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Euro area inflation differentials: the role of fiscal policies revisited

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Abstract

This paper provides a comprehensive empirical analysis of the role of discretionary fiscal policy for inflation differentials across the 19 euro area countries over the period 1999-2019. The results confirm existing (older) literature that it is difficult to find robust evidence of the fiscal policy stance or impulse impacting directly on inflation differentials. We do find, however, support for an indirect effect of discretionary fiscal policy on inflation differentials working through the output gap channel. There is also some evidence that fiscal policy may be especially potent in influencing inflation differentials – with fiscal tightening cooling (and fiscal expansion increasing) inflation pressures – when the economy is above its potential. Finally, going from the overall fiscal stance or impulse to individual fiscal instruments, we find that value added tax (VAT) rate changes and public wage growth are statistically significant determinants of inflation differentials in our sample.

Keywords: Fiscal policy, inflation differentials, tax policy, public wages

JEL classification: E31, E62, E63, F45

Non-technical summary

Substantial inflation differentials in a monetary union entail challenges for the conduct of a "one-size-fits-all" monetary policy. Monitoring the sources of inflation differentials in the euro area is therefore important to distinguish desirable short-run adjustment processes from potentially persistent divergences that complicate the conduct of a single monetary policy. In this paper, we analyse to what extent fiscal policy, which is conducted at the national level, is a source of inflation differentials across Economic and Monetary Union (EMU).

In theory, a country running more expansionary discretionary fiscal policies compared to the euro area average is expected to face a higher acceleration in prices, contributing to a positive inflation differential with respect to the average. In their seminal contribution, Honohan and Lane (2003) do not find robust evidence for this channel in the sample of initial member countries and first years of EMU. Since then, few studies have extended the analysis. Comprehensive evidence including the years following the sovereign debt crisis, the whole set of euro area member countries, as well as potentially important channels, asymmetries and interactions is missing.

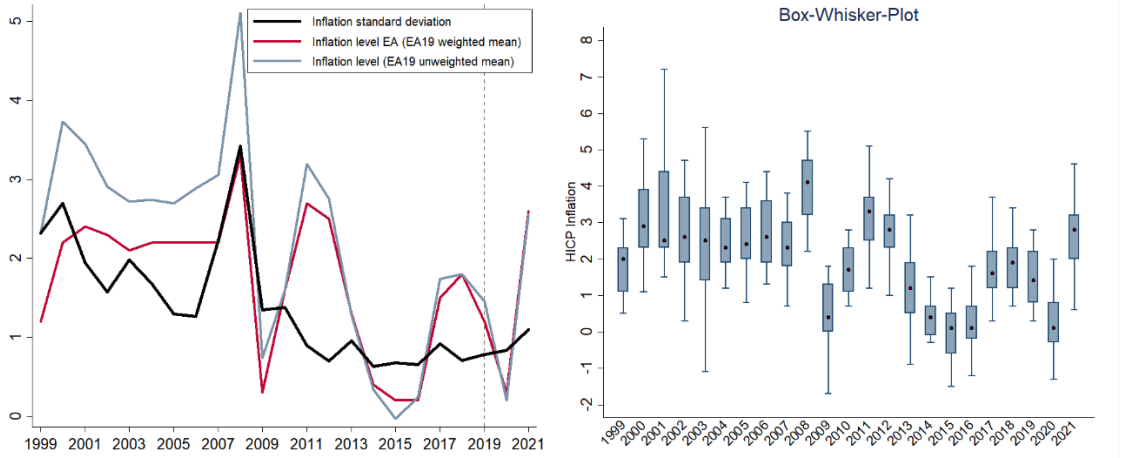
We aim to fill this gap by using a sample of annual data for all euro area (EA-19) Member States covering the period 1999-2019. We perform panel econometric analyses, controlling for the potential endogeneity of different discretionary fiscal policy measures, that is, those beyond the automatic reaction of public finances to cyclical developments. These measures capture both the *level* of support coming from fiscal policies ("fiscal impulse") and *changes* therein ("fiscal stance"). We also consider potential asymmetries in fiscal policy regimes and the presence of an indirect channel running through output gap differentials. Moreover, we consider interactions with the prevalent monetary policy stance, in an echo of the monetary-fiscal interaction literature. Lastly, we document the impact of specific fiscal policy instruments, such as indirect tax changes, which are associated with an immediate pass-through into price developments, and public wage increases, which are expected to operate through spill-over effects to private wage developments. The more recent pandemic period is excluded from the analysis. Given the unique features of this shock and the specific measures governments implemented to bolster its economic impact, it would require a separate analytical approach.

Overall, we conclude that there does not seem to be robust evidence for fiscal policy (measured as either stance or impulse) to contribute directly to inflation differentials across the EA-19 in the period considered. This conclusion does not change under various robustness-checks, including in relation to monetary policy. However, in a stylised simultaneous equations model, we can show that there is an indirect effect of the fiscal stance/impulse on inflation differentials working through the output gap. There is also some evidence that fiscal policy may be especially potent in influencing inflation differentials – with fiscal tightening cooling (and fiscal expansion increasing) inflation pressures – when the economy is above its potential. Finally, acknowledging that an overall nonsignificant effect of the fiscal stance/impulse on consumer price inflation differentials might overshadow significant, yet opposing, influences of different fiscal policy instruments, we additionally allow for a separate effect of two specific policies. Indeed, we find support for value added tax (VAT) rate changes and public wage growth being related to the evolution of inflation differentials.

1. Introduction

Since the onset of Economic and Monetary Union (EMU) attention has been paid to the degree to which inflation developments differ across its member countries. Substantial inflation differentials may render the conduct of monetary policy challenging. Setting nominal interest rates according to a single inflation target may imply a too accommodative monetary policy for countries with inflation rates (well) above the euro area average, while those with (well) below-average inflation might be faced with too high tightening policy pressures. The implied divergence in real interest rates affects real returns on savings and investment and might lead to an upward spiral in divergence if it manifests itself into expectations of real rates. Looking at developments in the euro area, the inflation differentials, as measured by the cross-country standard deviation in the annual HICP inflation rates across the 19 Member States at the time of writing (EA-19), have been volatile, but have overall followed a declining trend before broadly stabilising as of 2012 (see Figure 1, left panel, black line). The Great Financial and Economic Crisis led to a notable divergence in HICP inflation rates in 2007 and 2008. Still, the relatively low standard deviation from 2012 onwards masks considerable heterogeneity in inflation rates across countries, as visible from the Box-Whisker Plot in the right panel of Figure 1. With the inflation levels dropping significantly at the beginning of the pandemic in 2020 and then rebounding even more strongly in 2021, inflation differentials started increasing again.

Figure 1: Distribution of HICP inflation rates in the euro area



Sources: Own calculations and Eurostat for the aggregate euro area HICP (Harmonised Index of Consumer Prices) inflation series (EA-19 GDP-weighted mean), and the country-level HICP data with equal weights on all countries.
Notes: Outside values in the Box-Whisker Plot (defined as values higher than the 75th percentile plus 1.5 times the interquartile range and values below the 25th percentile minus 1.5 times the interquartile range) are not displayed. For completeness, data for 2020-21 are shown although they do not feed into our analysis.

The factors influencing inflation differentials in a monetary union may provide important insights for predicting their future evolution and for assessing whether there are risks of lasting divergences. Specifically, it is important to gauge whether such inflation differentials are likely to be transitory or more long-lasting, whether they are part of a natural and desirable adjustment process among currency union countries or a sign of self-reinforcing imbalances, in part determined by national economic policies.

Abstracting from price level convergence (in line with the Balassa-Samuelson effect), which operates in the longer term, inflation differentials across countries may arise due to asymmetric shocks and unaligned business cycles or different degrees of openness and external exposure, causing spill over effects of nominal effective exchange rate movements into domestic consumer prices. Both factors are considered largely transitory and there is no particular concern that they are leading to structural divergences. On the other hand, if national price developments are shaped by discretionary

public policies, which might be ill-timed and infrequently adjusted, paired with nominal rigidities, they might contribute to inefficient and potentially lasting inflation differentials.

Fiscal policy in EMU is determined at the national level, despite its orientation being coordinated at the EU level through the provisions of the Stability and Growth Pact (SGP), and remains the most important short to medium-run policy tool for macroeconomic stabilisation. It is therefore natural to consider a role for fiscal policy in shaping country-level inflation and, thus, inflation differentials. For instance, government spending can increase output and inflation in the short-term, being potentially more effective in periods when monetary policy's reaction space is constrained. Further, government spending that is procyclical or not related to the business cycle might itself introduce volatility in output and prices in the national economy.

Existing empirical studies assessing the impact of discretionary fiscal policy mostly fail to detect a significant and robust impact on inflation differentials across EMU countries. However, the results might be specific to the measure that is employed in the analyses to capture fiscal policy or the time period covered, since most studies focus on the early years of EMU. They therefore abstract from the financial and economic crisis and the subsequent period with monetary policy moving towards the effective zero lower bound. Moreover, the country sample entailed in these studies comprises mostly the initial euro area Member States, which might have been characterized by more aligned fiscal policies than the whole set of current EMU members.

We therefore aim to reassess the question of which factors shape inflation differentials in the euro area and, especially, what role can be assigned to differences in fiscal policies across countries, considering the time period up to 2019 and extending the sample to the EA-19 country group. We perform panel econometric analyses since we are interested in cross country differences over a longer period of time rather than in the impact of idiosyncratic shocks. This is also why we exclude most recent data points from 2020 and 2021, given the atypical and temporary nature of the Covid-19 pandemic crisis, which constitutes a structural break in the relationships we are trying to estimate. Extending the analysis to the Covid crisis is thus left for further research. In our analysis, we allow for a range of different fiscal policy measures. These capture both measures of the level of support coming from fiscal policies ("fiscal impulse") and changes therein ("fiscal stance"). We also consider potential asymmetries in fiscal policy regimes and the presence of an indirect channel running through output gap differentials. Moreover, we consider interactions with the prevalent monetary policy stance, in an echo of the monetary-fiscal interaction literature. Lastly, we document the impact of specific fiscal policy instruments, such as indirect tax changes, which are associated with an immediate pass-through into price developments, and public wage increases, which are expected to operate through spill-over effects to private wage developments.

Our findings indicate that there is no robust evidence that fiscal policy (measured as either stance or impulse) contributed to HICP or core HICP inflation differentials for the EA-19 country group over 1999 to 2019. However, we provide evidence of an indirect effect of fiscal policy on inflation differentials working through the output gap. Moreover, allowing the effects to vary across periods of fiscal expansions or contractions or countries' position in the business cycle permits us to discover some asymmetries, which have been overshadowed by restricting the effect to a single coefficient. Lastly, we can document that specific fiscal instruments contribute to inflation differentials. This applies notably to Value Added Tax (VAT) rate changes and to a lesser extent to the growth rate of public wages.

The paper is structured as follows. Chapter 2 presents a literature review of the relationship between fiscal policy and inflation (differentials), whereby empirical findings are reported mostly for the euro area. Chapter 3 describes the empirical setup and performs a range of regression analyses to identify the impact of fiscal policy on inflation

differentials in the euro area, applying various measures of the level and change in discretionary budgetary policy. It also includes a battery of robustness checks, with most of the results detailed in the appendix. Finally, the chapter also provides an analysis of specific fiscal policy instruments. Chapter 4 concludes.

2. Literature review

2.1 The role of discretionary fiscal policy for inflation developments

This subsection reviews the three main strands of literature linking government action to national price developments. In the first strand of literature, fiscal policy affects inflation through governments' spending decisions that shift the output gap. While, in general, monetary policy is given precedence over discretionary fiscal policy in business cycle stabilization since it is considered to work in a more timely manner, this may not apply to two specific circumstances. First, in currency unions, different from monetary policy, fiscal policy can be targeted to country-specific shocks. Second, fiscal policy can have a particular role to play in times when monetary policy is constrained by the effective zero lower bound on the nominal interest rate. Specifically, in a liquidity trap, with fixed nominal interest rates, government spending stimulates inflation and thereby reduces the real interest rate. This in turn stimulates private consumption, which leads to further inflation (see Christiano et al. (2011) and Eggertsson (2011)). However, Farhi and Werning (2016) caution that the effect of spending in a currency union is different from the liquidity trap analysis, arguing that a fixed exchange rate implies a fixed nominal interest rate, while the reverse was not true: In the zero-lower-bound scenario, implicitly, the government spending shock is paired with a one-off devaluation, while in the currency union, additional spending leads to inflation in domestically produced goods. The resulting loss in competitiveness appreciates the terms of trade and reduces overall private spending.

The second strand of literature is concerned with inflationary pressure arising from non-sustainable fiscal policy. In the case of a fiscal authority operating under a fiscal-dominance (FD) or non-Ricardian regime, future primary surpluses are regarded as insufficient to satisfy the intertemporal government budget constraint, leading the central bank to accommodate inflation accordingly, such that the price level is in effect determined by fiscal policy (Fiscal Theory of the Price Level). Empirically, e.g. Bajo-Rubio et al. (2009) analyse whether fiscal sustainability in EMU countries is achieved through the endogenous adjustment of the primary budget surplus - interpreted as a monetary dominance (MD) regime - or through the endogenous adjustment of the price level (FD regime), finding empirical evidence for the former.[1] Some empirical work assessing the relationship between budget deficits and inflation concludes that deficits are significant drivers of inflation only in high-inflation episodes and high-inflation economies (Catão and Terrones (2005), Lin and Chu (2013)). Kliem et al. (2016) estimate the low-frequency relationship between fiscal policy (proxied as the ratio between the public deficit and one-period lagged public debt) and inflation for Germany, Italy, and the U.S., over the period 1965-1999 and find that it is dependent on the degree of central bank independency and fiscal responsibility. If both are satisfied, the relationship is low, while it is high in times of non-responsible fiscal policy and accommodative behaviour of the monetary authority.

