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The fiscal sources of euro area inflation through the lens of the Bernanke-Blanchard model

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Abstract

We estimate the contribution of discretionary fiscal policy measures to euro area inflation in the post-pandemic era using an extension of Bernanke and Blanchard (2024b)'s semi-structural model. Since the pandemic, aggregate discretionary fiscal measures had a modest yet progressively increasing positive contribution to inflation that partly worked through an indirect effect on wage growth and inflation expectations. However, net indirect taxes helped to contain inflationary pressures, both during the pandemic and energy crises. Fiscal policy, therefore, can be a powerful tool to smooth the inflationary effects of adverse supply shocks, yet may also increase inflation persistence if fiscal stimulus is not timely withdrawn.

JEL Classification: C5, E32, E47, E62

Keywords: inflation, fiscal policy, semi-structural model

Non-technical Summary

On the backdrop of the surge in global inflation over the past years, this paper aims to provide new evidence on the contribution of discretionary fiscal policy measures to inflation in the euro area, during and after the pandemic. To this end, we use the semi-structural model from Bernanke and Blanchard (2024a) and we augment it with a measure that captures discretionary fiscal policy changes as estimated by fiscal experts within the Eurosystem.

The Bernanke-Blanchard model was originally built to investigate the drivers of US inflation and consists of four equations describing the dynamics of wage growth, inflation, short-term inflation expectations and long-term inflation expectations. In their suggestions for further research and development of the model, the authors mention explicitly the incorporation of fiscal policy, which is the focus of our paper.

To start with, we estimate the model over the same sample, i.e. from 1999Q1 to 2023Q2, and using the same dataset that was used in the replication exercise of the Bernanke-Blanchard model for the euro area by Arce et al. (2024). We then augment the Bernanke-Blanchard model by including our series on euro area discretionary fiscal measures in both the wage growth and inflation equations. As such, we allow for the possibility that the discretionary fiscal measures taken by euro area governments have both a direct impact on inflation, e.g. through indirect taxes and subsidies, and an indirect effect through, for example, aggregate demand. We then conduct several robustness checks, such as extending the sample up to the latest available data, looking at the effects of disaggregated fiscal policy measures, and using energy and food price series at constant taxes to better insulate the contribution of fiscal policy measures, particularly during the energy crisis.

We find that, since the pandemic crisis, the contribution of discretionary fiscal measures to euro area inflation has been modest, yet became progressively more positive over time. This contribution of aggregate fiscal measures masks offsetting effects on inflation arising from different types of discretionary measures. In fact, when we distinguish between indirect taxes (net of subsidies) and other discretionary measures, we find that the contribution of the former to inflation has been considerably negative after the pandemic crisis. This result is in line with other ECB model-based studies showing that 'unconventional' fiscal stimulus through cuts in net indirect taxes helped to temporarily lower inflation in the euro area. In contrast, the impact on inflation of discretionary fiscal measures other than net indirect taxes has been mostly positive since 2020, reaching a peak contribution to inflation of almost 1 percentage point in 2022.

Our estimates further show that discretionary fiscal measures have been a key driver of wage growth, and that wages were an important conduit for the impact of fiscal policy on inflation. Moreover, to the extent that fiscal measures affect inflation and, in turn, inflation expectations, they also affect wage growth indirectly as wage demands adjust to changes in expected inflation. In the model-based historical decompositions, we also find a rather notable contribution from discretionary fiscal measures to short-term inflation expectations, but a very limited impact on long-term inflation expectations. The latter remained broadly unaffected by shocks, confirming their strong anchoring in the euro area.

Finally, our results support earlier findings from the literature that commodity price shocks and supply shortages together explain the bulk of the recent inflation surge in the euro area, while demand-side factors played a more limited, though increasing role. In this respect, our findings are consistent with those from Arce et al. (2024) for the euro area. Our main contribution, therefore, is to show that, in addition to the relevance of supply-side factors, fiscal policy played a non-negligible role in shaping inflation dynamics in the euro area. From that perspective, our results suggest that a well-calibrated set of fiscal policy instruments can smooth the inflationary effects of adverse supply shocks and could therefore complement monetary policy in ensuring price stability. Yet, fiscal policy may also increase inflation persistence, especially if the stimulus is not timely withdrawn.

1 Introduction

Numerous studies show that the post-pandemic inflationary surge in the euro area was driven by both supply- and demand-side factors.[1] The former refers, for example, to supply chain disruptions during and after the pandemic and the series of energy and other commodity price shocks following Russia's invasion of Ukraine in early 2022, while demand shocks may have arisen from the release of pent-up demand after the pandemic and from expansionary fiscal and monetary policy responses to the pandemic and energy crises. A common finding across most studies is that supply shocks accounted for the lion share of the inflation surge, particularly in its initial phase, while the contribution of demand shocks to inflation was more contained, yet may have gained in importance over time as economic recovery gradually unfolded.

We provide new evidence on the contribution of discretionary fiscal policy measures to inflation in the euro area, during and after the pandemic. To this end, we use the semi-structural model from Bernanke and Blanchard (2024b), which we augment with a measure that captures discretionary fiscal policy changes as estimated by fiscal experts within the Eurosystem. This series is constructed based on a narrative, country-specific and measure-by-measure approach on the revenue side and by benchmarking the growth of government consumption, government investment and discretionary transfers to nominal potential growth. The Bernanke-Blanchard model was originally built to investigate the drivers of US inflation and consists of four equations describing the dynamics of wage growth, inflation, short-term inflation expectations and long-term inflation expectations. In a joint effort by several central banks, the model has been used to analyze inflation dynamics in the pandemic era in various other economies, including the euro area (see Bernanke and Blanchard, 2024a). In their suggestions for further research and development of the model, the authors mention explicitly the incorporation of fiscal policy, which is the focus of our paper.

[1] See for example Bańbura et al. (2023), Höynck and Rossi (2023), Pallara et al. (2023), Arce et al. (2024), Ascari et al. (2024a), Ascari et al. (2024b), De Santis (2024), and Giannone and Primiceri (2024).

As a starting point, we estimate the model over the same sample that was used in the replication exercise of the Bernanke-Blanchard model for the euro area by Arce et al. (2024), i.e. from 1999Q1 to 2023Q2, and using the same dataset. We then augment the Bernanke-Blanchard model by including our series on euro area discretionary fiscal measures in both the wage growth and inflation equations. As such, we allow for the possibility that the discretionary fiscal measures taken by euro area governments have both a direct impact on inflation, e.g. through indirect taxes and subsidies, and an indirect effect through, for example, aggregate demand.

Although our series of fiscal policy changes capture the behavior of discretionary policies, they clearly include an endogenous component that reflects governments' response to the pandemic and energy (and other) crises. The discretionary measures are therefore not fully exogenous, which also applies to many of the other 'shocks' included in the original Bernanke-Blanchard model (such as labor market tightness, energy prices and food prices). Nevertheless, compared to other proxies of discretionary fiscal measures commonly used in empirical studies on the effects of fiscal policy, such as the change in the (cyclically adjusted) primary or overall budget balance, our measure is much less prone to this endogeneity bias, as it does not include the impact of automatic stabilisers and other factors that are largely endogenous (like revenue windfalls/shortfalls or the large support to the financial sector granted during the previous economic and euro area sovereign debt crises). Another advantage of our measure of discretionary fiscal policy changes is its granularity which allows us to consider different types of fiscal policies, which is relevant for our purposes as fiscal policy may impact inflation through both the demand- and supply-side of the economy, depending on the fiscal measure being used.

As a baseline, we focus on the contribution to inflation arising from changes in total discretionary fiscal measures, i.e. the sum of all changes in various types of government spending and revenue components. Next, we distinguish between measures that have a more direct impact on inflation, such as indirect taxes and subsidies that have been heavily deployed by governments in their fight against the energy crisis, and the remaining set of discretionary measures that are likely to affect inflation indirectly through aggregate demand. This latter set of measures includes transfers and wage subsidies that played an instrumental role in the fiscal response to the pandemic crisis, as well as government consumption, government investment, and discretionary measures on direct taxation.[2]

We find that, since the pandemic crisis, the contribution of discretionary fiscal measures to euro area inflation has been modest yet became progressively more positive over time. This contribution of aggregate fiscal measures masks offsetting effects on inflation arising from different types of discretionary measures. In fact, when we distinguish between indirect taxes (net of subsidies) and other discretionary measures, we find that the contribution of the former to inflation has been considerably negative since the pandemic crisis until 2023. This result is in line with other model-based studies showing that 'unconventional' fiscal stimulus through cuts in net indirect taxes helped to temporarily lower inflation in the euro area (see Bańkowski et al., 2023, and Angelini et al., 2025). As the energy crisis subsided and these measures were being withdrawn, their direct negative impact on prices faded away or reversed. At the same time, the stimulative effects of these measures on consumption built up slowly over time. In contrast, the impact on inflation of discretionary fiscal measures other than net indirect taxes has been mostly positive since 2020, reaching a peak contribution to inflation of almost 1 percentage point in 2022.

Our estimates further show that discretionary fiscal measures have been a key driver of wage growth, and that wages were an important conduit for the impact of fiscal policy on inflation. Within the Bernanke-Blanchard model, wage growth and inflation are directly linked by, on the one hand, the pass-through of wage growth to inflation and, on the other hand, a 'catch-up' term that captures the possibility of workers revising upwards their wage demands when faced with higher-than-expected inflation. Moreover, to the extent that fiscal measures affect inflation and, in turn, inflation expectations, they also affect wage growth

[2] An investigation of the impact of individual fiscal instruments is currently work in progress.

indirectly as wage demands adjust to changes in expected inflation. By affecting firms' marginal costs, changes in wage growth may then partly pass through to prices, thereby further affecting inflation. Our findings on the importance of discretionary fiscal measures in driving wage growth is consistent with the large-scale support programs implemented by euro area governments during the pandemic in the form of job retention or short-time work schemes, which supported employment and preserved wages. These programs accounted for more than a quarter of the euro area fiscal packages in 2020 and remained in effect in 2021.[3] Apart from the direct effect on wages, these measures – together with other forms of social transfers to households – also contributed to higher private savings, which supported demand when the economy reopened, potentially increasing inflation persistence.

Finally, our results support earlier findings from the literature that commodity price shocks and supply shortages together explain the bulk of the recent inflation surge in the euro area, while demand-side factors, which in the model are captured by changes in labor market tightness and in our paper also through discretionary fiscal policy, played a more limited role. In this respect, our findings are consistent with those from Arce et al. (2024) for the euro area, as well as with those from Bernanke and Blanchard (2024b) for the US. Our main contribution, therefore, is to show that, in addition to the relevance of supply-side factors, fiscal policy also played a non-negligible role in shaping inflation dynamics in the euro area. Moreover, we show that distinguishing between different types of fiscal measures is important, as some measures contributed negatively to inflation, while others contributed positively, and that wage growth played an important role in transmitting the indirect effects of fiscal policy to inflation. From that perspective, our results suggest that a well-calibrated set of fiscal policy instruments can smooth the inflationary effects of adverse supply shocks and could therefore complement monetary policy in ensuring price stability.

The rest of the paper is structured as follows. Section 2 presents a brief literature review on related studies focusing on the euro area. In Section 3, we provide an overview

[3]For more details on job retention schemes specifically, and euro area governments' support during the pandemic more generally, see Haroutunian et al. (2021).

of the original Bernanke-Blanchard model and show how we extend the model by including discretionary fiscal measures. Section 4 presents the main empirical results, while Section 5 concludes with several robustness exercises.

2 Brief literature review

Since fiscal policy typically consists of many different instruments that could affect inflation through both the supply- and demand side of the economy, it is not straightforward to assess its contribution to the post-pandemic rise in inflation. Currently, there is very limited empirical evidence on the relative contribution of fiscal policy to inflation dynamics in the euro area, compared to other drivers of inflation. Ascari et al. (2024a) use a Bayesian VAR on euro area data over the period 2002Q1 to 2023Q4 and find that expansionary fiscal policy shocks have been an important driver of inflation during the recent inflationary episode and the contribution of these shocks increased gradually over time and persisted even during the disinflation period.[4]

Recent model-based investigations of the impact of fiscal policy on inflation in the euro area, compared to a counterfactual of 'no fiscal policy change', point to a substantial degree of fiscal support to the economy, especially during the pandemic crisis.[5] Using proxies for discretionary fiscal policy measures adopted by euro area governments since the pandemic crisis – disaggregated by main fiscal instruments – such analyses find overall some upward effects on inflation from fiscal policy (Bańkowski et al., 2023 and Angelini et al., 2025). So-called 'non-conventional' energy and inflation compensatory fiscal measures adopted in response to the energy crisis, following Russia's invasion of Ukraine, are found to have reduced inflation in 2022, but also increased its persistence due to the eventual reversal of the measures and because the impact of income support measures on inflation only gradually

[4]The authors include 6 variables in their BVAR model (real GDP growth, HICP inflation, shadow rate, GSCPI, real Brent oil price, primary budget deficit), identify the shocks using sign restrictions, and apply the Lenza-Primiceri method used to adjust the residual covariance matrix.

