Economic Modelling 151 (2025) 107227

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

Impact of monetary policy on functional income distribution: A panel vector autoregressive analysis

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ARTICLE INFO

Handling editor: Sushanta Mallick

JEL classification:
E24
E52
E58

Keywords:
Monetary policy
Functional income distribution
Panel vector autoregression
Labor share
Labor market

ABSTRACT

This study examines the impact of monetary policy on functional income distribution, which is defined here as the level of real wages and the size of the labor share of income. This topic has often been overshadowed by analyses of personal income inequality. Although prior research has presented mixed evidence while focusing on short-term effects, we investigate the medium-to long-term distributional consequences of monetary tightening. Using a panel vector autoregressive framework and a dataset encompassing 15 advanced economies from 1970 to 2019, we analyze how real wages and the labor share respond to contractionary monetary policy. Our findings reveal that contractionary monetary policies lead to persistent declines in both real wages and the labor share. By disentangling the underlying transmission mechanisms, we identify the labor market channel as the primary driver: the scarring effects on wages and labor force participation endure even after output and prices stabilize. These results underscore the importance of incorporating long-term distributional considerations into the formulation of monetary policy.

1. Introduction

In most countries, recurring crises resulting from financial instability, COVID-19, rising inflation, and wars have had far-reaching consequences. Among them are major shifts in the conduct of monetary policy, ranging from prolonged periods of unconventional measures to the recent adoption of restrictive policies characterized by significant interest rate hikes. These crises have also exacerbated income and wealth inequality. For example, real household incomes at the lower end of the distribution fell sharply in countries most affected by the Great Recession (OECD, 2015), and the COVID-19 pandemic further intensified this trend (Ahmed et al., 2020). Rising inequality has wide-ranging macroeconomic implications. Hence, it is unsurprising that policymakers have turned their attention to the distributional effects of monetary policy (e.g., Bernanke, 2015; Draghi, 2015). As such, researchers have also engaged with this issue, and “the last decade has seen an explosion of empirical and theoretical research on the links between monetary policy and inequality” (McKay and Wolf, 2023, p. 121). However, the empirical literature offers no consensus on how monetary policy shocks affect inequality (Colciago et al., 2019; McKay and Wolf, 2023). Although Dossche et al. (2021) suggested that expansionary monetary policy has helped contain income inequality in Europe, Davtyan (2023) found the opposite in the U.S. Despite their beneficial effects on economic activity, these policies may have increased income inequality by raising capital income more than wages and widened wealth inequality by boosting stock prices more than housing prices.

Furthermore, most of the literature has focused on the effects of monetary policy on personal income distribution rather than on functional income distribution (Kappes, 2023). Notable exceptions include Christiano et al. (1997, 2005), who found for the U.S. that expansionary (contractionary) monetary policy has a positive (negative) effect on real wages. More recently, Cantore et al. (2021) examined the Great Moderation period across five countries and confirmed the negative impact of restrictive monetary policy on real wages. However, they also noted a positive effect on the labor share because labor productivity declined more sharply than real wages.

Our study contributes to the literature on the transmission mechanisms of monetary policy and its effects on income distribution in three major areas. First, we specifically examine the impact of monetary

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https://doi.org/10.1016/j.econmod.2025.107227
Received 7 October 2024; Received in revised form 3 July 2025; Accepted 11 July 2025
Available online 15 July 2025

policy on functional income distribution by analyzing the evolution of nominal and real wages, as well as the labor share, over the medium to long term (Colciago et al., 2019). To this end, we employ a panel vector autoregression (VAR) methodology using a comprehensive dataset covering 15 advanced economies from 1970 to 2019.

Second, we identify and disentangle the transmission channels behind these distributional effects, distinguishing between short-term and long-term mechanisms. In particular, we emphasize the labor market channel as a key driver of changes in functional income distribution, highlighting its adverse impact on workers' bargaining power and the persistence of its effects beyond the short run.

Third, building on these insights, our study contributes to the hysteresis literature (e.g., Acharya et al., 2022; Jordà et al., 2024) by demonstrating how monetary policy shocks lead to persistent and long-lasting effects on labor market dynamics. To test this hypothesis, we decompose unemployment trends, examining labor force participation and various indicators of short-term and long-term unemployment.

According to our results, a contractionary monetary policy shock causes persistent negative effects on real wages, and these effects are sustained over the medium to long term. The influence of such a shock on the labor share depends on its combined effect on real wages and labor productivity (Cantore et al., 2021; Mendieta-Muñoz et al., 2021). We find that the labor share declines following a contractionary monetary policy shock. Although there is some recovery, the labor share does not return to preshock levels. This pattern is primarily due to the 'scarring' effects of contractionary policy on the labor market. Specifically, such policies increase unemployment by reducing economic activity in the short to medium run, but their effects on income distribution persist even after the "cost" and "activity" channels bring price level and GDP back to their original values. This persistence is due to lasting impacts on several labor market indicators, including nominal wage levels, the number of both short-term and long-term unemployed individuals, and the overall size of the labor force.

The paper is structured as follows. Section 2 introduces the relevant literature and outlines the general framework for the study. Section 3 presents the data, empirical methodology, identification strategy, and key findings. Section 4 discusses the results and offers a broader interpretive framework, and Section 5 concludes.

2. Theoretical and empirical background

Given the renewed attention to inequality and monetary policy, it is unsurprising that their interaction has been the subject of extensive academic inquiry. Policymakers have also expressed strong interest in the topic, stating that monetary policy has distributional effects through macroeconomic channels (Bernanke, 2015; Draghi, 2015; Carney, 2016).

According to Colciago et al. (2019), the overall evidence yields a mixed assessment of the roles played by both conventional and unconventional monetary policy in shaping income and wealth inequality. Focusing on the European context, Dossche et al. (2021) argued that the European Central Bank's recent expansionary monetary policies have likely mitigated income inequality.[1] In contrast, Davtyan (2023) found that despite improving general economic conditions, unconventional monetary policies in the U.S. tended to increase income inequality by boosting capital income more than wages. Additionally, these policies contributed to greater wealth inequality by raising stock prices more than housing prices. Another recent study by McKay and Wolf (2023) emphasized that, whereas expansionary monetary policy may affect households through various channels, its overall impact tends to be relatively evenly distributed. Furthermore, Kappes (2023) contended that, on average, the literature supports the view that both conventional and unconventional expansionary monetary policies reduce inequality.

A key point often emerging from the literature is the belief that the effects of monetary policy on inequality are short-lived. The concept of money neutrality is widely discussed in this context. As Jordà et al. (2024) noted, monetary policy is generally considered neutral in the long run with respect to economic growth, with its influence limited to cyclical fluctuations. However, they argued that contractionary monetary policy can exert lasting adverse effects on productive capacity and potential output.[2] The notion that monetary policy only influences inequality in the short term also persists in works on income distribution. In this regard, Colciago et al. (2019, p. 1224) observed that most studies they review focus on the cyclical effects of monetary policy, stating that "over the longer horizon, the distributional impact is likely to die out given the temporary nature of the effects of monetary policy shocks". In contrast, Kappes (2023) argued that monetary policy plays a meaningful role in shaping inequality beyond the short run, based on the available empirical findings.

Evidence supporting this longer-term perspective is now emerging. Gahn (2024) found that contractionary monetary policy increases the rate of profit in a panel of 11 Eurozone countries and that a long-run relationship exists between the real interest rate and the profit rate. Specifically, Gahn argued that the nominal interest rate is one determinant of the profit rate and applies an ARDL methodology to investigate this long-run relationship. In addition to this evidence on profitability, Cucciniello et al. (2022) showed that restrictive monetary policy shocks reduce real wages in the U.S. (1959–2018). They interpreted this outcome as a result of nominal wages failing to keep pace with price increases triggered by monetary shocks.

We now turn to the importance of studying the effects of monetary policy on functional income distribution. As noted below, the literature has disproportionately focused on personal income distribution. On this distinction, Atkinson (2009) maintained that the analysis of income shares is crucial for addressing several key issues. These include the relationship between macroeconomic and household-level incomes, the need to refine inequality analysis in personal income distribution, and the importance of fairness in the distribution of income originating from different sources. Atkinson also noted that income shares can serve as indicators of the relative power held by different social groups. Similarly, Glyn (2011) argued that studying income shares is essential for both normative and positive analysis of economic systems, as well as for evaluating their implications for household income distribution, capital accumulation, and macroeconomic stability. Like Atkinson (2009), Glyn emphasized the need to consider fairness in how income from different sources is distributed.

Checchi and García-Peñalosa (2005) empirically demonstrated that labor share and relative wages are important determinants of inequality in a panel of OECD countries (1970–1996). Daudey and García-Peñalosa (2007) also found that the labor share is a key factor in personal inequality across 39 developed and developing countries (1970–1994), with higher labor shares associated with lower Gini indices.

In addition to the link between functional and personal income

[1] For an analysis of how individuals perceive the distributional effects of monetary policy in the euro area, see Hayo (2023).

[2] They maintain that higher interest rates are conducive to lower production and tighter credit conditions engendering a reduction in investments and causing workers to lose their skills. Moreover, from a perspective more focused on smaller and younger firms, Alam and Alvi (2024) confirm these findings. Their results highlight the strong persistence of the negative effects of restrictive monetary policies on research and development investments, and consequently on the productivity of firms in the manufacturing sector. Regarding the persistent effects of monetary policy related to the phenomenon of hysteresis, particularly concerning the unemployment rate, Stockhammer and Sturn (2012).

distribution, analyzing the relationship between functional income distribution and monetary policy can inform both theoretical and empirical debates. On the theoretical side, Rudd and Whelan (2005) discussed proposals by some scholars to use the labor share of income as a proxy for the output gap, thus providing central bankers with an additional variable when designing monetary policy. More recently, Cantore et al. (2021) contended that their empirical finding in which contractionary monetary policy increases the labor share while reducing real wages is difficult to reconcile with conventional new-Keynesian models. This discrepancy opens an avenue for future research to investigate the causes of such divergence. On this topic, also Chu (2020).

As noted earlier, the existing literature reveals a lack of focus on functional income distribution—a concept that, in our study, is defined by the labor share and real wage levels. This neglect manifests in two ways. First, there is a relative scarcity of studies compared to the abundant work on personal income distribution (Kappes, 2023). Second, there is an absolute gap, as only a handful of studies explicitly analyze the effect of monetary policy on functional income distribution. For instance, as noted by Cantore et al. (2021), even the comprehensive literature review on monetary policy shocks by Ramey (2016) does not address their influence on real wages and the labor share.

Nonetheless, empirical studies have examined the effects of monetary policy on real wages and labor share. Christiano et al. (1997) found that in the U.S., real wages decline following a contractionary monetary policy shock. In a later study, Christiano et al. (2005) reported that expansionary monetary policy positively affects real wages. While Sims and Zha (2006) supported similar findings, Altig et al. (2011) did not observe a significant response of real wages to monetary policy shocks. Normandin (2006), using separate VAR models for each G7 country, found that expansionary monetary policy reduces real wages in Canada, France, and the U.K., while producing opposite effects in the other countries. McCallum and Smets (2007), focusing on European economies and using a factor-augmented VAR approach, showed that restrictive monetary policy generally lowers real wages. However, cross-country heterogeneity is more pronounced for real wages than for GDP or employment: in Germany and France, real wages initially increase, whereas in Spain and Italy, they fall sharply.

Continuing this focus on both real wages and the labor share, Cantore et al. (2021) analyzed the Great Moderation period for the U.S., Canada, Euro Area, Australia, and the U.K.[3] Their results showed that restrictive monetary policy negatively affects real wages but positively affects the labor share, as labor productivity declines more than wages. Supporting this finding, Nekarda and Ramey (2020) showed that expansionary monetary policy increases price markups, which are the inverse of the labor share. At a more granular level, Coibion et al. (2017) estimate the effects of interest rate hikes across different wage percentiles. They find that restrictive monetary policy raises income and wage inequality, increasing wages at the top of the distribution while suppressing those at the bottom.