Lastly, fiscal policy might itself be the source of business cycle and price fluctuations if it is procyclical or even set irrespective of economic conditions (e.g., for political economy reasons). Many studies attempt to estimate the degree of procyclicality of fiscal policy in the euro area. For instance, Fatas and Mihov (2010) find that (cyclically adjusted) fiscal policy in the EA-12 in the first years of EMU was mildly procyclical. More recent work finds evidence of

[1] This is in line with the long strand of literature on the fiscal reaction function and the testing of "weak" sustainability condition coined by Bohn (1998). See also Checherita-Westphal and Zdarek (2017) for a recent review of the literature and (similar) findings for the euro area.

procyclicality in the sample of EU countries over 1972-2017 (Larch et al. (2021)). Gootjes and de Haan (2022) also find evidence of pro-cyclical fiscal policies, which however seems to stem mostly from non-euro area countries, using sample years 2000-2015. Lastly, Aldama and Creel (2022) consider differential degrees of procyclicality in upturns and downturns and find that over 1996-2017 the euro area countries in their sample exhibit procyclicality only during downturns, with fiscal policy being acyclical in upturns. Concerning the impact of fiscal policy on inflation volatility, the evidence is rather inconclusive as well. While Rother (2004) finds in panel estimations of 15 OECD countries that activist fiscal policies might have an important impact on Consumer Price Inflation (CPI) volatility, Badinger (2009) can only find an indirect effect through output volatility in a similar sample. More recently, Afonso and Jalles (2020) find that the year-on-year change in the cyclically adjusted primary balance has a positive correlation with inflation volatility during 1980-2013, albeit only significantly in the emerging market subsample of the 54 countries considered. In our analysis, we will account for this channel by allowing for an additional role for the fiscal stance in shaping inflation through output gap differentials.

2.2 The role of discretionary fiscal policy for inflation differentials across EMU

Contrary to the previous subsection, which reviewed studies analysing the fiscal parameters driving inflation levels of a certain country, this subsection collects available evidence on how fiscal policy affects inflation differentials vis-à-vis a certain sample average. Importantly, these results also hinge on the extent to which discretionary fiscal policies across countries are not aligned.

Available theoretical models allow constructing a counterfactual in which fiscal policy only moves in one country, thereby enabling an assessment of the causal effect of this isolated change on the inflation differential of the country under consideration vis-à-vis the other economies in the model. There are, however, only few papers investigating the interplay between discretionary fiscal policy and inflation in a country of a monetary union vis-à-vis the union average with a structural model setup. One is Altissimo et al. (2005) who build a model of two regions in a monetary union with flexible prices and government spending on domestic non-traded goods, financed by lump-sum taxes. Their model predicts that a relative increase in government spending in the domestic economy increases price differentials of this country with respect to the currency union, with the effect becoming stronger the lower the labour mobility between tradable and non-tradable sectors. Duarte and Wolman (2008) assess whether a region participating in a currency union is able to affect its inflation differential with respect to the union average through fiscal policy. They consider a symmetric 2-region general equilibrium model of a currency union with sticky prices and the government financing an exogenous stream of expenditure via labour income taxation or bond issuance. Calibrated to quarterly German data over the period 1991 to 2001, they find that lowering the labour income tax in response to a positive inflation differential does succeed in compressing it - at the expense of higher foreign and union-wide inflation volatility.

Turning to empirical studies, the first set of papers considers the impact of fiscal shocks identified in Vector-Auto-Regression (VAR) models on inflation differentials. Canova and Pappa (2003) estimate a Bayesian VAR with quarterly data on 9 EU countries from 1999Q1 to 2002Q2. They identify fiscal shocks using sign restrictions and find that, on average, deficit-financed expansionary fiscal disturbances increase price differentials, while expansionary fiscal shocks financed by distortionary taxation decrease them. Moreover, from a variance decomposition they gauge that, on average, during the period considered, fiscal shocks explained between 14 and 23 percent of the price fluctuations in the EU, with substantial heterogeneity across countries.

The second strand of the empirical literature – to which our paper belongs as well – analyses the impact of fiscal policy on inflation differentials using a panel econometric approach. The pioneering reference here is Honohan and Lane

(2003) who gauge the determinants of inflation differentials among the initial euro area countries over the period 1999-2001, using pooled Ordinary Least Squares (OLS) and Generalized Method of Moments (GMM) estimators. Among the potential driving forces they consider are price level convergence in the spirit of the Balassa-Samuelson effect, cyclical forces proxied by the output gap, nominal effective exchange rates and a measure of "fiscal stance" that resembles, however, a fiscal impulse (in levels). Except for this fiscal stance measure, all variables are found to be statistically significant and economically relevant. In particular, a stronger than average position in the business cycle or larger depreciation of the nominal effective exchange rate seems to be related to a positive inflation differential vis-à-vis the euro area average. The failure to detect any significant effect for fiscal policy in their regressions may be an indication that fiscal developments in the countries and period considered did not influence inflation, at least not beyond the potential impact they had on the output gap. This latter hypothesis was, however, not tested in the study and it is a point that we will follow upon in our analysis.[2]

Other studies employing a panel regression approach include Égert (2007), Andersson et al. (2009), Aldasoro and Z'd'árek (2009) as well as Piranovo and Van Poeck (2011). They broaden the analysis both with respect to the sample considered – extending the time dimension up to 2010 and the cross-sectional dimension up to the EA-15 country group – and the set of explanatory variables employed. This latter aspect mainly applies to the inclusion of lagged inflation as an additional regressor. All papers find that inflation persistence and differences in business cycle positions are important determinants of current-period inflation differentials, while the role of catching-up effects is diminished. Moreover and importantly, they fail to detect any robustly significant impact of fiscal impulse proxies.

These findings might however not lead to the conclusion that a relationship between fiscal policy and inflation differentials does not exist. One reason might be that the time period and country sample considered did not provide enough variation in the fiscal stimulus to shape inflation differentials. Therefore, there is scope for finding a role for fiscal policies in determining inflation differentials in a country sample that is more heterogeneous than the initial member countries[3]. To this end, we consider the sample of all current euro area member countries (EA-19). Moreover, a longer time span up until 2019 allows considering different episodes of EMU, especially times in which monetary policy has been constrained by the effective lower bound. Furthermore, none of the empirical papers considers asymmetric effects of fiscal contractions and expansions or the degree to which output gap differentials interact with and are themselves determined by fiscal policy variations.

2.3 The impact of specific fiscal policy instruments on inflation (differentials)

Apart from the overall net budgetary impact of discretionary fiscal policy as measured by the fiscal stance, its composition may also play a role in determining inflation and differentials therein across countries. This warrants an investigation of specific fiscal instruments. For example, an expansionary fiscal stance that results from increased government spending raising aggregate demand can have a positive effect on inflation. At the same time, if the budgetary expansion is associated, for instance, with a decrease in indirect tax rates, companies are likely to pass-on this change at least partly to consumers, resulting in a decline in inflation.

There is indeed evidence of a relatively high pass-through of Value-Added Tax (VAT) changes into inflation. Estimating the impact of changes in standard VAT rates on monthly log changes of the harmonized consumer price index for 17

[2] In Honohan and Lane (2004) the same authors confirm their previous results also in an extended sample until 2003.

[3] Égert (2007) finds that the government deficit is strongly and significantly related to HICP inflation differentials when adding a sample of 10 Central and Eastern Economics (CEE) to the initial euro area countries (over the period 1996-2005). The effect is found to be negligible when only the initial euro area members are considered.

eurozone countries between 1999 and 2013, Benedek et al. (2015) find that it is almost 100%. Correa-López et al. (2014) perform panel regressions on a set of 20 OECD countries between 1960 and 2006 and also conclude that there is a positive and significant relationship between the indirect tax wedge (i.e. the difference between total indirect taxes and total subsidies over total household final consumption expenditure) and inflation. Lastly, concerning euro area core HICP inflation, ECB (2021) finds in a VAR analysis that an indirect tax shock generates a positive inflation response on impact and continued elevated inflation for the following quarters, peaking 2 years after the shock. The evidence on the impact of indirect tax changes on inflation differentials across countries is, however, limited. Only Mody and Ohnsorge (2007) consider determinants of the "national component of inflation" of euro zone countries over 2002-2005, which can be taken as an approximation to inflation differentials, and include year-on-year VAT rate changes among their set of explanatory variables, finding that such changes contribute considerably to country-specific inflation.

Other fiscal instruments with potential to contribute more strongly to inflation are public sector wages, in particular through their spillover effects to private sector wages. Several studies document such a relationship (see, for instance, Checherita-Westphal (ed. 2022), for a recent analysis and review of the literature with a focus on the euro area). This study finds a reaction of private wage growth of between 0.3 and 0.5 percentage points for a 1 percentage point increase in public wage growth, while controlling for other determinants of wages). Bénétrix and Lane (2013) estimate a panel VAR model on real exchange rate movements with annual data over 1970 to 2008 from a panel of euro area member countries. They document that shocks to the wage component of government consumption lead to more persistent real appreciation than shocks to the non-wage component and the effect is working via an increase in inflation differentials. Lastly, since government consumption and especially the wage component are prone to procyclicality (Lane (2003)), it might also exacerbate business cycle fluctuations.

Given these identified relationships, we will consider VAT and public wages in our analysis, as potential explanatory variables for inflation differentials across EA-19.

3. Empirical analysis

3.1 Baseline regression analysis and extensions around fiscal policy measures

3.1.1 Baseline regression analysis

As a starting point, we choose a panel regression setup that follows the seminal contribution of Honohan and Lane (2003) as stated in equation (1). Under the assumption of a common long-run price level, the differential of inflation of a country i in year t, π_{it}, with respect to the euro zone average, π_t^{EA}, can be expressed as functions of the previous period's difference of the respective country's price level P_{it-1} vis-à-vis the euro area average P_{t-1}^{EA} and the deviation of other national variables $\boldsymbol{z_{it}}$ from their euro zone average $\boldsymbol{z_t^{EA}}$. ε_{it} reflects the usual error term. The time frequency in our analysis is annual:

$$\pi_{it} - \pi_t^{EA} = \boldsymbol{\beta}\,(\boldsymbol{z_{it}} - \boldsymbol{z_t^{EA}}) - \delta(P_{it-1} - P_{t-1}^{EA}) + \varepsilon_{it} \qquad (1)$$

Note that this baseline specification does not include country fixed effects as these would imply the existence of permanent inflation differentials across euro area member countries.[4]

[4] Since they are, however, found to be relevant (see Table A.1.3 in the Appendix), this assumption will be relaxed in later specifications.

With all euro zone variables combined into a time dummy, φ_t, the regression equation can be written as

$$\pi_{it} = \varphi_t + \boldsymbol{\beta z_{it}} - \delta P_{it-1} + \varepsilon_{it} \quad (2)$$

and is thus explaining inflation differentials in terms of idiosyncratic national changes in the determinants.[5]

The regressor of main interest is the $\boldsymbol{z_{it}}$ vector, which hereby represents the fiscal policy variable, reflecting the net budgetary impact of discretionary fiscal policy measures. In addition, it includes the lagged change in the nominal effective exchange rate and the contemporaneous output gap in line with the setup proposed by Honohan and Lane (2003). In what follows, we look into alternative measures of aggregate fiscal policy. In the baseline, we follow the definition used in Honohan and Lane (2003) and construct it as the difference of the primary balance from its past 5-year moving average (denoted $FISC_{it}$). An increase in this variable, being indicative of a tighter fiscal policy, is expected to dampen economic activity in the short run and have a negative impact on a country's inflation vis-à-vis the rest of the euro area.

The main outcome variable considered is HICP inflation but results for core HICP inflation (excluding food and energy prices) are also presented. A list of detailed variable descriptions and data sources can be found in the Appendix Table A.1.1.

Since the fiscal policy indicator and the output gap might suffer from reverse causation, we employ pooled GMM estimation with the two variables being instrumented by their lagged values.

Table 1 below shows in Column 1 the original results of Honohan and Lane (2003) on the EA-12 sample for the period 1999-2001. Column 2 presents the outcome of a direct replication attempt of their study, applying the same data sources but factoring in revisions in data subsequent to its release.[6] Column 3 shows the outcome of an extension of the analysis to the time period 1999-2019 for the EA-12 sample, while Columns 4-6 reflect different sample specifications involving all euro area members (EA-19).[7]

[5] Therefore, any empirical study performing macroeconomic panel econometric analyses including time fixed effects to assess determinants of a national variable can essentially be interpreted as explaining the differential of this national variable with respect to the cross-sectional sample average.
[6] While all analyses employ the sources listed in Table A.1.1 of the Appendix, Column 2 uses three different variable sources to come as close to the original analysis in Honohan and Lane (2003) as possible: First, the price level is taken from the Penn World Table version 6.1 instead of 10.0, Second, the source of the nominal effective exchange rate is the annual nominal effective exchange rate from the IMF International Financial Statistics, and lastly, the output gap is taken from the OECD instead of the ECB's series.
[7] Panel unit root tests following Levin, Lin and Chu (2002) confirm that we can reject the null hypothesis of a unit root in all series in favour of the alternative of stationarity in both the EA-12 and the EA-19 country group over this time period. For all series except for the price level this result holds at the 1% level of statistical significance, for the price level at the 5% level. Results can be requested from the authors.

Table 1: Replication Results (Dependent variable: HICP inflation)

	(1) HL (2003) EA12	(2) EA12	(3) EA12	(4) EA19 (Unbalanced sample)	(5) EA19 (Balanced weighted sample)	(6) EA19 (Balanced sample)
$\Delta NEER_{t-1}$	-0.28***	-0.16	-0.16*	-0.12	-0.29***	-0.33***
	(-3.43)	(-1.64)	(-1.93)	(-1.46)	(-4.43)	(-5.09)
$outputgap_t$	0.23***	0.27*	0.23***	0.18***	0.17**	0.18*
	(3.99)	(1.92)	(6.68)	(5.81)	(2.35)	(1.87)
$FISC_t$	0.07	0.15	-0.02	-0.03	-0.11	-0.17*
	(1.71)	(1.27)	(-0.20)	(-0.39)	(-1.36)	(-1.74)
$price_{t-1}$	-0.03***	-0.03**	-0.01*	-0.01**	-0.03***	-0.04***
	(-4.53)	(-2.39)	(-1.91)	(-2.29)	(-3.25)	(-3.43)
Time FE	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO
Time period	1999-2001	1999-2001	1999-2019	1999-2019	1999-2019	1999-2019
Observations	36	36	252	318	399	399
KP LM-Stat. (p)		0.0373	0.0177	0.0147	0.00880	0.00681
lagged resids (p)		0.881	0.0000	0.0000	0.0000	0.0000

Notes: Column (1) is an exact reproduction of the results of Honohan and Lane (2003, Table 6, Column 1). Specifications (2)-(6) employ two-step feasible GMM with robust standard errors and the output gap and fiscal policy variable FISC instrumented by their first lag (exact identification). Columns (3)-(6) additionally guard against autocorrelation in the residuals by employing Driscoll-Kraay standard errors. Properties of this standard error adjustment are independent of the cross-sectional dimension N but rely on large T asymptotics. T=21 can be considered part of the lower bound of the required time dimension's length. Column (4) only considers observations after the countries have joined EMU (unbalanced sample), while Column (6) employs the "Constant EA-19" sample, which comprises all observations of the current 19 euro area member states since 1999. Column (5) presents estimation results using the balanced EA-19 sample as in Column (6), but with pre-EMU observations weighted by 0.5. Time fixed effects are partialled out. The Kleibergen-Paap (KP) LM test is a test of instrument relevance: Its null of zero correlation between the (excluded) instruments and the endogenous regressors shall be rejected to mitigate concerns of weak instruments. The row "lagged resids (p)" displays the p-value of the coefficient of including as additional regressor the lagged predicted residuals of the same regression and is a test for residual autocorrelation, as suggested by Wooldridge (2010, pp.198-199). Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

The direct replication attempt reveals coefficients similar in direction and, broadly, also in size to the original analysis by Honohan and Lane (2003), although their statistical significance is somewhat weaker.[8] In line with their findings, we also detect that the coefficient of the deviation of the primary budget balance from its past 5-year moving average is not significantly different from zero, hence assigning it no explanatory power for inflation differentials among the EA-12 during 1999-2001. Extending the sample until 2019 (Column 3) generally increases the statistical significance of non-fiscal variables. We therefore confirm previous findings that changes in nominal effective exchange rates, business cycle non-alignments as well as initial price levels seemed to have been more important factors driving inflation dynamics in the initial euro area country group.