[5]This fiscal support also led to higher deficits and government debt levels, which in many countries and at the euro area aggregate, are still above pre-pandemic levels and continue increasing.

developed over time.

Furthermore, several recent papers find evidence of fiscal stimulus shocks having a positive effect, not only on inflation, but also on inflation expectations (Coibion et al., 2021; Grigoli and Sandri, 2023; Baumann et al., 2025). This effect is particularly pronounced in times of high public debt or when the monetary policy stance is relatively more expansionary (Cevik and Miryugin, 2025; Eminidou et al., 2023; Checherita-Westphal and Pesso, 2024).

3 Extending the Bernanke-Blanchard model

In this section, we first provide a brief overview of the original model proposed by Bernanke and Blanchard. We then discuss how we extend the model with discretionary fiscal policy measures and the data that we used to estimate the model.

3.1 A brief overview of the original Bernanke-Blanchard model

The original Bernanke-Blanchard model (henceforth referred to as the BB model) is a semi-structural model consisting of four equations which describe the dynamics of four endogenous variables: (1) wage growth, (2) inflation, (3) short-term inflation expectations, and (4) long-term inflation expectations. The model is a reduced-form representation of a more structural model of wage- and price-setting by households and firms that takes into account various interdependencies between the endogenous variables. The equations for wage growth and inflation include product- and labor market shocks that are likely to be relevant drivers of inflation. As we will explain in more detail below, it is in this part of the model where we introduce our proxies for discretionary fiscal policy measures.

$$\begin{aligned}\pi_{w,t} = c_w + \sum_{k=1}^{4} \rho_{w,k}\pi_{w,t-k} + \sum_{k=1}^{4} \beta_k vu_{t-k} + \sum_{k=1}^{4} \delta_{w,k}\pi^e_{t-k} \\ + \kappa_w A_{t-1} + \sum_{k=1}^{4} \alpha_k cu_{t-k} + \iota_w D_t + u_{w,t}.\end{aligned} \tag{1}$$

The wage growth equation is shown in Equation (1) and relates nominal wage growth, $\pi_{w,t}$, to a measure of labor market tightness, vu_t, short-term inflation expectations, π_t^e, labor productivity, A_t, and a 'catch-up' term, cu_t, that captures the impact of higher-than-expected inflation on workers' wage demands. All these factors are expected to drive wages upward. A tighter labor market prompts firms to raise wages to attract or retain workers. Higher inflation expectations push workers to demand higher wages to maintain their purchasing power. Increased labor productivity raises the marginal product of labor, lifting equilibrium wages. Additionally, when inflation exceeds expected inflation, workers seek compensation for lost real income, with the strength of this catch-up effect depending on workers' bargaining power and the size of the inflation surprise. The variable D_t (which we shall label as "Lockdown" when presenting the historical decompositions) is a dummy that equals 1 in the second and third quarters of 2020 and zero otherwise, and is included to absorb some of the heightened volatility in wage growth observed at the height of the pandemic. The wage growth equation features a rich lag structure, allowing wage growth to depend on past values of itself and of the explanatory variables. Underlying the fact that all explanatory variables enter with a lag is the assumption that wages adjust only gradually due to fixed wage contracts. In the long run, nominal wages are assumed to move one-to-one with expected inflation, as workers eventually anticipate inflation accurately, ensuring real wages remain stable. This assumption implies a vertical long-run Phillips curve, i.e. $\sum_{k=1}^{4} \rho_{w,k} + \sum_{k=1}^{4} \delta_{w,k} = 1$.[6]

$$\pi_t = c_p + \sum_{k=1}^{4} \rho_{p,k}\pi_{t-k} + \sum_{k=0}^{4} \mu_k \pi_{w,t-k} + \sum_{k=0}^{4} \eta_k \pi_{EN,t-k} + \sum_{k=0}^{4} \xi_k \pi_{F,t-k} \tag{2}$$
$$+ \sum_{k=0}^{4} \chi_k \text{shortage}_{t-k} + \kappa_p A_t + u_{p,t}.$$

The inflation equation, shown in Equation (2), relates inflation, π_t, to wage growth, energy and food price inflation (relative to wage growth), $\pi_{EN,t}$ and $\pi_{F,t}$, supply shortages, shortages$_t$, and productivity growth. Higher wages raise firms' marginal costs, prompting

[6] All our results are robust to relaxing this homogeneity constraint that implies the vertical long-run Phillips curve.

price increases to maintain profit margins. However, the extent of this pass-through depends on factors like market competition and firms' ability to absorb costs into their profit margins. Supply shortages, e.g. due to supply chain disruptions or rising shipping costs, may also drive up prices, especially when an economy relies heavily on global supply chains. Energy and food price hikes directly affect the aggregate consumption price level, as energy and food are part of the household's consumption basket. These commodity shocks can also have indirect effects, such as cost-driven price increases by firms or wage demands aimed at preserving purchasing power. To separate the direct effects from these second-round effects on inflation of commodity price shocks, energy and food prices are deflated by nominal wages. Note that, while energy and food prices are assumed to be exogenous in the model, the ratio of energy and food prices to wages adjusts endogenously throughout the simulations. This endogeneity will also enable an additional channel in the fiscal transmission mechanism of our extended model. Higher productivity growth, in contrast, reduces marginal costs and therefore is expected to lower prices. Like the wage growth equation, the inflation equation includes lagged values of both dependent and independent variables, and assumes a vertical long-run Phillips curve, i.e. $\sum_{k=1}^{4} \rho_{p,k} + \sum_{k=0}^{4} \mu_k = 1$, ensuring price growth aligns one-to-one with wage growth over time.

$$\pi_t^* = \sum_{k=1}^{4} \rho_{\pi^*,k} \pi_{t-k}^* + \sum_{k=0}^{4} \Gamma_k^* \pi_{t-k} + u_{\pi^*,t}. \tag{3}$$

$$\pi_t^e = \sum_{k=1}^{4} \rho_{\pi^e,k} \pi_{t-k}^e + \sum_{k=0}^{4} \Upsilon_k \pi_{t-k}^* + \sum_{k=0}^{4} \Gamma_k \pi_{t-k} + u_{\pi^e,t}, \tag{4}$$

The equation describing long-term inflation expectations, Equation (3), relates long-term inflation expectations, π_t^*, to their own lags and actual inflation. This equation helps to assess how strongly inflation expectations are anchored, which will depend both on the persistence in long-term inflation expectations and their sensitivity to actual inflation. Finally, the dynamics of short-term inflation expectations are described by Equation (4), which relates short-term inflation expectations, π_t^e, to actual inflation and long-term inflation expectations.

Equation (4) reflects how agents are likely to predict inflation in the short term based on recent inflation developments, while also anchoring their expectations partly on some long-run value they believe inflation will eventually converge to. The assumption of a long-run Phillips curve implies $\sum_{k=1}^{4} \rho_{\pi^*,k} + \sum_{k=0}^{4} \Gamma_k^* = 1$ and $\sum_{k=1}^{4} \rho_{\pi^e,k} + \sum_{k=1}^{4} \Upsilon_k + \sum_{k=1}^{4} \Gamma_k = 1$.

3.2 Model extension with discretionary fiscal measures

In our effort to extend the BB model, we take a parsimonious, yet theoretically grounded, approach. We keep the size of the system the same at four equations, to maintain the tractability of the original model, and simply add an additional term that captures discretionary fiscal measures to two equations: the wage growth equation and the inflation equation. Specifically, let dm_t denote a series of discretionary measures. The wage growth and inflation equations in the extended BB model are then given by Equations (5) and (6):

$$\pi_{w,t} = c_w + \sum_{k=1}^{4} \rho_{w,k}\pi_{w,t-k} + \sum_{k=1}^{4} \beta_k vu_{t-k} + \sum_{k=1}^{4} \delta_{w,k}\pi^e_{t-k} \tag{5}$$

$$+ \kappa_w A_{t-1} + \sum_{k=1}^{4} \alpha_k cu_{t-k} + \iota_w D_t + \sum_{\boldsymbol{k=1}}^{\boldsymbol{5}} \boldsymbol{\omega_{w,k} dm_{t-k}} + u_{w,t},$$

$$\pi_t = c_p + \sum_{k=1}^{4} \rho_{p,k}\pi_{t-k} + \sum_{k=0}^{4} \mu_k \pi_{w,t-k} + \sum_{k=0}^{4} \eta_k \pi_{EN,t-k} + \sum_{k=0}^{4} \xi_k \pi_{F,t-k} \tag{6}$$

$$+ \sum_{k=0}^{4} \chi_k \text{shortage}_{t-k} + \kappa_p A_t + \sum_{\boldsymbol{k=0}}^{\boldsymbol{5}} \boldsymbol{\omega_{p,k} dm_{t-k}} + u_{p,t}.$$

In keeping with the spirit of the original BB model, in which wage growth is affected only by lagged values of the various shocks, we assume that discretionary measures have no contemporaneous effect on wage growth, yet only a lagged effect. Moreover, and in contrast to the BB model, we allow five, instead of four, lags of the discretionary measures to enter the wage growth equation to capture the fact that fiscal policy often faces substantial implementation delays and restrictions that cause its impact on the economy to develop only slowly over time.[7] In the inflation equation, discretionary measures do enter contemporaneously,

[7]While allowing discretionary measures to enter the wage growth inflation contemporaneously does not

just like the other explanatory variables in that equation, and also enter with 5 lags.[8]

Inclusion of the discretionary fiscal measures in the inflation equation helps to capture the impact on inflation of fiscal measures that have both direct price effects, such as indirect taxes and energy subsidies that reduce the marginal cost of energy consumption, as well as indirect effects that arise through their impact on aggregate demand, such as government consumption and transfers to households. Both these direct and indirect effects may also operate through wage growth, which is why the discretionary measures are included in the wage growth equation. For some fiscal measures, this 'wage channel of fiscal policy' is more evident, for example when the government introduces wage subsidies and job-retention schemes or raises public employment that affect wage growth and inflation more directly. For other fiscal measures, the wage channel may capture the indirect impact of fiscal policy on wage growth through their impact on inflation expectations. For instance, in the event of an increase in energy prices, when governments announce a reduction in the VAT on energy consumption, workers may adjust downwards their expectations on the impact of the energy price shock on consumer price inflation, which in turn may cause them to lower their short-term inflation expectations and, in turn, moderate their wage demands (see e.g. D'Acunto et al., 2018). This dampening effect on wage growth could then also work to partly offset the impact of the energy price shock and dampen price pressures, which further helps to reduce (short- and long-term) inflation expectations and wage growth.

3.3 Data

We use quarterly data for the euro area aggregate that covers the period 1999Q1 to 2023Q2. Our main variable of interest, i.e. the discretionary fiscal policy measures, is a proxy based on

qualitatively affect our results, using 4 instead of 5 lags does have more material implications. With just 4 lags, the model suggests a weaker contribution to inflation from discretionary fiscal measures, especially when the sample is extended to 2024Q3 as done in one of our robustness exercises. This suggests that not taking proper account of the potentially long lags of fiscal policy transmission may result in a significant underestimation of the macroeconomic effects of fiscal policy.

[8]Experimenting with alternative lag structures for the inflation equation does not significantly alter our main results.

