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Review

Why the European Central Bank lacked efficacy to fight against the recent surge in inflation

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Abstract: The paper focuses on the determinants of the surge in inflation between 2021 and 2023 and on the efficacy of monetary policy in fighting against these inflationary tensions. The main role of the European Central Bank is to ensure that inflation expectations remain anchored to a clear target. An active monetary policy can also stabilize future expected inflationary tensions or demand shocks. However, a simple theoretical model can explain the incapacity of European monetary policy to fight against the supply-side factors of inflation in the post-COVID period: inflationary tensions inherited from previous periods, imported from foreign countries (energy and food), or due to higher current or anticipated profit margins. In these cases, a huge increase in the nominal interest rate and a very contractionary monetary policy only risk creating a strong recession without avoiding inflationary tensions.

Keywords: European Central Bank; monetary policy; inflationary factors; economic activity
JEL Classification Numbers: E31; E52; E58; E61; E65

1. Introduction

The COVID-19 pandemic initially implied a deflationary shock, as consumption was compelled to remain very low in the context of lockdowns. However, as economies reopened, and with the war in Ukraine, inflation recovered quickly. Then, after a period of great moderation and particularly low inflation since the beginning of the 2000s, inflation was back at very high levels in 2021. This sudden rise in inflation, at unexpected levels since 1973, represents a new subject of interest and study in the economic literature. This high inflation is a challenge for policymakers who must face radical uncertainty. However, we can identify factors for this high inflation rate as well as the means to fight against it.

Factors influencing the inflation rate are related to aggregate demand and supply. Indeed, after 2022, inflation grew because of the strong post-pandemic recovery (driven by accommodative monetary and fiscal policies), associated with lasting supply-side restrictions (global value chain bottlenecks). The purchasing power of households was enhanced by the excessive sparing capacity accumulated during the COVID-19 pandemic. Afterward, when this extra saving was used to increase consumption, it implied strong tensions on demand. Nevertheless, some factors could prevent households from spending their accumulated excess savings: keeping precautionary savings and reserves and deleveraging (repaying debts) for firms and households. Besides, the increase in saving was mainly concentrated in high-income and older households, which have a weaker propensity to consume and suffer less from income losses (see Attinasi et al. [1]). At the same time, supply bottlenecks in production factors (raw materials, energy) as well as in labor supply reinforced the

extra demand to imply inflationary tensions. Inflationary tensions were also related to unpredictable geopolitical forces, for example, related to the extraordinary cost-push shock linked to energy prices (oil and gas) due to the war in Ukraine. Indeed, Russia's invasion of Ukraine has disarticulated the world network of energy sources and implied a steep escalation of their prices, bringing inflation rates back to the heights of the 1970s. Whelan [2] mentions that these external factors were the main driving force of inflationary tensions in Europe.

Euro area inflation has reached double-digit levels, the highest since the oil crisis in 1973. In October 2022, headline inflation reached 10.7%. This was due to the surge in energy prices due to the war and also to food price inflation, linked to the surging prices of energy inputs but also to extreme weather events. Indeed, Europe is very dependent on energy prices and imports for 62% of its energy consumption. Energy prices (oil, but this time also natural gas) could explain a large part of inflation in Europe in 2022. Inflation has been particularly high in Estonia, Latvia, and Lithuania, and dispersion among countries has also increased.

To address these exceptional inflationary tensions, policy interest rates were raised by central banks (the FED as well as the ECB) in 2022, after a period of highly accommodative monetary stance. However, as mentioned by Bonatti et al. [3] or Whelan [2], the inflation surge in the United States owed much to excess demand, supply bottlenecks, and labor market tightness, whereas inflation in the Euro area had mainly to do with a large cost-push shock and sectoral imbalances associated with the prolonged energy shock. Indeed, in the United States, the system is more energy-absorbing, whereas the European Union is more dependent on foreign energy suppliers. So, in the first case, monetary and fiscal policies could play together to moderate aggregate demand and reduce inflation: higher nominal interest rates and a contractionary fiscal policy were thus appropriate. On the contrary, in the second case, in the Euro area, the coordination of monetary and fiscal policies with structural policies appeared necessary to ensure that inflation pressures do not start a wage-price spiral and to protect the most vulnerable from the impact of high inflation rates and economic recession. The situation was then complicated by the risk of stagflation, as reducing inflation involved the unavoidable danger of contracting GDP.

In such an inflationary background, central banks faced risks of under-tightening; too soft a reaction could lead inflation expectations to de-anchor and an uncontrolled explosion of inflation. But on the contrary, over-tightening could imply a severe recession for the global economy, weighing on the population who suffered most of the real income losses due to high inflation. Indeed, monetary tightening was accompanied by a strong recession and a decrease in GDP in Europe in 2022. The IMF [4] also mentions that social tensions might intensify in response to the cost-of-living crisis, resulting in a more expansionary fiscal stance that could force central banks to further tighten monetary policy. Therefore, fiscal policies should act to avoid boosting aggregate demand and making it harder for monetary policy to tame inflation. According to the IMF [4], fiscal policies regarding energy prices, for example, should remain temporary and targeted. The authorities could also moderate negotiated wage increases in the medium term and favor one-time wage bonuses rather than permanent wage increases. Indeed, more contractionary fiscal policies and stronger fiscal consolidation could also help to ease demand pressures and achieve disinflation at a

smaller cost in terms of interest rate increases, which could endanger financial stability.

The current paper aims to shed light on the sources of the surge of inflation between 2021 and 2023 and on the potential efficacy of monetary policy to fight against these inflationary tensions, particularly in the context of the European Union. Regarding monetary policy, we find that the main role of the European Central Bank is to ensure that inflation expectations remain anchored to a clear target. An active monetary policy can also stabilize future expected inflationary tensions or demand shocks. However, monetary policy appears relatively inefficient in fighting against the supply-side factors of inflation in the post-COVID period: inflationary tensions inherited from previous periods, imported from foreign countries (energy and food), or due to higher current or anticipated profit margins. In these cases, a huge increase in the nominal interest rate and a very contractionary monetary policy only risk creating a strong recession without avoiding inflationary tensions. The rest of the paper is organized as follows. The second section mentions stylized facts regarding the global context, various potential factors of current inflationary tensions, and economic policies conducted in the European Economic and Monetary Union. The third section presents a simple modelling of the evolution of the inflation rate and economic activity according to the monetary policy conducted by the central bank. The fourth section mentions the various theoretical and empirical inflationary factors in Europe since 2021, as well as the relative efficacy of monetary policy in fighting against these inflationary sources. The fifth section concludes the paper.

2. Stylized facts in the European Union

As mentioned by the IMF [5], a contractionary monetary policy is necessary to bring core inflation down decisively and closer to the inflation target to avoid a dangerous de-anchoring of expectations. Failure to do so would require even more contractionary macroeconomic policies in the future and a more prolonged and more severe recession. Therefore, the European Central Bank (ECB) increased its interest rates on the Main Refinancing Operations from 0% in June 2022 (the level kept since March 2016) to 4.5% in September 2023 (see **Figure 1**), a fast and huge increase unknown in the history of the ECB.

Indeed, a tighter monetary policy is necessary to ensure the credibility of the ECB to fulfill its primary objective: to maintain price stability and an inflation rate below 2% and to avoid accelerating inflation due to rising inflation expectations and de-anchoring of these expectations. Nevertheless, the ECB waited until July 2022 to begin a contractionary monetary policy. Indeed, an arbitrage must be made between fighting against inflation with higher interest rates and the danger to economic activity as well as the financial stability of this monetary policy, raising borrowing costs and destabilizing the financial situation of debtors, with smaller credit flows to the real economy. The ECB must be careful in substantially tightening its monetary policy, as there are then risks of causing stress in financial markets (especially on sovereign bond markets), accentuating the excessive indebtedness of some countries, and slowing down the recovery from the pandemic.

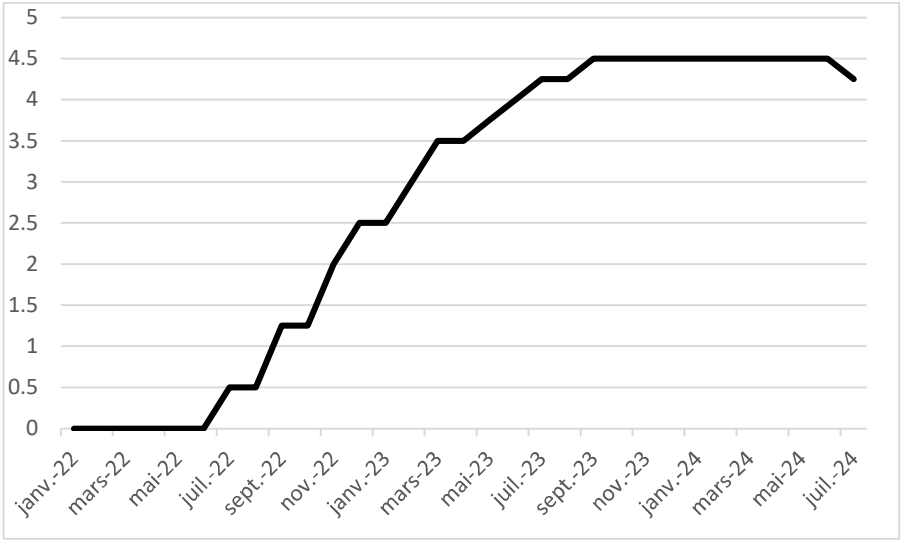

Figure 1. Interest rates on the Main Refinancing Operations of the ECB.