In addition to identifying the type of inequality analyzed, it is also essential to distinguish the various channels through which monetary policy can affect income distribution. In the literature on monetary policy and personal income distribution, several so-called distributional channels are discussed (Amaral, 2017; Colciago et al., 2019). A key contribution in this field—also relevant to our analysis—is the classification of channels into direct and indirect types (Ampudia et al., 2018). The direct channels reflect partial-equilibrium effects of policy rate changes while holding employment and wages constant. The indirect channels capture general equilibrium responses of output, prices, employment, and wages to monetary shocks. Within this framework, Samarina and Nguyen (2023) decomposed the effects of monetary policy shocks in a panel of Euro Area countries (1999–2014) into direct (driven by changes in interest income and payments) and indirect effects. The latter were further split into labor market and financial channels. Financial channels operate through asset price changes caused by monetary shocks, which alter firm net worth and capital financing costs, ultimately influencing employment and wages. Labor market channels, in contrast, involve changes in employment and earnings due to shifts in aggregate demand and investment.

The literature examining monetary policy and functional income distribution explores multiple factors. In new-Keynesian DSGE models, the relationship between interest rates and real wages depends on the specific frictions incorporated. In sticky-wage models with labor market frictions, this relationship is typically positive, as price adjustments move inversely to interest rates. In contrast, sticky-price models with frictions in goods markets suggest that changes in interest rates have symmetrical effects on both nominal and real wages[4] (i.e., increases (decreases) in rates reduce (raise) wage levels). Additionally, new-Keynesian models assume that the labor share equals the inverse of the price markup and moves procyclically with monetary shocks. At the same time, the price markup is expected to respond counter-cyclically (Galì, 2015). This occurs because, under sticky prices, a demand shock raises both output and marginal costs, causing the markup (price over marginal cost) to fall, and vice versa. Even in medium-scale new--Keynesian models with sticky wages, a counter-cyclical price markup is central to propagating both monetary and fiscal policy shocks (Nekarda and Ramey, 2020). However, as Cantore et al. (2021) pointed out, the link between price markups and the labor share becomes ambiguous when factoring in cost channels or fixed production costs.

In recently developed heterogeneous agent new-Keynesian models, attention has primarily focused on personal inequality in response to monetary policy shocks. Nonetheless, it is possible to identify mechanisms that also affect real wages. The logic is that, under search-and-matching labor market frictions, a positive demand shock induced by expansionary monetary policy increases employment. However, these frictions limit the full transmission of the shock, which is partially reflected in rising wages at the lower end of the income distribution (Dolado et al., 2021; Komatsu, 2023).

In a post-Keynesian framework, as summarized in Lofaro et al. (2023), Moore (1989) argued that monetary policy can influence the labor share through markup pricing mechanisms. He maintained that persistent changes in interest rates could inversely affect the labor share, provided that price markups over normal unit costs remain unchanged. In empirical studies, Hein and Schoder (2011) analyzed the effects of interest rate changes on capacity utilization, capital accumulation, and profit in the U.S. and Germany (1960–2007). They find that rising interest rates slow economic activity and increase the profit share in both countries. Regarding real wages, scholars such as Panico (1988), Pivetti (1991), and Stirati (2001) argued that restrictive monetary policy, when it raises interest rates for an extended period, increases normal production costs. If nominal wages and other intermediate input costs remain constant, this drives up price levels and reduces real wages, thereby shifting income distribution. Cucciniello et al. (2022), mentioned earlier, based their interpretation of results on this line of reasoning.

[3] Additional evidence on the Japanese and European cases can be found in Latsos (2018), Israel and Latsos (2020), Saiki and Frost (2020).

[4] In the DSGE literature, Smets and Wouters (2003) estimate a Bayesian DSGE model and find that interest rate hikes have a negative impact on real wages, which exhibit an inverted U-shaped response like that of other real variables. Additionally, Christoffel et al. (2006) estimate a sticky-price DSGE model with labor market frictions and obtain similar evidence, as expansionary monetary policies have a positive effect on real wages.

3. Empirical analysis

3.1. Data

We used annual data from a panel of 15 advanced economies covering 1970–2019 to analyze the macroeconomic impact of monetary policy on real wages,[5,6] Variables included short-term interest rate (*i*), real gross domestic product (*GDP*), the GDP deflator (*P*), commodity price index (*PCOM*), nominal compensation per employee (*W*), real compensation per employee (*WR*), labor share of income (*LS*), unemployment rate (*UN*), labor force (*LF*), short-term unemployment (*SHORTUN*), and long-term unemployment[7] (*LONGUN*).[8] See Table 1 for variable definitions. Note that the short-term interest rate was sourced from the AMECO dataset, OECD, and the Jordà–Schularick–Taylor Macrohistory Database (Jordà et al., 2017). Distributive variables (i.e., nominal wages, real wages, and labor share) were obtained from the AMECO dataset. Data on GDP, GDP deflator, and labor market indicators were sourced from OECD databases.

To account for forward-looking variables (e.g., expected inflation) and following the price-puzzle literature (Sims, 1992; Leeper et al., 1996; Christiano et al., 1999; Mallick and Sousa, 2012), we included a cross-country uniform global energy commodity price index (USD) from the World Bank. We also considered the role of external shocks by replacing commodity prices with the real effective exchange rate[9] (*REER*), produced by Bruegel (Darvas, 2021) as a robustness check. Additionally, to account for the zero lower bound period, we used a shadow interest rate (*SH*) measure where available (Wu and Xia, 2016). For the Euro area, the U.S., and the U.K. *SH* was sourced from Wu's website.[10] For Japan, it was sourced from Li's website (Ikeda et al., 2024).[11] Where necessary, variables were converted to USD using the PPP Index from the OECD. Apart from interest and unemployment rates, all variables were expressed in logarithmic levels.

Before delving into the methodology and presenting our estimation results, we provide a brief overview of the evolution of monetary policy, labor market conditions, and income distribution in the 15 countries examined. Accordingly, Figs. 1–3 illustrate the 50-year trends (1970–2019) in the interest rate, the unemployment rate, and the labor share, respectively, and Appendix A summarizes the key values for each series in Table A1.

Although with some variation, Fig. 1 shows that after a peak around the 1980s—coinciding with the U.S. experiment under Volcker and the

Table 1
Variable definitions.

Variable	Label	Note	Source
Short term interest rate	*i*	Typically the central bank policy rate or equivalent market rate, depending on country availability	AMECO (Italy and U.K.); Jordà, Schularick, Taylor Macro-Dataset (Spain and Sweden); OECD, Economic Outlook No 112, November 2022 (Australia, Belgium, Canada, Finland, France, Germany, Japan, Netherlands, Norway, Portugal, United States)
GDP Deflator	*P*	A price index used also to deflate nominal variables into real terms	OECD Stats Economic Outlook
Nominal compensation per employee	*W*	Nominal compensation per employee in PPP	AMECO (Gross Domestic Product (GDP), Income approach)
Real compensation per employee	*WR*	Computed as nominal compensation per employee deflated with GDP Deflator	AMECO (Gross Domestic Product, Income approach)
Real Gross Domestic Product	*GDP*	GDP (expenditure approach) Constant prices, constant PPPs, OECD base year	OECD National Accounts
Adjusted Labor Share	*LS*	Labor compensation as a share of GDP, adjusted to account for the labor income of self-employed workers and other non-wage labor components	AMECO
Energy commodities price index	*PCOM*	Expressed in U.S. dollars	World Bank
Purchasing power parities	*PPP*	Purchasing power parities for GDP, National currency per U.S. dollar	OECD, PPPs and exchange rates
Unemployment rate	*UN*	Unemployment rate (as a percentage of the active labor force)	OECD, Labor Force Statistics.
Short-term unemployment	*SHORTUN*	Unemployment by duration: Less than 6 months (15–64 years, thousand persons)	OECD, Labor Force Statistics.
Long-term unemployment	*LONGUN*	Unemployment by duration: 6 months or more (15–64 years, thousand persons)	OECD, Labor Force Statistics.
Labor force	*LF*	Labor force (15–64 years, thousand persons)	OECD, Labor Force Statistics.
Real effective exchange rate	*REER*	CPI-based Real effective exchange rate	Bruegel https://www.bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database
Shadow interest rate	*SH*	Available only for the United States, United Kingdom, Eurozone countries and Japan	https://sites.google.com/view/jingcynthiawu/shadow-rates https://www.lishangshang.com/shadow_rate.html

[5] More specifically, the countries analyzed are as follows: Australia, Belgium, Canada, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, United States.

[6] We exclude the pandemic years from our analysis to ensure a more robust identification of monetary policy effects. The unprecedented nature of the COVID-19 crisis, which led to high volatility in real variables, combined with extraordinary fiscal and monetary interventions, complicates the estimation of standard macroeconomic relationships. Including this period could introduce confounding factors that are difficult to disentangle within a panel-VAR framework.

[7] Short-term unemployed individuals are defined as those who have been seeking employment for less than six months, while long-term unemployed individuals are defined as those who have been searching for more than six months. The results remain robust across various definitions, including one that classifies long-term unemployment as a duration of one year or more. These results are available upon request.

[8] Generally, the dataset spans the period 1970–2019 for all countries, except for Japan, whose data begin in 1980. Information on short-term and long-term unemployment is available from at least 1985 for all countries, except Norway, where such data are only available from 1998.

[9] An increase in the index indicates appreciation of the home currency against the basket of trading partners' currencies.

[10] https://sites.google.com/view/jingcynthiawu/shadow-rates.

[11] https://www.lishangshang.com/shadow_rate.html.

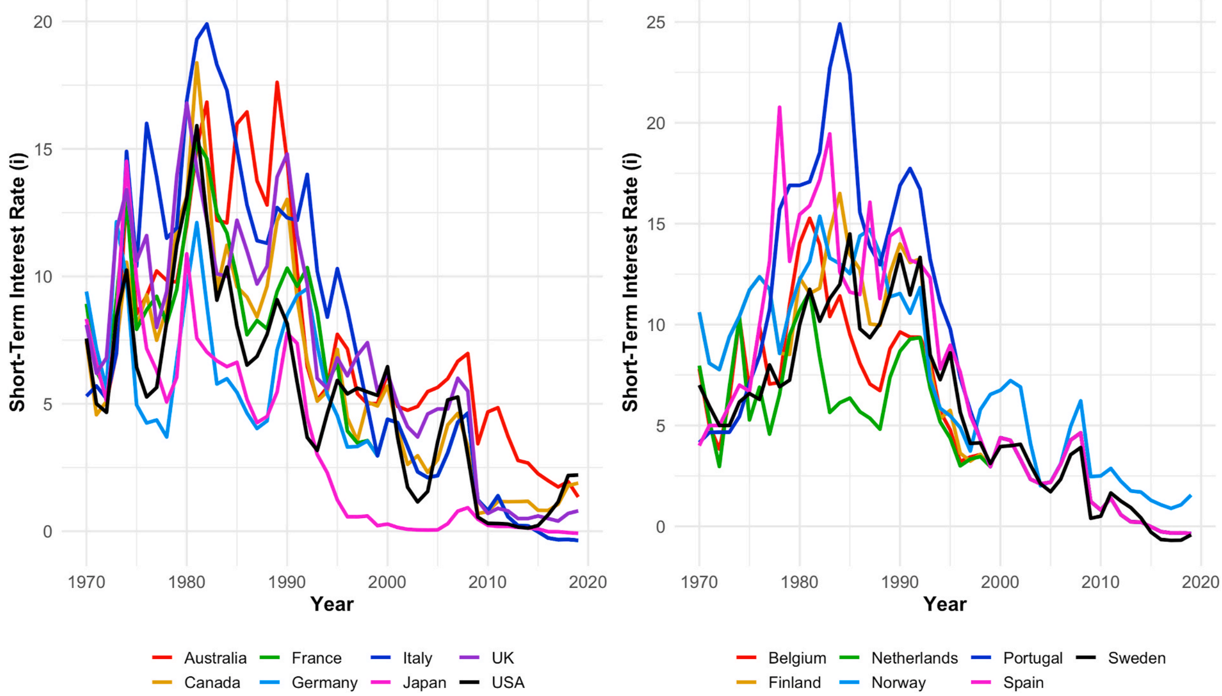

Fig. 1. 50-year trend of short-term interest rates (i) for the 15 countries in this study.

