Economics Letters 230 (2023) 111241

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

Modelling monetary policy's impact on labour markets under Covid-19☆

Anastasios Evgenidis [a,*], Apostolos Fasianos [b,c]

[a] Newcastle University, Newcastle University Business School, 5 Barrack Road, NE1 4SE Newcastle Upon Tyne, United Kingdom
[b] University of Macedonia, Department of Economics, 156 Egnatia St., Thessaloniki 54006, Greece
[c] Brunel University London, Department of Economics and Finance, Uxbridge UB8 3PH, United Kingdom

ARTICLE INFO

Article history:
Received 4 May 2023
Received in revised form 27 June 2023
Accepted 28 June 2023
Available online 11 July 2023

JEL classification:
C32
D31
E52

Keywords:
Monetary policy
VAR
Extreme events
Covid-19
Inequality

ABSTRACT

This paper investigates the effectiveness of monetary policy on macroeconomic and labour market variables in the US, taking into account the impact of the Covid-19 pandemic. Using a medium scale Bayesian VAR that explicitly incorporates the exceptionally large shocks during the pandemic, we find that expansionary monetary policy has more pronounced and durable effects on labour market variables, in comparison to a non-pandemic setup for the same sample. Additionally, our analysis suggests that a non-pandemic setup, would result in rises in income inequality. In contrast, our proposed setup predicts a significant reduction in income inequality due to an increase in the income share of the bottom 50%.

1. Introduction

This study investigates the effectiveness of US monetary policy on macroeconomic and labour market variables in a vector autoregression (VAR), while accounting for the occurrence of extreme events. While fiscal policy traditionally addresses labour and distributional issues, there is a growing interest in understanding the role of monetary policy in shaping inequality and labour market outcomes (Cantore et al., 2021; Ma, 2022; McKay and Wolf, 2023).

Most of the existing literature on labour markets does not account for extreme events such as the Covid-19 pandemic, which had a profound impact on employment and inequality. Fig. 1 highlights the pandemic period as a significant outlier in the time series, with employment rate changes falling by more than 10% and inequality changes increasing by over 20%. To mitigate the effects of the pandemic, the Fed released QE packages which resulted in the expansion of its balance sheet by more than 20% (red line in the graph). This episode underscores that the inclusion of observations from the pandemic period in time-series models has the potential to severely distort parameter estimates and hence the structural identification of monetary policy shocks and their impact on labour markets.

Only a limited number of studies have examined monetary policy during the pandemic. Most of them either include the pandemic period without analysing its distinctive impact on the data (Cortes et al., 2022; Anderl and Caporale, 2022; Ciminelli et al., 2022; Sznajderska and Haug, 2023), or estimate their model up to 2019 and treat the Covid-19 period separately (Rebucci et al., 2022).

We address this challenge by adopting a method proposed by Cascaldi-Garcia (2023) to incorporate time dummies on pandemic observations. In contrast to Schorfheide and Song (2021) who discard extreme observations, our approach aligns with Lenza and Primiceri (2020) and Carriero et al. (2022), who assume that past macroeconomic relationships remain informative during the pandemic period and therefore should not be dropped.[1]

☆ Acknowledgements: We would like to thank Danilo Cascaldi-Garcia for providing us with the Pandemic priors code and for his helpful suggestions. We are also grateful to the editor and the referee for valuable feedback on the first version of this article. Additionally, we benefited from helpful comments by conference participants at the 8th International Conference on Applied Theory, Macro and Empirical Finance in Thessaloniki, Greece.

* Corresponding author.
E-mail addresses: anastasios.evgenidis@newcastle.ac.uk (A. Evgenidis), fasianos@uom.edu.gr (A. Fasianos).