Turning to the sample of current euro area member countries (EA-19), we consider three sample specifications: (i) an unbalanced sample entailing only observations when a country was participating in EMU (Column 4); (ii) a balanced sample over 1999-2019, including observations before a country has joined EMU (with regression results presented in column 6 in Table 1), and (iii) an intermediate set-up entailing all observations, but weighing those pre-dating participation in EMU by 0.5 (balanced weighted sample, Column 5). The results show that the more weight is put on pre-EMU observations (columns further to the right of Table 1), the starker the driving forces of HICP inflation differentials among this larger set of countries differ compared with the EA-12 results presented above. While in the unbalanced EA-19 sample regression, the results of EA-12 largely carry over, inflation differentials in the balanced sample are to a greater degree influenced by price level convergence and exchange rate effects, while the output gap coefficient is dampened in magnitude and significance. Moreover, the fiscal policy coefficient has turned markedly negative (-0.17) and mildly significant.

[8] However, most regressors are less significant. A potential explanation for this finding might be ex-post data revisions. Since it is also possible that the analysis of Honohan and Lane (2003) is based on a more restricted sample, as a robustness check, we consider all combinations of excluding either one or two countries from the sample, with major results and significance levels broadly unchanged. Results can be requested from the authors.

While the estimations involving only EA-12 countries provide a valuable comparison possibility with existing literature, for the remainder of the paper, we focus solely on the whole EA-19 country group, since this is the policy-relevant sample from today's perspective, for which potential imbalances between countries need to be detected. In order to balance the trade-off between assigning too much weight to pre-EMU observations and not considering these observations at all, we take the intermediate path employed in Column 5 of Table 1 – the balanced EA-19 country sample but observations of countries before they joined the monetary union weighted by 0.5 instead of 1.[9]

In order to identify the main regression specification moving forward, we proceed, first, by including unit labour cost growth as an additional regressor, in line with theory and empirical evidence.[10] Second, aiming to control for unobservable, time-constant effects potentially influencing the regressors and inflation in each country, we employ regression specifications with country fixed effects. Lastly, we include lagged HICP inflation as an additional dependent variable to account for potential persistence in inflation differentials. This relates the observation that countries are often below or above the unweighted EA-19 sample mean of HICP inflation for a number of consecutive years (see Table A.1.3 in the Appendix). From an econometric point of view, estimating a model which simultaneously contains a lagged dependent variable and fixed effects with standard fixed effects methods potentially implies dynamic panel bias (see Nickell, 1981). The bias disappears with growing time dimension, but Judson and Owen (1999) caution that it is still present even if T=20. A straightforward solution of circumventing dynamic panel bias issues is to employ a dynamic panel estimator such as the difference GMM estimator proposed by Arellano and Bond (1991), which removes the fixed effects by differencing the regression equation and then instruments the differenced equation with suitable lags of the dependent variable and the regressors. One problem with this method in our context is, however, that estimating a regression that already involves the difference of each variable with respect to the sample mean additionally in first differences adds a lot of noise to the estimates. This may potentially be worse than the dynamic panel bias (this point has been raised by Afonso and Gomes (2014)). We will therefore consider both options, on the one hand, employing the Arellano and Bond (1991) difference GMM estimator and, on the other hand, disregarding dynamic panel bias and estimating the model in levels.

Table 2 below presents results for the considered modifications to our preferred EA-19 balanced weighted sample. Column 1 displays estimated coefficients of the baseline setup plus contemporaneous unit labour cost growth. Column 2 adds country fixed effects and Columns 3 and 4 consider the dynamic model including lagged inflation as an additional regressor. While Column 3 performs GMM estimation in levels, Column 4 presents estimation results of the Arellano and Bond (1991) difference GMM estimator.

[9] Since all strong outlier observations in the cross-sectional distribution of HICP inflation between 1999 and 2019 are also found among more recent accession countries before 2009 (see Table A.1.4 in the appendix), by weighting these observations less, we also implicitly take care of these outliers.

[10] Unit labour costs are assumed to directly feed into prices in New Keynesian Models and recent empirical evidence for France, Germany, Italy, and Spain by Bobeica et al. (2019) confirms a role for cost-push inflation in this regard. Moreover, ECB (2003) notes that diversity of inflation rates in the early years of EMU might be related to unit labour cost developments across countries.

Table 2: Baseline Extensions (DV: HICP inflation, Sample: Balanced weighted EA-19, 1999-2019)

	(1) GMM	(2) GMM	(3) GMM	(4) diff GMM
$\Delta NEER_{t-1}$	-0.29***	-0.28***	-0.16***	-0.05
	(-4.45)	(-4.77)	(-3.50)	(-0.73)
$outputgap_t$	0.09	0.11	0.07*	0.09**
	(1.45)	(1.67)	(2.09)	(2.20)
$FISC_t$	-0.11	-0.11	-0.05	-0.02
	(-1.65)	(-1.42)	(-1.32)	(-0.68)
$price_{t-1}$	-0.02**	-0.06**	-0.04**	-0.17***
	(-2.65)	(-2.27)	(-2.20)	(-3.18)
$unitlabourcost\ growth_t$	0.13***	0.10**	0.09**	0.04
	(2.86)	(2.57)	(2.26)	(1.28)
$HICPinfl_{t-1}$			0.49***	0.66**
			(8.38)	(2.52)
$HICPinfl_{t-2}$				-0.13
				(-0.87)
Time FE	YES	YES	YES	YES
Country FE	NO	YES	YES	YES
Observations	399	399	399	399
KP LM-Stat. (p)	0.00893	0.00823	0.0105	
Hansen (p)				0.686
AB-test AR1 (p)				0.0968
AB-test AR2 (p)				0.195

Notes: Dependent variable: HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, with pre-EMU observations weighted by 0.5. Specifications (1)-(3) employ two-step feasible GMM estimation with Driscoll-Kraay standard errors with the first lag of the output gap and the fiscal policy variable used as instruments for the contemporaneously included variables (instrumentalization of unit labour cost growth led to underidentification and was therefore disregarded). Column (4) performs one-step Arellano-Bond (1991) difference GMM estimation with robust standard errors. The lagged nominal effective exchange rate change and the lagged price level are considered predetermined and their first to 3rd lag are used as instruments for the differenced equation. The same holds for unit labour cost growth which is instrumented by its first to 4th lag. HICP inflation is instrumented by its 3rd to 5th lag. Lastly, the output gap and the fiscal policy variable are potentially endogenous so only lags starting from 2 are valid instruments. We take their 2nd and 2nd to 4th lag, respectively. In order to reduce the instrument count further as suggested by Roodman (2009), all instruments are additionally collapsed. The Hansen test for the validity of overidentifying restrictions shall not be rejected and lastly, the Arellano-Bond test should detect no autocorrelation of order higher than 1, implying that the residuals themselves are correlated but the first differences in residuals not. Time fixed effects in all specifications are partialled out. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

As Table 2 shows, the coefficient of unit labour cost growth is positive and significant at the 5% level in specifications (1)-(3). The output gap coefficient loses in significance, while the other variables remain relatively unaffected. Taking care of country fixed effects by within differencing the data does not change the sign of the estimated coefficients. Whenever the lagged dependent variable is included among the regressors, the coefficient of its first lag is sizeable (around 0.5) and significant at least at the 5% level.[11] Moreover, the exchange rate and unit labour cost variables lose statistical significance, while the output gap gains it again. The fiscal stance indicator remains insignificant, with the size of its coefficient dampened even more.

The decision whether to include HICP inflation as a lagged dependent variable or not is therefore no trivial choice.[12] We believe that over the course of a year prices are flexible enough to adjust to new circumstances, such that an individual country's inflation level is less driven by its own persistence and more by the variables representative of business cycle fluctuations, external influences, price convergence dynamics and fiscal influences that we are considering.[13] Without a clear theory at hand of what is driving the estimated persistence parameter, we assign it little value for the understanding of the roots of inflation differentials and therefore proceed with not including it as an

[11] It was necessary to include the second lag of the dependent variable to arrive at a specification in which the hypothesis of first-differenced residuals being uncorrelated could not be rejected (p-value of the AB-test with null hypothesis of no second-order autocorrelation in the residuals >0.1).

[12] While not including the lagged dependent variable when it is actually an important explanatory factor certainly produces omitted variable bias, falsely including the lag despite a clear causal connection to the outcome variable can seriously downward bias the other regressors' parameter estimates (see Keele and Kelly (2006)). In the context of the New Keynesian Phillips curve, Fuhrer (2006) notes that, for conventional parameter estimates, inflation inherits little persistence from driving variables such as marginal costs and output gaps, but its persistence is "intrinsic", stemming from the lagged inflation term, which is then not a "second-order add-on to the optimizing model; it *is* the model". One would therefore still need to find sources of this intrinsic persistence in order to learn more about why inflation behaves the way it does.

[13] Micro evidence on the frequency of price adjustments in the euro area published in Álvarez et al. (2006) showed that consumer prices are adjusted on average every 13 months. With digitalization and online shopping accelerating over the past 20 years, and price adjustments becoming potentially even more convenient for firms, this number may have well dropped further by now.

additional regressor in the remainder of the paper. Our static GMM estimation results might then be read as an upper bound of the true effect on inflation differentials.

Headline HICP inflation is the most policy-relevant inflation rate in the euro area. However, additionally looking at core HICP inflation (excluding energy and food prices) differentials could yield further insights concerning the structural determinants of inflation differentials. Therefore, Table A.2.1 in the appendix presents results for the same regression models (concentrating on EA-19 specifications) but employing HICP inflation excluding food and energy prices as the outcome variable of interest. As differences in these two inflation measures are especially associated with extra-EMU trade, as expected, focusing on core inflation yields less explanatory power for nominal exchange rate changes in determining inflation differentials among EA-19 countries. By contrast, domestic forces such as output gap misalignments gain significance. However, there is no significant coefficient of the fiscal policy indicator (reflecting the deviation of the primary balance from its past 5-year moving average) in any specification. Last, unit labour cost growth exerts a similar influence on core HICP inflation differentials as previously detected on HICP inflation differentials.

All in all, we can conclude that findings concerning the determinants of inflation differentials among the EA-12 country group broadly carry over to the EA-19 country sample. However, in the extended sample, HICP inflation differentials are to a greater extent shaped by differential changes in the nominal effective exchange rate and past price level heterogeneities, and to a lower degree by short-term business cycle fluctuations measured via output gap differentials. When it comes to a potential role for the net budgetary impacts of discretionary fiscal policy in driving the observed inflation differentials, over the period 1999-2019 we find somewhat stronger effects in the EA-19 country group than among the initial euro area countries. In our preferred specification, which extends the baseline setup of Honohan and Lane (2003) by including unit labour cost growth and country fixed effects, while taking away weight from pre-EMU observations (Column 2 of Table 2), the coefficient on the fiscal policy variable (measured as the deviation of the primary balance from its past 5-year moving average) is quite sizeable (-0.11). However, it is statistically not distinguishable from zero.

In the following subsection we assess whether our findings regarding the mostly non-statistically significant impact of discretionary fiscal policy on inflation differentials in the euro area are specific to the fiscal stance measure employed, or whether they differ when applying other - potentially more straightforward - definitions.

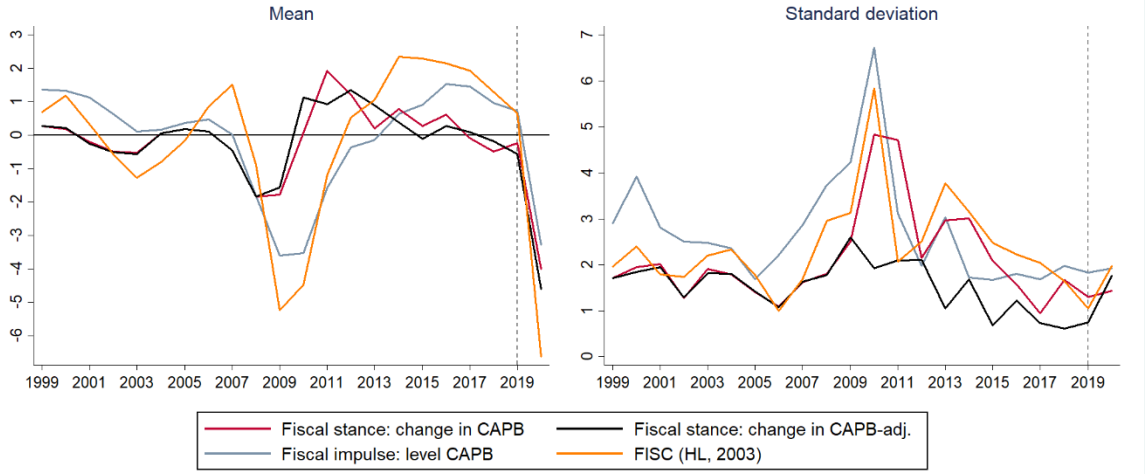
3.1.2 Alternative measures of discretionary fiscal policy

One might argue that the deviation of the primary budget balance from its past 5-year moving average does not clearly represent budgetary developments stemming solely from discretionary fiscal policy, but also reflect, inter alia, the impact of the business cycle on budgetary outcomes. Therefore, in the following we employ a more conventional definition of the "fiscal stance", namely the annual *change* in the cyclically adjusted primary balance (CAPB),$\Delta CAPB_t$. Since this measure might entail substantial support to the financial sector during and in the aftermath of the financial crisis, which is not obviously related to price developments in the affected economies, we also take into account a measure of fiscal stance cleaned for government support measures to the financial sector, $\Delta CAPB\_adj_t$, as calculated by the Eurosystem.[14] As the right-hand-side of Figure 2 below shows, from 2009 onwards, the adjusted measure displays substantially less cross-sectional standard deviation in the balanced EA-19 sample than the alternative measures. Lastly, we also consider the *level* of the cyclically adjusted primary balance, which is a measure of the overall "fiscal impulse"

[14] Missing values (for most countries applying to years 1999 and earlier) are replaced by values of $\Delta CAPB_t$.

to the economy, and whose evolutions of first and second moment resemble those of the FISC-variable proposed by Honohan and Lane (2003).