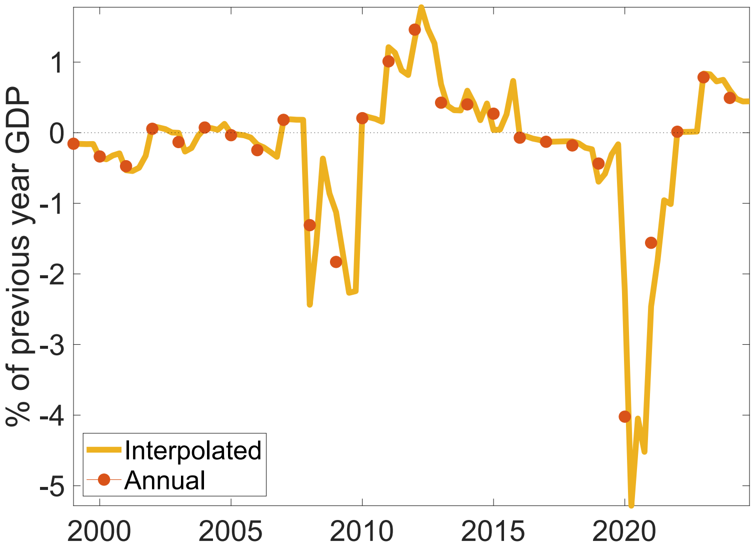
estimates from the Eurosystem's Working Group of Public Finance (WGPF).[9] This annual series is constructed based on a narrative, country-specific and measure-by-measure approach on the revenue side and by benchmarking the growth rate of three relevant expenditure categories, i.e. government consumption, government investment and discretionary transfers, to nominal potential growth. More specifically, on the revenue side, changes in taxes and social security contributions in each year t are documented measure-by-measure and then aggregated using the ex-ante budgetary costs (i.e. excluding second-round macroeconomic effects) as estimated by WGPF experts. On the expenditure side, the method involves classifying a measure as discretionary fiscal stimulus (consolidation) when the expenditure item in nominal terms at year t is above (below) the level that would have prevailed if the item in $t-1$ had grown at the same rate as nominal potential GDP. The proxy on fiscal transfers excludes spending on unemployment benefits, which respond directly to current cyclical fluctuations (apart from the ex-ante fiscal impact of specific changes in legislation), as well as the (large and temporary) capital transfers to financial institutions that were granted from 2007 onwards in response to the global financial and euro area sovereign debt crisis. These proxies for discretionary fiscal policy measures are regularly used in the ECB/Eurosystem macroeconomic forecasting and simulation models to evaluate the impact of fiscal assumptions on growth and inflation.[10] The discretionary measures are calculated at the country level and, for the purpose of the present paper, are aggregated at the euro area level.

To estimate the extended BB model with quarterly data, we convert the annual series for the discretionary measures to a quarterly frequency using an interpolation based on the quarterly time profile of the primary budget balance. Specifically, for each year, we calculate the annual sum of the primary balance and the weight of each quarterly observation within that year. We then use these weights to distribute the discretionary measures over the

[9]See also Checherita-Westphal and Pesso (2024) for another recent study using this data.

[10]For more details on the size of the discretionary measures and their composition across five broad instruments (government consumption, government investment, fiscal transfers, indirect taxes, and direct taxes and social security contributions) at the euro area aggregate level over recent years, see Checherita-Westphal (2023) and Angelini et al. (2025).

Figure 1: Aggregate discretionary fiscal measures, euro area



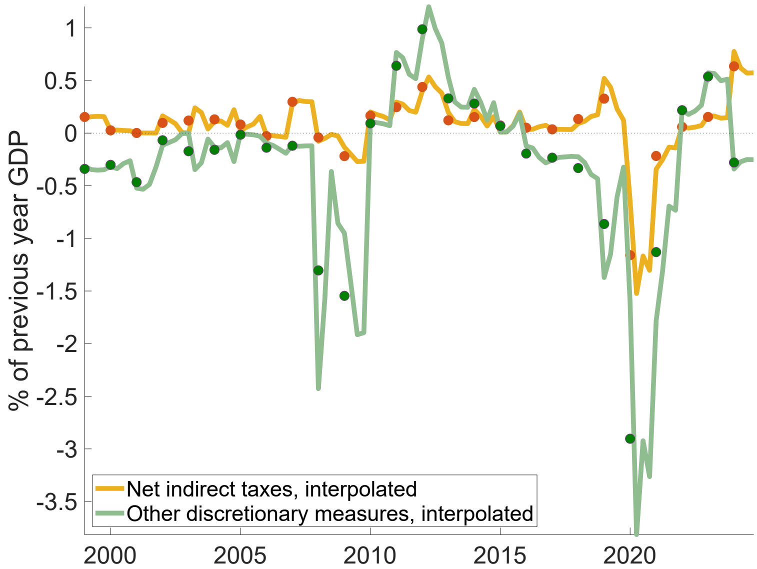
Source: Eurosystem/ECB Database on discretionary fiscal policy measures and own calculations. Negative (positive) numbers denote fiscal stimulus (tightening).

different quarters within the corresponding year. Figure 1 plots the annual and quarterly interpolated total discretionary fiscal measures for the euro area aggregate. The figure shows that the amount of discretionary fiscal loosening during the pandemic crisis has been around twice as large as that observed during the global financial crisis, reaching an unprecedented peak of 4% of GDP in 2020. Given its enormous size, this change in the fiscal stance clearly warrants a thorough investigation into how fiscal policy might have affected inflation.

In addition to examining the impact of the overall sum of discretionary measures, we also distinguish between different types of measures. In particular, we isolate from the overall measures those measures that can be labeled as indirect taxes, net of subsidies. Doing so may be important for our purposes, as net indirect taxes are likely to affect prices more directly compared to other discretionary measures. Figure 2 plots the annual and quarterly interpolated series for the net indirect taxes and for the rest of the discretionary measures. The figure shows that, in the past two decades, discretionary changes in net indirect taxes have been much less common than discretionary changes in other fiscal measures yet became more pronounced during the pandemic crisis.

For the remaining variables, we follow closely Arce et al. (2024). Wage growth is mea-

Figure 2: Net indirect taxes and other discretionary fiscal measures, euro area



Source: Eurosystem/ECB Database on discretionary fiscal policy measures and own calculations. Negative (positive) numbers denote fiscal stimulus (tightening).

sured by the annualized quarter-on-quarter growth rate of negotiated wages. Note that negotiated wages are less likely to be distorted by job retention schemes employed during the pandemic crisis than alternative wage measures, such as compensation per employee. Inflation is measured by the annualized quarter-on-quarter growth rate of the harmonized consumer price index (HICP). Data on short- and long-term inflation expectations are taken from Consensus Economics and the Survey of Professional Forecasters and measured by, respectively, the 1-year and 6-to-10-year ahead inflation forecasts. Labor market tightness is measured by the vacancy-to-unemployment ratio (backcasted using the European Commission's labor shortage indicator), which is likely to be a better gauge of labor demand pressures than the (more commonly used) unemployment rate, especially in times of large sectoral shifts and when matching efficiency within the labor market deteriorates. Energy and food price inflation are measured by the energy and food price components of the HICP and are deflated by the nominal wage to separate the direct effects from the second-round effects of commodity price shocks. Productivity growth is calculated as the eight-quarter moving average of gross value added per hour worked. Supply shortages are captured by the

Table 1: Description and sources of data

Variable	Description	Source
π_w	Negotiated wages	ECB
π	HICP	ECB
π^e	1-year ahead inflation forecast	CE
π^*	6-to-10-year ahead inflation forecast	SPF
vu	Vacancy-to-unemployment ratio, z-score	ECB
cu	Surprise inflation, $\frac{1}{4}\sum_{k=1}^{4}\pi_{t-k}-\pi^e_{t-k}$	Own calculations
A	GVA-to-employment ratio, 8-quarter MA of quarterly change	ECB
π_{EN}	HICP energy, relative to wages	ECB
π_F	HICP food (including alcohol and tobacco), relative to wages	ECB
shortage	Global Supply Chain Pressure Index, z-score	NYF
dm	Discretionary fiscal measures, % of GDP from previous year	ECB

Notes: π_w, π, π_{EN} and π_F are expressed in annualized quarter-on-quarter growth rates. ECB = European Central Bank; CE = Consensus Economics; SPF = Survey of Professional Forecasters; NYF = Federal Reserve Bank of New York.

Global Supply Chain Pressure Index constructed by the Federal Reserve Bank of New York. Finally, the catch-up term is defined as the difference between average inflation over the past four quarters and short-term inflation expectations from the previous year. A summary of the data and their sources is provided in Table 1.

4 Results

4.1 Estimation results

As a starting point, we use the same sample, i.e. from 1999Q1 to 2023Q2, that was used by Arce et al. (2024), who estimated the original BB model on euro area aggregate data. Such a comparison helps to better identify the added value of extending the model with discretionary fiscal measures. Tables 2 and 3 report the estimated coefficients of both the original and extended BB model for, respectively, the wage growth and inflation equation.[11]

[11]The coefficient estimates for the short- and long-term inflation expectations equations are reported in Tables 4 and 5 in the Appendix.

Table 2: Wage growth equation, 1999Q1-2023Q2

		Dependent variable: wage growth							
		L. Wage growth	Labor market tightness	Catch-up variable	Short-term inflation exp.	Prod. growth	DM	NIT	REST DM
Baseline without DM	Sum of coefficients	0.309	0.873	0.066	0.691	0.075			
	p(sum)	0.126	0.566	0.595	0.001	0.288			
	p(joint)	0.285	0.147	0.003	0.000	0.288			
	Adjusted R^2	0.651							
With overall DM	Sum of coefficients	0.187	0.285	0.007	0.813	0.096	-0.158		
	p(sum)	0.360	0.862	0.958	0.000	0.173	0.090		
	p(joint)	0.194	0.070	0.001	0.000	0.173	0.002		
	Adjusted R^2	0.716							
With disaggregated DM	Sum of coefficients	0.180	-0.164	0.041	0.820	-0.227		0.017	-0.227
	p(sum)	0.429	0.923	0.752	0.001	0.253		0.970	0.242
	p(joint)	0.195	0.152	0.001	0.000	0.253		0.367	0.001
	Adjusted R^2	0.728							
	Obs.	89							

Notes: DM = discretionary measures; NIT = net indirect taxes; RESTDM = discretionary measures minus net indirect taxes. p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

Table 3: Inflation equation, 1999Q1-2023Q2

	Dependent variable: inflation									
		L. Inflation	Wage growth	Energy price	Food price	Shortage	Prod. growth	DM	NIT	REST DM
Baseline without DM	Sum of coefficients	0.687	0.313	0.038	0.013	0.216	0.073			
	p(sum)	0.000	0.060	0.040	0.872	0.034	0.213			
	p(joint)	0.001	0.115	0.000	0.000	0.050	0.213			
	Adjusted R^2	0.964								
With overall DM	Sum of coefficients	0.386	0.614	0.049	0.153	0.164	-0.011	-0.010		
	p(sum)	0.078	0.006	0.011	0.116	0.163	0.873	0.905		
	p(joint)	0.158	0.011	0.000	0.000	0.044	0.873	0.034		
	Adjusted R^2	0.968								
With disaggregated DM	Sum of coefficients	0.387	0.613	0.048	0.153	0.187	-0.011		0.186	-0.006
	p(sum)	0.111	0.013	0.025	0.143	0.133	0.881		0.550	0.966
	p(joint)	0.250	0.031	0.000	0.000	0.088	0.881		0.707	0.246
	Adjusted R^2	0.965								
	Obs.	90								

Notes: DM = discretionary measures; NIT = net indirect taxes; RESTDM = discretionary measures minus net indirect taxes. p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

We find that overall discretionary fiscal policy measures (labeled as “DM”) have a negative and statistically significant impact on both wage growth and inflation. The size of this overall impact seems relatively modest: an increase by 1 percentage point of GDP in discretionary measures (which constitutes a fiscal tightening) reduces wage growth by 0.16 p.p. and inflation by 0.01 p.p. When disaggregating the discretionary measures, we find a much stronger (and more significant) impact from both net indirect taxes (“NIT”) and the rest of the discretionary measures (“RESTDM”) on wage growth and inflation. Extending the BB model with discretionary measures helps to improve the fit of the wage growth equation, especially when using the disaggregated measures, as evidenced by the higher adjusted R^2. For inflation, however, the disaggregation of discretionary measures results in the coefficients on both subgroups to become insignificant. Moreover, adding discretionary measures does little to improve the model fit of the inflation equation (which is not too surprising, given that the adjusted R^2 for the baseline BB model already stands very high at 0.96). Note, however, that wage growth has a substantial and significant effect on inflation in all three models. Therefore, it seems that, in the euro area and over the sample period that we consider, discretionary fiscal measures affected inflation directly, but also indirectly through its effect on wages.

With regards the other driving forces of wage growth and inflation, we find similar results as in Arce et al. (2024). For the wage growth equation, we find a flat Phillips curve, a significant impact arising from short-term inflation expectations and a negligible role for surprise inflation and labor productivity growth. For the inflation equation, we find a significant relationship with commodity prices, a significant role for supply shortages and an insignificant contribution from productivity growth. Hence, augmenting the BB model with our series of discretionary fiscal measures does not change the overall conclusions from earlier studies that point to the importance of supply-side factors in driving inflation dynamics in the euro area. At the same time, it reveals how fiscal policy has been an important driver as well and suggests that wage growth is likely to have been an important conduit through which fiscal policy impacts inflation. Moreover, as we will show in the model-implied historical shock decompositions, adding the fiscal policy variables reduces the contribution of other factors in explaining wage growth and inflation. More specifically, the contributions of labor market tightness and supply shortages to wage growth declines, while the contributions of shortages and food prices to inflation seem to be most affected. To quantify the contribution of discretionary fiscal policy measures to inflation while taking into account the interdependencies between all the endogenous variables in the model, we now turn to the model-implied historical shock decompositions.