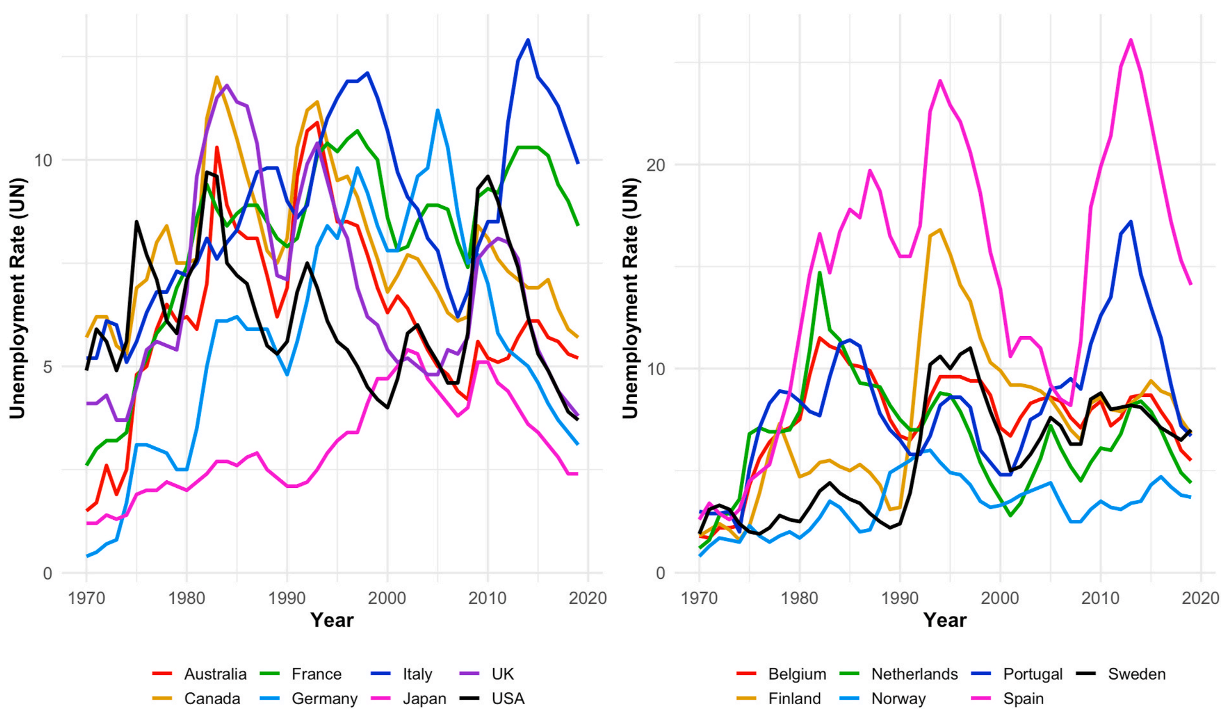

Fig. 2. 50-year trend of unemployment rate (UN) for the 15 countries in this study.

Reagan and Thatcher administrations—interest rates have gradually declined over the past 30 years. This downward trend, commonly referred to in the literature as secular stagnation, became even more pronounced after the 2008 crisis, when central banks reduced rates to near zero.

Fig. 2 presents the evolution of labor market conditions and economic activity through the unemployment rate. Across countries, cyclical patterns are evident, with significant peaks in the early 1980s that coincide with sharp interest rate hikes, suggesting that monetary tightening substantially affected economic activity and labor markets. Similar peaks are observed in some cases during the early 1990s. Notably, the highest unemployment rates in recent years have occurred in European countries. Since the 2008 crisis, Italy, Portugal, Spain, and France have recorded the highest unemployment levels across the 50-year span, highlighting the severe labor market effects of the Great Recession.

Finally, given our interest in the distributive effects of monetary policy, Fig. 3 tracks the evolution of the wage share across the countries

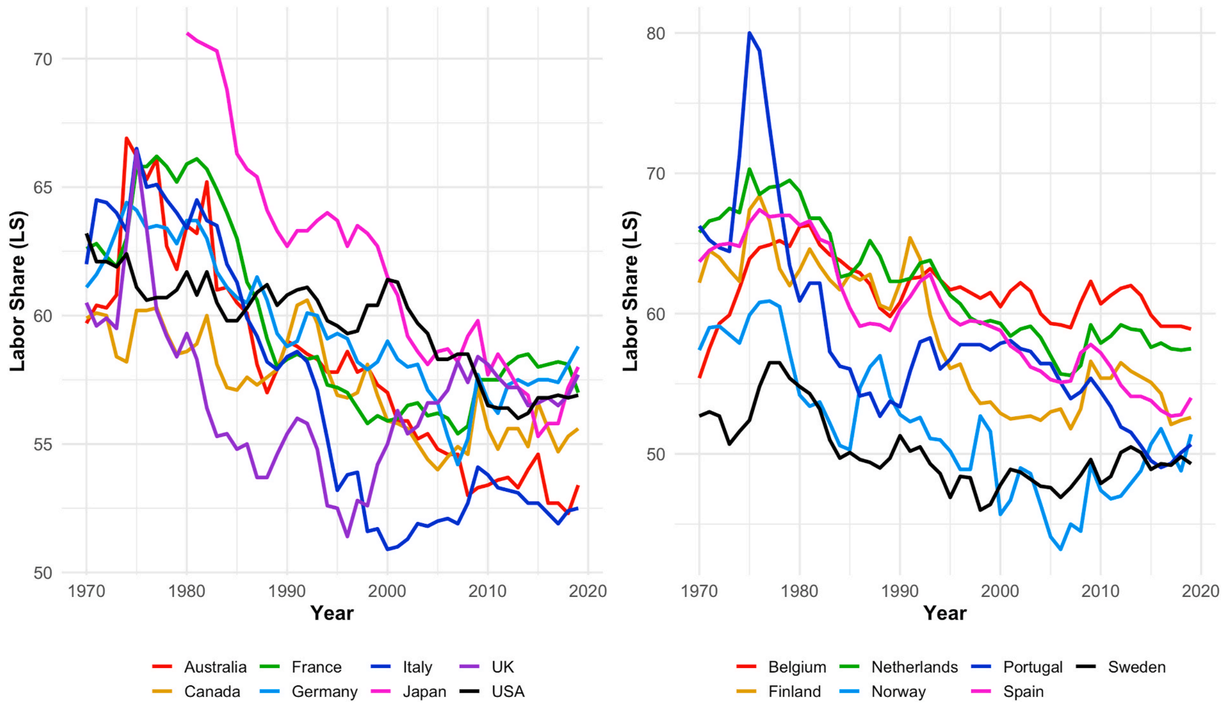

Fig. 3. 50-year trend of the adjusted labor share (LS) for the 15 countries in this study.

in the panel. Notably, the labor share has followed a broadly consistent downward trend over the 50-year period. Specifically, this share ranged between 60 % and 66 % in the early years but has since declined by about 10 percentage points, now lying between 50 % and 57 %.

Having outlined these general trends, the following sections examine how monetary policy influences the evolution of income distribution (particularly real wages and the labor share) and the dynamics of economic activity and labor markets (approximated by GDP and unemployment rate).

3.2. Methods and findings

We used a panel-VAR (PVAR) model (Goodhart and Hofmann, 2008; Canova and Ciccarelli, 2013; Beetsma et al., 2021) to assess the effect of monetary policy on functional income distribution. This methodology allowed us to account for individual heterogeneities and capture dynamic interdependencies in the data using a minimal set of restrictions (Canova and Ciccarelli, 2013). Consistent with the empirical macroeconomic literature (Blanchard and Quah, 1989; Sims, 1992; Uhlig, 2005), the imposed restrictions allowed us to isolate exogenous shocks and directly compute the impulse responses of variables to the shock of interest.

In the first specification (Eq. (1)), the PVAR model includes seven endogenous variables: $\boldsymbol{Y} = [PCOM, \ GDP, \ UN, \ P, \ WR, \ LS, \ i]$, where i denotes the country and t the year of observation:

$$Y_{i,t} = A(L)Y_{i,t-1} + CX_{i,t} + u_{i,t} \tag{1}$$

Here, $Y_{i,t}$ is a vector of endogenous variables, and $u_{i,t}$ is a vector of errors. $A(L)$ is a polynomial matrix in the lag operator, with lag length determined by selection criteria allowing up to two lags.[12] Consistent with previous literature (Bénétrix and Lane, 2010; Beetsma et al., 2021), $X_{i,t}$ includes country-specific effects (α_i) and global macroeconomic shocks captured by year dummies (d_t). We also included country-specific linear trends (γ_i) in $X_{i,t}$ to capture varying time trends across countries and address potential nonstationarity. Matrix C contains the coefficients for individual fixed effects, time fixed effects, and country-specific trends. $u_{i,t}$ is the vector of error terms in the reduced form of the PVAR.

The PVAR structural model is obtained by premultiplying Eq. (1) with the matrix of contemporaneous relationships, A_0, as shown in Eq. (2):

$$A_0 Y_{i,t} = B(L)Y_{i,t-1} + DX_{i,t} + \epsilon_{i,t}, \tag{2}$$

where $B(L) = A_0A(L)$, $D = A_0C, \epsilon_{i,t} = A_0u_{i,t}$

The model is considered "structural" because the elements of $\epsilon_{i,t}$ are mutually uncorrelated and can be interpreted within an economic framework. Specifically, they represent exogenous shocks (Kilian and Lütkepohl, 2017). We identify these exogenous shocks using a recursive approach based on Cholesky factorization, which imposes a lower triangular structure on the contemporaneous relations matrix (Christiano et al., 1999).[13] Because variable ordering matters in Cholesky identification, our model follows the ordering in Eq. (1), placing the short-term interest rate last—consistent with most monetary policy SVARs.[14] This implies that monetary policy has a delayed effect on the other variables, consistent with the empirical evidence of Smets and

[12] The selection of two lags is supported by evidence from three different types of information criteria, specifically: Akaike, Schwarz, and Hannan-Quinn. However, our results remain robust even with a model based on only one lag. These results are available upon request.

[13] This strategy is also employed by Cantore et al. (2021, p. 1615) in a study similar to ours on the effects of monetary policy on the wage share, showing that impulse responses are largely consistent across different identification methods, including proxy-SVAR. They state: "As shown, the responses using proxy and Cholesky identification virtually overlap for all five variables. However, comparing confidence sets [...], we can see that the bands around the proxy responses are larger than for the Cholesky responses. Therefore, the Cholesky VAR seems to be more precise and we choose to use it for estimation.".

[14] In any case, the ordering of the variables does not seem to affect our results. First, our findings would still hold if we adopted an ordering that places the interest rate first, as suggested by Barbieri Góes and Deleidi (2022). Furthermore, this will also be supported in appendix B where we utilize Generalized Impulse Response Functions (GIRF), which are invariant to the ordering in the P-VAR (Pesaran and Shin, 1998).

