy rules) the high debt incidence goes down in both subsamples. Introducing the low-for-longer monetary policy rules, however, without adjusting fiscal policy results in an increase of the ELB occurrence, because the ELB episodes are longer. The frequency of ELB episodes is reduced in the post-pandemic sample when fiscal policy provides an additional stimulus.

A qualitative difference between the two samples relates to the occurrence of high debt incidences. While in the historical sample the combination of expansionary-for-longer fiscal policy and low-for-longer monetary policy is reducing the incidence frequencies for high debt, the opposite is true in the extended scenario. Here expansionary-for-longer fiscal policy is leading to an increase of high debt events. This is related to the properties of the extended horizon where both inflation and output are below their target/natural level for almost all observations. In this setting, fiscal policy provides continued support during a protracted period, driving up the debt level. Other mechanisms, potentially leading to adverse repercussions of higher debt, are not in the model.[28]

[28]There are many proposals in the literature how to model the effect of fiscal policy and debt on macroeconomic dynamics. Notable examples are a sovereign cost channel (Corsetti et al. (2013), the considerations about active and passive fiscal and monetary policy (Leeper (1991)) or the analysis of government default (Mendoza and Yue (2012))

Table 1: Incidence frequencies in stochastic simulations (% share of simulation episodes)

HISTORICAL ASSESSMENT until 2019	ELB	Low inflation	Deep recessions	High debt
TR & Estimated	10.24	45.51	34.73	16.19
TR & Counter-cyc.	8.60	42.07	14.35	17.32
TR & Expansionary-for-longer III	3.14	40.45	12.71	18.49
Low-for-longer II & Counter-cyc.	15.14	39.22	13.06	10.47
Low-for-longer III & Expansionary-for-longer III	16.00	36.07	10.30	11.70

EXTENDED SCENARIO 2021 to 2030	ELB	Low inflation	Deep recessions	High debt
TR & Estimated	38.66	37.00	26.91	22.94
TR & Counter-cyc.	19.81	27.14	5.50	47.20
TR & Expansionary-for-longer III	6.70	22.32	3.40	75.83
Low-for-longer II & Counter-cyc.	39.20	24.03	5.00	24.01
Low-for-longer III & Expansionary-for-longer III	17.28	13.44	5.42	63.88

Sources: ECB-BASE simulations.

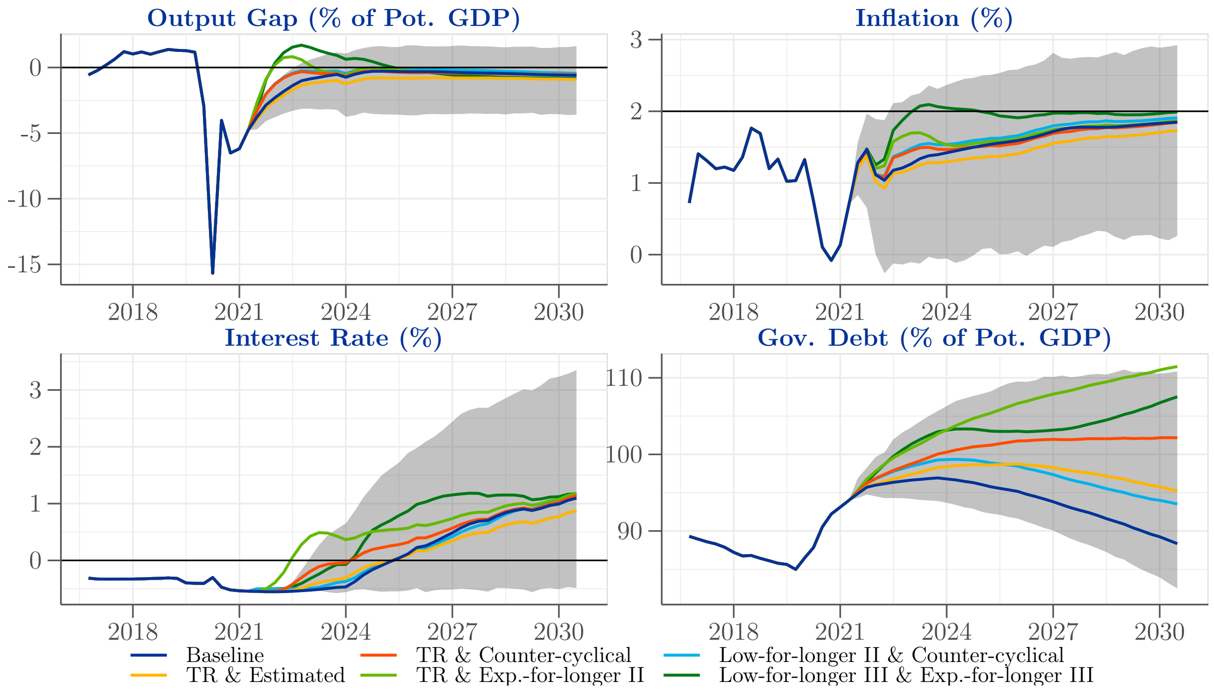
Notes: The incidence rates are based on a number of periods fulfilling the following criteria within the 500 simulation paths for the historical simulation or 2000 paths for the post-pandemic scenario.[29]
ELB: interest rate at the ELB
Low inflation: inflation below 1.25%
Deep recessions: negative output gap of 2% of GDP or larger
High debt: debt-to-GDP ratio of above 100%