Besides, using a Structural Vector Auto-regressions with exogenous variables (SVARX) model, Debortoli et al. [6] find that monetary policy easing and tightening have asymmetric effects. A policy easing has large effects on prices but small effects on real activity variables. The opposite is found for policy tightening: large real effects but small effects on prices. Indeed, a restrictive monetary policy harms private investment, consumption, and thus potential demand. Therefore, with nominal wage rigidities in the labor market, preventing them from decreasing in response to a contractionary shock, the unemployment rate increases. For example, the interest rate on the main refinancing operations of the ECB increased from 2.5% in April 1999 to 4.75% in October 2000. A high inflation rate was then not avoided, as the inflation rate increased on average in the Euro Area from 1.9% in 1999 to 2.9% in 2000 and 2001. However, this restrictive monetary policy was very harmful to economic growth, as the annual GDP growth rate in the Euro Area fell from 3.9% in 2000 to 1% in 2002.

In the same way, the recent increase in interest rates had limited efficacy in reducing excessive inflation in the European Union; the inflation rate reached nearly 10% in 2022-Q3 (see **Figure 2**). On the contrary, the contractionary monetary policy could make a large recession unavoidable. Indeed, after the huge recession due to the COVID-19 crisis and the strong recovery afterward, the real GDP growth rate was only around 1.9% in 2022-Q4 and even became slightly negative in 2023-Q3 (see **Figure 2**). According to the IMF [4], weaker consumer confidence, higher inflation, and tighter financial conditions (higher interest rates restricting credit conditions) weighed on household spending, and this weaker consumption undermined growth. Firms were also likely to hold back investment, given the record-high uncertainty, more expansive input and borrowing costs, and lower demand from external trading partners.

In this context, what should be the optimal monetary policy for the European Central Bank? If inflation is due to increases in energy or commodity prices, likely to fade out at some time, it is less a concern for the ECB; its intervention is not mandatory and can even be useless in the case of such supply-side disturbances. On the contrary,

if inflation pressures are related to higher demand (release of pent-up demand or expansionary fiscal policy), it should be more of a concern for the ECB. The ECB should also avoid wage-price spirals and contribute to anchoring expectations. Indeed, inflation can be influenced by many factors.

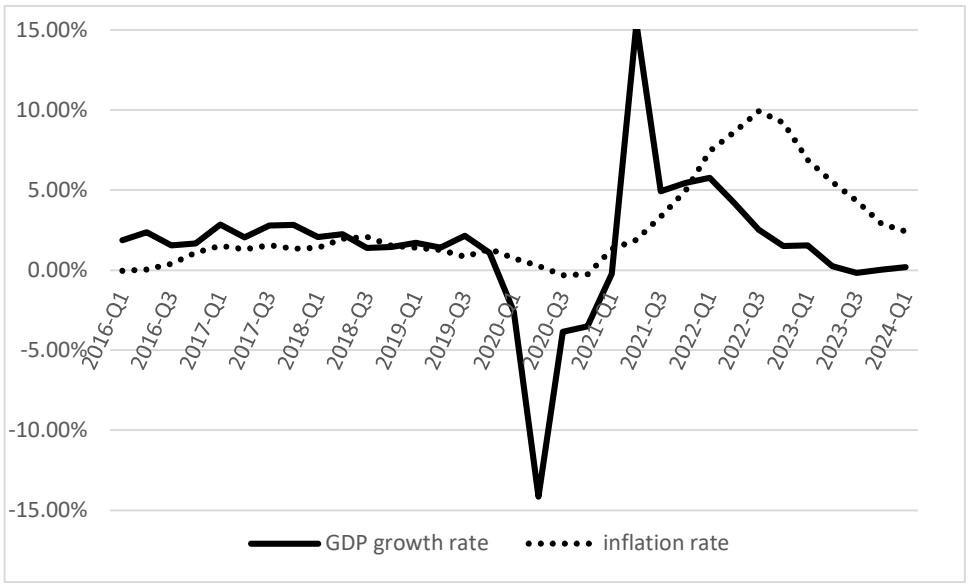

Figure 2. GDP growth rates and inflation rates in the Euro Area.

Source: Eurostat; data for Euro 19 countries; GDP at constant prices, chain linked volumes, index 2010 = 100; variation from quarterly data the previous year. HICP, monthly data, index 2015 = 100; variation from quarterly data the previous year.

Inflation can be influenced by import price inflation: energy (fuels, electricity, and natural gas) and non-energy manufacturing import prices, nominal wage growth adjusted for trend productivity, and core price inflation (commodity prices and HICP excluding energy and unprocessed food). It is also influenced by economic growth (or a measure of economic slack like the unemployment gap) and by the anchoring of long-term inflation expectations, which directly depends on the credibility of monetary policy. Indeed, according to Beckmann et al. [7], the fundamental goal of the ECB is to anchor expectations on a monetary target: inflation below 2% and to ensure the credibility of its monetary policy. Therefore, informing the public about this goal is an important instrument to control the transmission channel of monetary policy. Monetary policy can influence economic activity by managing the expectations of households (long-term interest rates and preference for saving) and firms (price-setting behavior). However, beyond informing about the target, to fix inflation expectations on this target, the central bank should also show a positive long-term experience and efficacy in achieving its inflation target. For example, Bems et al. [8] construct an index of inflation expectations' anchoring, using survey-based inflation forecasts for 45 countries between 1989 and 2018. They show that anchoring is positively related to the transparency of monetary policy. For example, adopting a clear inflation-targeting regime and the age (maturity) of the regime make a significant impact. Anchoring is also reinforced by strong institutions ensuring a sound and sustainable fiscal policy and the maturity of existing fiscal rules.

Inflation is also usually related to excess demand above production capacities. Indeed, regarding the production supply chain, the COVID-19 crisis implied

disruptions in the supply chain in 2020 and 2021 because of pandemic-related restrictions. In 2023, there were still persistent supply bottlenecks, which hampered production in manufacturing. Eurostat data show that in the European Union, between 2019 and 2022, when the share of transport decreased by 0.7 percentage points and the share of recreation and culture by 0.3 percentage points in global household consumption, the share of household expenditure for furnishings, household equipment, and routine household maintenance increased by 0.2 percentage points. With the decrease in the consumption of private households for services, the demand for durable consumption goods and associated raw materials and intermediates (metals, chemicals, or semiconductors) increased. As producers of these goods could not meet this demand immediately, delivery times and prices increased. These bottlenecks took some time to disappear. However, the problem of excess demand over supply is, by definition, temporary, and finally, it has disappeared after some years.

Inflation was also driven by expansionary fiscal policies in the European Union and by the increase of primary budget deficits during the COVID-19 crisis in 2020–2021 due to fiscal packages and rescue measures to sustain economic activity and employment. Fiscal rules of the fiscal compact have been suspended with the crisis, and therefore, budget deficits and public debts have strongly increased. With the reactivation of fiscal rules, fiscal policies are probably today excessively active. Nevertheless, Beckmann et al. [7] considered that expansionary fiscal policies didn't imply a major risk of inflationary tensions in the recessionary context of the post-COVID-19 crisis.

Besides, labor markets became tighter in all European Union countries. Unemployment rates became quite low in 2023, which boosted the bargaining power of workers and unions and increased the probability of substantial wage increases. Therefore, in addition to the problem of production factors and labor shortages, workers were tempted to pass the increase in consumption prices in wage increases to reduce their loss of purchasing power. So, wage increases were also an important determinant of inflationary tensions. That is why Ball and Mazumder [9] consider, as a measure of core inflation, the weighted median of industry inflation rates (instead of the traditional indicator: inflation excluding food and energy prices) between 1999 and 2018. This allows filtering out large shocks in all industries and provides a less volatile measure of underlying inflation. Besides, they consider the deviation between headline and core inflation over the current and previous three quarters to capture the idea that movements in headline inflation are partially passed through into core inflation through wage adjustment and the cost of intermediate inputs. The pass-through of wage increases is, therefore, important to explain accurately the evolution of inflation.