Wouters (2005), who observe lags of one to two years. This approach assumes that other variables do not respond contemporaneously to monetary shocks, while central banks can react within the same year to other shocks (Christiano et al., 2005; Castelnuovo and Surico, 2010; Cantore et al., 2021).[15]

After identifying the exogenous shocks, we compute structural shocks to estimate impulse response functions (IRFs), which trace the dynamic effects of a monetary policy shock on all variables in the model. Standard errors are calculated using the Monte Carlo method with 1000 repetitions, and IRFs are reported with one standard deviation error bands (68 % confidence intervals).

We begin by examining the IRFs derived from our primary econometric model, estimated using the full sample of 15 countries from 1970 to 2019. Our analysis focuses on a restrictive monetary policy shock, operationalized as a 1 % increase in short-term interest rates (i), as illustrated in Fig. 4 and summarized in Table 2.

In the short term, we observe a positive and statistically significant response of the GDP deflator (P) to the monetary policy shock. As shown in Table 2, prices peak at an increase of 0.19 % three years after the monetary contraction, before returning to preshock levels. We also examine the effect on economic activity, represented by *GDP* and the unemployment rate (*UN*). Following the interest rate hike, *GDP* declines by 0.62 % after three years, as *UN* increases, reaching a peak of 0.34 %. Although these effects are most prominent in the short term, both GDP and unemployment eventually return to their initial levels after about 10 years.

In contrast, two variables, real wages (*WR*) and labor share (*LS*), fail to return to preshock levels. As shown in Fig. 4, real wages respond negatively and persistently to the interest rate hike, with a 0.35 % decline observed five years after the shock. This effect remains statistically significant across the full time horizon, leaving real wages approximately 35 basis points below their preshock level even after a decade.

Turning to the LS, we find a similar sustained decline following the monetary contraction, with the most pronounced effect (0.27 % decrease) occurring six years after the shock. Notably and in contrast with some prior studies (e.g., Cantore et al., 2021), the LS does not recover to its preshock level.[16]

[15] The identification strategy places commodity prices (*PCOM*) as the first variable in the SVAR model, based on the assumption that these prices are largely exogenous for the countries in our panel, as they are determined in international markets. This assumption aligns with previous studies that adopt a similar Cholesky ordering (e.g., Mallick and Sousa, 2012; Bodenstein et al., 2018; Naraidoo and Paez-Farrell, 2023). While an alternative ordering—placing commodity prices after GDP and the unemployment rate but still before the interest rate, as done, for instance, by Cantore et al. (2021)—may also be reasonable, it is important to note that this would not alter our results. As shown by Stock and Watson (2001), in a recursive ordering, modifying the position of variables that precede the policy variable (in this case, the interest rate) does not affect the identification of the monetary policy shock and, therefore, the impulse response functions of the model.

[16] It should be noted that we have checked the robustness of our results using the monetary policy surprises from Jordà et al. (2019, 2020), which apply the instrumental variable identification strategy based on the trilemma of international finance (available in the Macro-Financial Database by Jordà et al., 2017, accessible at https://www.macrohistory.net/database/). Indeed, even when using these surprises, the results remain broadly in line with those obtained through Cholesky identification. In this case as well, a restrictive monetary policy appears to have a recessionary effect on GDP and the unemployment rate, while exerting upward pressure on prices. Regarding income distribution, we confirm the negative effect on real wages and, at least in the long run, on the labor share. These additional results are available upon request.

4. Discussion

After presenting the empirical evidence obtained from our PVAR model, we now interpret these results by identifying the transmission channels involved, which we discuss below.

4.1. Cost channel

The cost channel is important in the short to medium term because monetary policy shocks can trigger both demand- and supply-side effects, especially by altering the financial costs faced by firms.[17] Specifically, a restrictive monetary policy may lead to price increases (Sims, 1992), and when wages are sticky, this results in a higher price–wage ratio and falling real wages. Previous literature has provided several examples of this mechanism. For instance, Barth III and Ramey (2001) found evidence of a substantial cost channel effect in multiple U.S. industries. Similar results were reported by Chowdhury et al. (2006) for the G7 and, more recently, by Aruoba and Drechsel (2024). Moreover, with a focus on the housing sector, recent studies have shown that higher interest rates can increase rent prices, amplifying cost–push effects. For example, Dias and Duarte (2019, 2022) and Barbieri Góes (2023) demonstrated how contractionary monetary policy can raise rents, thereby intensifying cost-side inflation in housing and other interest-sensitive sectors, with important consequences for income and wealth distribution.

In our setting, we observe that the price level rises in the first years following a monetary contraction but subsequently reverts to its initial level. In this respect, our results align with those of Cucciniello et al. (2022). Recently, Beaudry et al. (2024) and Nie et al. (2025) emphasized that the cost channel helps explain the inflationary effects of monetary policy when the Phillips curve is flat.[18]

Over a longer horizon, however, the price level response to contractionary shocks tends to fade. This suggests that while the cost channel may sustain price increases in the short run, the demand-side effects of monetary policy dominate in the medium to long term, resulting in lower price levels due to reduced economic activity (as in Cantore et al., 2021). Thus, beyond the short term, the demand-side effects of monetary policy outweigh the supply-side pressures induced by the cost channel. These dynamics also affect real wages: their decline is more pronounced in the short to medium term and gradually weakens over time, mirroring the behavior of the price level.

4.2. Activity channel

As shown in our results, contractionary monetary policy negatively affects economic activity in the short to medium term. The decline in GDP is persistent, reaching a peak after 3–4 years. This helps explain the gradual resolution of the price puzzle, which is mitigated by subdued economic activity. Additionally, the unemployment rate rises markedly in the short to medium term, although it gradually returns to steady-state levels. This evidence suggests that while monetary policy can

[17] However, the idea of a cost channel is not new in the history of economic thought, as it was already observed by Thomas Tooke in the 19th century. In the past century, a positive relationship between prices and interest rates was also considered possible by Keynes, who referred to it as the Gibson Paradox. For a deeper discussion of these and other perspectives supporting a co-movement between interest rates and prices, Lima and Setterfield (2010) and Levrero (2023).

[18] A reduced role of the cost channel in determining inflation within a New Keynesian Phillips curve is demonstrated by Aragón and Galvão (2023). In a similar New-Keynesian context, Hülsewig et al. (2009) investigate the role of the banking sector in transmitting this channel using a DSGE model. Additionally, to understand how the presence of a cost channel can influence central bank actions, see the recent contributions by Chattopadhyay and Ghosh (2020), Ida (2023), and Pathberiya (2024).

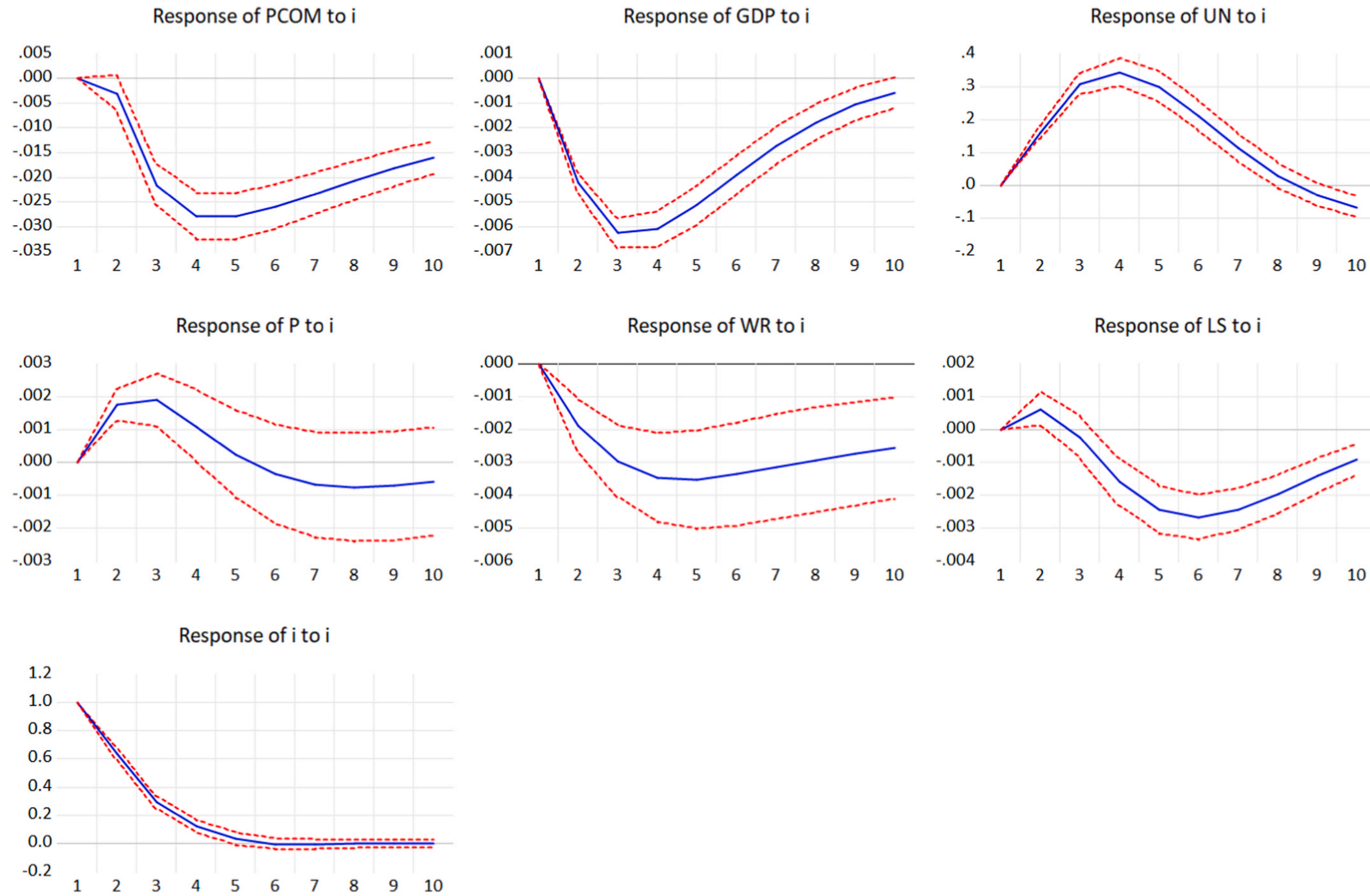

Fig. 4. Primary econometric model—1970–2019 monetary policy shocks (i). Impulse response functions (IRFs) (Eq. (1)) are reported with a 68 % confidence interval level.

Table 2
Effects of a monetary policy shock (*i*) using the primary econometric model.

	GDP	*UN*	*P*	*WR*	*LS*
First Period	−0.42	0.16	0.17	−0.19	0.06
Last Period	−0.06	**−0.07**	−0.06	**−0.26**	**−0.09**
Highest Value	−0.06 (10)	**0.34 (4)**	**0.19 (3)**	**−0.19 (2)**	**0.06 (2)**
Lowest Value	**−0.62 (3)**	**−0.07 (10)**	−0.08 (8)	**−0.35 (5)**	**−0.27 (6)**

Note: Values are normalized to 1 %. The year in which the highest and lowest values occurred are in parentheses, and estimates >68 % are in bold.

exert substantial short-to medium-term effects on activity levels, it does not support the claim by Jordà et al. (2024) that monetary policy has permanent effects on output.

By examining the simultaneous decline in GDP and real wages, we can further interpret the behavior of the LS by decomposing it into the ratio between real wages and labor productivity.[19] Because both GDP and real wages fall alongside the LS, we infer that real wages must decline more than labor productivity in the short to medium term. In the medium to long term, GDP returns fully to its preshock level, while real wages partially recover. However, the LS, despite a gradual rebound from its trough, remains lower than its initial level. This may imply that some factor is slowing the full recovery of real wages or that labor productivity has increased at the new steady state due to changes in employment or both. Overall, this finding contrasts with that of Cantore et al. (2021), who reported a rise in the LS following a contractionary monetary policy shock before it reverts to its preshock level.