Figure 2: Comparison of Different Discretionary Fiscal Policy Measures



Source: Eurosystem and own calculation. Moments calculated for balanced EA-19 sample with equal weights on all countries.
Note: For completeness, data for 2020 are shown although they do not feed into our analysis.

When assessing the effect of each fiscal policy measure by panel econometric techniques below, we allow either for a contemporaneous (as before) or lagged effect of the fiscal stance variable on inflation differentials, thereby enabling either immediate or one-year-delayed passthrough into consumer prices.

Table 3 below shows GMM estimation results for our preferred specification of the balanced weighted EA-19 sample over 1999-2019 (as represented in Column 2 of Table 2), employing one of the above presented discretionary fiscal policy measures at a time.

Table 3: Comparison of Various Measures of Discretionary Fiscal Policy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fiscal stance/impulse	$FISC_t$	$FISC_{t-1}$	$CAPB_t$	$CAPB_{t-1}$	$\Delta CAPB_t$	$\Delta CAPB_{t-1}$	$\Delta CAPB\_adj_t$	$\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.28***	-0.28***	-0.28***	-0.28***	-0.27***	-0.25***	-0.28***	-0.25***
	(-4.77)	(-4.51)	(-4.70)	(-4.42)	(-4.26)	(-4.59)	(-4.38)	(-4.56)
$outputgap_t$	0.11	0.13*	0.08	0.10	0.13*	0.12	0.13*	0.11
	(1.67)	(1.94)	(1.22)	(1.58)	(1.92)	(1.51)	(1.90)	(1.28)
fiscal stance/impulse	-0.11	-0.05	-0.12*	-0.07	0.03	-0.00	0.09	-0.04
	(-1.42)	(-1.19)	(-1.77)	(-1.44)	(0.68)	(-0.12)	(1.65)	(-0.66)
$price_{t-1}$	-0.06**	-0.05*	-0.07**	-0.05**	-0.04*	-0.03	-0.04**	-0.03
	(-2.27)	(-2.06)	(-2.55)	(-2.22)	(-1.93)	(-1.49)	(-2.20)	(-1.48)
$unitlabourcost\ growth_t$	0.10**	0.10**	0.11***	0.11**	0.10**	0.13***	0.11**	0.13***
	(2.57)	(2.54)	(2.97)	(2.75)	(2.45)	(3.23)	(2.70)	(3.34)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	399	399	397	397	397	391	397	391
KP LM-Stat. (p)	0.00823	0.00347	0.00541	0.00384	0.00312	0.00409	0.00352	0.00362

Notes: Dependent variable (DV): HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. In columns (1) and (3) the output gap as well as the fiscal stance variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered exogenous and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

First, introducing alternative measures of discretionary fiscal policy does not seem to have a substantial impact on covariates since magnitude and statistical relevance of the other included variables do not vary considerably across specifications. Second, as is visible in Figure 2, the first and second moment of the level of the cyclically adjusted

primary balance, CAPB, move very much in line with the fiscal stance variable (FISC) of Honohan and Lane (2003), employed so far. It is thus not surprising that in the regression results the coefficients of CAPB and FISC are rather similar – albeit being mildly statistically distinguishable from zero only in one specification. The specifications involving the *change* in the cyclically adjusted primary balance (Columns 5-8) are even less conclusive, not settling on a clear qualitative direction of the effect. Concerning the question whether discretionary fiscal policy is exerting a contemporaneous effect on inflation differentials or whether it operates with a one-year lag, the regression outcomes cannot provide a definite answer.

Estimating the effect of the different fiscal policy measures on core HICP inflation differentials (see Table A.2.2 in the appendix) yields very similar results: negative but insignificant coefficients for the FISC measure and the CAPB in levels, and indeterminate signs for the specifications involving the change in the CAPB.

Overall, we do not find a significant effect of fiscal stance/impulse differentials on (core) HICP inflation differentials even when considering a range of different measures and allowing the effect to operate with a one-year lag.[15]

3.1.3 Assessing fiscal stance effects in relation to the business cycle

There might be reasons to believe that the impact of discretionary fiscal policy affects inflation depending on countries' position in the business cycle. The same net budgetary impact of discretionary fiscal policy might entail different inflationary pressure depending on whether the economy finds itself in a boom or slack period.

We conjecture from the literature on the effects of pro-cyclical fiscal policy that expansionary fiscal policy in an economy that is relatively more overheated (positive output gap differential) is more likely to raise the inflation differential of this country vis-à-vis the rest of the euro area than the same discretionary expenditure when the country is experiencing a negative output gap. We test this by interacting the fiscal stance measure with a dummy indicating whether the budgetary movement falls into a period of positive output gap and zero otherwise:[16]

$$\pi_{it} = \alpha_1 FiscalPolicy_{it} + \alpha_2 FiscalPolicy_{it} \cdot d(outputgap_{it} > 0) + \boldsymbol{\beta z_{it}} - \delta P_{it-1} + \varphi_t + \theta_i + \varepsilon_{it} \quad (3)$$

Estimation results are presented in Table 4. In these models, the interpretation of the coefficient of the (non-interacted) fiscal stance/impulse indicator yields the effect of discretionary budget movements on HICP inflation differentials whenever the output gap is negative or zero, and the interaction term yields the additional effect when the economy is experiencing a positive output gap. We unveil some (weak statistical) evidence for our hypothesis concerning different effects of fiscal policy along the business cycle, predominantly operating with a one-year lag. While there is rarely a significant impact of the fiscal policy measure on inflation differentials when the output gap is negative or zero, whenever it is positive, discretionary budget tightening in levels (fiscal impulse) brings down HICP inflation differentials and, conversely, an expansionary policy in levels fuels inflation and raises the differential vis-à-vis the

[15] In Section A.2.1.2 of the appendix we additionally allow for asymmetric effects of the net budgetary effect of cyclically adjusted fiscal policy. The results suggest that a less (more) supportive fiscal position is associated with lower (higher) (core) HICP inflation differentials only when fiscal support is withdrawn from an economy (in the regime fiscal impulse>0), while results are inconclusive when fiscal impulse ≤0 or when fiscal stance regimes are considered.

[16] In particular, $d(outputgap_t > 0) = 1$ whenever $outputgap_t > 0$ and $d(outputgap_t > 0) = 0$ whenever $outputgap_t \leq 0$. Due to the high correlation between the positive output gap dummy and the continuous output gap variable, we refrain from including the former as a separate additional regressor in order to avoid problems of multicollinearity. The vector $\boldsymbol{z_{it}}$ collects the remaining regressors, i.e., the lagged change in the nominal effective exchange rate, the output gap, and the growth rate of unit labour cost.

sample average. The corresponding results for core HICP inflation differentials (see Table A.2.5) are qualitatively similar, but coefficients are not even mildly statistically significant (apart from one model with CAPB in levels).

Table 4: Heterogeneous Fiscal Stance/Impulse Effects by Output Gap Direction

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.27***	-0.28***	-0.29***	-0.29***	-0.27***	-0.26***	-0.28***	-0.26***
	(-4.53)	(-4.61)	(-4.57)	(-4.61)	(-4.29)	(-4.68)	(-4.39)	(-4.65)
$outputgap_t$	0.12*	0.12*	0.10	0.08	0.13*	0.11	0.13*	0.10
	(1.87)	(1.96)	(1.42)	(1.48)	(1.91)	(1.45)	(1.89)	(1.29)
fiscal stance/impulse	-0.05	-0.07*	-0.07	-0.09***	0.04	-0.03	0.09	-0.06
	(-1.13)	(-1.74)	(-1.32)	(-3.07)	(0.72)	(-0.98)	(1.57)	(-1.02)
fiscal stance/impulse	-0.07	-0.09	-0.14***	-0.17***	0.03	-0.09	0.00	-0.11*
x d($outputgap_t > 0$)	(-1.42)	(-1.43)	(-2.92)	(-3.33)	(0.54)	(-1.64)	(0.01)	(-1.97)
$price_{t-1}$	-0.04*	-0.05**	-0.05*	-0.06**	-0.04*	-0.03	-0.04**	-0.03
	(-1.98)	(-2.22)	(-1.98)	(-2.56)	(-1.97)	(-1.52)	(-2.18)	(-1.59)
$unitlabourcost\ growth_t$	0.09**	0.09*	0.10**	0.11**	0.10**	0.12***	0.11**	0.12***
	(2.23)	(2.08)	(2.37)	(2.54)	(2.45)	(3.13)	(2.62)	(3.17)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	399	399	398	397	397	391	397	391
KP LM-Stat. (p)	0.00377	0.00341	0.00456	0.00387	0.00317	0.00439	0.00355	0.00370

Notes: Dependent variable: HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. The output gap is instrumented by its first lag (exact identification). Lagged fiscal impulse/stance variables are considered predetermined and instrumenting of the contemporaneous ones and their interaction with the positive output gap dummy was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The variables entering the interaction term were within-differenced before as suggested by Giesselmann and Schmidt-Catran (2020). The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

So far, we have not considered the possibility that output gap differentials between countries might themselves be shaped by discretionary fiscal policy differentials. Building on the fiscal multiplier literature, we examine the channel of fiscal policy indirectly influencing inflation differentials through the output gap. We therefore build a small simultaneous 2-equation model, in which the equation determining inflation differentials remains as in the baseline[17] and, additionally, we estimate an equation with explicit feedback from fiscal policy to the output gap. As exogenous instruments for the output gap equation we include the lagged change in private investment[18] and the lagged change in the labour force participation rate.[19] Both are meant to capture developments in input factors of potential output (denominator of the output gap, see ECB (2011)). Additionally, the contemporaneous change in the unemployment rate (instrumented by its first lag) is included as a proxy for demand effects determining actual output differentials (numerator).[20] As above, the inclusion of time fixed effects (μ_t) permits the interpretation of individual country-specific variables as deviations from the cross-country sample average at each point in time, and country fixed effects (χ_i) are also included.

Output gap differential equation:

$$outputgap_{it} = \mu_t + \beta_1 \Delta investment_{it-1} + \beta_2 \Delta lfparticipation_{it-1} + \beta_3 \Delta unemplrate_{it} + \beta_4 fiscalpolicy_{it} + \chi_i + \epsilon_{it} \quad (4)$$

We estimate the system by 3-stage least squares, while taking care of potential heteroskedasticity and autocorrelation in the disturbances by employing HAC standard errors based on Bartlett kernel with 2 lags.

[17] $\pi_{it} = \varphi_t + \alpha_1 \Delta NEER_{it-1} + \alpha_2 outputgap_{it} + \alpha_3 fiscalpolicy_{it} + \alpha_4 P_{it-1} + \alpha_5 unitlabourcostgrowth_{it} + \theta_i + \varepsilon_{it}$
[18] That is, the change in gross fixed capital formation as percentage of GDP for the business sector, obtained from Eurostat (SDG_08_11).
[19] The labour force participation rate (source OECD) is defined as the labour force divided by total population in age group 25-64.
[20] The unemployment rate in the age group 15-74 is taken from Eurostat (UNE_RT_A_H).

Table 5: 3-Stage Least Squares Estimation (Sample: Balanced weighted EA-19, 1999-2019)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
HICP Inflation Differential Equation:								
$\Delta NEER_{t-1}$	-0.28***	-0.27***	-0.27***	-0.26***	-0.27***	-0.26***	-0.27***	-0.26***
	(-5.05)	(-5.36)	(-5.18)	(-5.25)	(-5.21)	(-5.21)	(-5.09)	(-5.19)
$outputgap_t$	0.14**	0.15***	0.11	0.13**	0.16***	0.16***	0.15***	0.16**
	(2.29)	(2.65)	(1.60)	(2.17)	(2.67)	(2.74)	(2.82)	(2.55)
fiscal stance/impulse	-0.09	-0.04	-0.09	-0.05	-0.06	0.02	0.20	0.01
	(-1.11)	(-1.07)	(-1.28)	(-1.16)	(-1.03)	(0.96)	(0.40)	(0.40)
$price_{t-1}$	-0.06**	-0.06**	-0.06**	-0.06**	-0.05**	-0.05**	-0.06*	-0.05**
	(-2.39)	(-2.23)	(-2.54)	(-2.31)	(-2.10)	(-2.08)	(-1.65)	(-2.08)
$unitlabourcost\ growth_t$	0.13***	0.13***	0.14***	0.14***	0.13***	0.13***	0.15***	0.13***
	(3.38)	(3.40)	(3.68)	(3.60)	(3.38)	(3.43)	(2.62)	(3.46)
Output Gap Differential Equation:								
$\Delta investment_{t-1}$	-0.75**	-0.40**	-0.67**	-0.41**	-0.46***	-0.35**	-0.39**	-0.30**
	(-1.99)	(-2.22)	(-2.36)	(-2.51)	(-2.74)	(-2.34)	(-2.33)	(-2.29)
$\Delta labourforceparticipation_{t-1}$	0.75	0.53	0.65*	0.49	0.41	0.40	0.38	0.37
	(1.64)	(1.52)	(1.71)	(1.51)	(1.35)	(1.40)	(1.26)	(1.41)
$\Delta unemploymentrate_t$	-5.19***	-3.86***	-4.16***	-3.62***	-3.07***	-2.86***	-2.87***	-2.38***
	(-4.25)	(-5.20)	(-5.49)	(-5.52)	(-5.17)	(-5.28)	(-3.86)	(-5.49)
fiscal stance/impulse	-0.93***	-0.35***	-0.76***	-0.40***	-0.14*	-0.26***	-0.18	-0.59***
	(-2.78)	(-2.80)	(-3.99)	(-2.82)	(-1.93)	(-3.58)	(-0.85)	(-5.60)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	324	324	324	324	324	324	324	324
Hansen (df)	2	2	2	2	2	2	2	2
Hansen (p)	0.997	0.997	0.996	0.997	0.997	0.997	0.997	0.996

Notes: Two-step GMM estimation with heteroskedasticity- and autocorrelation-consistent weighting matrix and standard errors using Bartlett kernel with 2 lags. All variables are instrumented by themselves except for the contemporaneous output gap and fiscal impulse/stance indicators in levels, as well as the change in the unemployment rate, which are instrumented by their first lag. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level. Hansen's J statistic of overidentifying restrictions should not be rejected (large p-value). Since investment over GDP data of businesses is only available from 2000 onwards and not available for Malta, the inclusion of its lagged change implies that the estimation period can only start in 2002. Results are robust to the exclusion of this investment variable and implied extension of the estimation period until 1999, with the lagged change in the labour force participation rate gaining statistical relevance.