4.2 Model-based simulations

Figures 3 through 6 show the decompositions of the endogenous variables of the extended BB model into their various sources over the post-pandemic period.[12] These decompositions take into account the full dynamic and general equilibrium effects inherent in the model. For example, changes in discretionary measures may impact inflation indirectly through their effect on wage growth. As realized inflation partly affects inflation expectations, discretionary measures may then have a further knock-on effect on wages as these are also influenced by changes in inflation expectations.

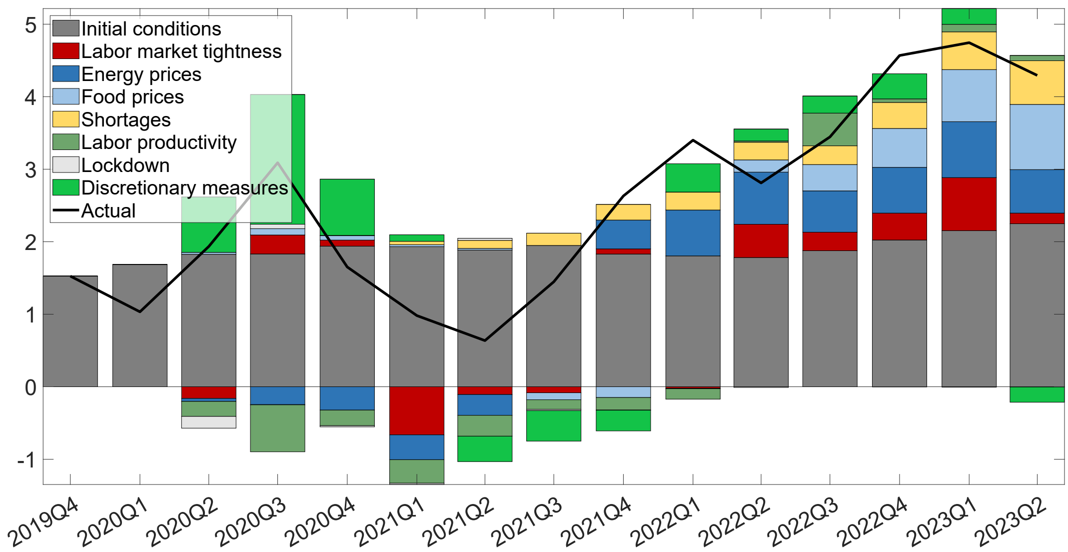
Figure 3 shows that discretionary measures have been a particularly important driver of wage growth in the midst of the pandemic (green bars). This is not surprising, given the wide use of wage subsidies, and job retention schemes more generally, that supported wage growth during that time, even as labor market conditions deteriorated. As the economy recovered from the pandemic and fiscal support was gradually being rolled back, improved labor market conditions became a relatively more important driver of wage growth dynamics in the euro area (red bars). Note that, during the energy crisis, relative energy and food prices were putting substantial upward pressure on wages.

[12]For comparison purposes, we plot the decompositions of all endogenous variables for the original BB model without discretionary measures in Figures 12 to 15 in the Appendix. As mentioned above, this also allows us to assess the change in the contributions of other factors after controlling for the discretionary fiscal policy measures.

Discretionary fiscal measures also played a non-trivial role in driving inflation dynamics, see Figure 4. In the years following the pandemic, the contribution of discretionary measures became progressively more positive, with an average contribution to inflation of around 0.4 p.p. in 2021 and almost 1 p.p. in 2022. Thereafter, the fiscal contribution to inflation declined to an average of 0.3 p.p. in 2023. This time profile is consistent with the hump-shaped response of economic aggregates to fiscal shocks and closely resembles the dynamic contribution of fiscal shocks to euro area inflation in recent years shown by Ascari et al. (2024a). As discussed earlier, the impact of fiscal policy on inflation is likely to have been amplified by the wage channel, which works through the interaction between wage growth, realized inflation and inflation expectations as implied by the model. Indeed, Figure 5 shows a notable contribution from discretionary fiscal measures on short-term inflation expectations in the years following the pandemic. However, as shown by Figure 6, long-term inflation expectations have remained remarkably stable, even as realized inflation reached historically high levels. The limited role of both discretionary measures and the other shocks in driving long-term inflation expectations confirms the strong anchoring of inflation expectations in the euro area.

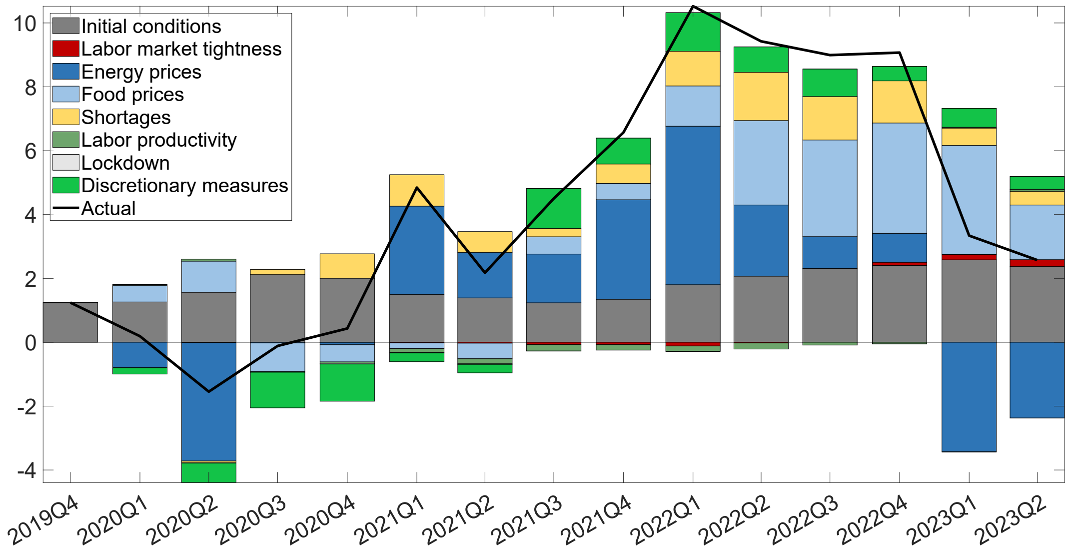
Our results show that, overall, discretionary fiscal policy measures have been an important driver of euro area inflation. However, they do not overturn the conclusions from the results of the original BB model that commodity prices have been the dominant source of the recent inflation surge and that demand-side factors played a smaller, yet increasingly more important, role.

Figure 3: Sources of euro area wage growth



Notes: The figure shows a decomposition of the sources of wage growth, based on the solution of the extended BB model. Bars show the contributions of the various shocks in each quarter. Effects of equation residuals are omitted. The grey bars (initial conditions) show predicted values in the absence of shocks from 2020Q1 onward.

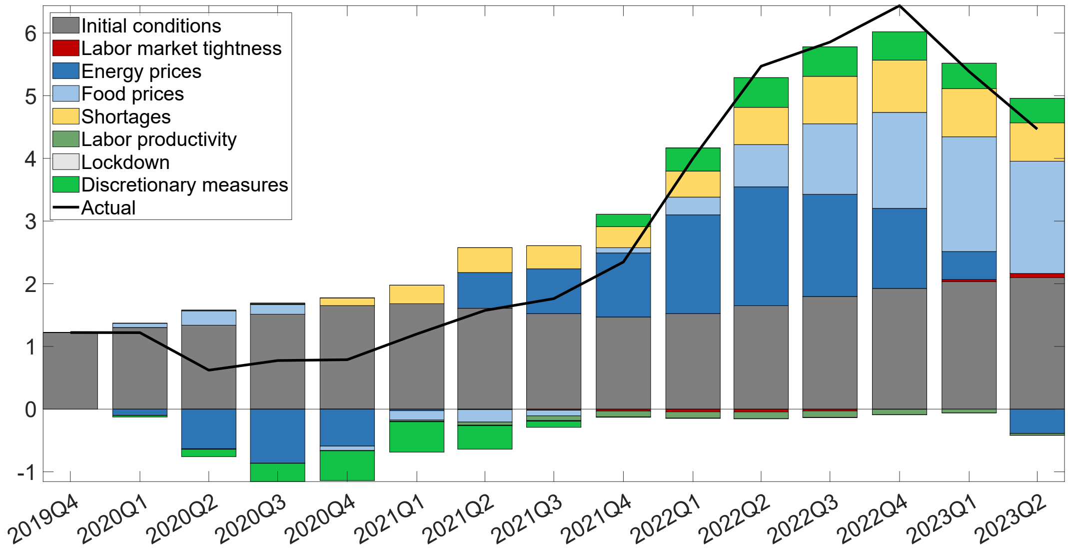
Figure 4: Sources of euro area inflation



Notes: See notes under Figure 3.

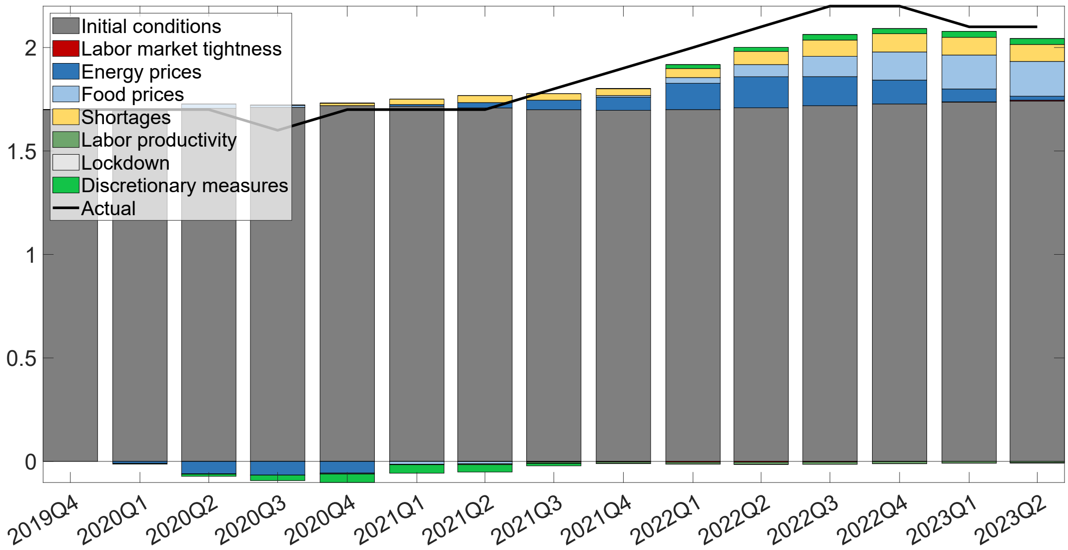
Figures 7 and 8 show the decomposition of euro area wage growth and inflation, respectively, as implied by the BB model featuring disaggregated discretionary fiscal measures (to preserve space, we relegate the corresponding decompositions for the other two endogenous variables to Figures 16 and 17 in the Appendix). Compared to Figures 3 and 4, these figures paint a more nuanced picture on the inflationary consequences of fiscal policy, showing that

Figure 5: Sources of euro area short-term inflation expectations



Notes: See notes under Figure 3.

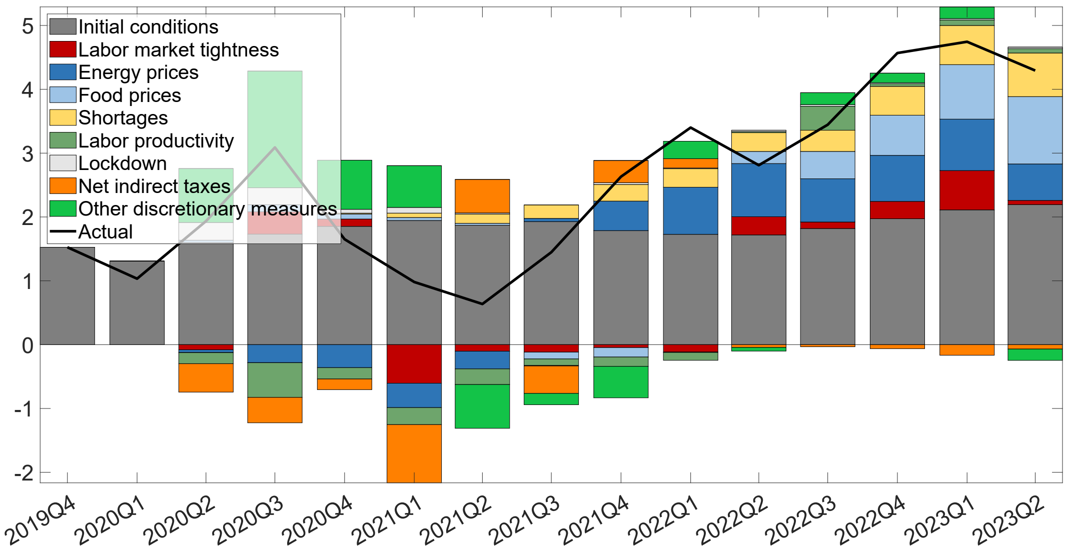
Figure 6: Sources of euro area long-term inflation expectations



Notes: See notes under Figure 3.