[1] Although the approach proposed by Schorfheide and Song (2021) may be convenient for parameter estimation in short periods, it becomes more challenging when considering longer horizons, due to the prolonged nature of

https://doi.org/10.1016/j.econlet.2023.111241

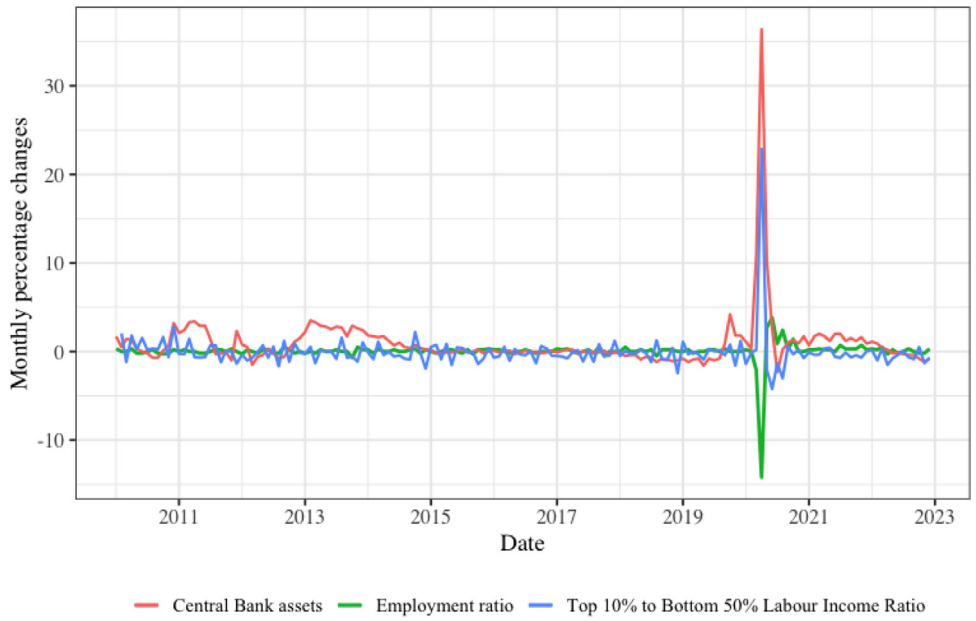

Fig. 1. Central bank assets, Employment ratio, and Labour income inequality from 2010 to 2022. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Federal Reserve Economic Data; Blanchet et al. (2022).

The approach of this study offers a simpler solution to address extreme episodes compared to more complex methods (Carriero et al., 2022), by allowing direct intercept shifts for the variables during the pandemic period. As opposed to Lenza and Primiceri (2020) who estimate VARs by assuming a common shift and persistence of the volatility of all shocks during Covid-19, our approach allows for different shifts and persistence during the pandemic.[2]

Our study adds to the existing literature by examining potential distortions in the estimated coefficients arising from pandemic-related observations and how these may affect the structural identification of monetary policy shocks. We also contribute to the literature linking inequality and monetary policy (Coibion et al., 2017; Colciago et al., 2019; Ma, 2022; McKay and Wolf, 2023). Two challenges identified in this literature stem from the absence of high-frequency data on inequality and the under-representation of the rich in the upper tales of the distribution.[3] Our study addresses both issues by utilizing a high-frequency dataset that combines distributional national accounts with survey data, enabling us to obtain reliable information on the various distributions, including those at the top 0.01%.

We show that an expansionary monetary policy shock has a stronger and more persistent impact on output and labour market variables in our proposed VAR pandemic setup compared to a non-pandemic setup, where its effect is insignificant and weak. Moreover, the pandemic setup predicts a substantial decrease in income inequality, whereas the setup that does not account for extreme events produces increases in income inequality. These findings underline the severe distortions of the effects of monetary policy shocks caused by the large turbulence in labour markets during the pandemic. Notably, labour-related indicators, including employment and the unemployment rate, experienced unprecedented and substantial fluctuations, unlike anything seen in the past. Furthermore, these significant variations in labour market dynamics were not caused by monetary policy itself. Instead, they were primarily driven by the exceptional circumstances of mobility restrictions and lockdown measures. Consequently, our findings provide additional evidence that highlights how extreme events, such as the pandemic, can substantially distort estimated parameters in VARs and thus generate misleading signals to policymakers regarding the effectiveness of monetary policy.