With the help of a simple macroeconomic model, the goal of the current paper is then to try to discuss the potential efficacy of monetary policy in fighting against inflation, particularly in the framework of the European Union. Indeed, the optimal monetary policy seems to vary according to the above-mentioned various potential factors of inflationary tensions.

3. A simple modelling of the various factors of inflation

In DSGE models, nominal rigidities and the non-neutrality of monetary policy imply that there is room for welfare-enhancing interventions by the monetary policy; however, other distortions cannot be canceled by monetary policy [see, for example, the precise description in Gali [10] for DSGE models]. This section now aims to expose analytically the situations where monetary policy can be efficient and those where it cannot be efficient.

3.1. Variation of the inflation rate

We consider traditional modelling of the variation of the inflation rate, used in DSGE models, relying on a New Keynesian Phillips Curve. See, for example, Eser et al. [11] or Benigno and Eggertsson [12]. This equation is derived from firms' optimal price-setting choices in a context where prices are only partially flexible. Indeed, in a Calvo-type framework, price stickiness implies that in each period, only a share of firms adjust their prices.

$$\left(\widehat{\pi_t}^{GDP} - \gamma\widehat{\pi_{t-1}}^{GDP}\right) = \kappa\hat{y}_t + \beta\left[E_t\left(\widehat{\pi_{t+1}}^{GDP}\right) - \gamma\widehat{\pi_t}^{GDP}\right] + \varphi_t \quad (1)$$

Where: $(\widehat{\pi_t}^{GDP})$ represents the deviation of producer inflation (GDP deflator) from its long-term steady state value. Therefore, this deviation depends on the lagged and expected future inflation gaps.

$(\hat{y}_t)$ represents the output gap, which measures output relative to its natural or potential level (which would prevail if prices were flexible). A higher output gap increases marginal production costs. It increases labor demand by firms, a demand that households are only willing to provide for higher wages, leading to cost increases for firms.

(φ_t) represents innovations on desired markups, related to the pricing decisions of firms, to the evolution of their margins. A positive shock to the markup corresponds to an increase, whereas a negative shock corresponds to a decrease in profits. The introduction of this shock to markups is justified by the empirical importance of this factor in explaining variations in inflation, independently of fluctuations in economic activity or monetary policy.

(β): time discount factor, the discount rate of the future.

(γ): persistence of inflation.

(κ): Phillips curve's slope. According to Bonatti et al. [3], this slope is the arbitrage that a country can do between inflation and economic growth in a broader acceptance. The 'sacrifice ratio' represents the cost in terms of output of reducing inflation. Theoretically, this slope is positive ($\kappa > 0$), and it decreases if prices are more rigid and sticky, if real rigidities are more severe (competition reduces the incentive to depart from prices of the competitors), and if the country is more open (imported goods are more substitutable to domestic goods). In New Keynesian models, the slope is only negative ($\kappa < 0$) if the unemployment gap is considered.

The Phillips curve is the traditional tool to predict future variations of the inflation rate according to an indicator of economic activity, such as the unemployment rate. Banbura and Bobeica [13] find that this Phillips curve helps to forecast inflation in the Euro area for a period between 1994 and 2018, but with important model instabilities.

To estimate the economic slack, they find that the output gap based on filtering (log) real GDP performs relatively well.

Therefore, with: $E_t\left(\widehat{\pi_n}^{GDP}\right) \underset{n\to\infty}{\longrightarrow} 0$, iterating Equation (1) forwards implies:

$$\widehat{\pi_t}^{GDP} = \gamma\widehat{\pi_{t-1}}^{GDP} + \kappa\sum_{k=0}^{\infty}\beta^k E_t(\widehat{y_{t+k}}) + \sum_{k=0}^{\infty}\beta^k E_t(\varphi_{t+k}) \quad (2)$$

In Equation (2), ($\widehat{\pi_{t-1}}^{GDP}$) introduces backward-looking indexation, which fits the empirical stickiness of inflation: path dependency is an important phenomenon. Besides, firms set prices for multiple periods and don't reset prices for each period (cf. the Calvo-type framework). So, expectations of future costs and markups appear in Equation (2). That is why the interest rate and the credibility of monetary policy influence the current inflation rate but also the future anticipated path of future growth and inflation. Forward guidance and clarity of communication are fundamental. The evolution path of the anticipated economic growth, as well as the persistence of demand or supply shocks, is important.

Furthermore, the deviation of consumer price inflation from its long-term steady-state value ($\widehat{\pi_t}$) increases with domestic producer prices but also with import prices. Therefore:

$$\widehat{\pi_t} = (1-\nu)\widehat{\pi_t}^{GDP} + \nu\widehat{\pi_t}^{M} \quad (3)$$

($\widehat{\pi_t}$): deviation of consumer inflation from its long-term steady state value.

($\widehat{\pi_t}^{M}$): deviation of foreign prices from their long-term steady state value.

(ν): degree of openness of the country, share of imported goods in consumption.

Equation (3) also implies:

$$\widehat{\pi_t} = \widehat{\pi_t}^{GDP} + \frac{\nu}{(1-\nu)}(\widehat{\pi_t}^{M} - \widehat{\pi_t}) \quad (4)$$

Imported inflation increases with the real exchange rate: the deviation of consumer-price inflation from its long-term steady state value increases if foreign prices tend to increase faster than domestic prices. So, by combining Equations (3) and (4), we obtain:

$$\widehat{\pi_t} = \gamma(1-\nu)\widehat{\pi_{t-1}}^{GDP} + \kappa(1-\nu)\sum_{k=0}^{\infty}\beta^k E_t(\widehat{y_{t+k}}) + (1-\nu)\sum_{k=0}^{\infty}\beta^k E_t(\varphi_{t+k}) + \nu\widehat{\pi_t}^{M} \quad (5)$$

3.2. Monetary policy and variation of economic activity

In New-Keynesian models, the dynamic (IS) equation mentions how monetary policy can influence output. A higher interest rate increases sparing and reduces consumption regarding households' decisions, and it also reduces investment decisions. Therefore, a higher interest rate has recessionary consequences regarding the intertemporal choice of the representative household. This can be expressed by the following demand equation:

$$\widehat{y_t} = E_t(\widehat{y_{t+1}}) - \frac{1}{\sigma}[i_t - E_t(\pi_{t+1})] + d_t \quad (6)$$

(i_t): nominal interest rate, instrument of the central bank.

(d_t): positive demand shock, measuring non-monetary factors influencing economic activity.

(σ): intertemporal elasticity of substitution.

In the long run, economic activity is stable at its long-term level, $\lim_{n\to\infty} \widehat{y_n} = 0$, so by solving Equation (6) forwards, we obtain:

$$\widehat{y_t} = -\frac{1}{\sigma}\sum_{k=0}^{\infty}[i_{t+k} - E_t(\pi_{t+k+1})] + \sum_{k=0}^{\infty} E_t(d_{t+k}) \tag{7}$$

Regarding monetary policy, the maximization of a quadratic central bank's loss function, assigning different weights to inflation, output gap and interest rate smoothing in this loss function, can be simplified into a Taylor rule[1]:

$$i_t = -\log(\beta) + \pi^* + \Phi_\pi(\pi_t - \pi^*) + \Phi_y \widehat{y_t} \tag{8}$$

With: (π^*): central bank's inflation target.

The central bank is committed to achieving its inflation objective, and the main goal is the inflation target (with a weight: $\Phi_\pi > 1$); in particular, this is the main goal of the European Central Bank in Europe. However, the central bank can also consider global economic activity (Φ_y). Besides, the central bank is constrained by the zero lower bound: the nominal interest rate cannot decrease below zero ($i_t \geq 0$).

By definition, the long-term and steady-state inflation rate is equal to the central bank's objective: $\lim_{n\to\infty} \pi_n = \pi^*$. Therefore, according to equations (6) and (8), the long-term nominal interest rate is: $[i = -\log(\beta) + \pi^* = \sigma d + \pi^*]$.