4.3. Labor market channel

The inclusion of the unemployment rate in the model allows us to test the influence of mechanisms that are "indirect in nature; for example, expansionary policy may lead to a tighter labor market, thus resulting in higher wages for workers" (McKay and Wolf, 2023). Moreover, it enables us to examine labor market dynamics beyond household-level labor supply responses to monetary policy shocks[20] (Cantore et al., 2022).

In this framework, a rise in the unemployment rate not only reflects the decline in GDP discussed earlier but may also weaken workers' bargaining power in ways that outlast the temporary increase in unemployment, even after it returns to preshock levels. Based on this reasoning, we extend the baseline PVAR model by incorporating additional variables specifically designed to capture the labor market effects of a contractionary monetary policy shock. In particular, we examine the impact on: the nominal wage level (*W*), considering that wage bargaining may be disrupted by a contractionary shock; the number of short-

[19] For a more detailed decomposition of the labour share behavior, Mendieta-Muñoz et al. (2021).

[20] The heterogeneity of the labor market in studying the distributive impact of monetary policy is also emphasized by Rolim et al. (2024). They argue that a monetary policy rule that employs the unemployment rate as a tool to achieve the target inflation rate would exacerbate wage and income inequalities, by having a more pronounced effect on the unemployment rates of workers at the bottom of the income distribution.

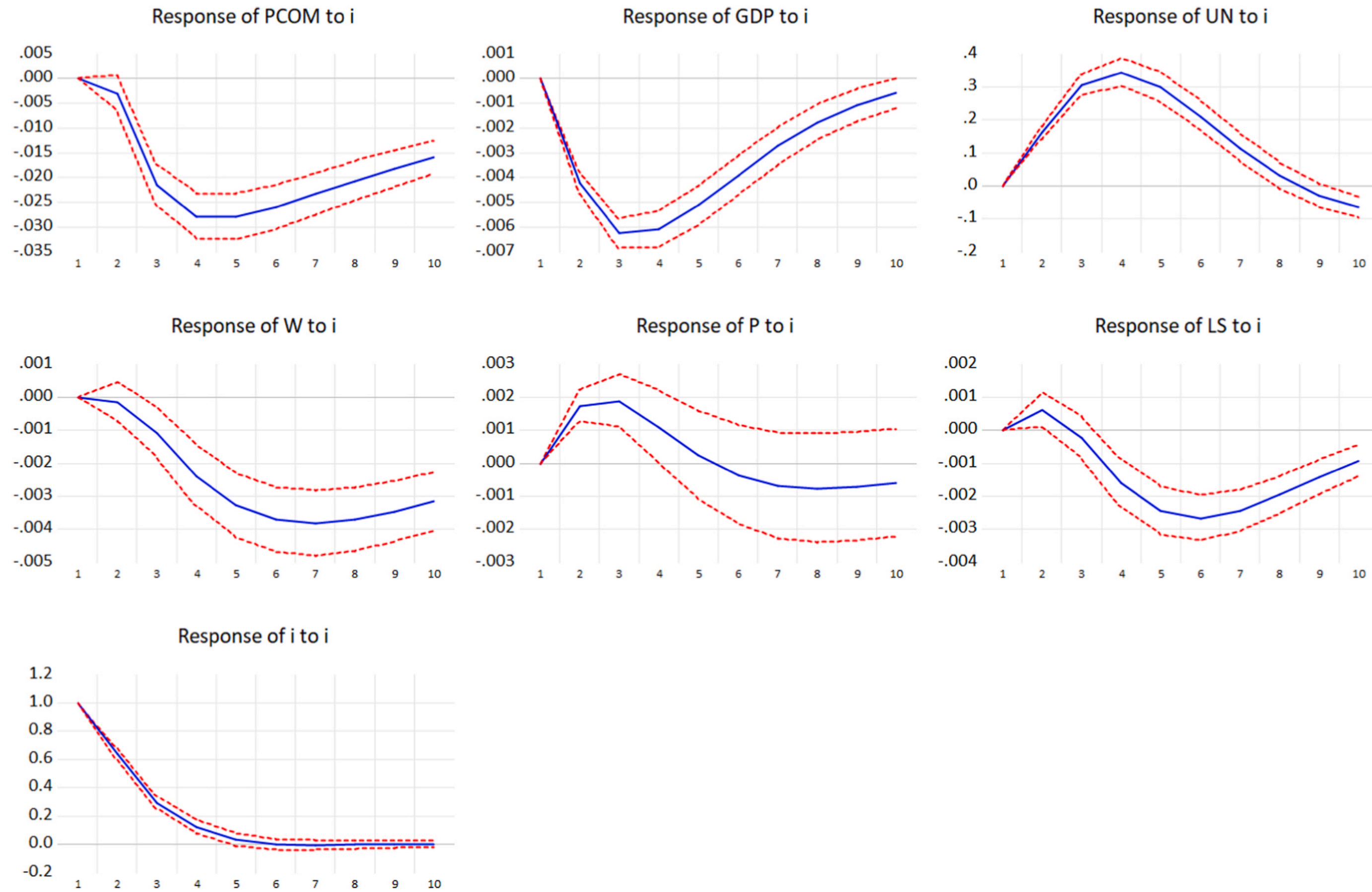

Fig. 5. Impact on the nominal wage level—1970–2019 monetary policy shocks (*i*). IRFs Model 2 are reported with a 68 % confidence interval level.

term unemployed (*SHORTUN*) and long-term unemployed (*LONGUN*), to capture shifts in unemployment duration; and the labor force (*LF*), which reflects potential labor market exits among discouraged workers.[21] The impulse responses for these models are presented in Figs. 5–8. Table 3 reports the initial, final, minimum, and maximum values for each labor market indicator.

As shown in Fig. 5, nominal wages appear to be a primary driver of the scarring effects associated with the labor market channel of monetary policy. Specifically, nominal wages decline immediately following the contractionary shock and fail to recover throughout the time horizon considered. This implies that in the short run, two forces influence real wages: first, the drop in nominal wages; second, the rise in the price level driven by the cost channel. However, as the cost channel's effect fades over time, the decline in nominal wages remains largely unaffected, thereby exerting a prolonged influence on real wage dynamics.

Turning to another aspect of the labor market, we decompose the unemployment rate into three components: short-term unemployed (*SHORTUN*), long-term unemployed (*LONGUN*), and labor force (*LF*). As shown in Figs. 6 and 7, replacing the unemployment rate with these specific unemployment categories leaves the overall narrative largely unchanged, but reveals notable differences in the magnitude of the responses. Specifically, as illustrated in Table 3, *LONGUN* shows a significantly larger peak response than *SHORTUN* following a contractionary monetary policy shock. Furthermore, *SHORTUN* returns to its steady-state level more quickly than *LONGUN*.

Additionally, the model that includes long-term unemployment (Model (4)) shows a stronger negative impact on both real wages and the LS than the model incorporating short-term unemployment (Model (3)). This finding aligns with debates in the new-Keynesian literature, which emphasize the role of long-term unemployment in shaping wage dynamics. It is generally assumed that individuals who experience prolonged unemployment lose bargaining power, thereby reducing their capacity to exert downward wage pressure. However, our results suggest that both conventional and long-term unemployment influence nominal wages, real wages, and LS in a similar direction (e.g., Paternesi Meloni et al., 2022; Romaniello, 2024).

The decline in the labor force, as depicted in Fig. 8, provides additional insight into labor market participation and job-seeking behavior. Although the labor force gradually returns toward its steady-state level, it never fully recovers to its initial value. This pattern suggests a permanent reduction in labor supply due to individuals exiting the workforce and becoming inactive, complementing the evidence observed in the unemployment rate dynamics shown in Fig. 4. Thus, the

[21] Therefore, in addition to the baseline model analyzed in the previous section, we estimate four additional models.

Model 2: $PCOM - GDP - UN - W - P - LS - i$;

Model 3: $PCOM - GDP - SHORTUN - WR - P - LS - i$;

Model 4: $PCOM - GDP - LONGUN - WR - P - LS - i$;

Model 5: $PCOM - GDP - LF - WR - P - LS - i$.

In the last three models, we substitute the unemployment rate (*UN*) with another labor market indicator (*SHORTUN*, *LONGUN*, or *LF*).

In Model 2, we include nominal wages (*W*) instead of real wages (*WR*), placing them prior to prices. This identification strategy is motivated by the slower adjustment capacity of nominal wages compared to prices, which is attributed to institutional and social factors (Azariadis and Stiglitz, 1983).

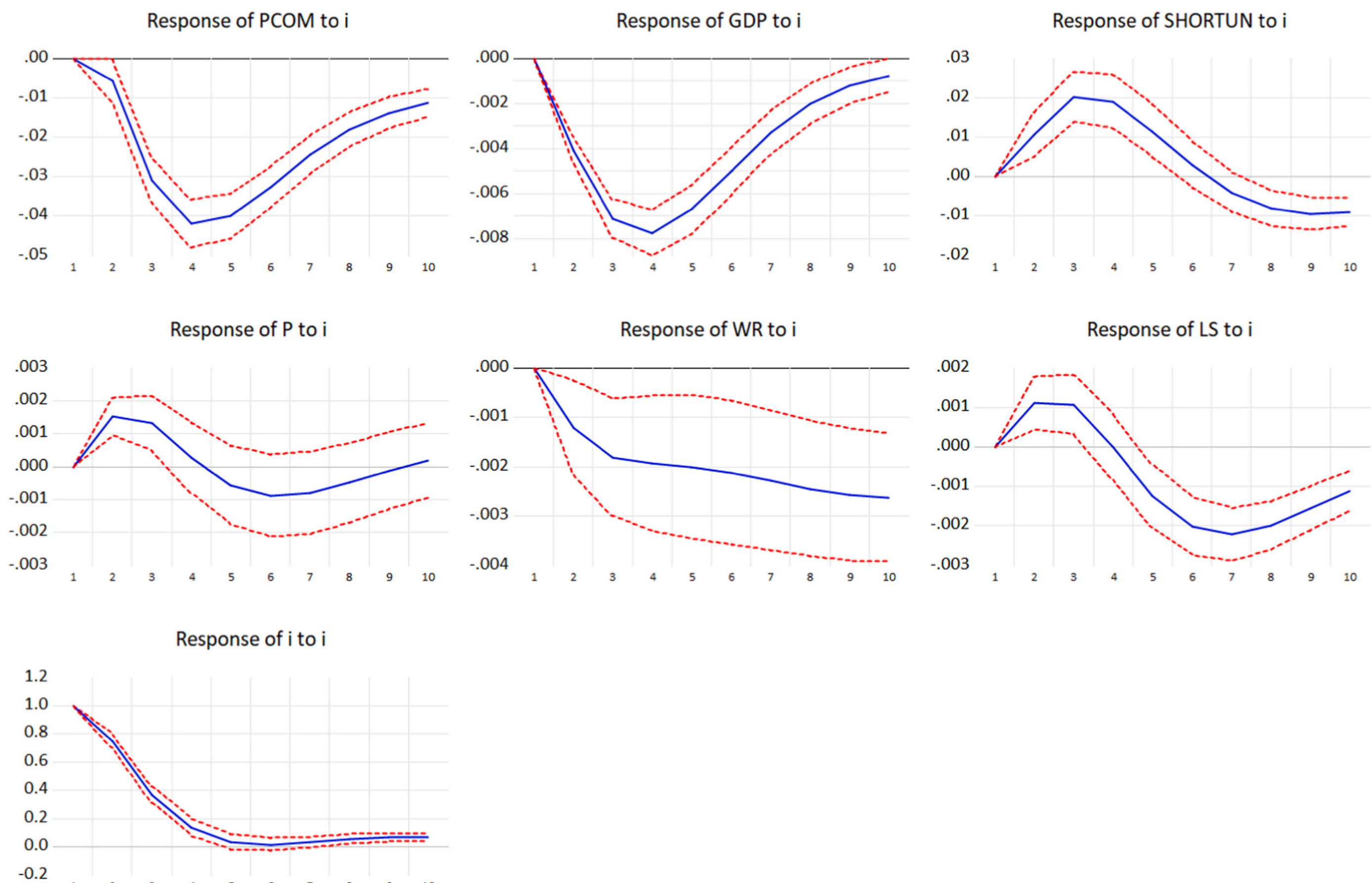

Fig. 6. Impact on short-term unemployment—1970–2019 monetary policy shocks (i). IRFs Model 3 are reported with a 68 % confidence interval level.