2. Data and methodology

We follow Cascaldi-Garcia (2023) who extends the dummy observations prior approach by Bańbura et al. (2010) to allow for time dummies on pandemic observations in a VAR. We consider the following VAR with n variables and p lags:

$$Y_t = c + \sum_{i=\alpha}^{a+h} \mathbb{I}_{t=i} d_i + \sum_{j=1}^{p} Y_{t-j} B_j + u_t \tag{1}$$

where u_t are innovations with $E(u_t u_t') = \Sigma$, Y_t is the matrix of endogenous variables, B_j is the coefficient matrix, c is the vector of constant terms, d_a through d_{a+h} are h vectors with n time dummies, namely Pandemic Priors (PP), for a pre-selected number of h periods from $t = \alpha$ to $t = \alpha + h$, which in our case is the pandemic period, $\mathbb{I}$ is an indicator function that takes value $\mathbb{I}_{t=i} = 1$ for the period set $i = \alpha, \ldots, \alpha + h$ and 0 otherwise. We incorporate twelve individual time dummies from March 2020 to February 2021.[4]

We estimate a monthly Bayesian VAR (BVAR) with PP in log levels (apart from the variables that are expressed in percentages

the pandemic beyond May 2020 which marks the end of the authors' sample period. Moreover, by excluding Covid-19 observations from a VAR study, the analysis may not fully capture the effectiveness and implications of policy responses.

[2] Our proposed mechanism enables us to capture variations across variables about the size of the intercept shift, as well as the timing and persistence of such shifts. Nevertheless, the impulse responses obtained from the two methods are almost indistinguishable (Cascaldi-Garcia, 2023).

[3] Most of these studies rely on low-frequency inequality measures, which are typically estimated with the Gini index and quantile shares reported on an annual basis.

[4] This period coincides with the onset of the pandemic, its peak during the winter of 2020, and the emergence of more transmissible variants of the virus, which contributed to increases in cases and deaths.

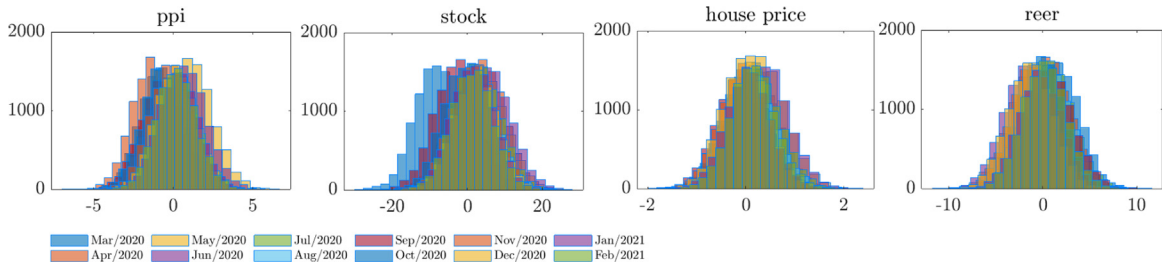

Fig. 2. Histograms of the intercept plus the time dummies from March 2020 to February 2021, of producer price index, stock and house prices, and reer.

for which no transformation is implemented), where we include the following endogenous variables: real GDP, unemployment rate, producer price index (PPI), employment, hours worked, real-time measures of labour income shares (Blanchet et al., 2022), Federal Funds shadow rate (Wu and Xia, 2016), S&P 500, real narrow effective exchange rate of the dollar, and the Case–Shiller home price index.[5] We use a Gibbs sampling algorithm to approximate the posterior distributions of the model parameters.[6,7] The estimation sample runs from January 1980 to December 2022. Based on standard information criteria, we include 4 lags.[8]

3. Results

The imposition of PP assumes that we should observe substantial shifts in intercepts of each variable in the VAR during the period of March 2020 to February 2021. This would distort the estimated coefficients and structural identification of the shocks, potentially leading to a misleading view of the effects of monetary policy on the macroeconomy. We provide a test for the applicability of the PP approach with a window of 12 months in the online Appendix.