To illustrate the risks around the baseline, tail events are considered, showing that the fiscal-monetary policy mix can stabilise the economy in negative tail events or positive tail events. To construct the tail events, 100 paths with the most positive and 100 paths with the most negative realisations of output are selected. (see Figures 15 and 16 where the means of the selected realisations under different policy rules are depicted). The pessimistic scenario is characterised by strongly subdued demand, passing through to low inflation. It shows that fiscal stabilisation policies stay effective in the lower tails of the distribution, while monetary policy is constrained by the effective lower bound and can only contribute via non-standard measures. The strongly accommodative stance of fiscal policy in combination with low output growth and low inflation is however boosting public expenditure, thereby leading to markedly increased debt-to-GDP ratios approaching 120%.[30] The rules effective in stabilising in the main scenario, show particularly high debt paths in

[30]For the case of low-for-longer III and expansionary-for-longer III we can observe an increasing slope of the government debt ratio in the latter part of the sample. This is due to the non-linearity implied by the ELB. While the interest rate normalisation around 2024 reduces the ELB frequency, for later parts of the sample the ELB frequency

the pessimistic scenario. This implies that stabilisation remains incomplete and inflation remains significantly below the target. Only in the most expansionary scenario, inflation is temporarily overshooting, triggering monetary tightening. The positive scenario is characterised by strong domestic demand and significant price pressures leading to inflation rates approaching 2.5 percent. It shows that the stabilisation rules switch their sign and bring the output gap to target from above. Under the positive scenario fiscal revenues increase, expenditures are reduced, and nominal output increases strongly. Consequently, the debt-to-GDP ratio stabilises fast under most combinations of policy rules.

Figure 14: Post-pandemic stochastic simulations: baseline with variants



Sources: ECB-BASE simulations.

Notes: The shaded area depicts the 95 percent confidence interval, based on 2000 simulation paths using bootstrapped residuals centred around the baseline. The lines represent the means.