Table 5 first confirms the positive impact of output gap on HICP inflation differentials in the inflation equation, as well as the largely absent direct fiscal impulse effect. Turning to the equation of determinants of output gap differentials, the lagged change in business investment as percentage of GDP exerts a negative effect on output gap differentials, most likely by driving up potential output (denominator) via increasing the capital stock. The lagged change in the labour force participation rate carries a positive yet insignificant coefficient, whereas contemporaneous unemployment rate increases are associated with lower output gap differentials, as one would expect from the implied decline in demand. Last, our main effect of interest, the impact of fiscal stance/impulse differentials on output gap differentials is also strongly statistically significant and negative in most cases. Fiscal policy *level* variables such as FISC and CAPB thereby display a higher contemporaneous effect on the respective country's output gap differential, while fiscal policy *change* indicators operate mostly with a one-year lag.

This strong indirect effect of discretionary fiscal policy on HICP inflation differentials via the output gap differentials can also be confirmed when core HICP inflation is considered (see Table A.2.6). Since the channel running from output gap to inflation differentials is even slightly stronger in this case, the indirect impact of fiscal policy is also correspondingly greater.

We also perform other robustness checks, in particular, related to the interaction between fiscal and monetary policy in the euro area. Yet, controlling for monetary policy – with either annual changes in the ECB's main refinancing operations rate (MRO) or in a shadow rate estimate in line with Wu and Xia (2017) – does not change the results with respect to the impact of the overall fiscal policy (stance or impulse) on inflation differentials. Moreover, various

interaction terms between fiscal and monetary policy change are not found to be the statistically significant (or robust enough) across different specifications. A summary of these results is presented in the Appendix (Tables A.2.7 – A.2.8).

3.2 Fiscal policy instruments

We have documented in the literature review that certain revenue or expenditure items looked at in isolation can add insights into the inflationary effects of fiscal policy that measures of the net budgetary impacts alone cannot offer. In particular, the composition of fiscal stance might be such that two policies which are equally associated with a looser stance yield opposing effects on inflation. A small or insignificant impact of the fiscal stance on inflation differentials might thus hide significant impacts of specific fiscal measures. Examples of two such expansionary fiscal policy instruments with heterogeneous effects on inflation are changes in the VAT rate and public wage increases. Concerning the level of inflation, reductions in indirect taxation have been shown to feed into declining consumer price developments to a substantial degree. On the expenditure side, government spending on employee compensation was shown to positively influence private wage negotiations and wage dynamics. Evidence concerning the question whether they also carry a role in driving inflation *differentials* across countries, not just individual inflation levels, is so far limited.

3.2.1 Indirect tax changes

Standard VAT tax rates have different levels across euro area countries, ranging from an average of 15.5% (Luxembourg) to 22.81 (Finland) over the sample period 1999-2019.[21] They are not adjusted frequently - on average only 2.1 times in each country of the sample – but can nevertheless be important shifters of idiosyncratic inflation and thus potentially inflation differentials across EMU. Since ECB (2021) find that the effect of VAT rate tax shocks on aggregate inflation peaks 2 years after the onset, we also allow for a lagged effect (by one year) of VAT rate changes, alongside a contemporaneous one.[22]

Table 6: Change in Standard VAT Rate

Fiscal stance/impulse	(1) $FISC_t$	(2) $CAPB_t$	(3) $\Delta CAPB_t$	(4) $\Delta CAPB\_adj_t$	(5) $FISC_{t-1}$	(6) $CAPB_{t-1}$	(7) $\Delta CAPB_{t-1}$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.28***	-0.28***	-0.28***	-0.28***	-0.26***	-0.26***	-0.24***	-0.24***
	(-4.75)	(-4.86)	(-4.61)	(-4.63)	(-5.19)	(-5.31)	(-5.72)	(-5.78)
$outputgap_t$	0.10	0.06	0.10	0.10	0.16*	0.13	0.14	0.13
	(1.44)	(0.96)	(1.48)	(1.46)	(1.85)	(1.51)	(1.46)	(1.26)
fiscal stance/impulse	-0.06	-0.08	0.01	0.04	-0.05	-0.06	-0.01	-0.05
	(-0.71)	(-1.02)	(0.41)	(0.86)	(-0.98)	(-1.23)	(-0.21)	(-0.71)
$\Delta VATrate_t$	0.39*	0.37*	0.39**	0.38*				
	(1.89)	(1.74)	(2.28)	(2.06)				
$\Delta VATrate_{t-1}$					0.22**	0.19*	0.21**	0.23**
					(2.19)	(1.78)	(2.20)	(2.31)
$price_{t-1}$	-0.06**	-0.06**	-0.05*	-0.05*	-0.06**	-0.06**	-0.04*	-0.04*
	(-2.09)	(-2.32)	(-1.97)	(-2.02)	(-2.22)	(-2.29)	(-1.82)	(-1.78)
$unitlabourcost\ growth_t$	0.13***	0.14***	0.13***	0.13***	0.11**	0.12**	0.13***	0.13***
	(3.17)	(3.59)	(3.36)	(3.32)	(2.55)	(2.79)	(3.39)	(3.53)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	354	354	354	354	353	353	350	350
KP LM-Stat. (p)	0.0103	0.00618	0.00295	0.00312	0.00314	0.00363	0.00353	0.00400

Notes: DV: HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. VAT rate data is not available for Cyprus and Malta; thus the effective sample comprises of only 17 countries. In columns (1) and (3) the output gap as well as the fiscal impulse variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal stance/impulse variables are considered exogenous and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

[21] VAT rate data is taken the OECD Tax Database and not available for Cyprus and Malta.
[22] Contemporary VAT rate changes are assumed to be exogenous to inflation.

Table 6 shows that an above-sample-average increase in the VAT rate is indeed positively related to the HICP inflation differential of a country with respect to the EA-19 sample average and vice versa. The effect is present both concerning contemporaneous and lagged changes, but the coefficient is greater in the former specification. Considering determinants of national consumer price inflation excluding energy and food prices (core HICP inflation) differentials with respect to the euro area average (see Table A.2.9) confirms the effect for contemporaneous VAT rate changes; however, the coefficients of lagged indirect tax changes are found to be much smaller in magnitude and insignificant. While in all regression setups we also include a fiscal policy indicator of the same lag specification as the tax change in order to still capture the impact of net budgetary impacts, there are limited indications of interaction dynamics between the two, since neither the fiscal stance/impulse measure is significantly altered upon inclusion of the VAT rate change compared to its respective baseline (see Table 3), nor are the VAT rate change coefficients substantially different depending on which fiscal stance measure is employed.

3.2.2 Public wage developments

While we have demonstrated that expansionary fiscal policy in the form of VAT tax decreases contribute to a reduction of inflation differentials across EA-19, budgetary loosening in the form of higher public wages in a country vis-à-vis the rest of the euro area is expected to fuel inflation in this country compared to the average of the considered sample. Moreover, the channels through which prices are affected differ: Price-setting producers might react directly to indirect tax increases or decreases, but effects of changes in wages paid to public employees are expected to influence prices more indirectly through demand and spill-over effects to the private sector.

To assess whether there is a role for public wage developments in driving consumer price inflation differentials beyond the indirect effect through unit labour cost growth, we include a proxy for public wage growth as an additional regressor, namely the growth rate of public employee compensation divided by a measure of the number of public employees.[23] Since one can expect that there is some lag in the transmission from public into private wages and inflation, we include the public wage growth proxy lagged by one year.

Table 7: Public Employee Compensation per Public Employee Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fiscal stance/impulse	$FISC_t$	$FISC_{t-1}$	$CAPB_t$	$CAPB_{t-1}$	$\Delta CAPB_t$	$\Delta CAPB_{t-1}$	$\Delta CAPB\_adj_t$	$\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.29***	-0.29***	-0.28***	-0.28***	-0.28***	-0.28***	-0.29***	-0.28***
	(-5.30)	(-4.82)	(-5.37)	(-4.81)	(-4.68)	(-4.73)	(-4.81)	(-4.63)
$outputgap_t$	0.07	0.08	0.04	0.06	0.08	0.08	0.08	0.08
	(1.25)	(1.43)	(0.63)	(0.95)	(1.40)	(1.32)	(1.34)	(1.11)
fiscal stance/impulse	-0.08	-0.04	-0.10	-0.05	0.02	0.00	0.08*	-0.02
	(-1.10)	(-0.97)	(-1.54)	(-1.29)	(0.69)	(0.04)	(1.90)	(-0.34)
$price_{t-1}$	-0.05*	-0.04	-0.05**	-0.04*	-0.03	-0.03	-0.04*	-0.03
	(-1.81)	(-1.70)	(-2.26)	(-1.92)	(-1.58)	(-1.64)	(-1.85)	(-1.59)
$unitlabourcost\ growth_t$	0.12***	0.12***	0.13***	0.13***	0.12***	0.12***	0.13***	0.12***
	(3.50)	(3.35)	(3.81)	(3.53)	(3.35)	(3.32)	(3.65)	(3.42)
$public\ empl\ growth_{t-1}$	0.03*	0.03*	0.03*	0.03*	0.03*	0.03*	0.03*	0.03*
	(1.88)	(1.91)	(1.93)	(1.99)	(1.93)	(2.05)	(1.97)	(2.02)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	385	385	385	385	385	384	385	384
KP LM-Stat. (p)	0.00941	0.00370	0.00619	0.00446	0.00339	0.00434	0.00378	0.00377

Notes: DV: HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. In columns (1) and (3) the output gap as well as the fiscal impulse variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal stance/impulse variables are considered exogenous and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

[23] In particular, the number of people working in the industry classified as public administration and defence and compulsory social security. Detailed variable sources and construction can be found in Table A.1.1 in the appendix.

Table 7 presents results for HICP and Table A.2.10 in the appendix for core HICP inflation differentials, where the statistical significance of results is stronger across all models. We can document that there are mild direct transmission effects from a higher-than-EA-19-average growth rate of public employee compensation per public employee to both HICP and core HICP inflation differentials vis-à-vis the EA-19 country group.

4. Conclusions

In this paper, we analyse the role of discretionary fiscal policy – in aggregate and based on a selection of fiscal instruments – in shaping HICP inflation differentials in the euro area.

We expand the existing literature by using an updated sample of annual data for all euro area (EA-19) Member States covering the period 1999-2019. We perform panel econometric analyses, controlling for the potential endogeneity of different discretionary fiscal policy measures, that is, those beyond the automatic reaction of public finances to cyclical developments. These measures capture both the *level* of support coming from fiscal policies ("fiscal impulse") and *changes* therein ("fiscal stance"). We also consider potential asymmetries in fiscal policy regimes and the presence of an indirect channel running through output gap differentials. Moreover, we consider interactions with the prevalent monetary policy stance, in an echo of the monetary-fiscal interaction literature. Lastly, we document the impact of specific fiscal policy instruments, such as indirect tax changes, which are associated with an immediate pass-through into price developments, and public wage increases, which are expected to operate through spill-over effects to private wage developments.

The results indicate that the aggregate fiscal stance or impulse does not appear to significantly contribute (directly) to HICP or core HICP inflation differentials. This confirms early findings of Honohan and Lane (2003) for the EA-12 sample and follow-up papers from other authors. Our conclusion does not change under various robustness-checks, including in relation to monetary policy. The annual setup might still imply that inflationary effects of fiscal policies, which are short-lived are not visible if there are offsetting tendencies within the year, a point that Rother (2004) brings forward.

We do find, however, evidence for an indirect effect of discretionary fiscal policy on inflation differentials working through the output gap. There is also some evidence that fiscal policy may be especially potent in influencing inflation differentials – with fiscal tightening cooling (and fiscal expansion increasing) inflation pressures – when the economy is above its potential (i.e., in times of positive output gap). Lastly, given that net budgetary developments may overshadow economically important channels running from specific fiscal policy instruments to inflation differentials, we analyse changes in indirect taxes and adjustments in public employee compensation. We document that VAT rate changes significantly contribute to inflation differentials in our sample, with most of the effect being visible in the initial period of the tax change. Concerning public wage developments, we find that the growth rate of compensation per public employee is – throughout all specifications – mildly significantly contributing to inflation differentials in the euro area sample between 1999 and 2019.