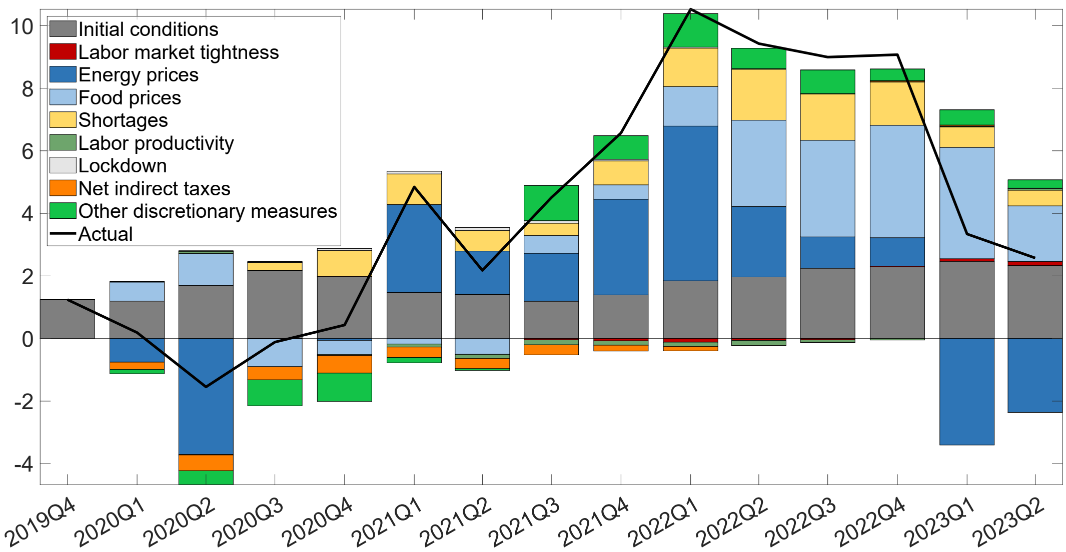
net indirect taxes contributed negatively to both wage growth and inflation in the post-pandemic years (orange bars), thereby offsetting partly the positive contributions arising from other discretionary measures during that time (green bars). These results imply that, while fiscal policy exerted an overall positive effect on inflation, some measures that impacted prices more directly, such as changes in VAT, also helped smooth out and contain the inflation profile over time, for instance by containing wage growth. Seen from that perspective, fiscal policy, when calibrated correctly, can be a powerful complement to monetary policy in the pursuit for macroeconomic stability when the economy faces large adverse supply shocks, as a myriad of different types of discretionary fiscal measures can be deployed to address different kinds of macroeconomic challenges.

Figure 7: Sources of wage growth and disaggregated discretionary measures



Notes: See notes under Figure 3.

Figure 8: Sources of inflation and disaggregated discretionary measures

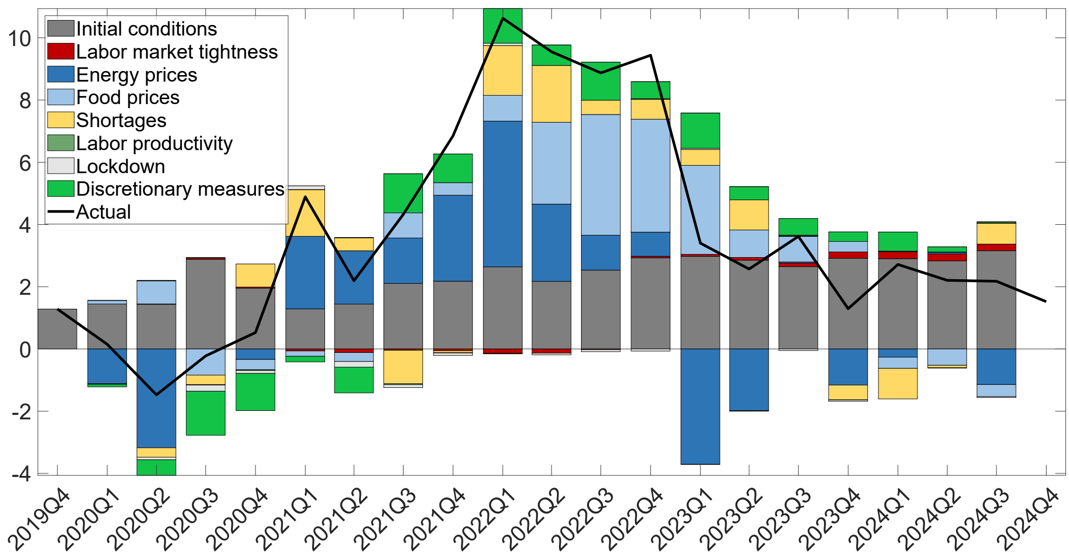


Notes: See notes under Figure 3.

5 Robustness and areas for future work

In this section, we briefly discuss the results from several robustness exercises. The first and most straightforward exercise is to extend the dataset up to 2024Q3, the latest quarter for which all data is available at the time of writing. Figure 9 shows the shock decomposition for inflation using this extended dataset. The results are both qualitatively and quantitively very similar to our main results shown in Figure 4, with the contribution of overall discretionary measures on inflation becoming progressively more positive following the pandemic crisis, and gradually declining towards the end of the sample. The conclusions remain robust for the disaggregated fiscal policy measures and their impact on the other endogenous variables (to preserve space, we move the respective results to the Appendix, see Figures 18 to 21). Tables 6 and 7 in the Appendix further show that the coefficient estimates for the wage growth and inflation equations also do not change much when the model is estimated with this longer sample. If anything, these estimates point to a slightly stronger relationship between, on the one hand, discretionary fiscal measures and, on the other hand, wage growth and inflation.

Figure 9: Sources of inflation using data until 2024Q3

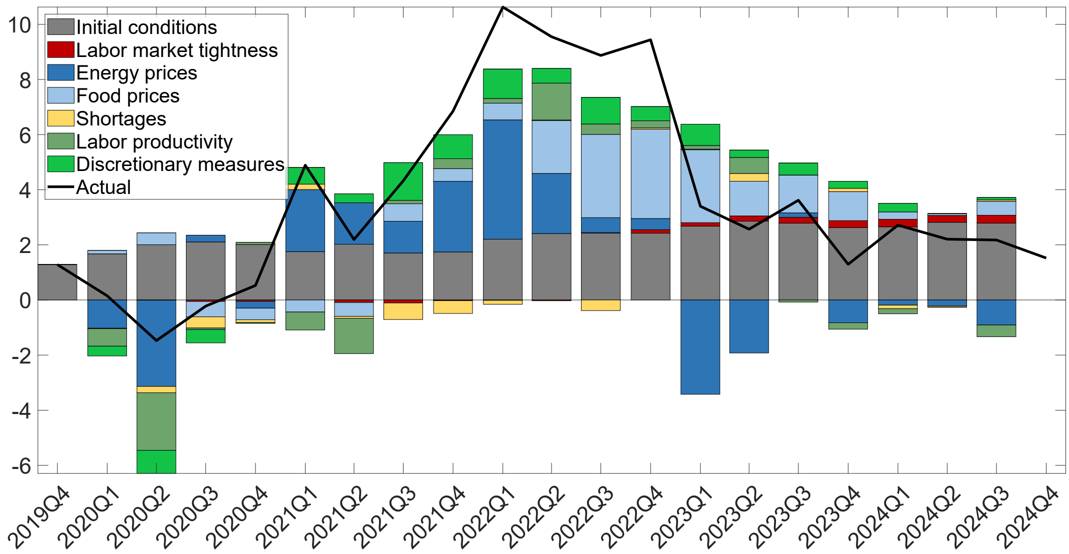


Notes: See notes under Figure 3.

Next, we estimate the model using pre-COVID data to avoid the unusual residual volatility observed during the pandemic years that may bias our results. The results, shown in

Figure 10, show again that our main results hold up, with discretionary measures having a positive and non-trivial contribution to inflation. A striking difference with our baseline results is that the contribution to inflation stemming from fluctuations in supply shortages becomes negligible, which may be due to the fact that, before the large global supply chain disruptions that occurred during the pandemic crisis, supply chains have remained relatively stable since 1999.

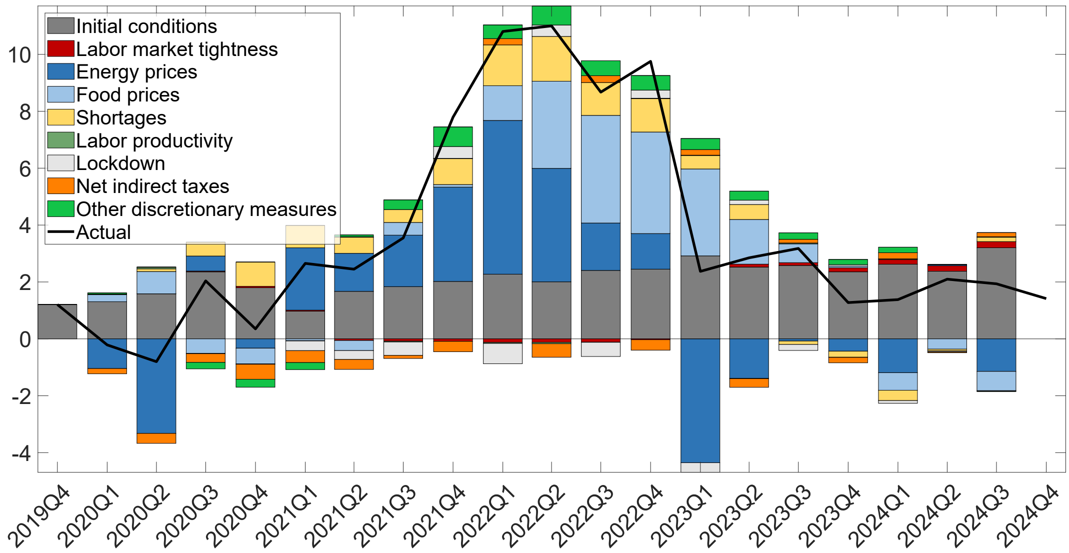
Figure 10: Sources of inflation using pre-COVID data



Notes: See notes under Figure 3.

Finally, an important robustness check relates to the fact that energy and food prices, which are used as exogenous shocks (before being deflated by nominal wages), are in fact final prices that are themselves directly affected by fiscal policy measures, such as indirect taxes (energy taxes and VAT). In this way, our decomposition may misrepresent the contribution of these factors. This may be particularly the case for the years 2022 and beyond, given governments' large responses to the energy crisis and the ensuing inflationary pressures. We thus aim to clean the energy and food price data for the direct fiscal impacts and use series for these two variables at constant taxes, available from Eurostat. These series are not available for the entire sample that we consider: for HICP and HICP energy, they start from December 2002, while for HICP food it starts from December 2012. We use growth rates of the seasonally adjusted standard series to backcast the tax-constant series. Results with the constant tax series are broadly in line with our main results (see Figure 11). We continue to see negative inflation contributions from net indirect taxes and positive contributions from other discretionary measures. Some quarters exhibit positive contributions from net indirect taxes also in 2022, but overall annual contributions remain negative and do not turn positive until 2024 when these measures have started to reverse.

Figure 11: Sources of inflation using constant tax price indices



Notes: See notes under Figure 3.

Other extensions that we consider for future work include, first, to endogenize labor market tightness in the model. This is an important feature of the economy that is likely to be affected by fiscal policy and, in turn, impacts wages and inflation.

Second, we plan to go into more granular detail with regards to the pandemic-related support by pinning down specifically the role of short-term work schemes versus other types of support. Analyzing more closely the consequences of withdrawing that support and partly replacing it with measures intended to lower the cost of energy for firms and support the purchasing power of households during the energy crisis could also help in clarifying the various transmission channels of fiscal policy to inflation.