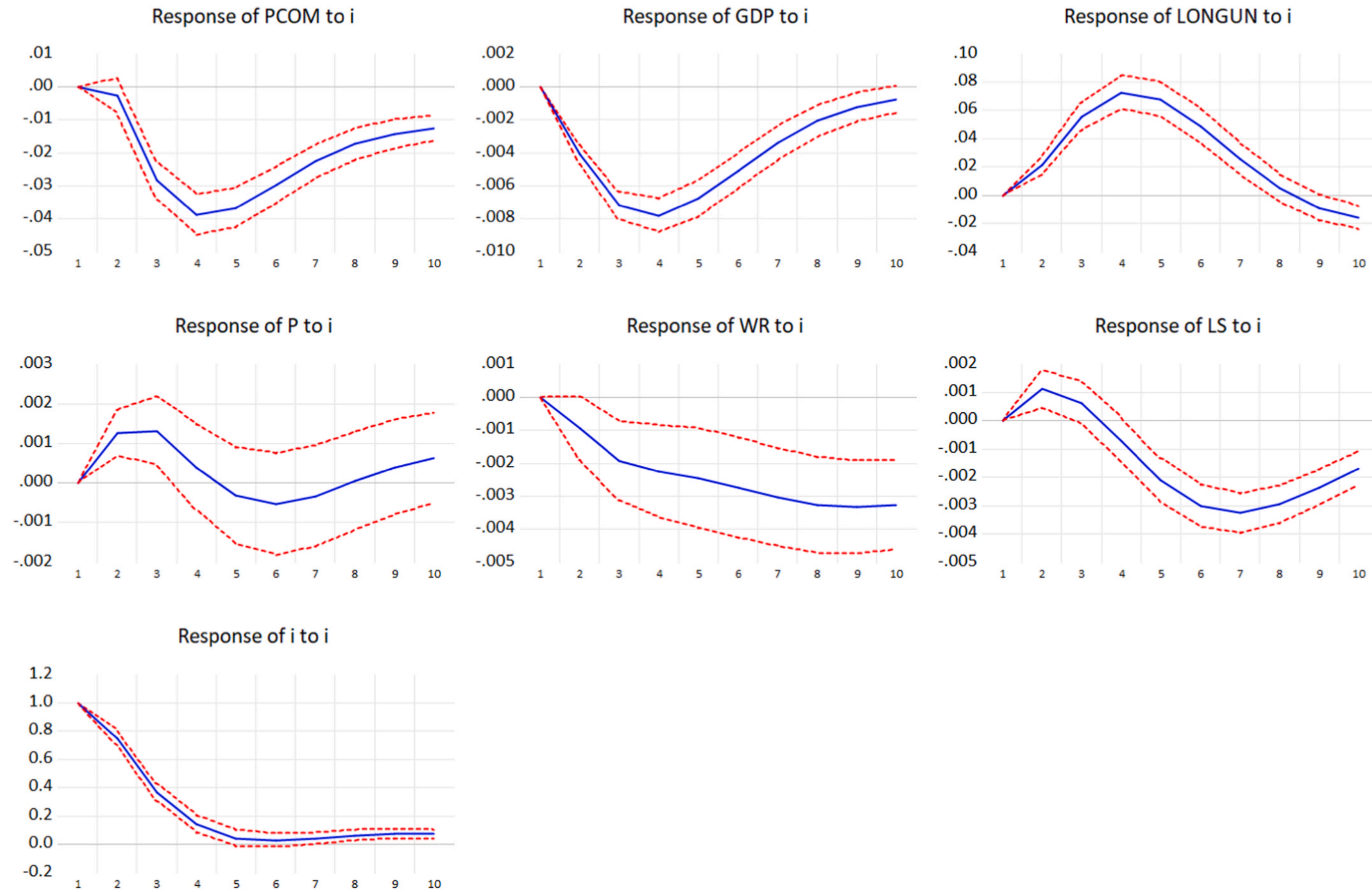

Fig. 7. Impact on long-term unemployment—1970–2019 monetary policy shocks (i). IRFs Model 4 are reported with a 68 % confidence interval level.

unemployment rate's return to its steady-state level is driven by two factors: first, GDP returns to its preshock level; second, the number of people actively seeking employment permanently declines, increasing the share of inactive individuals.

This combined pattern can also be interpreted through the lens of LS decomposition: although real wages remain depressed even in the medium to long term, labor productivity increases. This occurs because, given that GDP recovers, the total number of employees falls. As a result, this dynamic helps maintain the LS below its preshock level.

4.4. Summary

Through the graphical representation of Fig. 9, we summarize the key relationships explored in this study and offer a general interpretive framework for our findings. The figure depicts how contractionary monetary policy shocks propagate to GDP, unemployment, and price level. These effects unfold in the short to medium term and the medium to long term. During both periods, the three macroeconomic responses jointly influence the LS via their effects on both the real wage level and labor productivity. Although real wages are directly observable, productivity must be inferred by analyzing the joint behavior of GDP, unemployment, and labor force; the latter was introduced in Fig. 8 to isolate the role of the labor market channel. Within this network of relationships, we highlight several transmission pathways, particularly those linked to the cost, activity, and labor market channels.

We return to Samarina and Nguyen's (2023) distinction between "direct" and "indirect" distributional channels of monetary policy with respect to personal income distribution (see Section 2), and we adapt their framework to functional income distribution. Within this adaptation, the primary financial transmission mechanism corresponds to the cost channel, where a contractionary monetary policy shock raises the short-term nominal interest rate, directly increasing the price level in the short term. However, in line with Samarina and Nguyen (2023), this short-lived direct effect is ultimately overshadowed by longer-lasting indirect effects propagated through the activity and especially the labor market channels. While the former shapes the cyclical pattern of unemployment, the latter serves as the main conduit through which monetary policy exerts enduring effects on functional income distribution beyond the short to medium term horizon.

5. Conclusions

Given the now prolonged reliance on both conventional and unconventional monetary policies by major central banks, the relationship between monetary policy and inequality has garnered substantial attention. This paper focused on whether monetary policy exerts lasting

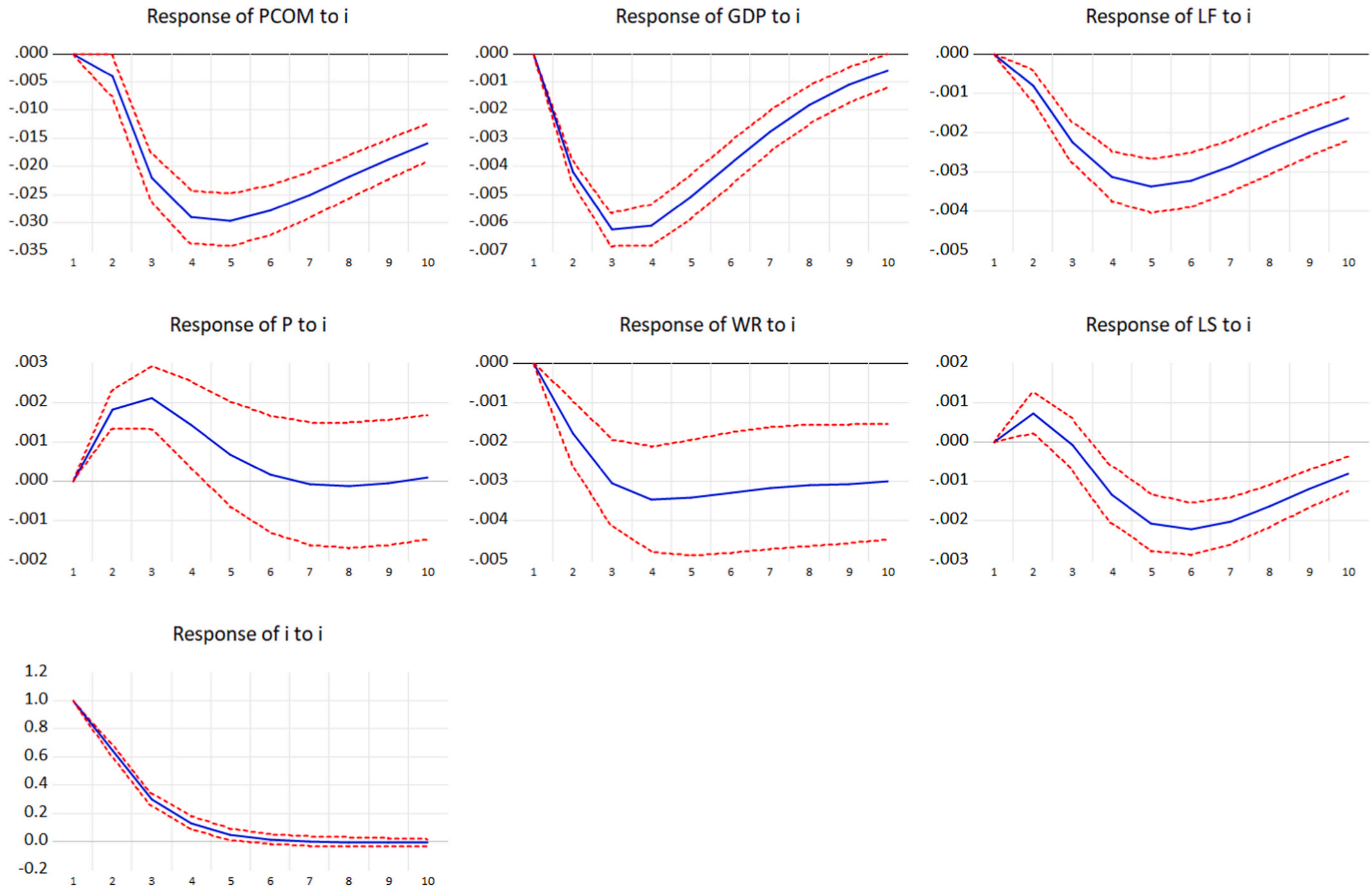

Fig. 8. Impact on the labor force—1970–2019 monetary policy shocks (i). IRFs Model 5 are reported with a 68 % confidence interval level.

Table 3
Effects of monetary policy shock (*i*) on initial, final, minimum, and maximum values of labor market indicators.

	W	*SHORTUN*	*LONGUN*	*LF*
First Period	−0.02	**1.06**	**2.13**	**−0.08**
Last Period	**−0.32**	**−0.89**	**−1.60**	**−0.17**
Highest Value	−0.02 (2)	**2.02 (3)**	**7.27 (4)**	**−0.08 (2)**
Lowest Value	**−0.38 (7)**	**−0.94 (9)**	**−1.60 (10)**	**−0.34 (5)**

Note: Values are normalized to 1 %. The year in which the highest and lowest values occurred are in parentheses, and estimates >68 % are in bold.

effects on functional income distribution, specifically in terms of real wages and the labor share of income. To this end, we employed a PVAR methodology using data from 15 advanced economies spanning 1970–2019.