By combining Equations (5), (7), and (8), using the deviation of inflation from its target and long-term steady state value: ($\widehat{\pi_t} = \pi_t - \pi^*$), and the previous expression of the long-term interest rate, the optimal interest rate is as follows:

$$\begin{aligned}(i_t - i) = {} & \frac{\Phi_\pi\sigma[\gamma(1-\nu)\widehat{\pi_{t-1}}^{GDP} + \nu\widehat{\pi_t}^{M}]}{[\Phi_\pi\kappa(1-\nu) + \Phi_y + \sigma]} + \frac{\Phi_\pi\sigma(1-\nu)}{[\Phi_\pi\kappa(1-\nu) + \Phi_y + \sigma]}\sum_{k=0}^{\infty}\beta^k E_t(\varphi_{t+k}) \\ & + \sum_{k=0}^{\infty}\frac{[(1-\beta^{k+1})\Phi_\pi\kappa(1-\nu) + (1-\beta)\Phi_y]}{(1-\beta)[\Phi_\pi\kappa(1-\nu) + \Phi_y + \sigma]}[E_t(\widehat{\pi_{t+k+1}}) + \sigma E_t(d_{t+k} - d)] \\ & - \sum_{k=1}^{\infty}\frac{[(1-\beta^{k+1})\Phi_\pi\kappa(1-\nu) + (1-\beta)\Phi_y]}{(1-\beta)[\Phi_\pi\kappa(1-\nu) + \Phi_y + \sigma]}[E_t(i_{t+k}) - i]\end{aligned} \tag{9}$$

Therefore, the optimal monetary policy and the variation of the interest rate depend on the nature of shocks affecting the economy. The interest rate quite unambiguously increases in the case of a positive demand shock in order to compensate for the inflationary tensions due to the shock. On the contrary, in the case of a supply shock (for example, past inflation, foreign prices, or profit margins), the following section 4 will show that monetary policy depends on the relative preferences between stabilizing inflation or economic activity. Indeed, there is then an obvious trade-off between the inflation and output stabilization objectives, as the central bank risks creating a negative output gap by reducing the above-target inflationary tensions.

By combining Equations (7) and (9), we can then obtain the following variation of economic activity:

$$\begin{aligned}\widehat{y_t} = &-\frac{\Phi_\pi[\gamma(1-\nu)\widehat{\pi_{t-1}}^{GDP} + \nu\widehat{\pi_t}^{M}]}{\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]} - \frac{\Phi_\pi(1-\nu)}{\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]}\sum_{k=0}^{\infty}\beta^k E_t(\varphi_{t+k}) \\ &-\sum_{k=0}^{\infty}\frac{[\Phi_\pi\kappa(1-\nu)\beta\left(1-\beta^k\right)-\sigma(1-\beta)]}{\sigma(1-\beta)\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]}[E_t(\widehat{\pi_{t+k+1}}) + \sigma E_t(d_{t+k}-d)] \\ &+\sum_{k=1}^{\infty}\frac{[\Phi_\pi\kappa(1-\nu)\beta\left(1-\beta^k\right)-\sigma(1-\beta)]}{\sigma(1-\beta)\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]}[E_t(i_{t+k})-i]\end{aligned} \quad (10)$$

By combining Equations (5) and (10), we obtain the following variation of inflation:

$$\begin{aligned}\widehat{\pi_t} = &\frac{\left(\Phi_y+\sigma\right)[\gamma(1-\nu)\widehat{\pi_{t-1}}^{GDP} + +\nu\widehat{\pi_t}^{M}]}{\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]} + \frac{(1-\nu)\left(\Phi_y+\sigma\right)}{\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]}\sum_{k=0}^{\infty}\beta^k E_t(\varphi_{t+k}) \\ &+\frac{\kappa(1-\nu)}{\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]}\sum_{k=0}^{\infty}\left[\frac{\Phi_y\beta\left(1-\beta^k\right)+\sigma\left(1-\beta^{k+1}\right)}{\sigma(1-\beta)}\right][E_t(\widehat{\pi_{t+k+1}}) + \sigma E_t(d_{t+k}-d)] \\ &-\frac{\kappa(1-\nu)}{\left[\Phi_\pi\kappa(1-\nu)+\Phi_y+\sigma\right]}\sum_{k=1}^{\infty}\left[\frac{\Phi_y\beta\left(1-\beta^k\right)+\sigma\left(1-\beta^{k+1}\right)}{\sigma(1-\beta)}\right]E_t(i_{t+k}-i)\end{aligned} \quad (11)$$

Therefore, with an efficient monetary policy, which is defined optimally according to Equation (8), no effect of the output gap on inflation is observed in the data. The policymaker in the model is able to set policy to achieve any desired level of the output gap. Because policy-makers know how the Phillips curve operates, they can perfectly offset its effects on equilibrium inflation. Indeed, McLeay and Tenreyro [14] underline that if the central bank sets monetary policy with the goal of minimizing welfare losses (measured as the sum of deviations of inflation from its target and output from its potential), subject to a Phillips curve, it will seek to increase inflation when output is below potential. This targeting rule will impart a negative correlation between inflation and the output gap, blurring the identification of the (positively sloped) Phillips curve. The following section 4 will show that with an optimal monetary policy, inflation and economic activity then only depend on past and future inflation, foreign inflation, demand shocks, profit margins, and the anchoring of anticipations.

3.3. Calibration of the model

According to standard calibrations in the economic literature, the time discount factor (β) is calibrated at 0.99. The persistence of inflation (γ) is calibrated at 0.86; see Eser et al. [11]. According to McGregor and Toscani [15], in the traditional Phillips curve, a tighter labor market (less unemployment) is associated with higher inflation. The coefficient would be an average of 0.024 for the effect of the deviation of the vacancy to unemployment rate from the trend on the inflation rate. The traditional coefficient using the unemployment gap would give a coefficient of −0.075. These coefficients appear as relatively stable in time. In the current paper, the Phillips curve's

slope (κ) is calibrated at 0.01, according to the results in Eser et al. [11] [various empirical estimations range between 0.009 and 0.024].

The degree of openness of the country (ν), the share of imported goods in consumption, is very heterogeneous among worldwide countries and even in the European Union. Nevertheless, on average, we can calibrate this degree of openness at 0.4. The intertemporal elasticity of substitution (σ) is calibrated at 0.5.

The central bank's inflation target (π^*) is calibrated at 0.02 according to the main goal of the European Central Bank. Besides, regarding the central bank, the weight given to the goal of stabilizing inflation is ($\Phi_\pi = 1.5$), and the weight given to the goal of stabilizing economic activity is ($\Phi_y = 1$), in conformity with the Taylor rule. Indeed, ($1 < \Phi_\pi < 1.5$) and ($0 < \Phi_y < 1$) in the economic literature, even if ($\Phi_y = 0$) in the case of a strict inflation targeting rule. Nevertheless, in order to study the sensitivity of our results to the previous calibration, in section 4, we will analyze the robustness of our results to the variation of all parameters of our model.

4. Inflationary factors and efficacy of monetary policy

4.1. Past inflationary tensions

As part of inflation is backward-looking [see Equation (1)], current inflation increases with the past increase of inflation. So, if inflationary tensions were high in the previous period, monetary policy must be contractionary, and the nominal interest rate must increase [$\frac{\partial i_t}{\partial \widehat{\pi_{t-1}^{GDP}}} = 0.26$ with our basic calibration]. Besides, according to Equation (14), the increase of the nominal interest rate is all the more accentuated as the goal of stabilizing inflation is important for the central bank in comparison with the one of stabilizing economic activity. Nevertheless, according to Equations (12) and (13), monetary policy then cannot prevent the increase of inflationary tensions [$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_{t-1}^{GDP}}} = 0.51$] and the decrease of economic activity [$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_{t-1}^{GDP}}} = -0.51$]; its efficacy is quite limited. Indeed, Equations (9) to (11) imply:

$$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_{t-1}^{GDP}}} = \frac{\gamma(1-\nu)(\Phi_y + \sigma)}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{12}$$

$$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_{t-1}^{GDP}}} = -\frac{\Phi_\pi \gamma(1-\nu)}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{13}$$

$$\frac{\partial i_t}{\partial \widehat{\pi_{t-1}^{GDP}}} = \frac{\Phi_\pi \sigma \gamma(1-\nu)}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{14}$$

The central bank's preference for stabilizing economic activity reduces monetary activism [$\frac{\partial i_t}{\partial \widehat{\pi_{t-1}^{GDP}}} \xrightarrow[\Phi_y \to \infty]{} 0$]. The inflation rate then only marginally increases [$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_{t-1}^{GDP}}} \xrightarrow[\Phi_y \to \infty]{} \gamma(1-\nu) = 0.52$], whereas economic activity is less reduced [$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_{t-1}^{GDP}}} \xrightarrow[\Phi_y \to \infty]{} 0$]. On the contrary, the central bank's preference for stabilizing inflation strongly accentuates the monetary activism and the increase in the nominal

interest rate. However, the increasing inflation is then only marginally limited, whereas economic activity is much more reduced. Equations (12) to (14) show that to compensate for past inflationary tensions, to perfectly stabilize the current inflation rate $[\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_{t-1}}^{GDP}} \xrightarrow[\Phi_\pi \to \infty]{} 0]$, the increase of the interest rate should be excessively high $[\frac{\partial i_t}{\partial \widehat{\pi_{t-1}}^{GDP}} \xrightarrow[\Phi_\pi \to \infty]{} \frac{\sigma\gamma}{\kappa} = 43]$, and the cost in terms of recession would be excessively important $[\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_{t-1}}^{GDP}} \xrightarrow[\Phi_\pi \to \infty]{} -\frac{\gamma}{\kappa} = -86]$. Therefore, monetary policy seems quite inefficient in stabilizing inflationary tensions inherited from the past.