Third, controlling for (proxies of) monetary policy shocks would allow to better identify the relative contribution of demand-side policies to inflation. Indirectly, the effects of monetary policy (credibility) are already reflected in the model through the equation that pins down long-term inflation expectations.

Finally, as suggested in Bernanke and Blanchard (2024a), of more narrow interest would be the reconciliation of the estimates for the euro area aggregate with those of the individual euro area member countries. This investigation would be particularly important from a fiscal perspective, given that fiscal policies are conducted at an individual country level and initial fiscal positions, especially debt burdens, may also play a role in the transmission of fiscal and monetary policy. Our analysis is still relevant as it stands, given that, from a monetary policy perspective, we are interested in the fiscal policy impact on euro area-wide inflation.

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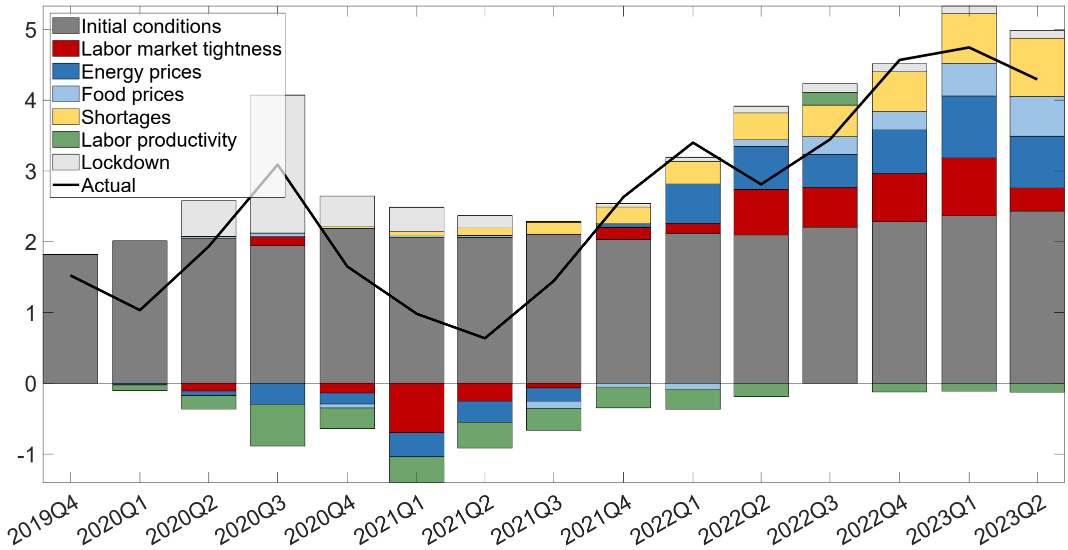
A Appendix

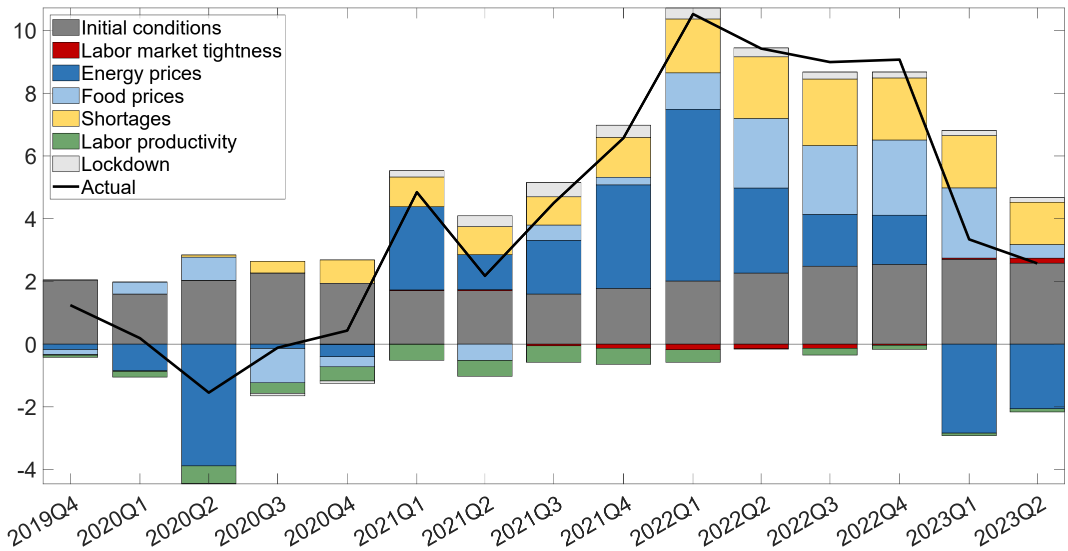
A.1 Additional tables and figures

Figure 12: Sources of euro area wage growth without discretionary measures



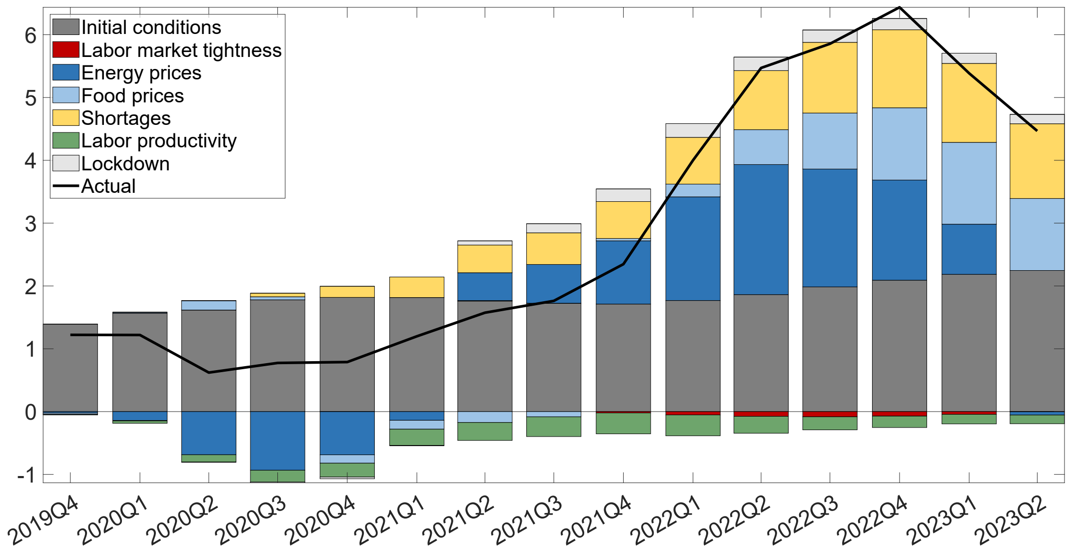
Notes: See notes under Figure 3.

Figure 13: Sources of euro area inflation without discretionary measures



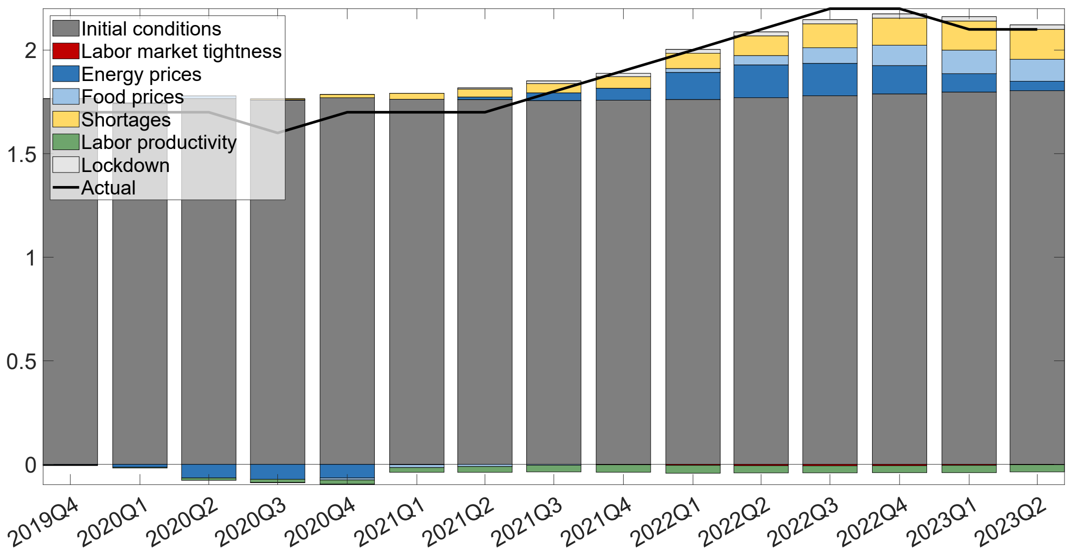
Notes: See notes under Figure 3.

Figure 14: Sources of euro area short-term inflation expectations without discretionary measures



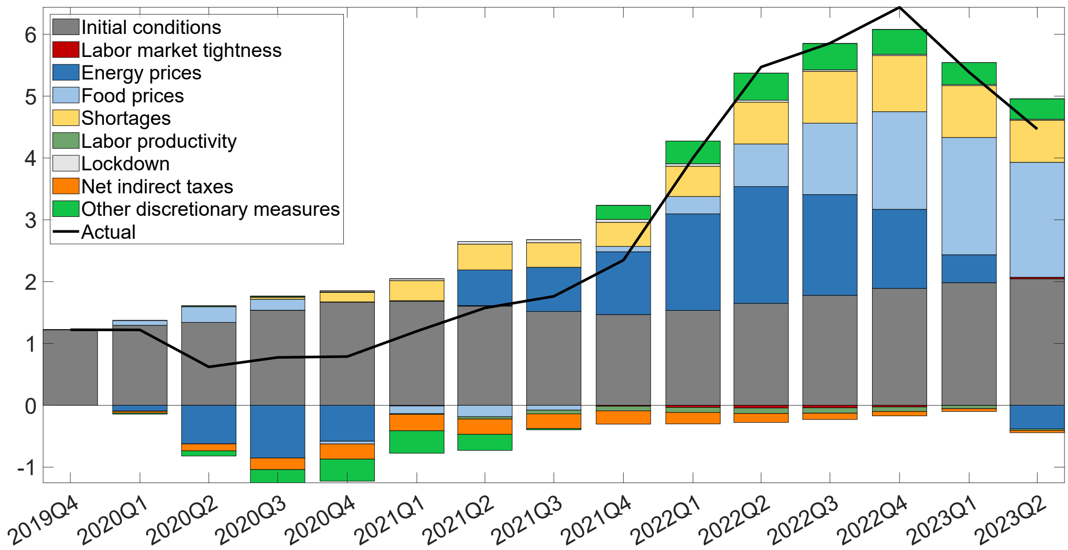
Notes: See notes under Figure 3.

Figure 15: Sources of euro area long-term inflation expectations without discretionary measures



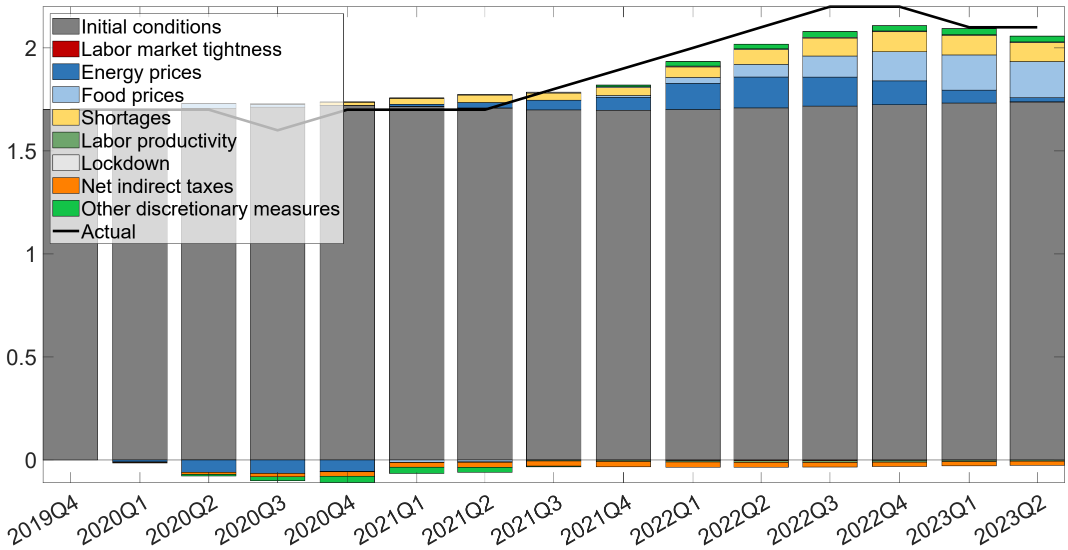
Notes: See notes under Figure 3.