We studied the effects of a contractionary shock to the short-term nominal interest rate. Regarding the cost channel, the response of the GDP deflator aligns with the short-term "price puzzle" but returns to preshock levels in the medium to long term. In terms of the activity and labor market channels, we observe that GDP falls and unemployment rises in the short run, but both variables return to their preshock levels over the longer term. Consistent with Christiano et al. (2005), we found that real wages decline in response to a monetary tightening; however, in our setting, this decline is persistent. Notably, unlike Cantore et al. (2021), we found that the labor share drops following a contractionary shock and fails to return to its initial level, despite showing signs of gradual recovery. We attribute this outcome to the combined impact of the shock on both real wages and productivity. In addition, this research advances the literature by giving greater attention to the labor market channel. Although the restrictive policy shock leads to a temporary rise in the unemployment rate, its longer-term consequences include a persistent decline in nominal wages and labor force participation, as well as a sharper increase in long-term unemployment relative to short-term unemployment.

By concentrating on the labor market channel, we identified a persistent and substantial influence of monetary policy on functional income distribution, affecting both real wages and the labor share. In our view, future work should incorporate nonlinear methods that better capture labor market spillover effects on income distribution in monetary policy studies. Furthermore, future research should explore how liberal labor market reforms (Siena and Zago, 2022) and the erosion of workers' bargaining power (Fontanari et al., 2024) mediate these effects.

In terms of limitations, this analysis would benefit from closer attention to open economy dynamics, especially the role of commodity prices and exchange rates in shaping inflation, real wages, and profit margins (e.g., Cover and Mallick, 2012; Miranda-Pinto et al., 2023). Although our study did not directly address these international transmission mechanisms, further inquiry into the interplay between

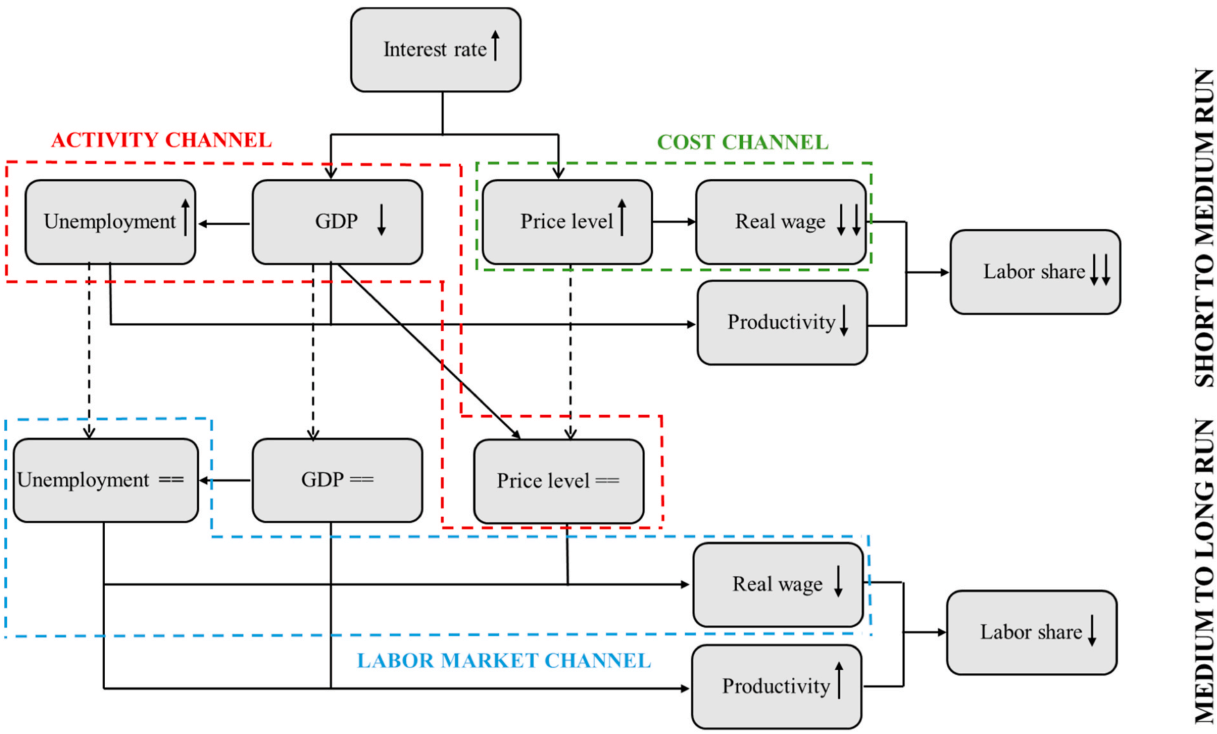

Fig. 9. Transmission channels.

monetary policy and global price dynamics could yield important insights into the broader distributional consequences of monetary policy.

Funding

SDB acknowledges funding from the Italian MUR through the PRIN 2022 PNRR project Disentangling the EnvironMental and Energy efficiency impact of public innovation investment for a green TRAnsition (DEMETRA) (P2022SRW8N, CUP D53D23017910001) financed by the European Union.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We wish to thank Daniele Siena, Matteo Fragetta, Mario Di Serio, Giovanna Ciaffi, Marwil Dàvila-Fernàndez, Santiago Gahn, Serena Ionta, Davide Romaniello, Antonio Savoia, Federica Cappelli, the IPE Research Group at the Berlin School of Economics and Law, the research group at the Central Bank of Argentina, the participants at the IARIW–Bank of Italy Conference (Naples, 2023), and the participants at the Brown Bags Lunch Meetings at the Italian Ministry of Economy and Finance for their insightful comments. We are also grateful to the Associate Editor, Copy Editor, and two anonymous referees of this journal for their valuable feedback, which greatly improved the quality of the paper. The usual caveat applies. Lastly, SDB dedicates this paper to the memory of Speranza Coata.

Appendix A. Descriptive Statistics

Table A1
Summary statistics by country: mean, median, standard deviation, maximum, and minimum values of the unemployment rate (*UN*), labor share (*LS*), and short-term interest rate (*i*)

Country	Variable	Mean	Median	SD	Min	Max
Australia	*UN*	6.25	6.10	2.17	1.50	10.90
	LS	58.06	57.85	4.01	52.30	66.90

(*continued on next page*)

Table A1 (*continued*)

Country	Variable	Mean	Median	SD	Min	Max
	i	7.74	6.57	4.42	1.34	17.61
Belgium	*UN*	7.54	7.75	2.36	1.70	11.50
	LS	61.60	61.60	2.24	55.40	66.30
	i	5.49	4.71	4.17	−0.36	15.27
Canada	*UN*	7.90	7.55	1.71	5.30	12.00
	LS	57.30	57.20	1.96	54.00	60.60
	i	6.11	5.10	4.23	0.69	18.38
Finland	*UN*	7.41	7.40	3.71	1.60	16.80
	LS	58.54	57.05	4.98	51.80	68.40
	i	6.62	5.55	5.06	−0.36	16.50
France	*UN*	8.14	8.75	2.16	2.60	10.70
	LS	59.69	58.25	3.58	55.40	66.20
	i	5.90	5.68	4.36	−0.36	15.26
Germany	*UN*	5.70	5.85	2.79	0.40	11.20
	LS	59.58	59.05	2.62	54.20	64.40
	i	4.55	4.30	3.31	−0.36	12.14
Italy	*UN*	8.85	8.70	2.16	5.10	12.90
	LS	57.12	54.65	5.22	50.90	66.50
	i	7.62	6.25	6.11	−0.36	19.90
Japan	*UN*	3.09	2.80	1.20	1.20	5.40
	LS	61.80	62.10	4.40	55.30	71.00
	i	3.48	1.76	3.69	−0.08	14.51
Netherlands	*UN*	6.70	6.90	2.67	1.20	14.70
	LS	62.06	61.80	4.25	55.60	70.30
	i	4.57	4.48	3.22	−0.36	11.62
Norway	*UN*	3.30	3.35	1.29	0.80	6.00
	LS	51.86	51.25	4.75	43.20	60.90
	i	7.43	7.07	4.49	0.89	15.37
Portugal	*UN*	8.28	8.15	3.33	2.00	17.20
	LS	58.14	56.59	6.97	49.04	80.00
	i	8.04	4.67	7.20	−0.36	24.90
Spain	*UN*	14.46	15.50	6.62	2.60	26.10
	LS	59.87	59.25	4.48	52.70	67.40
	i	7.21	5.24	5.97	−0.36	20.77
Sweden	*UN*	5.64	6.05	2.76	1.90	11.00
	LS	50.16	49.60	2.56	46.00	56.50
	i	5.71	5.33	4.29	−0.70	14.49
U.K.	*UN*	6.84	6.10	2.38	3.70	11.80
	LS	56.85	56.60	2.87	51.40	66.40
	i	7.06	6.50	4.59	0.40	16.80
USA	*UN*	6.21	5.80	1.58	3.70	9.70
	LS	59.68	60.35	1.92	56.00	63.20
	i	5.29	5.30	3.74	0.12	15.91

Appendix B. Robustness Check

To test the robustness of our main results, we conducted a series of robustness checks. In the previous analysis, we used a PVAR model and identified shocks using the Cholesky decomposition method, where the ordering of variables plays a crucial role. To verify the robustness of the results from Eq. (1), we employed an alternative approach by computing generalized impulse response functions (GIRFs), which, unlike Cholesky-based IRFs, are invariant to variable ordering in the VAR framework (Pesaran and Shin, 1998).

As illustrated in Fig. B1, the core results remain consistent. A 1 % increase in interest rates leads to a rise in the GDP deflator. Restrictive monetary policy continues to exert a recessionary effect on economic activity, causing a decline in GDP and a rise in the unemployment rate. Comparing the GIRFs in Fig. B1 with the impulse responses in Fig. 4 confirms that both GDP and unemployment return to their preshock levels in the long run.

Again, the influence of monetary policy on functional income distribution appears robust. A 1 % increase in interest rates produces a persistent decline in real wages over the entire 10-year horizon, with effects even more pronounced than those in the baseline estimates. The GIRFs also show a prolonged negative impact on the LS, which remains in negative territory even over the long term. Taken together, these results indicate that the core conclusions of our main analysis are robust across identification strategies.