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Appendices

A.1 Variable sources and descriptive statistics

Table A.1.1: Data Description and Sources

Variable Name	Description	Source	Availability Limitations
HICP inflation	Annual average rate of change of the overall Harmonized Index of Consumer Prices (HICP)	Eurostat	
Core HICP inflation	Annual average rate of change in HICP - all items excluding energy and food	Eurostat	
ΔNEER	Change in the annual Nominal Effective Exchange Rate, 66 trading partners considered in Table 1, Column 2: Change in the annual Nominal Effective Exchange Rate, Consumer Price Index	Bruegel database (see Darvas, 2021) IMF International Financial Statistics (IFS)	
Price	Price level of household consumption, price level of USA GDPo in 2017=100 in Table 1 Column 2: price level of consumption	Penn World Table 10.0 Penn World Table 6.1	
Outputgap	Output gap as percentage of potential GDP at constant prices in Table 1 Column 2: output gap as percentage of potential GDP	Eurosystem estimates OECD	missing values for Lithuania, Malta and Slovenia before 2002 are imputed by output gap estimates from the AMECO database (AVGDGP)
FISC	Deviation of the primary surplus (net lending/net borrowing excluding interest payable) as % of GDP from its past 5-year moving average	ESCB Government Finance Statistics	Only available since 1995, so observations before 2001 are constructed with fewer than 5 lags
CAPB, ΔCAPB	(Change in) cyclically adjusted primary balance	Eurosystem estimates	CAPB-data is only available since 1999 and for some countries even later, so missing values are imputed by the corresponding AMECO variable (UBLGB)
ΔCAPB_adj	Fiscal stance adjusted for financial sector support measures	Eurosystem estimates	This measure is only available since 2000 and for Latvia, Malta and Slovenia even later. Thus, missing values are replaced by ΔCAPB
unitlabourcost growth	Growth rate of the nominal unit labour cost index	European Commission's AMECO Database (PLCD)	

Table A.1.1: Data Description and Sources (continued)

Variable Name	Description	Source	Availability Limitations
Δinvestment	Change in gross fixed capital formation as percentage of GDP for the business sector	Eurostat (SDG_08_11)	not available for Malta, only since 2001 for all other countries
Δlfparticipation	Change in labour force divided by the total population in the age group 25-64	OECD	Only available since 2001 for Cyprus, Latvia, Lithuania, Malta, and Slovenia
Δunemplrate	Change in the unemployment rate of age group 15-74	Eurostat (UNE_RT_A_H)	
MRO ΔMRO	ECB Main refinancing operations – fixed rate tenders Annual dataset created by taking the mean of the rate over all months of the year, whereby, whenever a change took place within the month, the new rate is assigned to the whole month. year-on-year change in MRO	ECB	 Only available since 2000
Shadowrate ΔShadowrate	2005-2021: shadow-rate estimate by Wu and Xia (2017), annual dataset created by taking the mean of all monthly rates 1998-2004 imputed using the annual mean of end-of-month shadow-rate estimates by Krippner (2016), scaled by the ratio of both shadow rate estimates in 2005. year-on-year change in SR	Wu and Xia (2017) Krippner (2016)	
ΔVATrate	Change in VAT standard rate	OECD Tax database	Not available for Cyprus and Malta; for Slovenia only available since 2000
public empl growth	Growth rate of: Public employee compensation as % of GDP * GDP / number of employees (age 15+) working in the industry classified as public administration and defence and compulsory social security	Public employee compensation expenditure as % of GDP: AMECO GDP at market prices: Eurostat (NAMA_10_GDP) number of employees working in public administration and defence and compulsory social security: Eurostat (LFSA_EEGANA) until 2008, (LFSA_EEGAN2) from 2008 onwards. If observations are overlapping in 2008, the average of both is taken in this year, otherwise the one of LFSA_EEGAN2.	Only available for Latvia and Slovakia since 1999, for Cyprus since 2000, for Malta since 2001, and Lithuania since 2005

Table A.1.2: Descriptive statistics (Balanced EA-19 sample, 1999-2019)

Variable	Mean	Avg. annual st. dev.	Min	Max	Corr. with HICP inflation	Corr. with core HICP inflation
HICP inflation	2,23	1,43	-1,70	15,30	1,00	0,84
core HICP inflation	1,72	1,23	-4,00	9,10	0,84	1,00
ΔNEER	0,40	1,33	-9,86	10,41	-0,01	0,07
price	77,61	16,41	24,38	129,37	-0,31	-0,34
outputgap	-0,18	2,39	-11,99	12,09	0,30	0,30
FISC	0,11	2,37	-27,30	11,83	-0,10	-0,05
CAPB	0,04	2,73	-28,10	7,83	-0,18	-0,09
ΔCAPB	-0,01	2,11	-17,86	19,01	-0,06	-0,08
ΔCAPB_adj	0,00	1,51	-5,80	6,60	-0,10	-0,16
unitlabourcost growth	2,24	3,22	-15,61	26,48	0,47	0,53
Δinvestment	0,04	1,48	-6,98	25,52	-0,05	-0,06
Δlfparticipation	0,41	0,62	-2,28	3,23	0,10	0,09
Δunemplrate	-0,06	0,75	-2,80	6,30	0,06	0,05
ΔVATrate	0,10	0,42	-3,00	4,00	0,00	-0,02
public empl growth	3,80	6,69	-14,66	41,83	0,30	0,35

Source: Own calculations.

Table A.1.3: HICP Inflation Differentials, Balanced EA-19

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AT	-1,83	-1,76	-1,16	-1,22	-1,43	-0,77	-0,60	-1,20	-0,86	-1,88	-0,34	0,09	0,36	-0,19	0,83	1,12	0,84	0,73	0,49	0,31	0,03
BE	-1,21	-1,04	-1,03	-1,36	-1,22	-0,88	-0,16	-0,56	-1,24	-0,61	-0,75	0,73	0,16	-0,14	-0,04	0,15	0,66	1,53	0,49	0,50	-0,21
DE	-1,70	-2,31	-1,56	-1,58	-1,66	-0,96	-0,77	-1,11	-0,79	-2,35	-0,49	-0,49	-0,71	-0,60	0,32	0,43	0,72	0,12	-0,04	0,13	-0,11
ES	-0,11	-0,24	-0,64	0,68	0,37	0,32	0,68	0,68	-0,21	-0,97	-0,98	0,44	-0,14	-0,33	0,24	-0,53	-0,59	-0,58	0,30	-0,07	-0,68
FI	-1,03	-0,77	-0,80	-0,90	-1,45	-2,59	-1,93	-1,61	-1,47	-1,19	0,89	0,08	0,13	0,40	0,93	0,87	-0,12	0,15	-0,90	-0,64	-0,32
FR	-1,77	-1,91	-1,68	-0,97	-0,56	-0,40	-0,81	-0,99	-1,45	-1,94	-0,64	0,13	-0,90	-0,54	-0,30	0,27	0,12	0,06	-0,58	0,29	-0,16
GR	-0,20	-0,82	0,18	1,02	0,71	0,28	0,79	0,43	-0,07	-0,87	0,61	3,10	-0,07	-1,73	-2,14	-1,74	-1,06	-0,23	-0,60	-1,04	-0,94
IE	0,10	1,56	0,53	1,79	1,28	-0,44	-0,52	-0,20	-0,18	-1,98	-2,43	-3,22	-1,98	-0,86	-0,76	-0,04	0,00	-0,45	-1,48	-1,09	-0,58
IT	-0,70	-1,11	-1,14	-0,29	0,08	-0,48	-0,49	-0,66	-1,03	-1,61	0,03	0,01	-0,26	0,55	-0,05	-0,11	0,15	-0,29	-0,41	-0,57	-0,83
LU	-1,32	0,06	-1,06	-0,85	-0,21	0,51	1,06	0,07	-0,41	-1,01	-0,73	1,19	0,54	0,13	0,41	0,35	0,10	-0,21	0,37	0,21	0,19
NL	-0,31	-1,38	1,66	0,95	-0,50	-1,35	-1,21	-1,23	-1,47	-2,89	0,24	-0,67	-0,72	0,06	1,27	-0,03	0,25	-0,14	-0,44	-0,21	1,22
PT	-0,17	-0,92	0,95	0,79	0,50	-0,23	-0,57	0,16	-0,63	-2,45	-1,64	-0,21	0,36	0,01	-0,85	-0,50	0,55	0,39	-0,18	-0,64	-1,16
CY	-1,20	1,13	-1,47	-0,12	1,24	-0,84	-0,68	-0,64	-0,89	-0,72	-0,57	0,96	0,29	0,34	-0,91	-0,60	-1,51	-1,46	-1,06	-1,02	-0,91
EE	0,76	0,21	2,16	0,68	-1,35	0,30	1,42	1,56	3,69	5,50	-0,54	1,14	1,89	1,46	1,96	0,13	0,11	0,56	1,91	1,60	0,81
LT	-0,90	-2,63	-1,91	-2,57	-3,81	-1,58	-0,03	0,87	2,76	5,99	3,42	-0,42	0,93	0,40	-0,13	-0,10	-0,64	0,43	1,98	0,72	0,78
LV	-0,23	-1,09	-0,94	-0,94	0,20	3,45	4,19	3,69	7,02	10,15	2,52	-2,83	1,03	-0,48	-1,28	0,35	0,25	-0,14	1,16	0,74	1,29
MT	-0,05	-0,68	-0,95	-0,29	-0,80	-0,01	-0,18	-0,31	-2,36	-0,42	1,10	0,44	-0,68	0,47	-0,31	0,43	1,21	0,66	-0,48	-0,07	0,06
SI	3,77	5,23	5,16	4,59	2,91	0,92	-0,27	-0,34	0,75	0,42	0,11	0,45	-1,12	0,05	0,64	0,02	-0,73	-0,40	-0,18	0,12	0,23
SK	8,10	8,47	3,69	0,60	5,70	4,74	0,09	1,38	-1,17	-1,17	0,19	-0,91	0,89	0,98	0,17	-0,45	-0,31	-0,73	-0,35	0,72	1,31
EA19 mean	2,34	3,72	3,46	2,91	2,74	2,74	2,70	2,88	3,06	5,10	0,74	1,61	3,19	2,76	1,29	0,34	-0,04	0,24	1,74	1,81	1,46

Notes: This Table denotes the difference of a country's HICP inflation rate with respect to the unweighted EA-19 country average in the respective year. Grey background indicates a positive differential.

Table A.1.4: Identified Outliers in HICP Inflation in Balanced EA-19 Sample

Country	Year(s)	Respective HICP Inflation Value	Total Number
Estonia	2007, 2008	6.8, 10.6	12
Latvia	2004, 2005, 2007, 2008	6.2, 6.9, 10.1, 15.3	
Lithuania	2008	11.1	
Slovakia	1999, 2000, 2004	10.4, 12.2, 7.5	
Slovenia	1999, 2000	6.1, 9.0	

Notes: Outlier observations were obtained by calculating the cross-sectional distribution of HICP inflation in EA-19 for each year and marking those observations as outliers that are above the 75th percentile plus 2.5 times the interquartile range and values below the 25th percentile minus 2.5 times the interquartile range. The procedure is only performed once, not iterated to remove outliers in the distribution of remaining non-outlier observations.

Table A.1.5: Distribution of Fiscal Stance/Impulse Measures (Balanced EA-19 sample, 1999-2019)

Fiscal Impulse	Number of positive observations (contractionary/ non-supportive fiscal policy)	Number of negative observations (expansionary/supportive fiscal policy)	Total N
FISC	234 (58.65%)	165	399
CAPB	228 (57.29%)	170	398
ΔCAPB	183 (46.10%)	214	397
ΔCAPBnofin	187 (47.10%)	210	397

Source: Own calculations and ESCB.

A.2 Additional regression results

A.2.1. Baseline regression analysis

Table A.2.1: Baseline Regression Results (Dependent variable (DV): core HICP inflation, 1999-2019)

	(1) EA19 (Unbalanced sample)	(2) EA19 (Balanced weighted sample)	(3) EA19 (Balanced sample)	(4)	(5) EA19 (Balanced weighted sample)	(6)	(7)
	GMM	GMM	GMM	GMM	GMM	GMM	diff GMM
$\Delta NEER_{t-1}$	-0.07	-0.19***	-0.23***	-0.20***	-0.19***	-0.10***	-0.05
	(-0.82)	(-3.61)	(-4.42)	(-3.58)	(-4.11)	(-3.15)	(-1.14)
$outputgap_t$	0.20***	0.21***	0.22***	0.12**	0.15***	0.09***	0.14***
	(7.93)	(4.18)	(3.30)	(2.73)	(2.94)	(4.16)	(2.93)
$FISC_t$	0.01	-0.07	-0.12	-0.06	-0.06	-0.01	0.02
	(0.11)	(-0.77)	(-1.18)	(-0.93)	(-0.76)	(-0.32)	(0.62)
$price_{t-1}$	-0.01	-0.02**	-0.03**	-0.01	-0.04	-0.04**	-0.11**
	(-1.39)	(-2.18)	(-2.38)	(-1.45)	(-1.69)	(-2.48)	(-2.24)
$unitlabourcost\ growth_t$				0.13***	0.11***	0.08**	0.03
				(4.34)	(4.05)	(2.43)	(1.08)
$CoreHICPinfl_{t-1}$						0.51***	0.55***
						(15.52)	(9.72)
Time FE	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	YES	YES	YES
Observations	318	396	396	396	396	395	394
KP LM-Stat. (p)	0.0147	0.00892	0.00695	0.00902	0.00846	0.0105	
Hansen (p)							0.128
AB-test AR1 (p)							0.00192
AB-test AR2 (p)							0.399

Notes: Core HICP inflation excludes food and energy prices. Specifications (1)-(6) employ two-step feasible GMM estimation with Driscoll-Kraay standard errors with the first lag of the output gap and the fiscal impulse variable are used as instruments for the contemporaneously included variables (instrumentalization of unit labour cost growth led to underidentification and was therefore disregarded). Column (7) performs one-step Arellano-Bond (1991) difference GMM estimation with robust standard errors. The lagged nominal effective exchange rate change and the lagged price level and unit labour cost growth are considered predetermined and their first to second lag are used as instruments for the differenced equation. In the same vein, the lagged core HICP inflation rate is also regarded predetermined and its 2nd to 3rd lags are included as instruments. Lastly, the output gap and fiscal policy are potentially endogenous so only lags starting from 2 are valid instruments. We take their 2nd and 3rd lag. In order to reduce the instrument count further as suggested by Roodman (2009), all instruments are additionally collapsed. Time fixed effects in all specifications are partialled out. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