Figure 16: Sources of short-term inflation expectations and disaggregated discretionary measures



Notes: See notes under Figure 3.

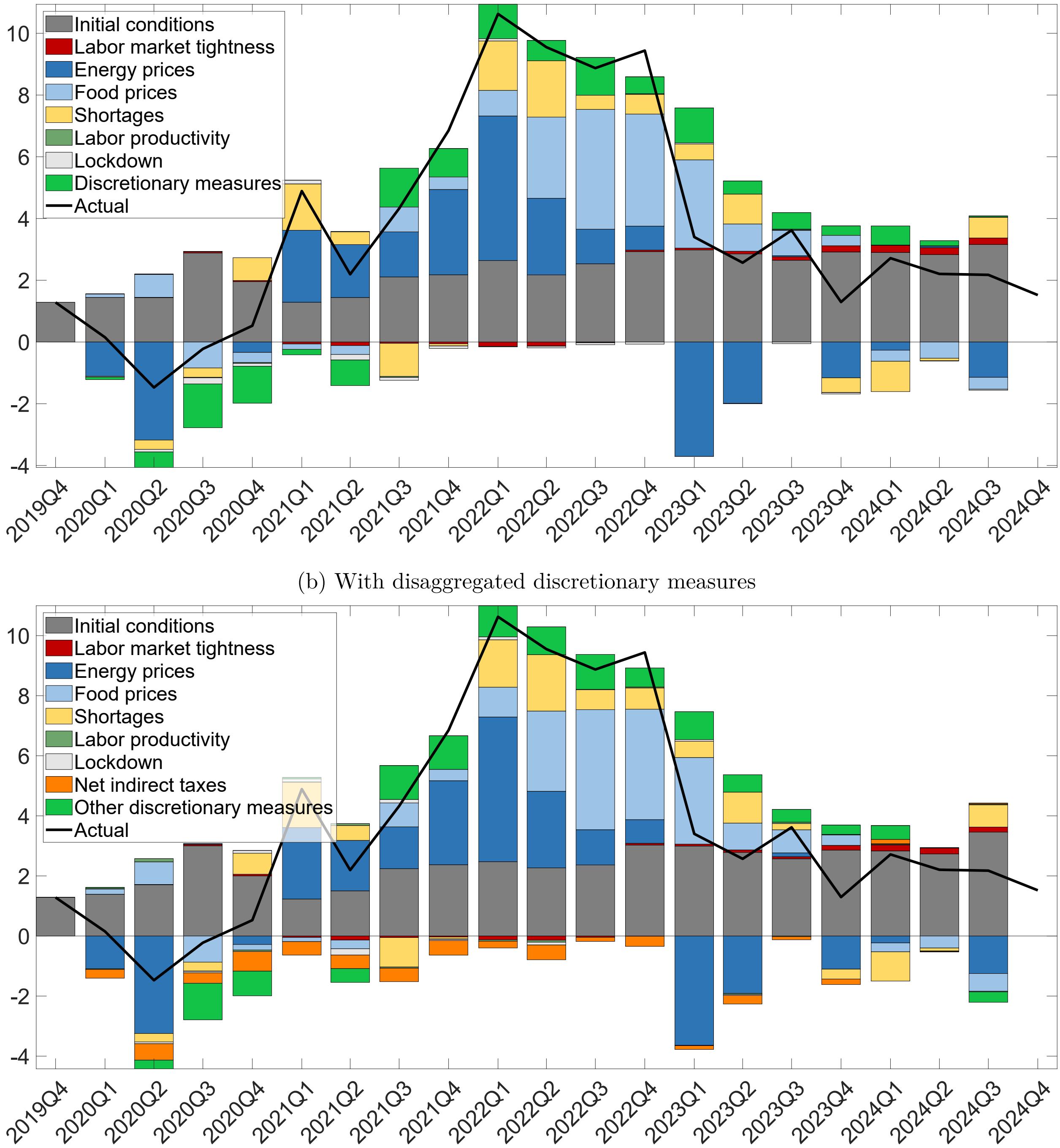
Figure 17: Sources of long-term inflation expectations and disaggregated discretionary measures



Notes: See notes under Figure 3.

Figure 18: Sources of inflation using data until 2024Q3

(a) With aggregate discretionary measures

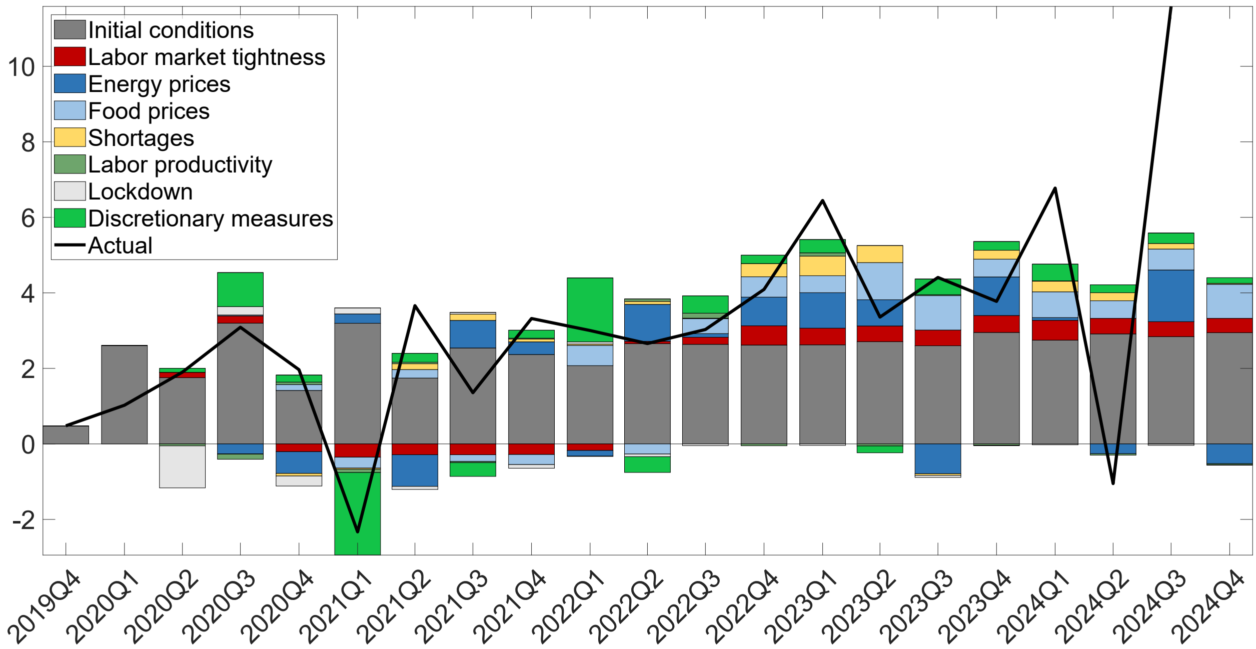


(b) With disaggregated discretionary measures

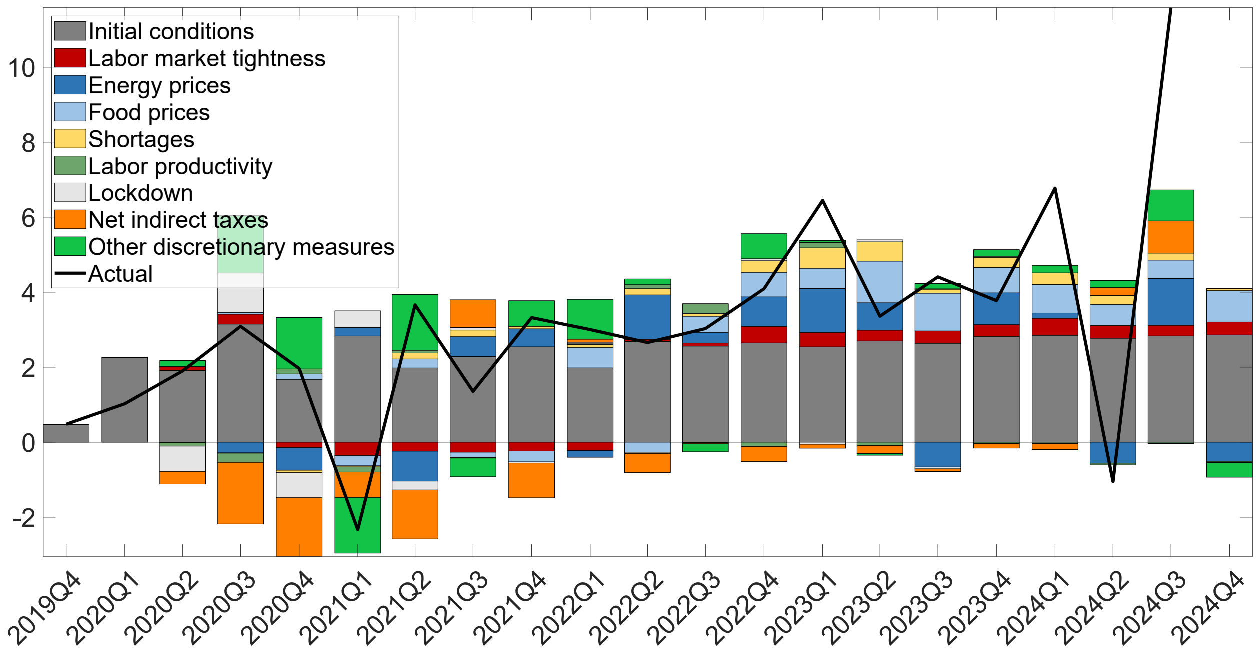
Notes: See notes under Figure 3.

Figure 19: Sources of wage growth using data until 2024Q3

(a) With aggregate discretionary measures



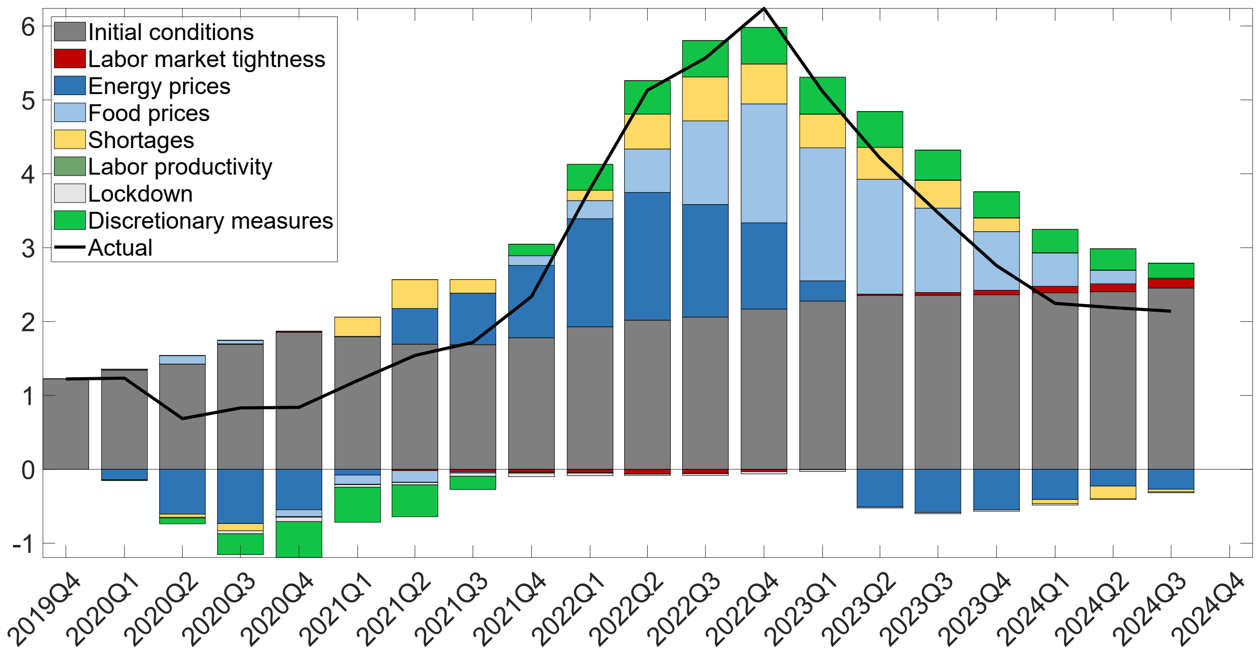
(b) With disaggregated discretionary measures