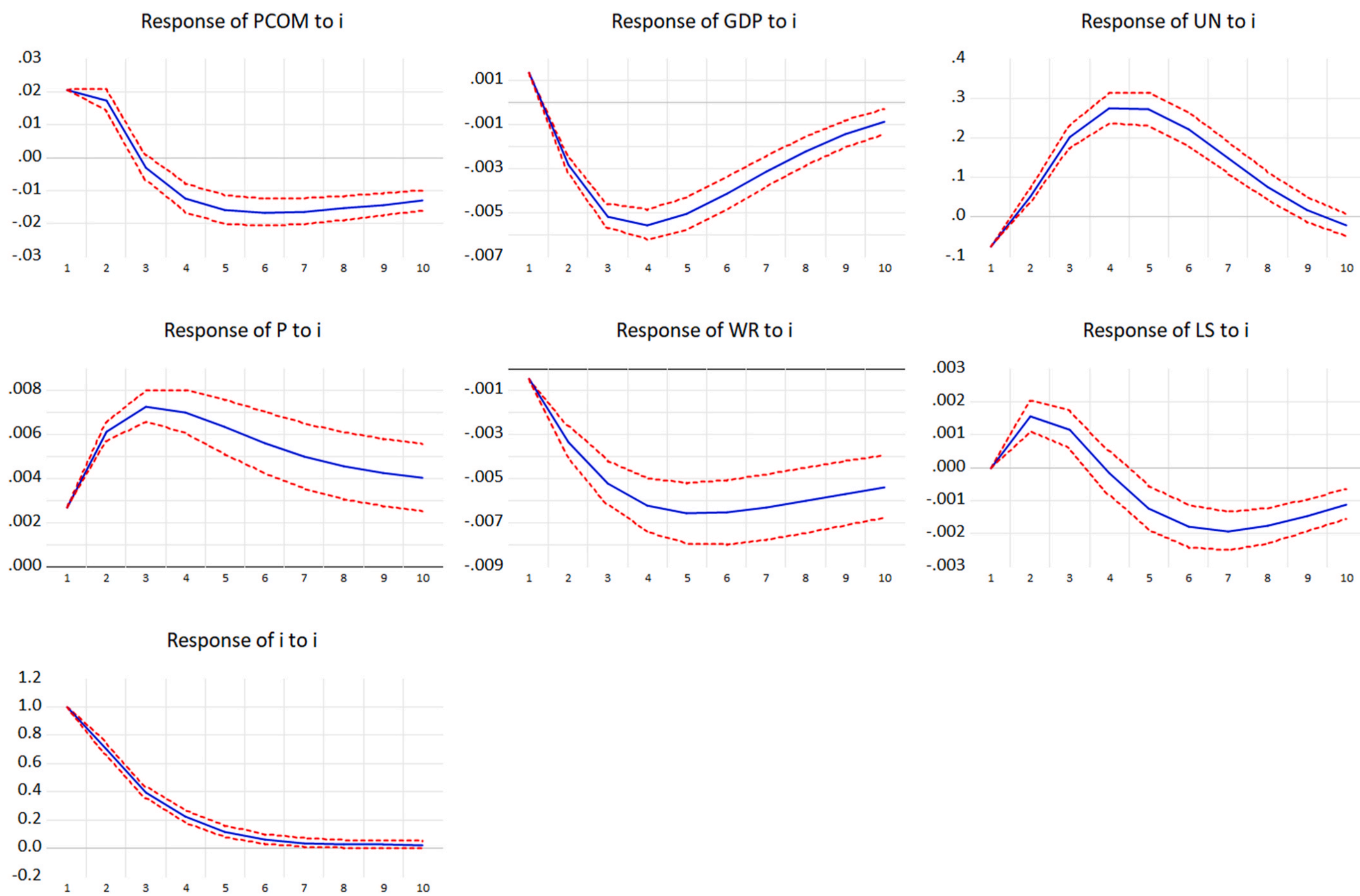

Fig. B1. Alternative impulse response functions —1970–2019 monetary policy shocks (i). Generalized impulse response functions (Eq. (1)) are reported with a 68 % confidence interval level.

To further validate our findings, we incorporated the shadow interest rate[22] (*SH*) to capture the effects of unconventional monetary policies implemented after the 2008 financial crisis, particularly during the zero lower bound (*ZLB*) period. Following the literature on the price puzzle (Sims, 1992; Leeper et al., 1996; Christiano et al., 1999; Mallick and Sousa, 2012), we also tested the sensitivity of our results by replacing the energy commodity price index (*PCOM*) in our main model[23] with the real effective exchange rate (*REER*).

The impulse responses for these two additional models are displayed in Figs. B2 and B3. Both the use of the shadow interest rate and the substitution of the real exchange rate confirm the presence of a cost channel in the short run. At the same time, the effects of contractionary monetary policy on economic activity—measured by GDP and the unemployment rate—fade over time, eventually reverting to their preshock levels. What does not fade, however, is the impact on the distributional variables. Even when the shadow interest rate is used, we continue to observe a significantly negative long-run effect of interest rate hikes on both real wages and the LS.

[22] Model 6: $PCOM - GDP - UN - P - WR - LS - SH$
[23] Model 7: $REER - GDP - UN - P - WR - LS - i$

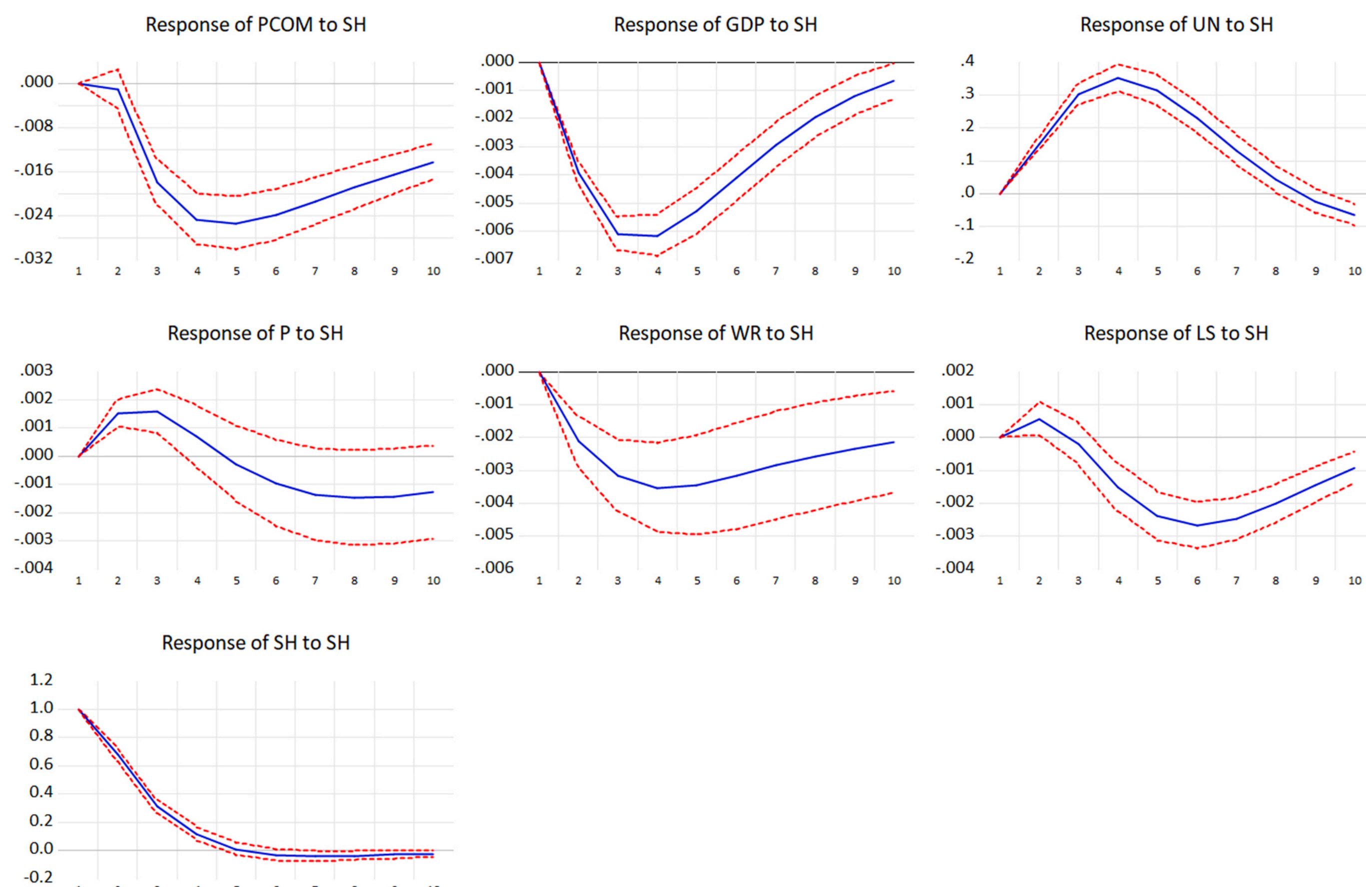

Fig. B2. Primary econometric model —1970–2019 shadow interest rate shocks (i). IRFs (Eq. (6)) are reported with a 68 % confidence interval level.

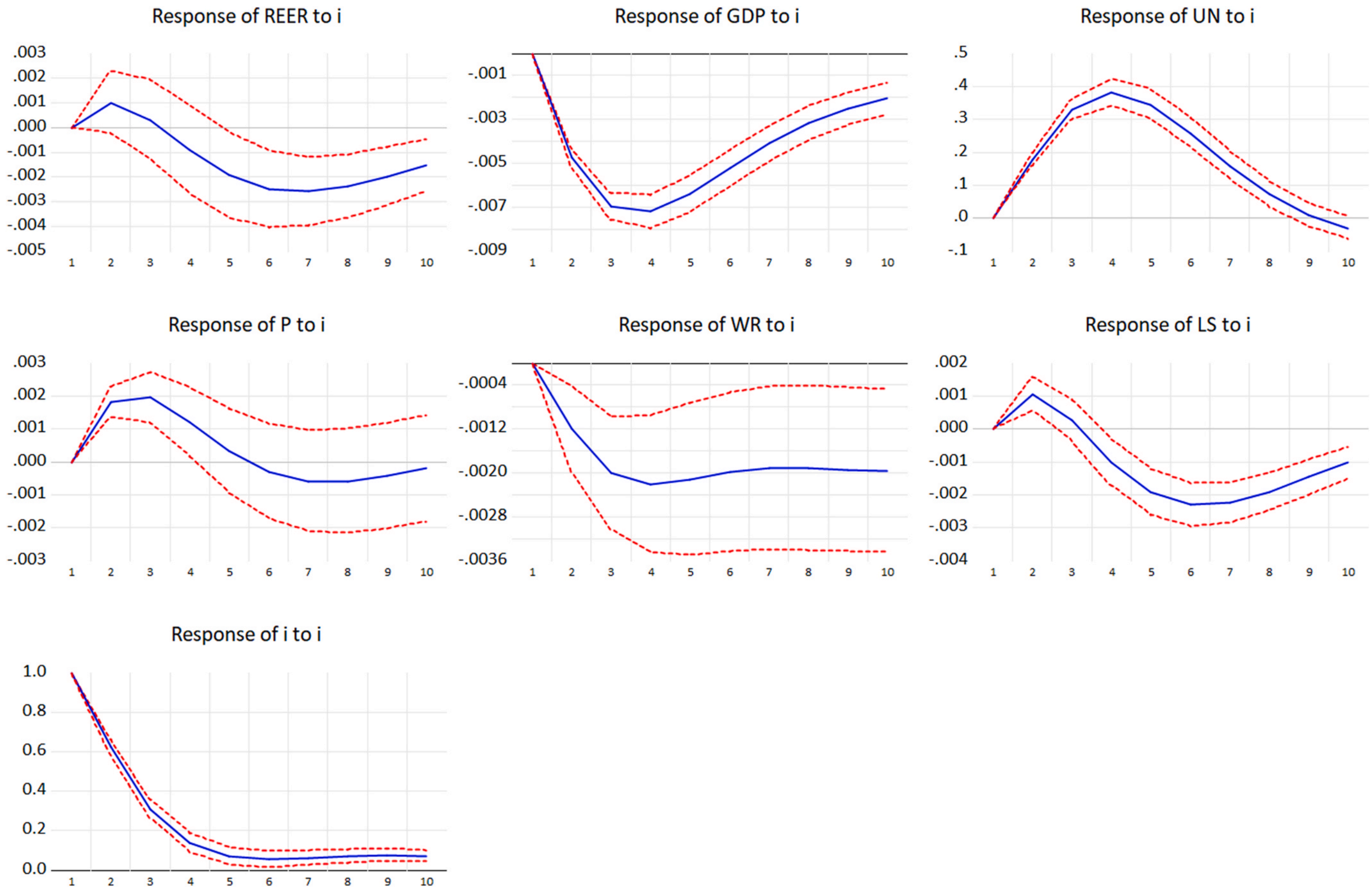

Fig. B3. Inclusion of the real effective exchange rate—1970–2019 monetary policy shocks (i). IRFs (Eq. (7)) are reported with a 68 % confidence interval level.

Data availability

We made replication info available through Mendeley.

Replication folder ECMODE-D-24-01693 (Reference data) (Mendeley Data)

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