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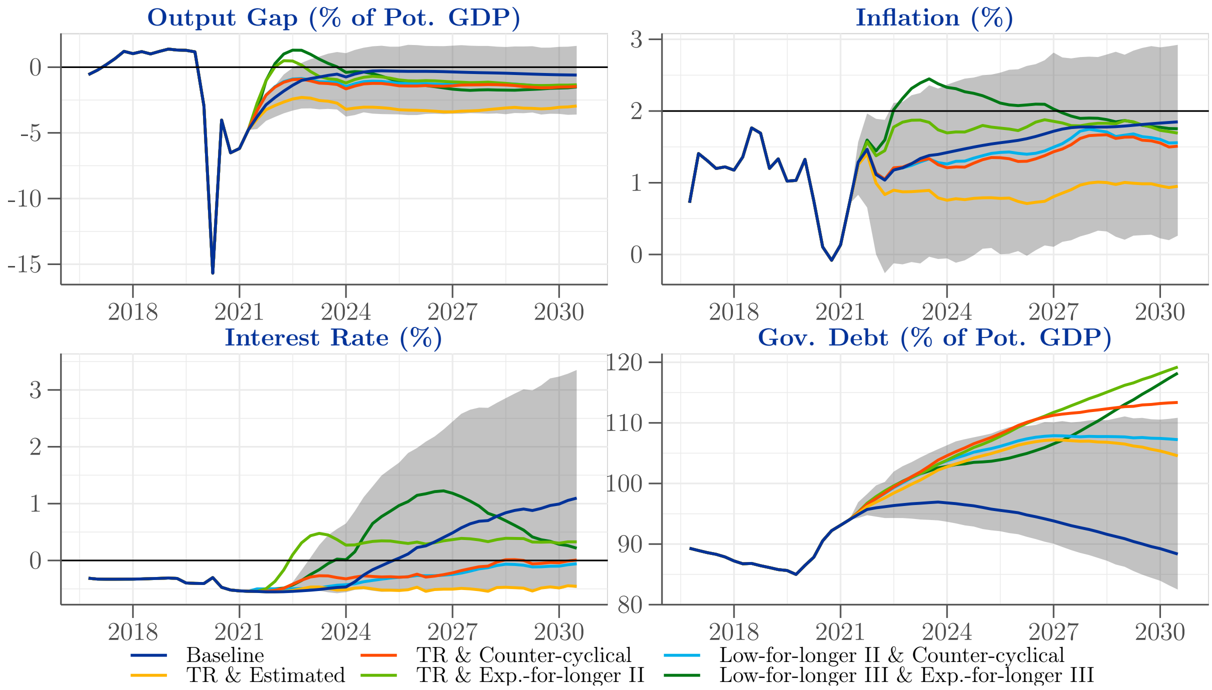
increases again due to the widening of the distribution. In the tails of the distribution, very negative growth and inflation paths, imply strongly expansionary fiscal policy and associated increases in public debt. For the respective positive realisation, monetary policy is containing the high output realisations via interest rate increases.

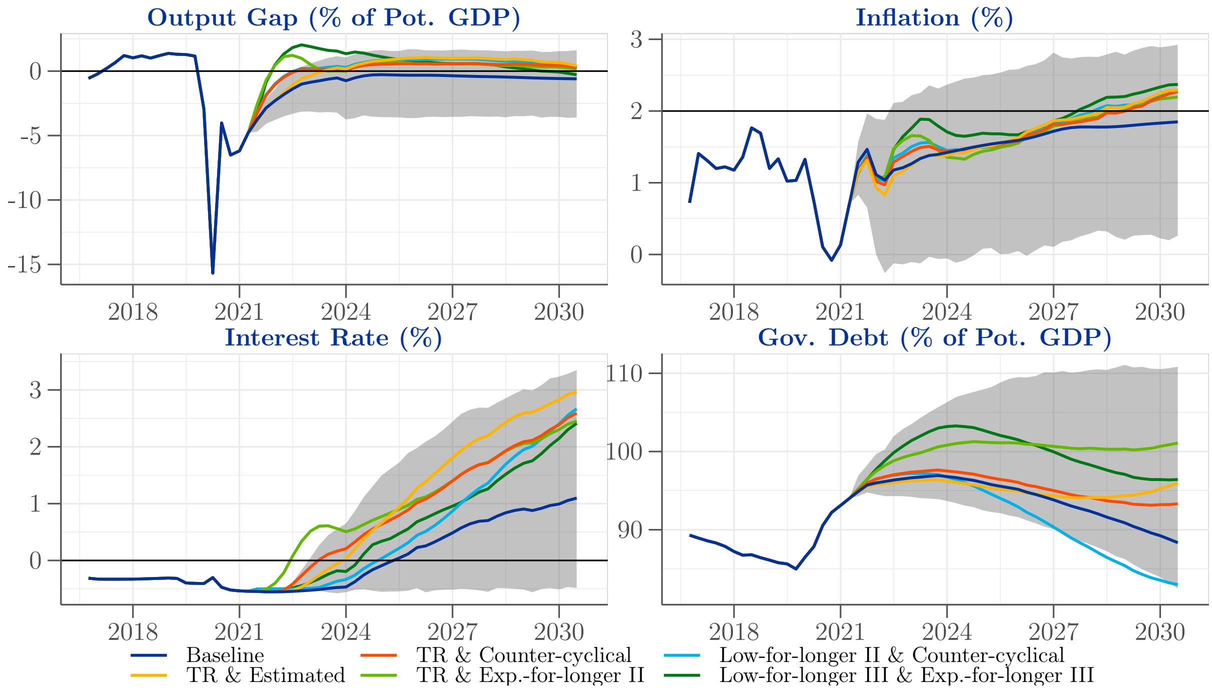
Figure 15: Post-pandemic stochastic simulations: pessimistic growth scenario



Sources: ECB-BASE simulations.