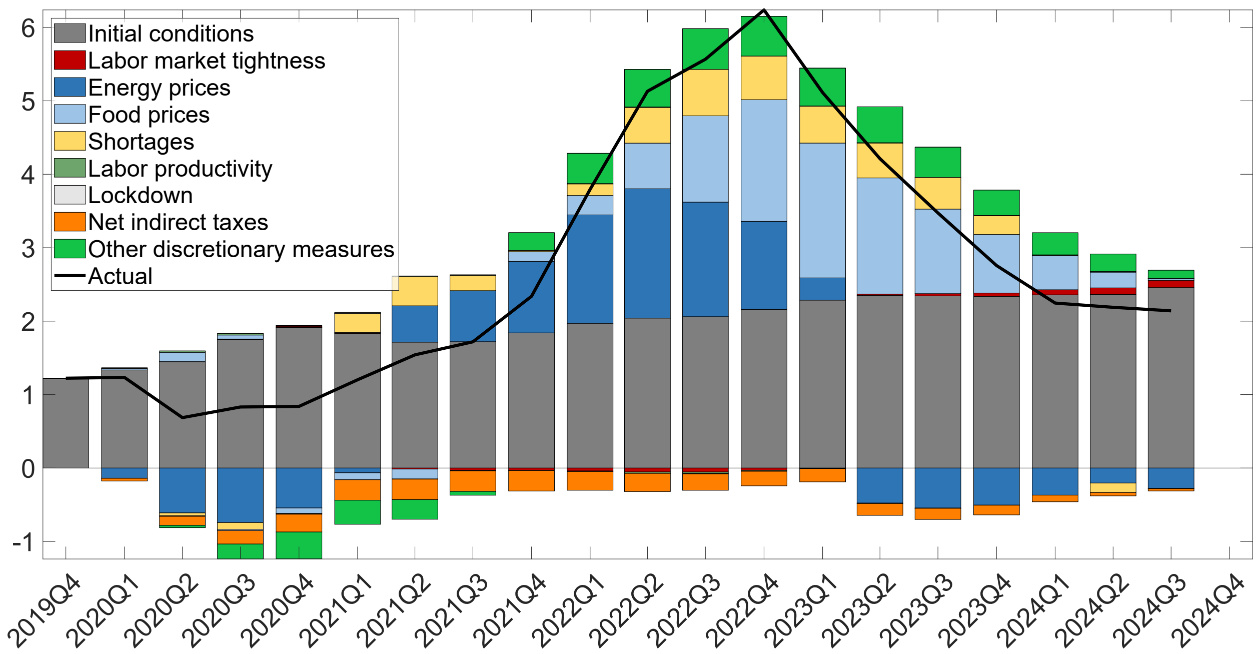
Notes: See notes under Figure 3.

Figure 20: Sources of short-term inflation expectations using data until 2024Q3

(a) With aggregate discretionary measures



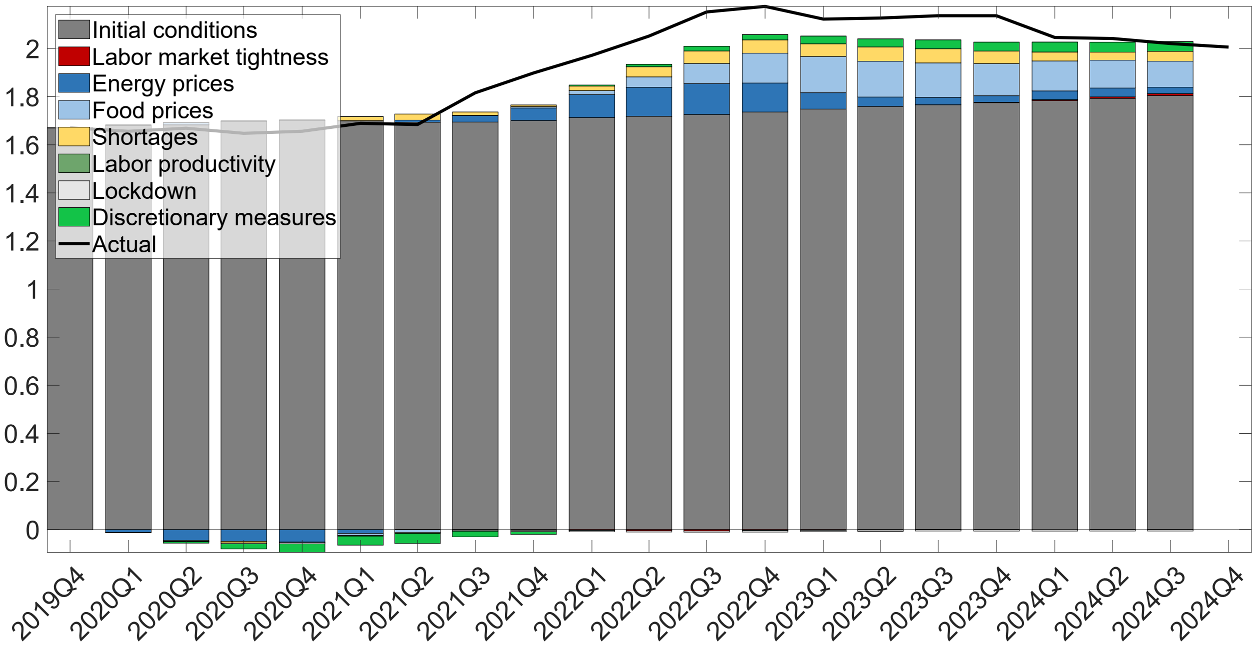
(b) With disaggregated discretionary measures



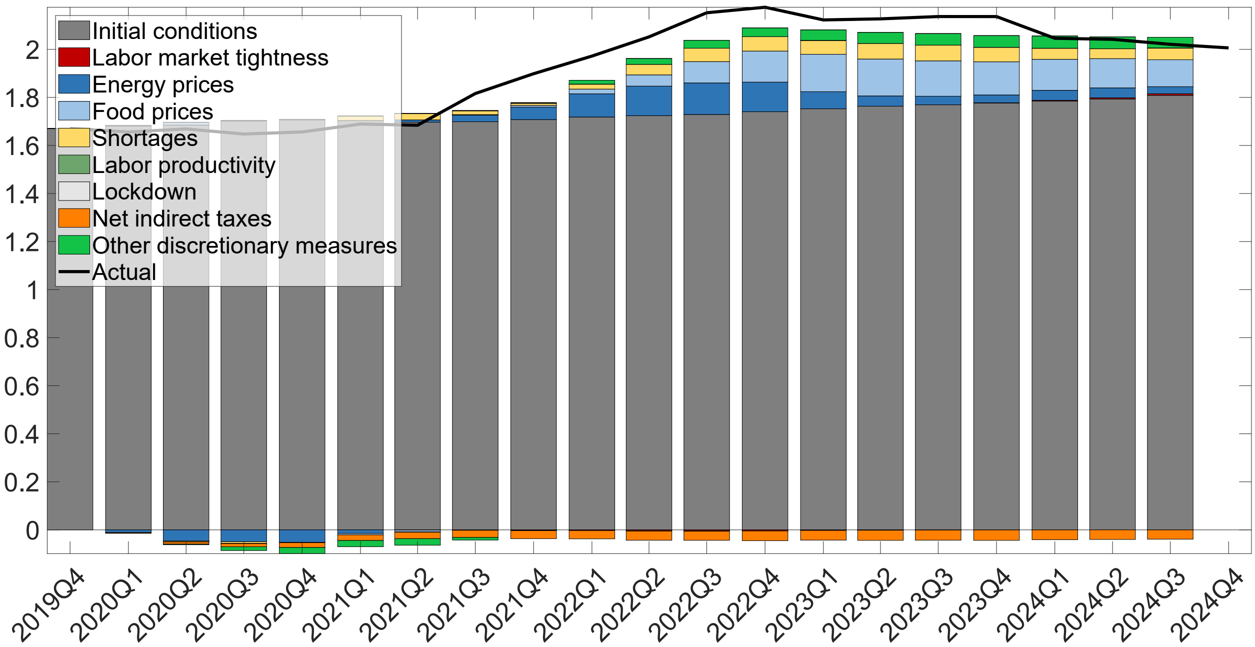
Notes: See notes under Figure 3.

Figure 21: Sources of long-term inflation expectations using data until 2024Q3

(a) With aggregate discretionary measures



(b) With disaggregated discretionary measures



Notes: See notes under Figure 3.

Table 4: Short-term inflation expectations equation, 1999Q1-2023Q2

Dependent variable: short-term inflation expectations			
	L. Short-term inflation expectations	Long-term inflation expectations	Realized inflation
Sum of coefficients	0.719	0.079	0.202
p(sum)	0.000	0.022	0.000
p(joint)	0.000	0.285	0.000
Adjusted R^2	0.982		
Obs.	90		

Notes: p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

Table 5: Long-term inflation expectations equation, 1999Q1-2023Q2

Dependent variable: long-term inflation expectations		
	L. Long-term inflation expectations	Realized inflation
Sum of coefficients	0.988	0.012
p(sum)	0.000	0.005
p(joint)	0.000	0.000
Adjusted R^2	0.816	
Obs.	90	

Notes: p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

Table 6: Wage growth equation, 1999Q1-2024Q3

		Dependent variable: wage growth							
		L. Wage growth	Labor market tightness	Catch-up variable	Short-term inflation exp.	Prod. growth	DM	NIT	REST DM
Baseline without DM	Sum of coefficients	-0.812	0.436	-0.418	1.812	-0.065			
	p(sum)	0.030	0.009	0.041	0.000	0.683			
	p(joint)	0.000	0.047	0.000	0.000	0.683			
	Adjusted R^2	0.565							
With overall DM	Sum of coefficients	-0.626	0.417	-0.540	1.626	0.029	-0.148		
	p(sum)	0.081	0.014	0.010	0.000	0.860	0.367		
	p(joint)	0.000	0.076	0.000	0.000	0.860	0.012		
	Adjusted R^2	0.619							
With disaggregated DM	Sum of coefficients	-0.765	0.344	-0.554	1.765	-0.638		1.329	-0.638
	p(sum)	0.048	0.051	0.010	0.000	0.745		0.120	0.074
	p(joint)	0.000	0.175	0.000	0.000	0.745		0.172	0.002
	Adjusted R^2	0.640							
	Obs.	95							

Notes: DM = discretionary measures; NIT = net indirect taxes; RESTDM = discretionary measures minus net indirect taxes. p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

Table 7: Inflation equation, 1999Q1-2024Q3

	Dependent variable: inflation									
		L. Inflation	Wage growth	Energy price	Food price	Shortage	Prod. growth	DM	NIT	REST DM
Baseline without DM	Sum of coefficients	0.538	0.462	0.052	0.078	0.230	0.043			
	p(sum)	0.003	0.009	0.019	0.227	0.040	0.575			
	p(joint)	0.001	0.000	0.000	0.000	0.045	0.575			
	Adjusted R^2	0.934								
With overall DM	Sum of coefficients	0.416	0.584	0.044	0.156	0.103	-0.003	-0.102		
	p(sum)	0.014	0.001	0.025	0.011	0.387	0.968	0.345		
	p(joint)	0.000	0.000	0.000	0.000	0.001	0.968	0.000		
	Adjusted R^2	0.952								
With disaggregated DM	Sum of coefficients	0.403	0.597	0.046	0.152	0.123	-0.018		0.127	-0.103
	p(sum)	0.037	0.002	0.039	0.020	0.319	0.828		0.688	0.532
	p(joint)	0.000	0.000	0.000	0.000	0.003	0.828		0.601	0.002
	Adjusted R^2	0.947								
	Obs.	98								

Notes: DM = discretionary measures; NIT = net indirect taxes; RESTDM = discretionary measures minus net indirect taxes. p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

Table 8: Short-term inflation expectations equation, 1999Q1-2024Q3

Dependent variable: short-term inflation expectations			
	L. Short-term inflation expectations	Long-term inflation expectations	Realized inflation
Sum of coefficients	0.769	0.090	0.141
p(sum)	0.000	0.008	0.000
p(joint)	0.000	0.063	0.000
Adjusted R^2	0.979		
Obs.	99		

Notes: p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

Table 9: Long-term inflation expectations equation, 1999Q1-2024Q3

Dependent variable: long-term inflation expectations		
	L. Long-term inflation expectations	Realized inflation
Sum of coefficients	0.990	0.010
p(sum)	0.000	0.001
p(joint)	0.000	0.000
Adjusted R^2	0.915	
Obs.	99	

Notes: p(sum) is the p-value for the null hypothesis that the sum of coefficients is zero, while p(joint) is the p-value for the joint hypothesis that each of the lag coefficients separately equals zero.

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