This inefficacy of monetary policy is accentuated if the degree of inflation persistence (γ) is high or if the country's degree of openness (ν) is weak. Indeed, according to Equations (12) to (14), inflation and recession are accentuated, despite the stronger interest rate increase. It is also slightly accentuated if the Phillips curve's slope (κ) is weak. Finally, this inefficacy is accentuated if the intertemporal elasticity of substitution (σ) is high: the higher increase of the nominal interest rate then attenuates the recession, but it cannot prevent a slight increase of inflationary tensions.

So, fighting against inflationary tensions inherited from the past is mainly beyond the competencies of the European Central Bank. Besides, according to Bandera et al. [16], learning effects and adaptive expectations would primarily cause economic agents to base their inflationary expectations on historical inflation from the recent past (backward-looking inertia). Usually, households' inflationary expectations are largely driven by idiosyncratic factors and perceptions of current inflation rather than by aggregate forward-looking factors. Households rely more on noisy, easily available signals rather than processing all relevant information to form their expectations.

Furthermore, the IMF [4] mentions that regarding core inflation, price setting tends to become still more backward-looking in the post-COVID-19 period. Indeed, workers bargain over an increase in wages in conformity with the exceptionally high current inflation, rather than expected future inflation, and higher input costs (wages and also commodities or energy prices) are passed by firms to higher prices. Core inflation has become more backward-looking, and the pass-through of global commodity prices to domestic inflation has increased after the COVID-19 crisis. As mentioned by the IMF [4], after the crisis, unemployment became a bad indicator of inflation for the Phillips curve. Indeed, the widespread use of short-term work programs artificially avoided the decrease in the employment rate during the crisis, and the pandemic implied a decrease in labor supply and a higher preference of households for leisure. Shortages regarding production factors (labor, but also materials) have also constrained production supply and contributed to a rise in inflation.

This implies a dangerous wage-price spiral, accentuated in an already high-inflation environment (this is the case with the COVID-19 crisis and afterwards the war in Ukraine), and if the central bank is not perceived as sufficiently credible to anchor expectations. As confirmed by our theoretical model and according to the fears of the IMF [4], this inflation could lead to monetary policy tightening and then to higher unemployment. In this context, in order to limit inflationary tensions inherited from the past, maintaining central bank independence, effective communication, and

transparency of the central bank are key to preserving hard-won credibility and containing inflationary pressures.

4.2. Imported inflation

Part of inflation is simply imported inflation [see Equation (3)]. So, if inflationary tensions are imported from foreign countries, monetary policy must be contractionary, and the nominal interest rate must increase [$\frac{\partial i_t}{\partial \widehat{\pi_t}^M} = 0.20$ with our basic calibration]. Besides, according to Equation (17), the increase in the nominal interest rate is all the more accentuated as the goal of stabilizing inflation is more important for the central bank compared to the one of stabilizing economic activity. Nevertheless, according to Equations (15) and (16), monetary policy then cannot prevent the increase of inflationary tensions [$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_t}^M} = 0.40$] and the decrease of economic activity [$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_t}^M} = -0.40$]; its efficacy is quite limited. Indeed, Equations (9) to (11) imply:

$$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_t}^M} = \frac{\nu\left(\Phi_y + \sigma\right)}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{15}$$

$$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_t}^M} = -\frac{\Phi_\pi \nu}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{16}$$

$$\frac{\partial i_t}{\partial \widehat{\pi_t}^M} = \frac{\Phi_\pi \sigma \nu}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{17}$$

The central bank's preference for stabilizing economic activity reduces monetary activism [$\frac{\partial i_t}{\partial \widehat{\pi_t}^M} \xrightarrow[\Phi_y \to \infty]{} 0$]. The inflation rate then only very marginally increases [$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_t}^M} \xrightarrow[\Phi_y \to \infty]{} \nu = 0.4$], whereas economic activity is less reduced [$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_t}^M} \xrightarrow[\Phi_y \to \infty]{} 0$]. On the contrary, the central bank's preference for stabilizing inflation strongly accentuates the monetary activism and the increase in the nominal interest rate. However, increasing inflation is then only very marginally limited, whereas economic activity is more reduced. Equations (15) to (17) show that to compensate for imported inflation, to perfectly stabilize the current inflation rate [$\frac{\partial \widehat{\pi_t}}{\partial \widehat{\pi_t}^M} \xrightarrow[\Phi_\pi \to \infty]{} 0$], the increase of the interest rate should be excessively high [$\frac{\partial i_t}{\partial \widehat{\pi_t}^M} \xrightarrow[\Phi_\pi \to \infty]{} \frac{\sigma\nu}{\kappa(1-\nu)} = 33.33$], and the cost in terms of recession would be excessively important[$\frac{\partial \widehat{y_t}}{\partial \widehat{\pi_t}^M} \xrightarrow[\Phi_\pi \to \infty]{} -\frac{\nu}{\kappa(1-\nu)} = -66.67$]. Therefore, it appears that monetary policy is quite inefficient in stabilizing inflationary tensions imported from foreign countries.

Obviously, this inefficacy of monetary policy strongly increases with the country's degree of openness (ν). Indeed, according to Equations (15) to (17), inflation and recession are both accentuated, despite the stronger increase in the interest rate. It is also slightly accentuated if the Phillips curve's slope (κ) is weak. Finally, this inefficacy is accentuated if the intertemporal elasticity of substitution (σ) is high: the higher increase of the nominal interest rate then attenuates the recession, but it cannot prevent a slight increase of inflationary tensions.

McGregor and Toscani [15] develop a bottom-up model of inflation in the euro area based on a set of augmented Phillips curves for seven subcomponents of core inflation and auxiliary regressions for non-core items between 2002 and 2022. They find a key role for international energy and food prices in explaining the recent surge in inflation: in Q2-2022, they account for about 75% of the increase in headline and 30% of the increase in core inflation. Anyway, in Europe, the surge in inflation between 2021 and 2023 can largely be explained by external factors and by imported inflation. Indeed, the war in Ukraine increased energy prices (gas and oil), whereas food prices (wheat and raw materials) afterward have strongly increased. Furthermore, in Europe, the cost-push shock and inflationary tensions were accentuated by the appreciation of the dollar due to a stronger rise in interest rates in the United States. This accentuated the surge of imported prices in Europe, final import prices, as well as prices of imported intermediate outputs. This implied an inflationary effect in Europe, as Europe is very dependent on US imports, depending on the trade openness of the countries. The contractionary effect of the worldwide decrease in demand, in particular coming from the United States, reducing European exports, was insufficient to compensate for the previous inflationary prices' effect. So, the increase in import prices implied a huge transfer of households' wealth in European countries to some energy and raw material producers in other countries.

Therefore, in this context, our theoretical model underlines a major problem of inefficacy for the European Central Bank. Monetary policy seems ill-suited to fight against inflationary tensions imported from foreign countries. Energy prices strongly increase the prices of some imported goods, change relative prices, and imply then a potential structural change in choices and arbitrage conditions of economic agents. However, monetary policy cannot shift demand away from higher-priced imported goods towards lower-priced domestic goods. As for inflation inherited from the past, in the case of imported inflation, a more contractionary monetary policy can only worsen the recession without really being efficient in limiting inflationary tensions. So, the unique mandate of the European Central Bank is to ensure price stability. Introducing a goal to limit the variations of the euro exchange rate would need to expand the mandate of the ECB, but it would also probably be useless, as, according to our model, the influence of a central bank is limited in influencing the exchange rate of its money and thus in mitigating the consequences of imported prices on the domestic inflation.

4.3. Anchoring of expectations

The credibility of monetary policy and the anchoring of expectations are very important to avoid the outburst of current inflation. Indeed, according to Equations (9) to (11), the current interest rate can be fixed at its long-term level ($i_t = i$), and current inflation and economic activity are perfectly stabilized ($\widehat{\pi_t} = \hat{y}_t = 0$), provided the central bank can credibly fix future inflationary anticipations at the level:

$$E_t(\widehat{\pi_{t+k+1}}) = E_t(i_{t+k}) - \sigma E_t(d_{t+k}) - \pi^* \ (\forall k \geq 1) \tag{18}$$

Therefore, credibly anchoring expectations to an announced target (π^*) is very important to control inflationary tensions. Since 2021, the European Central Bank has made efforts to ensure its credibility and its commitment to limit inflationary tensions

beyond the level of 2% in the long term. The ECB makes whatever necessary and huge increases in the nominal interest rate to reach this goal (see **Figure 1**). Indeed, the ECB's primary objective is to maintain price stability, that is, to preserve the euro's purchasing power. To this goal, the Harmonized Index of Consumer Prices (HIPC) increase must remain low, stable, and predictable; the ECB's Governing Council has adopted the target of 2% inflation over the medium term.