A.2.2 Alternative measures of discretionary fiscal policy

Table A.2.2. Comparison of Various Measures of Fiscal Stance (DV: core HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.19***	-0.19***	-0.19***	-0.19***	-0.18***	-0.17***	-0.19***	-0.17***
	(-4.11)	(-4.20)	(-4.31)	(-4.27)	(-4.17)	(-3.96)	(-4.28)	(-3.91)
$outputgap_t$	0.15***	0.16***	0.13**	0.15***	0.16***	0.15**	0.16***	0.15**
	(2.94)	(3.47)	(2.47)	(2.98)	(3.54)	(2.82)	(3.51)	(2.52)
fiscal stance/impulse	-0.06	-0.03	-0.07	-0.04	0.04	0.00	0.09**	-0.00
	(-0.76)	(-0.71)	(-1.03)	(-0.94)	(1.28)	(0.14)	(2.76)	(-0.06)
$price_{t-1}$	-0.04	-0.03	-0.04*	-0.04	-0.03	-0.02	-0.03**	-0.02
	(-1.69)	(-1.68)	(-1.73)	(-1.70)	(-1.70)	(-1.45)	(-2.15)	(-1.44)
$unitlabourcost\ growth_t$	0.11***	0.11***	0.12***	0.12***	0.11***	0.13***	0.12***	0.13***
	(4.05)	(4.13)	(4.79)	(4.50)	(4.09)	(4.88)	(4.37)	(5.05)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	396	396	394	394	394	389	394	389
KP LM-Stat. (p)	0.00846	0.00351	0.00533	0.00388	0.00314	0.00411	0.00356	0.00359

Notes: All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. In columns (1) and (3) the output gap as well as the fiscal impulse variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered and instrumenting the change in the CAPB was rejected due to underidentification, as well as unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

A.2.3 Assessing asymmetries in the effect of discretionary fiscal policy

Asymmetric effects in determinants of inflation differentials have for instance been detected by Honohan and Lane (2004) for nominal effective exchange rate changes. They document that exchange rate depreciations have a stronger impact on inflation differentials than have appreciations in their initial-EMU sample covering 1999-2003. Along the same lines, fiscal policy expansions might yield potentially stronger effects on inflation differentials than contractions due to downward rigidities in prices. Therefore, we split each fiscal stance/impulse indicator in positive (contractionary or non-supportive; >0) and negative (expansionary or supportive; <0) observations and let these two newly created fiscal stance/impulse variables take the place of the respective original one. The resulting regression equation therefore takes the form:

$$\pi_{it} = \varphi_t + \theta_i + \alpha_1 FS_{(FS<0),it} + \alpha_2 FS_{(FS>0),it} + \boldsymbol{\beta z_{it}} - \delta P_{it-1} + \varepsilon_{it} \quad (5)$$

where $FS_{(FS>0)}$ is equal to the original fiscal policy measure whenever positive and zero otherwise, while $FS_{(FS<0)}$ is equal to the original fiscal policy measure whenever negative and zero otherwise.[24] The vector $\boldsymbol{z_{it}}$ collects the remaining regressors, i.e., the lagged change in the nominal effective exchange rate, the output gap, and the growth rate of unit labour cost.

Table A.2.3: Asymmetric Fiscal Stance/Impulse Effect

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.25***	-0.27***	-0.27***	-0.27***	-0.28***	-0.25***	-0.28***	-0.26***
	(-4.41)	(-4.75)	(-4.34)	(-4.43)	(-4.27)	(-4.64)	(-4.36)	(-4.56)
$outputgap_t$	0.11	0.13**	0.08	0.11	0.13*	0.11	0.13*	0.11
	(1.58)	(2.10)	(1.33)	(1.68)	(1.90)	(1.48)	(1.92)	(1.31)
$fiscal\ stance/impulse_{<0}$	0.17	0.04	-0.05	-0.02	0.06	0.03	-0.04	-0.17**
	(0.77)	(1.27)	(-0.56)	(-0.53)	(0.96)	(0.66)	(-0.51)	(-2.46)
$fiscal\ stance/impulse_{>0}$	-0.36***	-0.18***	-0.24***	-0.16***	-0.00	-0.03	0.19***	0.06
	(-2.93)	(-3.86)	(-3.46)	(-3.39)	(-0.03)	(-0.70)	(3.07)	(0.69)
$price_{t-1}$	-0.05*	-0.06**	-0.07***	-0.07***	-0.04*	-0.03	-0.04*	-0.03
	(-1.91)	(-2.79)	(-3.07)	(-2.88)	(-2.05)	(-1.68)	(-2.01)	(-1.34)
$unitlabourcost\ growth_t$	0.07	0.09*	0.11**	0.10**	0.10**	0.13***	0.11**	0.13***
	(1.54)	(1.97)	(2.63)	(2.57)	(2.35)	(3.16)	(2.65)	(3.52)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	399	399	397	397	397	391	397	391
KP LM-Stat. (p)	0.0695	0.00337	0.0305	0.00392	0.00288	0.00369	0.00339	0.00335

Notes: Dependent variable: HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. In columns (1) and (3) the output gap as well as the fiscal impulse variables are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered predetermined. Instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

Results concerning HICP inflation differentials presented in Table A.2.3 are mixed. The fiscal impulse measures (variables FISC and CAPB, as well as their lagged values) seem to be statistically significant only in periods in which fiscal support is withdrawn from an economy (in the regime fiscal impulse>0 or cyclically-adjusted primary surpluses). The negative value of the coefficients in models 1-4 denote that a less (more) supportive fiscal position in this regime is associated with lower (higher) inflation differentials. The outcome is inconclusive and/or not statistically significant in periods in which the government runs deficits (fiscal impulse <0) or in various fiscal stance regimes. When excluding energy and food prices (see results for core HICP inflation differentials in Table A.2.4), the main result concerning the variables capturing the level of fiscal support is broadly confirmed.

[24] For a display of the distribution of observations in each category see Table A.1.5 in the Appendix. The number of contractionary versus expansionary observations is quite evenly distributed (not yet considering differentials).

Table A.2.4: Heterogeneous Fiscal Impulse Effects by Fiscal Stance Direction (DV: core HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.17***	-0.18***	-0.18***	-0.19***	-0.19***	-0.17***	-0.19***	-0.18***
	(-4.04)	(-4.33)	(-4.23)	(-4.39)	(-4.24)	(-3.91)	(-4.09)	(-3.92)
$outputgap_t$	0.15***	0.16***	0.14**	0.15***	0.16***	0.15**	0.16***	0.15**
	(2.88)	(3.58)	(2.60)	(3.10)	(3.57)	(2.80)	(3.51)	(2.54)
$fiscal\ stance/impulse_{<0}$	0.13	0.03	-0.01	-0.01	0.08*	0.03	-0.02	-0.11
	(0.75)	(1.01)	(-0.13)	(-0.13)	(1.74)	(1.26)	(-0.30)	(-1.50)
$fiscal\ stance/impulse_{>0}$	-0.23**	-0.11**	-0.17**	-0.11**	-0.00	-0.02	0.17***	0.08
	(-2.57)	(-2.41)	(-2.36)	(-2.27)	(-0.08)	(-0.73)	(3.69)	(1.60)
$price_{t-1}$	-0.04	-0.04**	-0.05*	-0.05**	-0.03*	-0.02	-0.03*	-0.02
	(-1.45)	(-2.20)	(-2.03)	(-2.14)	(-1.86)	(-1.71)	(-2.05)	(-1.26)
$unitlabourcost\ growth_t$	0.09***	0.10***	0.11***	0.11***	0.11***	0.13***	0.12***	0.13***
	(3.27)	(3.69)	(4.61)	(4.42)	(4.17)	(4.77)	(4.20)	(5.35)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	396	396	394	394	394	389	394	389
KP LM-Stat. (p)	0.0702	0.00342	0.0305	0.00395	0.00287	0.00369	0.00342	0.00332

Notes: All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. `$fiscal\ stance/impulse_{>0}$' is equal to the original fiscal policy variable for all positive values of this respective variable and zero otherwise, while `$fiscal\ stance/impulse_{<0}$' is equal to the original fiscal stance/impulse variable for negative values and zero otherwise. In columns (1) and (3) the output gap as well as the fiscal impulse variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered predetermined and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

A.2.4 Assessing fiscal stance effects in relation to the business cycle

Table A.2.5: Heterogeneous Fiscal Stance Effects by Output Gap Direction (DV: core HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.18***	-0.19***	-0.19***	-0.20***	-0.18***	-0.17***	-0.19***	-0.17***
	(-4.22)	(-4.22)	(-4.29)	(-4.40)	(-4.19)	(-3.92)	(-4.26)	(-3.90)
$outputgap_t$	0.16***	0.16***	0.15**	0.13***	0.16***	0.15**	0.16***	0.15**
	(3.40)	(3.48)	(2.83)	(2.99)	(3.52)	(2.82)	(3.50)	(2.54)
fiscal stance/impulse	-0.02	-0.04	-0.02	-0.06	0.04	-0.00	0.08**	-0.01
	(-0.43)	(-1.00)	(-0.51)	(-1.59)	(1.38)	(-0.22)	(2.54)	(-0.18)
fiscal stance/impulse	-0.04	-0.06	-0.10**	-0.11**	0.02	-0.03	-0.03	-0.03
x d($outputgap_t$ > 0)	(-1.27)	(-1.40)	(-2.58)	(-2.80)	(0.50)	(-0.83)	(-0.42)	(-0.75)
$price_{t-1}$	-0.03	-0.04*	-0.03	-0.04*	-0.03*	-0.02	-0.03**	-0.02
	(-1.56)	(-1.76)	(-1.26)	(-1.82)	(-1.79)	(-1.44)	(-2.12)	(-1.47)
$unitlabourcost\ growth_t$	0.11***	0.10***	0.11***	0.11***	0.11***	0.13***	0.12***	0.13***
	(4.04)	(3.74)	(4.11)	(4.30)	(4.07)	(4.84)	(4.38)	(4.86)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	396	396	395	394	394	389	394	389
KP LM-Stat. (p)	0.00383	0.00347	0.00462	0.00392	0.00319	0.00443	0.00358	0.00367

Notes: DV: Core HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. The output gap is instrumented by its first lag (exact identification). Lagged fiscal impulse/stance variables are considered predetermined and instrumenting of the contemporaneous ones and their interaction with the positive output gap dummy was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The variables entering the interaction term were within-differenced before as suggested by Giesselmann and Schmidt-Catran (2020). The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

Table A.2.6: 3-Stage Least Squares Estimation (DV in first equation: core HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
Core HICP Inflation Differential Equation:								
$\Delta NEER_{t-1}$	-0.24***	-0.23***	-0.23***	-0.23***	-0.24***	-0.23***	-0.24***	-0.23***
	(-4.24)	(-4.37)	(-4.26)	(-4.31)	(-4.20)	(-4.31)	(-4.46)	(-4.26)
$outputgap_t$	0.17***	0.18***	0.16***	0.17***	0.18***	0.19***	0.17***	0.19***
	(3.14)	(3.45)	(2.75)	(3.21)	(3.48)	(3.51)	(3.43)	(3.46)
fiscal stance/impulse	-0.04	-0.02	-0.03	-0.02	-0.05	0.01	0.36	0.03
	(-0.68)	(-0.66)	(-0.57)	(-0.54)	(-0.92)	(0.83)	(0.61)	(0.84)
$price_{t-1}$	-0.04*	-0.04	-0.04*	-0.04	-0.04	-0.04	-0.05	-0.04
	(-1.70)	(-1.63)	(-1.70)	(-1.64)	(-1.57)	(-1.55)	(-1.56)	(-1.57)
$unitlabourcost\ growth_t$	0.13***	0.13***	0.13***	0.13***	0.13***	0.13***	0.16***	0.13***
	(4.42)	(4.40)	(4.47)	(4.53)	(4.45)	(4.55)	(2.79)	(4.59)
Output Gap Differential Equation:								
$\Delta investment_{t-1}$	-0.75**	-0.40**	-0.67**	-0.41**	-0.46***	-0.35**	-0.39**	-0.30**
	(-2.01)	(-2.22)	(-2.38)	(-2.51)	(-2.75)	(-2.34)	(-2.34)	(-2.29)
$\Delta labourforceparticipation_{t-1}$	0.75*	0.53	0.65*	0.50	0.42	0.40	0.39	0.37
	(1.66)	(1.52)	(1.73)	(1.51)	(1.35)	(1.40)	(1.26)	(1.41)
$\Delta unemploymentrate_t$	-5.20***	-3.87***	-4.16***	-3.62***	-3.07***	-2.86***	-2.88***	-2.38***
	(-4.27)	(-5.18)	(-5.52)	(-5.49)	(-5.16)	(-5.28)	(-3.87)	(-5.48)
fiscal stance/impulse	-0.93***	-0.35***	-0.76***	-0.40***	-0.14*	-0.26***	-0.18	-0.59***
	(-2.80)	(-2.78)	(-3.92)	(-2.76)	(-1.91)	(-3.56)	(-0.85)	(-5.59)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	324	324	324	324	324	324	324	324
Hansen (df)	2	2	2	2	2	2	2	2
Hansen (p)	0.996	0.996	0.994	0.996	0.996	0.996	0.997	0.995

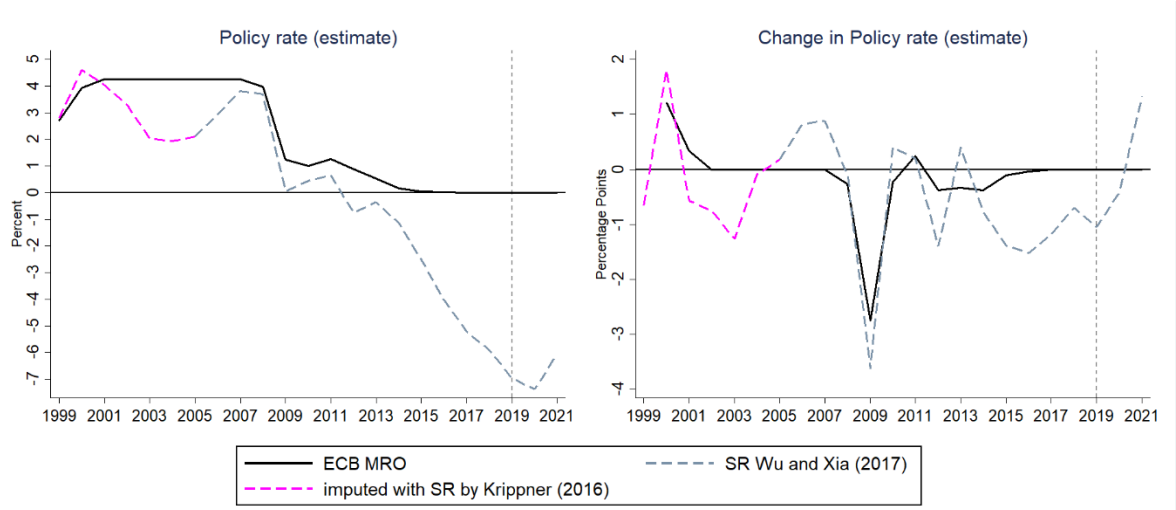
Notes: Two-step GMM estimation with heteroskedasticity- and autocorrelation-consistent weighting matrix and standard errors using Bartlett kernel with 2 lags. All variables are instrumented by themselves except for the contemporaneous output gap and fiscal policy indicators in levels, as well as the change in the unemployment rate, which are instrumented by their first lag. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level. Hansen's J statistic of overidentifying restrictions should not be rejected (large p-value). Since investment over GDP data of businesses is only available from 2000 onwards, the inclusion of its lagged change implies that the estimation period can only start in 2002. Results are robust to the exclusion of this investment variable and implied extension of the estimation period until 1999, with the lagged change in the labour force participation rate gaining statistical relevance.