Notes: The pessimistic scenario is constructed by choosing the 100 most negative path realisations of output and depicting the means of these paths and the respective paths of the other variables. See footnote for Figure 14 for further information.

Figure 16: Post-pandemic stochastic simulations: optimistic growth scenario



Sources: ECB-BASE simulations.

Notes: The optimistic scenario is constructed by choosing the 100 most positive path realisations of output and depicting the means of these paths and the respective paths of the other variables. See footnote for Figure 14 for further information.

5 Conclusions

Over the foreseeable future fiscal policy will have to play a key role in macroeconomic stabilisation next to monetary policy. This will also apply to the euro area even though its fiscal architecture is incomplete and fiscal policies can be expected to largely remain in the hands of national policy-makers. Still, the existing imperfect set-up should not hinder analysis on desirable economic policies in the EMU at the aggregate level. In the end, the fiscal counterpart to monetary policy is the aggregate euro area fiscal stance.

In this paper we show that a consistently countercyclical fiscal policy in the past creates a fiscal buffer in the good economic times and it is able to eliminate a large portion of the second downturn in the euro area. In the future, the combination of the expansionary-for-longer fiscal policy and the low-for-longer monetary policy can be particularly powerful in addressing great challenges faced by policy-makers, such as large output losses suffered by the euro economy amid the pandemic and inflation persistently deviating from the target. Also, our analysis demonstrates that at the current juncture fiscal and monetary policies reinforce each other and mutually create space for each other. In general, if fiscal and monetary policy are coordinated and mutually supportive the real economy can be stimulated and the inflation can be lifted towards its target more effectively and at a lower cost in terms of the government debt and the ELB duration compared to a situation when the two policies do not take account of each other.

The results of the macroeconomic simulations are affected by modelling choices and these should be kept in mind when interpreting the conclusions of the paper. In particular, the ECB-BASE is a model for the euro area. The aggregation misses important debt sustainability aspects determined at the country level. Moreover, the simulations are specific to the considered periods. While a strong link to the data makes the analysis relevant at the current juncture this comes at the cost of loosing some generality. Also, in our model an increase in government debt does not lead to negative repercussions. In reality, however, debt increases are usually costly in terms of future distortionary taxes or even lead to high rollover risks. In models with rational expectations future consolidations can limit the immediate impact of expansionary fiscal policy. Addressing these simplifications in the model could alter the relatively optimistic conclusions of this paper.