Nevertheless, persistent inflation (see **Figure 2** for Europe since 2021) can destabilize the expectations formation mechanisms, and inflation then accelerates. If short-term inflation expectations feed wage and price-setting decisions, the risk of spiraling inflation increases. Re-anchoring inflation expectations is then necessary; the central bank should keep expectations anchored to the target and preserve well-ordered wage negotiations and price setting. In particular, according to the European Commission [17], a high level of inflation with large inflation differentials implies a risk of inflation de-anchoring, which could facilitate the spillovers from prices to wages in the most affected countries. It would lower the optimality of a common monetary policy and create imbalances requiring costly adjustment. In this context, in 2021, the ECB [18] already feared that since 2007, longer-term inflationary expectations in the Euro Area were less well anchored: in 2021–2021, after some shocks, it has taken longer for inflation expectations to reach their new 'steady state' level.

Inflation expectations play a key role in monetary policy transmission through the 'expectation channel.' Expected inflation influences real interest rates and, therefore, consumption, investment, borrowing, and saving. This channel's effectiveness depends on the central bank's credibility in pursuing its price stability objective and on the anchoring of long-term inflation expectations. Measuring inflation expectations is a hard task, as mentioned by the ECB [18]; accurate data are still insufficient. With a given central bank strategy, adjustments to the monetary policy stance can lead to changes in short-term expectations without influencing long-term expectations. On the contrary, the re-anchoring channel implies an explicit role for monetary policy actions in impacting long-term inflation expectations by ensuring confidence in the central bank's inflation aims. Nevertheless, expectations are difficult to model, and their determination can be ambiguous. Indeed, Coibion et al. [19] show that detailed micro-level survey-based data and empirical evidence strongly contradict the assumption of full-information rational expectations. Therefore, contrary to the hypothesis of section 4.1, where economic agents could base anticipations on past inflationary tensions, empirical evidence shows that agents are largely rationally inattentive when forming their inflation expectations.

Bandera et al. [16] underline that economic agents cannot pay attention to all information, and therefore, in a highly inflationary context, where inflation was kept above target for several years, expectations could be de facto unstable and de-anchored, not insulated from cost-push shocks. In this case, monetary policy should be more contractionary and active to avoid these inflationary tensions due to more rational economic agents to re-anchor expectations. Indeed, central bank communication can then affect expectations: exposing households to information about the inflation target or level can have a strong effect, at least in the short term. In 1968, Friedman still underlined that the central bank could fight against inflation by

increasing unemployment only in the short term. In the long term, arbitrage is not possible, and when inflation expectations become unanchored, a persistent increase in inflation can take place whatever the monetary policy. So, returning inflation to the target is the soundest strategy to ensure inflation expectations remain anchored. Beaudry et al. [20] underline that in a context of bounded rationality, where economic agents form expectations using level-k thinking and where wage-price spirals are possible, it becomes optimal for central banks to initially ignore supply-driven inflationary shocks but then pivot to a much more aggressive monetary policy response if inflationary shocks cumulate above a certain threshold. Indeed, not pivoting could then induce long periods of high inflation driven solely by persistent deviations in inflation expectations. This theoretical framework would conform to the empirical observation of the behavior of central banks in 2021 and 2022 (see **Figure 1**). However, what was the empirical efficacy of this monetary policy in anchoring expectations?

Benigno and Eggertsson [12] consider that anchoring of expectations is well secured by the inflation targets of the central banks. Therefore, inflationary expectations would have been only 1% point above the target in the United States throughout the surge of the 2020s, as expectations were then better anchored, whereas it peaked close to 10% in the inflationary background of the 1970s. Nevertheless, in the current context, it seems fundamental to avoid any further drop in inflation expectations comparable to the 1970s. Regarding these risks, Coleman and Nautz [21] use a representative online survey to investigate the inflationary expectations of German consumers and the credibility of the ECB's inflation target during the recent high inflation period. They find that credibility has trended downwards since summer 2021; German consumers are more convinced that inflation will remain above the 2% target over the medium term. Furthermore, the high correlation between inflation expectations and the current inflation rate strongly indicates that inflation expectations could have been de-anchored from the inflation target. Besides, with a memory-based model, Gennaioli et al. [22] show that household inflation expectations remain rigid when inflation is anchored to the central bank target. However, during inflation surges, they can exhibit sharp instability, as similarity prompts retrieval of forgotten high-inflation experiences. Empirically, this can explain the de-anchoring and sharp rise of inflation expectations in the United States in 2022 and 2023, particularly among the elderly. According to the authors, the de-anchoring of expectations among the elderly is explained by selective memory and the importance of memory clues: High inflation today cues people to recall their similarly high inflation experiences from their database.

4.4. Future inflationary expectations and demand shocks

Future inflationary expectations or a positive demand shock increase the current inflation rate [see Equation (1)]; they decrease the real interest rate and increase current economic activity [see Equation (6)]. Therefore, monetary policy must be contractionary, and the nominal interest rate increases [$\frac{\partial i_t}{\partial E_t(\widehat{\pi_{t+1}})} = 0.67$ and $\frac{\partial i_t}{\partial d_t} = 0.33$ with our basic calibration]. According to Equations (19) and (20), inflation is

then well stabilized [$\frac{\partial \widehat{\pi_t}}{\partial E_t(\widehat{\pi_{t+1}})} = 0.004$], but a higher economic growth cannot be avoided [$\frac{\partial \widehat{y_t}}{\partial E_t(\widehat{\pi_{t+1}})} = 0.67$]. Equations (9) to (11) imply:

$$\frac{\partial \widehat{\pi_t}}{\partial [E_t(\widehat{\pi_{t+1}}) + \sigma d_t]} = \frac{\kappa(1-\nu)}{[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma]} \quad (19)$$

$$\frac{\partial \widehat{y_t}}{\partial [E_t(\widehat{\pi_{t+1}}) + \sigma d_t]} = \frac{1}{[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma]} \quad (20)$$

$$\frac{\partial i_t}{\partial [E_t(\widehat{\pi_{t+1}}) + \sigma d_t]} = \frac{[\Phi_\pi \kappa(1-\nu) + \Phi_y]}{[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma]} \quad (21)$$

A stronger preference of the central bank for stabilizing economic activity or inflation increases monetary activism [$\frac{\partial i_t}{\partial E_t(\widehat{\pi_{t+1}})} \underset{\Phi_\pi \to \infty}{\overrightarrow{\Phi_y \to \infty}} 1$]. Inflation is then very marginally reduced [$\frac{\partial \widehat{\pi_t}}{\partial E_t(\widehat{\pi_{t+1}})} \underset{\Phi_\pi \to \infty}{\overrightarrow{\Phi_y \to \infty}} 0$], whereas economic activity increases less [$\frac{\partial \widehat{y_t}}{\partial E_t(\widehat{\pi_{t+1}})} \underset{\Phi_\pi \to \infty}{\overrightarrow{\Phi_y \to \infty}} 0$]. We can mention that variations of the nominal interest rate or economic activity are negligible in the case of a strong preference of the central bank for stabilizing inflation, as (κ) is weak, and as inflation is always well stabilized. On the contrary, the increase in the nominal interest rate is stronger, and the increase of economic activity is more reduced if the central bank's preference for stabilizing economic activity increases. So, inflationary tensions are always well stabilized by an active monetary policy in case of future expected inflationary tensions or a positive demand shock, whereas economic activity is all the more limited and stabilized as the interest rate increases and as monetary policy is active.

According to Equations (19) to (21), the efficacy of monetary policy to stabilize future inflationary expectations and demand shocks is accentuated if the intertemporal elasticity of substitution (σ) is high: despite the smaller increase of the nominal interest rate, inflationary tensions are slightly more limited, and recessionary consequences are reduced. Finally, this efficacy of monetary policy slightly increases with the degree of openness (ν is high) of the country, and it decreases with the Phillips curve's slope (κ is weak). Despite the slightly smaller increase in the nominal interest rate, inflationary tensions are slightly weaker, even if the increase in economic activity is slightly accentuated. Therefore, according to our model, the central bank's action and an active monetary policy would be efficient and fundamental to stabilize future inflationary expectations and demand shocks.

The European Commission [17] underlines that inflationary expectations have strongly surged in Europe since 2021, in the inflationary framework of the war in Ukraine. However, long-term market-based inflation expectations have eased slightly as monetary policy has tightened. There was a peak of inflationary expectations of around 2.5% in April 2022 after the break of the war in Ukraine. Nevertheless, the ECB strongly increased interest rates and decided to end its massive asset purchases, so inflationary expectations were brought back to 2.2% in January 2023. Therefore, as

underlined by our theoretical model, monetary policy can efficiently stabilize future inflationary expectations.