A.2.5 Interactions with monetary policy

As explained in section 3.1, we also attempt to explicitly account for the interaction between fiscal policy and the (aggregate) monetary policy regime in determining inflation differentials across the EMU.

Figure 3 below illustrates the paths of the level and annual change in the ECB's main refinancing operations rate (MRO), alongside a shadow rate estimate by Wu and Xia (2017)[25] intended to offer a better account of the actual monetary policy stance at the effective zero lower bound. We can broadly identify three periods: (i) a high and stable nominal rate from the onset of the monetary union until around 2007; (ii) the crisis period 2008-2013, which saw a strong reduction in the policy rate (estimate) and (iii) the latest years of EMU with the nominal interest rate being at the zero lower bound and a rise of unconventional monetary policy measures yielding the shadow rate estimate of Wu and Xia (2017) to fall further into negative territory.

Figure 3: Visualization of (Estimated) Monetary Policy Rates



Sources: ECB, Wu and Xia (2017), and Krippner (2016). Notes: The shadow rate estimate by Wu and Xia (2017) is available since 2005. The years before are imputed using the shadow rate estimates from Krippner (2016), scaled by the ratio of the two estimates in 2005. The right-hand side chart shows annual changes in the MRO and shadow rate.

These three subperiods, 1999-2007, 2008-2013 and 2014-2019 correspond to different evolutions of the euro area aggregate fiscal stance and its dispersion across the EA-19 country group (see Figure 2 in the main text). Hence, after it had been broadly neutral in the early years of EMU, the crisis period 2008-2013 first saw massive fiscal expansions in most countries, even excluding the aid to the financial sector (ΔCAPB_adj), over the years 2008-2009 (alongside the fall in the nominal interest rate). Thereafter, particularly during the sovereign debt crisis, monetary policy quickly progressed with an accommodative stance while fiscal policy was tightening, thereby exhibiting a procyclical stance[26]. But these developments seem to have been heterogeneous across countries, yielding the cross-sectional standard deviation of fiscal policy measures to shoot up (as visible in Figure 2). The last period of our sample, 2014-2019, is again characterized by roughly neutral fiscal stance measures for the EA-19 on average and cross-country differences declining substantially.

When allowing for heterogeneous effects of the fiscal policy measures in the three subperiods 1999-2007, 2008-2019 and 2014-2019 on inflation differentials, no robust and significant effects are revealed for the crisis or post-crisis years compared to the first years of the monetary union.[27] See Tables A.2.7 for HICP (similar results are found for core HICP inflation differentials).

[25] The estimate is only available since 2005. Values from 1998 to 2004 are taken from Krippner (2016).
[26] See also a more detailed discussion documenting the paths and interactions of monetary and fiscal policies in Bankowski et al. (2021).
[27] The findings also carry over when considering an alternative period split into subperiods 1999-2008, 2009-2014, 2015-2019. Results are available from the authors upon request.

Table A.2.7: Subperiod Heterogeneity of Fiscal Stance/Impulse (DV: HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.26***	-0.29***	-0.23***	-0.27***	-0.28***	-0.25***	-0.28***	-0.25***
	(-4.31)	(-4.68)	(-4.83)	(-4.84)	(-4.53)	(-4.62)	(-4.44)	(-4.58)
$outputgap_t$	0.12	0.14**	0.18**	0.15**	0.12*	0.12	0.13*	0.11
	(1.70)	(2.16)	(2.23)	(2.43)	(1.82)	(1.48)	(1.90)	(1.35)
fiscal stance/impulse (baseline)	-0.47*	-0.18**	-0.41***	-0.26***	0.08	-0.09	0.07	-0.10
	(-1.91)	(-2.15)	(-5.73)	(-5.91)	(1.19)	(-0.89)	(1.21)	(-0.98)
fiscal stance/impulse (2008-2013)	0.59*	0.18*	0.44***	0.26***	-0.04	0.11	0.03	0.09
	(1.82)	(1.73)	(5.12)	(4.41)	(-0.49)	(1.03)	(0.38)	(0.93)
fiscal stance/impulse (2014-2019)	0.25	0.12	0.53***	0.31***	-0.13*	0.10	-0.01	0.12
	(0.93)	(1.41)	(3.21)	(5.70)	(-1.85)	(0.92)	(-0.05)	(1.27)
$price_{t-1}$	-0.03	-0.05**	-0.06**	-0.06***	-0.04*	-0.03	-0.04**	-0.03
	(-0.79)	(-2.21)	(-2.37)	(-2.97)	(-2.01)	(-1.33)	(-2.24)	(-1.33)
$unitlabourcost\ growth_t$	0.07	0.09**	0.06	0.09*	0.11**	0.12***	0.11**	0.12***
	(1.23)	(2.10)	(1.58)	(2.06)	(2.55)	(3.12)	(2.83)	(3.23)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	399	399	397	397	397	391	397	391
KP LM-Stat. (p)	0.0399	0.00298	0.0251	0.00490	0.00297	0.00398	0.00352	0.00407

Notes: Dependent variable: HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. The coefficient of "fiscal stance/impulse (baseline)" refers to period 1999-2007, the other two coefficients refer to additional effects in the denoted subperiods. In columns (1) and (3) the output gap as well as the fiscal impulse variables are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered predetermined and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

Next, we account for the workings of aggregate monetary policy stance on the relationship between fiscal policy and inflation differentials directly by including the interaction between the fiscal policy indicator (FP) and the direction of monetary policy stance (MP) as measured by the change in the Main Refinancing Operations Rate or the shadow rate estimate.[28] We consider various regimes of the two policies joint loosening, joint tightening or going in opposite directions. However, we do not find robust evidence for a change in the impact of the overall fiscal policy or for the interaction term between fiscal and monetary policy. In Table A.2.8 below we present the results with monetary policy loosening (shadow rate declining or MRO declining or unchanged) as this is the dominant regime (with most observations) in our sample. Results with other regimes are similar (available from the authors upon request).

Table A.2.8: Effect of Fiscal policy under regimes of Monetary Policy loosening (DV: HICP inflation)

Monetary stance (MP_t)	(1)	(2)	(3) ΔMRO	(4)	(5)	(6)	(7) Δshadowrate	(8)
Fiscal stance/impulse (FP_t)	$FISC$	$CAPB$	ΔCAPB	ΔCAPB adj	$FISC$	$CAPB$	ΔCAPB	ΔCAPB adj
$\Delta NEER_{t-1}$	-0.25***	-0.25***	-0.25***	-0.26***	-0.27***	-0.28***	-0.27***	-0.28***
	(-4.27)	(-4.64)	(-4.10)	(-4.27)	(-4.47)	(-4.29)	(-4.26)	(-4.44)
$outputgap_t$	0.11	0.11	0.12	0.11	0.11*	0.09	0.13*	0.13*
	(1.61)	(1.40)	(1.64)	(1.60)	(1.74)	(1.16)	(1.92)	(2.00)
FP_t	-0.11	-0.13	-0.04	0.04	0.02	0.01	0.03	0.05
	(-1.25)	(-1.24)	(-1.51)	(0.89)	(0.34)	(0.20)	(0.60)	(0.65)
FP_t x $d(MP_t \leq 0)$	0.08	0.11	0.10	0.07	-0.11*	-0.14***	0.00	0.06
	(0.93)	(1.10)	(1.44)	(0.91)	(-1.97)	(-2.91)	(0.03)	(0.97)
$price_{t-1}$	-0.04	-0.04*	-0.03	-0.04*	-0.05*	-0.06**	-0.04*	-0.04**
	(-1.65)	(-1.89)	(-1.53)	(-1.79)	(-2.03)	(-2.74)	(-1.92)	(-2.21)
$unitlabourcost\ growth_t$	0.12***	0.12***	0.12***	0.13***	0.10**	0.11**	0.10**	0.11**
	(3.17)	(2.94)	(3.11)	(3.71)	(2.42)	(2.79)	(2.46)	(2.68)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	380	380	379	379	399	398	397	397
KP LM-Stat. (p)	0.00417	0.00437	0.00336	0.00381	0.00383	0.00402	0.00284	0.00346

Notes: Dependent variable: HICP Inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. The output gap is instrumented by its first lag (exact identification). Instrumenting the current-period fiscal policy indicators and the interaction terms was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

[28] While the coefficient of the area-wide policy rate itself cannot be estimated since there is no variation in the cross-section and it would be perfectly collinear with the time dummies included in the regression, it is possible to include the interaction between the union-wide monetary policy rate and the country-level fiscal policy indicators.

A.2.6 Indirect tax changes

Table A.2.9: Change in Standard VAT Rate (DV: core HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $CAPB_t$	(3) $\Delta CAPB_t$	(4) $\Delta CAPB\_adj_t$	(5) $FISC_{t-1}$	(6) $CAPB_{t-1}$	(7) $\Delta CAPB_{t-1}$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.20***	-0.20***	-0.20***	-0.21***	-0.20***	-0.20***	-0.18***	-0.19***
	(-4.29)	(-4.40)	(-4.46)	(-4.47)	(-4.37)	(-4.52)	(-4.23)	(-4.30)
$outputgap_t$	0.14**	0.12*	0.14**	0.14**	0.18***	0.16**	0.16**	0.15**
	(2.48)	(2.04)	(2.62)	(2.58)	(2.98)	(2.50)	(2.43)	(2.14)
fiscal stance/impulse	-0.03	-0.04	0.03	0.06	-0.03	-0.04	-0.00	-0.03
	(-0.32)	(-0.55)	(1.16)	(1.65)	(-0.61)	(-0.80)	(-0.01)	(-0.50)
$\Delta VATrate_t$	0.36**	0.35**	0.34***	0.33**				
	(2.80)	(2.56)	(3.14)	(2.74)				
$\Delta VATrate_{t-1}$					0.16*	0.14	0.15	0.16
					(1.91)	(1.65)	(1.59)	(1.69)
$price_{t-1}$	-0.03	-0.04	-0.03	-0.03	-0.04	-0.04	-0.02	-0.02
	(-1.34)	(-1.39)	(-1.47)	(-1.68)	(-1.55)	(-1.56)	(-1.28)	(-1.24)
$unitlabourcost\ growth_t$	0.13***	0.14***	0.14***	0.14***	0.12***	0.12***	0.14***	0.14***
	(4.07)	(4.75)	(4.33)	(4.42)	(3.85)	(4.20)	(4.78)	(4.96)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	352	352	352	352	352	352	349	349
KP LM-Stat. (p)	0.0105	0.00611	0.00294	0.00311	0.00314	0.00363	0.00352	0.00396

Notes: Dependent variable: core HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. VAT rate data is not available for Cyprus and Malta; thus the effective sample comprises of only 17 countries. In columns (1) and (3) the output gap as well as the fiscal impulse variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered exogenous and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

A.2.7 Public wage developments

Table A.2.10: Public Employee Compensation per Public Employee Growth (DV: core HICP inflation)

Fiscal stance/impulse	(1) $FISC_t$	(2) $FISC_{t-1}$	(3) $CAPB_t$	(4) $CAPB_{t-1}$	(5) $\Delta CAPB_t$	(6) $\Delta CAPB_{t-1}$	(7) $\Delta CAPB\_adj_t$	(8) $\Delta CAPB\_adj_{t-1}$
$\Delta NEER_{t-1}$	-0.19***	-0.19***	-0.19***	-0.19***	-0.19***	-0.19***	-0.19***	-0.19***
	(-4.36)	(-4.38)	(-4.51)	(-4.44)	(-4.34)	(-4.41)	(-4.50)	(-4.32)
$outputgap_t$	0.12**	0.12**	0.10*	0.11**	0.12**	0.12**	0.12**	0.13**
	(2.57)	(2.95)	(1.80)	(2.25)	(2.93)	(2.77)	(2.83)	(2.49)
fiscal stance/impulse	-0.03	-0.01	-0.04	-0.02	0.03	0.01	0.07**	0.01
	(-0.41)	(-0.40)	(-0.69)	(-0.65)	(1.26)	(0.25)	(2.37)	(0.23)
$price_{t-1}$	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.03*	-0.02
	(-1.31)	(-1.40)	(-1.47)	(-1.47)	(-1.39)	(-1.47)	(-1.80)	(-1.48)
$unitlabourcost\ growth_t$	0.12***	0.13***	0.13***	0.13***	0.13***	0.12***	0.13***	0.13***
	(5.02)	(4.86)	(5.04)	(4.89)	(4.89)	(5.00)	(5.05)	(5.14)
$public\ empl\ growth_{t-1}$	0.02**	0.02**	0.02**	0.03**	0.03**	0.03**	0.03**	0.03**
	(2.24)	(2.31)	(2.28)	(2.36)	(2.38)	(2.36)	(2.44)	(2.40)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	382	382	382	382	382	382	382	382
KP LM-Stat. (p)	0.00975	0.00375	0.00609	0.00455	0.00342	0.00440	0.00383	0.00379

Notes: Dependent variable: core HICP inflation. All regressions are performed on the balanced EA-19 sample, 1999-2019, pre-EMU observations weighted by 0.5, with two-step feasible GMM estimation. In columns (1) and (3) the output gap as well as the fiscal impulse variable are instrumented by their first lag (exact identification). In the other specifications only the output gap is instrumented by its first lag since lagged fiscal policy variables are considered exogenous and instrumenting the change in the CAPB was rejected due to underidentification. The same applies to unit labour cost growth throughout all specifications. The time dummies are partialled out. T-statistics based on Driscoll-Kraay standard errors in parentheses. Stars indicate significance at the 10% (*), 5% (**) and 1% (***) level.

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