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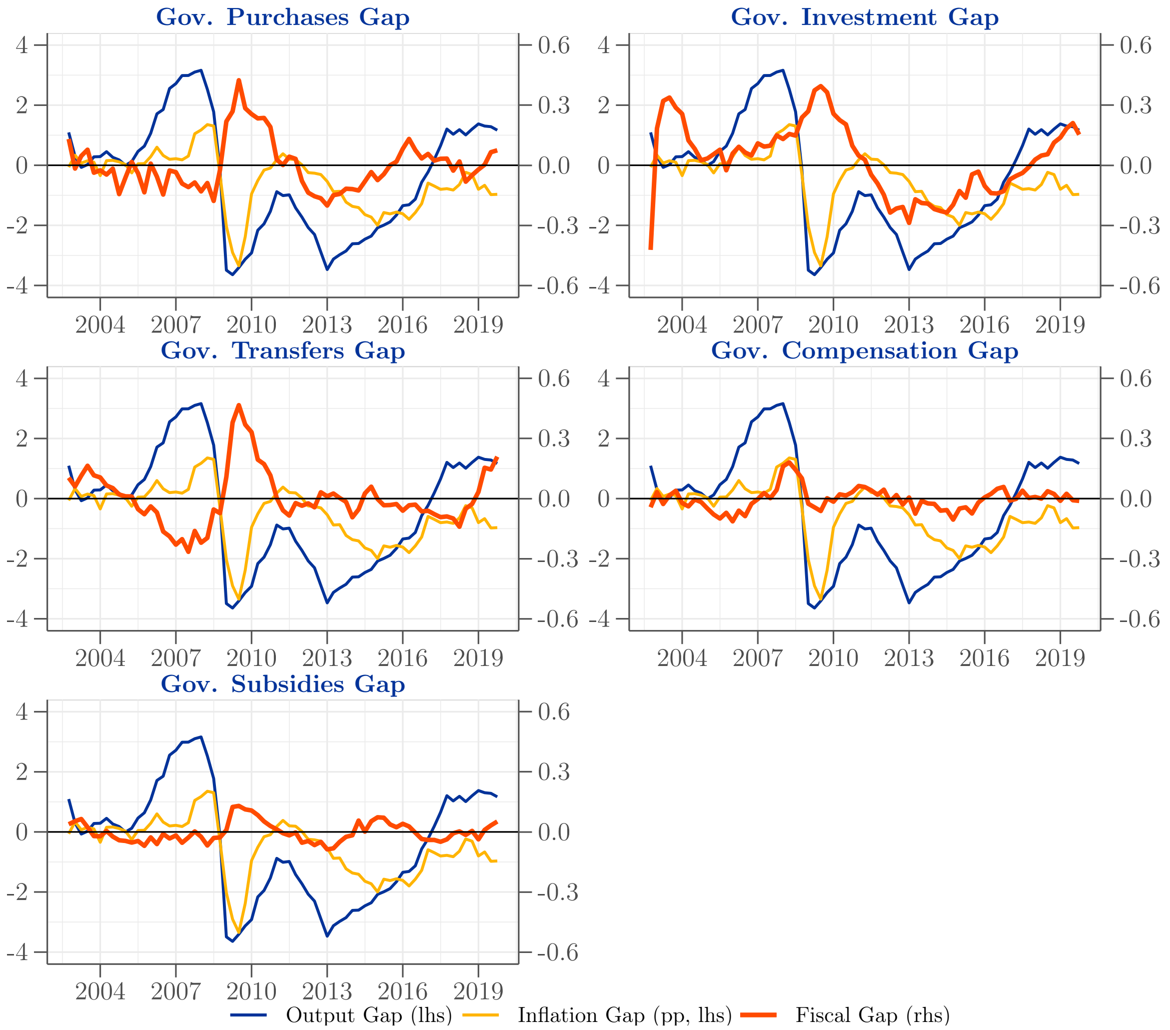
A Government spending instruments over the cycle

Figure A.1: Government spending deviations from a trend (% of potential GDP, unless otherwise stated)



Sources: Own calculations based on ECB, Eurostat and European Commission data.

Notes: The chart illustrates deviations from a trend for spending components in the model and contrasts them with the output gap and inflation gap. The size of the deviations is the largest for government purchases, government investment and government transfers. The movements within the remaining two instruments are considerably more muted. This observation provides an argument for using the three relatively elastic spending categories as stabilisation instruments in our exercise.

Table A.1: Coefficients on the output gap in estimated spending rules

Spending category	Output gap coefficient
Gov. Purchases	-0.01
Gov. Investment	0.00
Gov. Transfers	-0.02
Gov. Compensation	0.01
Gov. Subsidies	-0.00

Sources: ECB-BASE estimation based on 1999Q1-2019Q4 data.

Notes: The table presents the value of the estimated coefficients on the output gap in estimated fiscal rules described in Subsection 2.1. The values of the coefficients are standardised so that they are comparable to each other even though the size of spending categories differs significantly. The estimated figures are consistent with the illustration in Figure A.1. Most notably, they are the most negative for categories that move in the opposite direction to the output gap (see gov. transfers). Nevertheless, they are small compared to -0.1 value assumed in our countercyclical rule.

B Detailed presentation of fiscal and monetary policy rules

Fiscal Policy rules

- **Estimated fiscal rule**

$$\Delta g_t = \alpha(g_{t-1} - g^T_{t-1}) + \delta\Delta g^T_t + \sum_{k=1}^{2} \rho_k \Delta g_{t-k} + \gamma_Y \hat{Y}_t + \gamma_B(\frac{B_t}{\bar{Y}_t P_t} - \bar{b}) + \varepsilon^g_t \tag{B.1}$$

Where g_t is log of actual spending (i.e. investments, purchases or transfers), g^T_t is log of trend spending, $\hat{Y}_t$ is the real output gap, $\frac{B_t}{\bar{Y}_t P_t}$ is the debt ratio to nominal output, $\bar{b}$ is the debt target and ε^g_t the residual term.