4.5. Labor cost inflation and profit margins

Higher current and anticipated profit margins imply inflationary tensions [see Equation (2)]; so, monetary policy must be contractionary [$\frac{\partial i_t}{\partial \varphi_t} = 0.30$ with our basic calibration]. According to Equation (24), monetary policy is more contractionary if the goal of stabilizing inflation is more important than the goal of stabilizing economic activity for the central bank. Nevertheless, according to Equations (22) and (23), monetary policy then cannot prevent the increase of inflationary tensions [$\frac{\partial \widehat{\pi_t}}{\partial \varphi_t} = 0.60$] and the decrease of economic activity [$\frac{\partial \widehat{y_t}}{\partial \varphi_t} = -0.60$]; its efficacy is quite limited. Indeed, Equations (9) to (11) imply:

$$(\forall j \geq 0)\ \frac{\partial \widehat{\pi_t}}{\partial E_t(\varphi_{t+j})} = \frac{(1-\nu)(\Phi_y + \sigma)\beta^j}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{22}$$

$$(\forall j \geq 0)\ \frac{\partial \widehat{y_t}}{\partial E_t(\varphi_{t+j})} = -\frac{\Phi_\pi(1-\nu)\beta^j}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{23}$$

$$(\forall j \geq 0)\ \frac{\partial i_t}{\partial E_t(\varphi_{t+j})} = \frac{\Phi_\pi \sigma(1-\nu)\beta^j}{\left[\Phi_\pi \kappa(1-\nu) + \Phi_y + \sigma\right]} \tag{24}$$

The preference of the central bank for stabilizing economic activity obviously reduces monetary activism [$\frac{\partial i_t}{\partial E_t(\varphi_{t+j})} \underset{\Phi_\pi \to 0}{\overset{\Phi_y \to \infty}{\longrightarrow}} 0$]. However, the inflation rate very marginally increases [$\frac{\partial \widehat{\pi_t}}{\partial \varphi_t} \underset{\Phi_\pi \to 0}{\overset{\Phi_y \to \infty}{\longrightarrow}} (1-\nu) = 0.6$], whereas economic activity is less reduced [$\frac{\partial \widehat{y_t}}{\partial E_t(\varphi_{t+j})} \underset{\Phi_\pi \to 0}{\overset{\Phi_y \to \infty}{\longrightarrow}} 0$]. On the contrary, the central bank's preference for stabilizing inflation strongly accentuates the monetary activism and the increase in the nominal interest rate. However, the inflation rate then only very marginally decreases, whereas economic activity is more reduced. Equations (23) and (24) show that to compensate for inflation due to higher profit margins, to perfectly stabilize the current inflation rate [$\frac{\partial \widehat{\pi_t}}{\partial E_t(\varphi_{t+j})} \underset{\Phi_\pi \to \infty}{\longrightarrow} 0$], the immediate increase of the interest rate should be excessively high [$\frac{\partial i_t}{\partial \varphi_t} \underset{\Phi_\pi \to \infty}{\longrightarrow} \frac{\sigma}{\kappa} = 50$], and the cost in terms of recession would be excessively important [$\frac{\partial \widehat{y_t}}{\partial \varphi_t} \underset{\Phi_\pi \to \infty}{\longrightarrow} -\frac{1}{\kappa} = -100$]. Therefore, monetary policy would be quite inefficient in stabilizing inflationary tensions due to higher profit margins in the current period or anticipated for near-future periods.

Obviously, in case of variation of current or future anticipated profit margins, the inefficacy of monetary policy strongly increases with the degree of closeness to trade (ν is weak) of the country. Indeed, according to Equations (22) to (24), inflation and recession are both accentuated in a closed country, despite the stronger increase of the

interest rate $[\frac{\partial i_t}{\partial E_t(\varphi_t)} \underset{\nu \to 0}{\longrightarrow} 0.5; \frac{\partial \widehat{\pi_t}}{\partial E_t(\varphi_t)} \underset{\nu \to 0}{\longrightarrow} 0.99; \frac{\partial \widehat{y_t}}{\partial E_t(\varphi_t)} \underset{\nu \to 0}{\longrightarrow} -0.99]$. On the contrary, variations of current or anticipated profit margins have no economic consequences if the country is very open $[\frac{\partial i_t}{\partial E_t(\varphi_{t+j})} = \frac{\partial \widehat{\pi_t}}{\partial E_t(\varphi_{t+j})} = \frac{\partial \widehat{y_t}}{\partial E_t(\varphi_{t+j})} \underset{\nu \to 1}{\longrightarrow} 0]$. The inefficacy of monetary policy is also accentuated in case of higher profit margins anticipated for the nearest periods (j is small), or if the preference for the present is weak (β is high if $j >$ 1). Despite the stronger increase in interest rates, inflation and recession are then accentuated. Monetary policy is also slightly less efficient if the Phillips curve's slope (κ) is weak. Finally, monetary policy is less efficient if the intertemporal elasticity of substitution (σ) is high: the central bank must then accentuate the increase in the nominal interest rate; recessionary consequences are more reduced, but it cannot prevent a slight increase of inflationary tensions.

Let's explain more precisely the link between profit margins and inflation and why profit margins seem to have increased since 2021. In the post-Keynesian literature, an excess of wage gains over productivity gains is a determinant of price inflation. On the contrary, in the neoclassical theory, price changes imply a response of nominal wages in the employment negotiations to preserve the real wage and the purchasing power of households for a given productivity level. Beyond the covariation between prices and wages, empirical studies imply mixed results regarding the causality of the relationship. However, in a high-inflation environment, firms seem less likely to accept a decrease in their profits because of higher labor costs, and they are more likely to increase prices to preserve their margins, as interest rates and credit conditions could be hardened in the future.

As mentioned by the European Commission [17], profit margins were a cushion during the 2008 crisis: firms let them decrease and absorb cost shocks during the crisis instead of passing them on to consumers. Lower unit profits mitigated price pressures that originated from productivity losses and pushed up Unit Labor Costs (ULC). Boranova et al. [23] show that historically, wage growth has led to higher inflation, but the pass-through has weakened since 2009. They study 27 European countries from 1995 until 2019. Historically, wage growth has led to higher core inflation in Europe. From 2009 until 2019, the wage growth exceeding labor productivity gains, especially in the New Member States, should have led to higher inflation. However, the pass-through from labor costs to inflation was then lower. Indeed, empirically, the authors show that this pass-through is lower in periods of subdued inflation and inflation expectations (which are better anchored), and the beginning of the 2000s was characterized by price stability. The pass-through is also lower in sectors exposed to greater external (a higher share of imports) or internal (more deregulation) competitive pressures and robust corporate profitability. Indeed, in the case of profit buffers, firms can absorb the faster wage growth by reducing margins rather than passing the higher labor costs to their clients.

In the same way, Harding et al. [24] propose a macroeconomic model with a nonlinear Phillips curve having a flat slope when inflationary pressures are subdued and steepening when inflationary pressures are already initially elevated. This model implies a stronger transmission of shocks when inflation is high, and it can generate more sizeable inflation surges, especially in the case of cost-push shocks, than a

standard linearized model. The key feature of the model is a quasi-kinked demand schedule for goods produced by firms2: firms increase their prices by more when marginal costs go up. Indeed, in a context of increasing marginal costs, markups are low, and firms have a large incentive to increase their prices, even when this entails a substantial drop in demand. So, the authors show that in this model, the central bank faces a more severe trade-off between inflation and output stabilization when inflation is high. With a threshold VAR model, Hahn [25] finds that the wage-price pass-through is different between growth regimes for demand shocks but not for wage mark-up shocks. He shows a much smaller response of prices relative to wages, i.e., a smaller wage-price pass-through, and a smaller response of profit margins for demand shocks in recessions than in expansions. Businesses may rather aim for higher profit margins and consider them in their price-setting decisions if the economic environment is favorable and high demand strengthens their pricing power. In an unfavorable economic environment, preserving market shares may play a larger role than profit margin considerations.

In the context of a huge increase in wages and unit labor costs from mid-2017 onwards, Eser et al. [11] mention that the profit margins of firms compressed, limiting the pass-through to higher prices. On the contrary, the European Commission [17] underlines that with the COVID-19 crisis and afterward the inflationary environment, consumers were constrained to adopt a higher 'acceptance' of price increases, and producers allowed themselves higher profit margins in some sectors. Unit profits then did not cushion the increase in ULC, which instead was offset to some extent by unit taxes in a context of unprecedented policy support, including job retention schemes or moratoria aimed to prevent both layoffs and firm closures. Benigno and Eggertsson [12] also propose a non-linear inverted L New Keynesian Phillips curve to explain the surge of inflation in the 2020s. They consider that it was generated by an exceptionally tight labor market and can be explained by non-linearities in wage setting due to an imperfect labor market with search and matching frictions. Wages are highly flexible when the market is tight, in case of labor shortages, and there is then a high pass-through of wage increases and of supply shocks (like on energy prices) to inflation, whereas wages are more rigid under regular circumstances, when there is more wage inertia.