Coefficients are estimated over 1999Q1-2019Q4 and the one associated with the output gap turns out to be close to 0 (i.e. $\gamma_Y \approx 0$).

- **Countercyclical fiscal rule**

$$\Delta g_t = \alpha(g_{t-1} - g^T_{t-1}) + \delta\Delta g^T_t + \sum_{k=1}^{2} \rho_k \Delta g_{t-k} + \gamma_Y \hat{Y}_t + \gamma_B(\frac{B_t}{\bar{Y}_t P_t} - \bar{b}) + \varepsilon^g_t \tag{B.2}$$

Where $\gamma_Y \ll 0$, which makes this rule different (i.e. countercyclical) compared to the estimated one.

- **Expansionary-for-longer fiscal rules**

With $i \in \{nom, real\}$,

$$\Delta g_t = \alpha(g_{t-1} - g_{t-1}^T) + \delta \Delta g_t^T + \sum_{k=1}^{2} \rho_k \Delta g_{t-k} + \gamma_Y \hat{Y}_t^{aug,i} + \gamma_B (\frac{B_t}{\bar{Y}_t P_t} - \bar{b}) + \varepsilon_t^g \tag{B.3}$$

Where $\gamma_Y \ll 0$ and $\hat{Y}_t^{aug,i}$ is the augmented output gap defined with the nominal or real approach.

∗ **Nominal approach** $(i = nom)$

$$\hat{Y}_t^{aug,nom} = \hat{Y}_t + \mathbb{1}\left[R_t \leq 0\right] \hat{P}_t \tag{B.4}$$

Where R_t is the nominal short-term rate, and $\hat{P}_t$ is the price gap calculated as a discounted cumulation of inflation gaps $(\hat{\pi}_t)$

$$\hat{P}_t = \sum_{k=0}^{\infty} \beta^k \hat{\pi}_{t-k} \tag{B.5}$$

The higher the β coefficient the longer the memory of the cumulation process.

	Exp.-for-longer I	Exp.-for-longer II	Exp.-for-longer III
β	0.9	0.925	0.95

∗ **Real approach** $(i = real)$

$$\hat{Y}_t^{aug,real} = \hat{Y}_t + \mathbb{1}\left[R_t \leq 0\right] Y_t^{\hat{add}} \tag{B.6}$$

Where R_t is the nominal short-term rate, and $Y_t^{\hat{add}}$ is the cumulative output shortfalls defined as

$$Y_t^{\hat{add}} = \rho^{Y^{add}} Y_{t-1}^{\hat{add}} + \sum_{k=1}^{8} \mathbb{1}\left[\hat{Y}_{t-k+1} \leq 0\right] a_k \hat{Y}_{t-k+1} \tag{B.7}$$

$\rho^{Y^{add}}$ and a_k coefficients are calibrated so that the real approach results in broadly the same like the one calculated with the nominal approach. The importance of the past output shortfalls in the formula (as judged by $\sum_{k=1}^{8} a_k$) increases with the degree to which fiscal policy remains expansionary-for-longer.

	Exp.-for-longer I	Exp.-for-longer II	Exp.-for-longer III
$\sum_{k=1}^{8} a_k$	0.056	0.064	0.070

Monetary Policy rules

- **Standard Taylor rule**

$$R_t = \max\left[0.85R_{t-1} + 0.15(r^* + \bar{\pi}_t + \hat{Y}_t + (\bar{\pi}_t - \pi^*)), -0.5\right] + \varepsilon_t^R \tag{B.8}$$

Where r^* is the natural interest rate, $\bar{\pi}_t$ the inflation, $\hat{Y}_t$ is the real output gap, π^* the inflation target and ε_t^R the residual term.

- **Low-for-longer monetary rules**

Expansionary-for-longer monetary rules used in this paper correspond to average inflation targeting rules and can be defined as follows

$$R_t = \max\left[0.85R_{t-1} + 0.15(r^* + \bar{\pi}_t + \hat{Y}_t + T(\bar{\pi}_t{}^{(T-year)} - \pi^*)), -0.5\right] + \varepsilon_t^R \tag{B.9}$$

Where $\bar{\pi}_t{}^{(T-year)}$ is the average inflation over $(T - year)$ period.

	Low-for-longer I	Low-for-longer II	Low-for-longer III
$(T - year)$	2	3	4

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