In the same way, the IMF [4] underlines that recently, despite an increase in nominal wages, the latter increased less than inflation, and therefore, real wages decreased in European countries. Nevertheless, nominal wage growth has been closer to inflation in countries with higher economic growth, such as the Czech Republic, Hungary, Lithuania, Poland, and Romania. So, profit margins would mainly be increased since the COVID-19 crisis. Bobeica et al. [26] find a strong link between labor cost inflation (wage inflation adjusted for productivity developments) and price inflation in the four major economies of the euro area (Germany, France, Italy, and Spain) during the period 1985–2018, in a long-term perspective. However, the link between both variables is less obvious in the short run. The authors find that it is more likely that labor costs are passed on to price inflation with demand shocks, as the relationship is not conclusive for supply shocks. Furthermore, the pass-through would be systematically higher in periods of high inflation, as in the current post-COVID period. Bobeica et al. [26] assess that this can be explained by many factors. In a low-

inflation environment, wage reductions are difficult to realize because of downward wage rigidities, whereas wage increases are easier in the opposite situation. In a high-inflation environment, the larger price dispersion implies that the search intensity of consumers is less responsive to the effect of a single shock, and buyers are more likely to accept higher inflation.

5. Conclusion

The current paper focuses on the determinants of the surge of inflation between 2021 and 2023 and on the efficacy of monetary policy in fighting against these inflationary tensions. In particular, the main role of the European Central Bank is to ensure that inflation expectations remain anchored. This goes through the credibility of the central bank's monetary policy and through the clear announcement of the target of an inflation rate close to 2% in the medium term. In the current context, it seems fundamental to avoid any further drop in inflation expectations comparable to the 1970s. Furthermore, our theoretical model shows that inflationary tensions are always well stabilized by an active monetary policy in case of future expected inflationary tensions or of a positive demand shock, whereas economic activity is then all the more limited and stabilized as the interest rate increases and as monetary policy is active.

However, our theoretical model can also explain the incapacity of European monetary policy to fight against the supply-side factors implying inflation after 2021. Indeed, our model shows that monetary policy is quite inefficient to stabilize inflationary tensions inherited from previous periods or imported from foreign countries. Monetary policy is also inefficient in stabilizing inflationary tensions due to higher current or anticipated profit margins. In these cases, a huge increase in the nominal interest rate and a very contractionary monetary policy only risk creating a strong recession without avoiding inflationary tensions. Therefore, regarding these criteria, inflationary tensions between 2021 and 2023 were caused by factors difficult to fight. In the post-COVID period, inflation was more backward-looking and related to imported inflation (food and energy), whereas firms' profit margins have also increased. However, monetary policy was mainly inefficient when confronted with such supply-side factors; in this case, the global macroeconomic policy should mostly improve the diversification in production or trading partners' supplies. Higher interest rates only risk aggravating the recession, and they hinder borrowed fiscal resources and the capacity of fiscal policy from the government to invest in green transition, for example. So, in the current context where potential trend growth is reduced, regarding the stagnation of private consumption and investment, a too-contractionary monetary policy could aggravate the recession.

Therefore, the arbitrage between rising interest rates to anchor inflationary expectations and conducting a prudent restrictive policy to avoid a recession is definitely a hard task for the decision-makers of the European Central Bank's monetary policy.

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Notes

[1] If the central bank maximizes the following quadratic loss function: $L = \alpha_\pi \widehat{\pi_t}^2 + \alpha_y \widehat{y_t}^2 + \alpha_i (i_t - i)^2$, we obtain the Taylor rule in Equation (8) with ($\Phi_\pi = -\frac{\alpha_\pi}{\alpha_i}\frac{\partial \widehat{\pi_t}}{\partial i_t}$) and ($\Phi_y = -\frac{\alpha_y}{\alpha_i}\frac{\partial \widehat{y_t}}{\partial i_t}$).

[2] Harding et al. [24] consider a quasi-kinked demand curve of the form: $y = a - p^b$, a,b > 0.

References

1. Attinasi MG, Bobasu A, Manu A-S. The implications of savings accumulated during the pandemic for the global economic outlook. ECB Economic Bulletin. 2021; 5.
2. Whelan K. Global factors and ECB monetary policy. In: Inflation as a Global Challenge, Monetary Dialogue. ECON Committee, European Parliament; 2022. pp. 73–92.
3. Bonatti L, Fracasso A, Tamborini R. Tackling inflation at a time of radical uncertainty. In: Inflation as a Global Challenge, Monetary Dialogue. ECON Committee, European Parliament; 2022. pp. 7–42.
4. International Monetary Fund. The fog of war clouds the European oulook. In: Regional Economic Outlook: Europe. International Monetary Fund; 2022.
5. International Monetary Fund. Europe's balancing act: Taming inflation without a recession. In: Regional Economic Outlook: Europe, April 2023. International Monetary Fund; 2023.
6. Debortoli D, Forni M, Gambetti L, et al. Asymmetric effects of monetary policy easing and tightening. CEPR Press; 2020; 15005.
7. Beckmann J, Gern K-J, Hauber P, et al. Rising inflation: Transitory or cause for concern? In: Monetary Dialogue Papers. European Parliament; 2021.
8. Bems R, Caselli F, Grigoli F, et al. Expectations' anchoring and inflation persistence. Journal of International Economics. 2018; 132. doi: 10.1016/j.jinteco.2021.103516
9. Ball LM, Mazumder S. A Phillips curve for the Euro area. In: Working Paper Series. National Bureau of Economic Research; 2019.
10. Gali J. Monetary Policy, Inflation, and the Business Cycle. In: An introduction to the New Keynesian Framework and its Applications, 2nd ed. Princeton University Press; 2015.
11. Eser F, Karadi P, Lane P R, et al. The Phillips curve at the ECB. In: Working Paper Series. European Central Bank; 2020.
12. Benigno P, and Eggertsson G. It's baaack: The surge in inflation in the 2020s and the return of the non-linear Phillips curve. NBER Working Paper. 2023; 31197.
13. Banbura M, and Bobeica E. Does the Phillips curve help to forecast inflation in the Euro area? In: ECB Working Paper. European Central Bank; 2020.
14. McLeay M, and Tenreyro S. Optimal inflation and the identification of the Phillips curve. NBER Macroeconomic Annual. 2020; 34 (1): 199–255.
15. McGregor T, and Toscani F. A bottom-up reduced form Phillips curve for the Euro area. In: IMF Working Paper. International Monetary Fund; 2022.
16. Bandera N, Barnes L, Chavaz M, et al. Monetary policy in the face of supply shocks: The role of inflation expectations. In: Proceedings of the ECB Forum on central banking, Macroeconomic stabilization in a volatile inflation environment; 26–28 June 2023; Sintra, Portugal.
17. European Commission. Inflation in the Euro Area and the EU. Available online: https://www.consilium.europa.eu/media/62958/inflation-note.pdf (accessed on 11 August 2024).
18. European Central Bank. Inflation expectations and their role in Eurosystem forecasting. In: Occasional Paper Series. European Central Bank; 2021.
19. Coibion O, Gorodnichenko Y, Kamdar R. The formation of expectations, inflation, and the Phillips curve. Journal of Economic Literature. 2018; 56(4): 1447–1491. doi: 10.1257/jel.20171300
20. Beaudry P, Carter TJ, Lahiri A. Looking through supply shocks versus controlling inflation expectations: Understanding the central bank dilemma. In: Staff Working Papers. Bank of Canada; 2022. pp. 22–41.

21. Coleman W, and Nautz D. Inflation target credibility in times of high inflation. Economics Letters. 2023; 222: 110930. doi: 10.1016/j.econlet.2022.110930
22. Gennaioli N, Leva M, Schoenle R, Shleifer A. How inflation expectations de-anchor: The role of selective memory cues. In: NBER Working Paper. National Bureau of Economic Research; 2024.
23. Boranova V, Huidrom R, Nowak S, et al. Wage growth and inflation in Europe: A puzzle? Oxford Economic Papers. 2021; 73(4): 1427–1453. doi: 10.1093/oep/gpab051
24. Harding M, Linde J, Trabandt M. Understanding post-COVID inflation dynamics; Journal of Monetary Economics. 2023; 140: S101–S118. doi: 10.1016/j.jmoneco.2023.05.012
25. Hahn E. The wage-price pass-through in the Euro Area: Does the growth regime matter? In: ECB Working Paper Series. European Central Bank; 2020.
26. Bobeica E, Ciccarelli M, Vansteenkiste I. The link between labor cost and price inflation in the Euro Area. ECB Working Paper. 2019; 2235.