Figs. 2–4 present the posterior distributions of the intercept shift (intercept plus time dummy) for all variables for the period March 2020 to February 2021. While the effective exchange rate and price variables (PPI, house prices, and stock prices) show relatively stable intercepts, GDP and labour market variables (employment, unemployment, and hours worked) exhibit a persistence of abnormal intercepts over the entire period (Fig. 3). This pattern is also evident, although not to the same extent, for the income inequality measures (Fig. 4) as both variables representing the top 10% and bottom 50% of the income distribution exhibit divergent intercepts in some periods.

Our findings imply that, although the pandemic represents only about 2% of our sample period, not treating it as an outlier in a VAR framework could result in biased autoregressive coefficients, thereby distorting the impact of monetary policy shocks on labour markets and income inequality. To demonstrate this, we estimate a Bayesian VAR (BVAR) with and without PP. The non-PP specification assumes that the historical relationship among the variables remained unchanged during Covid-19. The analysis, which we further detail in the online Appendix, reveals significant differences in the posterior distributions of the autoregressive coefficients between the two setups.

We evaluate the effects of monetary policy shocks on the rest of the variables in the system, by producing impulse responses derived from the estimation of a structural BVAR with PP. We use the shadow rate to proxy monetary policy.[9,10] Figs. 5, 6, and 7 present the 36-month ahead impulse response functions of a one-standard deviation expansionary monetary policy shock. The solid red lines depict the posterior median response using the PP setup, and the blue solid lines show the posterior median response using the non-pandemic (or non-PP) setup. The red and blue shaded areas depict the 68% coverage bands.[11] As expected, unemployment falls, the dollar depreciates on impact, and GDP, employment, hours worked, stock market, and house prices increase following an expansionary policy shock.[12]

The coverage bands of S&P 500, REER and the PPI largely overlap, indicating that the effect of the shock on these variables has not been affected by the extreme values during the pandemic. The response of house prices however seems to be distinct between the two setups. In the PP setup, house prices would have increased by almost 0.3% in response to the shock, compared to 0.2% in the non-PP setup (Fig. 5).

The differences of the effects of an expansionary monetary policy shock on the labour markets are even more significant between the two setups, in terms of both the size and propagation of the shock. As Fig. 6 shows, not treating these twelve extreme observations of the pandemic as outliers would predict a very mild and insignificant increase in employment in response to the expansionary policy shock, by 0.015% two years after the shock. In contrast, the PP setup delivers a significant improvement in employment throughout the forecast horizon, reaching about 0.08% at the end of the second year. Similarly, hours worked would only increase (insignificantly) by around 0.02% in the non-PP setup, but they would sharply increase to 0.09% with the PP. Likewise, GDP increases by 0.07% in the PP setup, compared to a

[5] All other series are sourced from the Federal Reserve Economic Database (FRED).

[6] In the Appendix, we explain how the priors are implemented.

[7] The details of the estimation algorithm are described in Cascaldi-Garcia (2023).

[8] We show in the robustness section that our main results are largely unchanged when alternative lags are considered.

[9] The advantage of using the shadow rate instead of the Federal Funds rate is that the former constitutes a powerful instrument to accommodate the monetary policy stance at the zero lower bound (Wu and Xia, 2016; Claus et al., 2018; Evgenidis and Fasianos, 2021).

[10] Regarding the identification of the monetary policy shock, we follow the relevant literature on the monetary policy transmission popularized by Christiano et al. (1999, 2005) and we adopt a conventional recursive ordering of the variables under standard Cholesky decomposition. With respect to the ordering of the variables, the monetary policy variable is ordered after economic activity variables (GDP, employment, unemployment, hours worked), inflation and the inequality indices, and before the stock market prices, house prices and the REER. These restrictions on the macroeconomic variables are fairly standard in the literature and imply that output and prices react to monetary policy changes with a lag, while a monetary policy shock is allowed to affect financial variables contemporaneously. Note that the results from the main specification are robust to a different ordering scheme as we show in Section 3.

[11] Note that in contrast to the frequentist approach, it is quite common in the Bayesian VAR literature to use a lower confidence interval (see Sims and Zha, 1999; Bańbura et al., 2010, among others).

[12] There is some evidence for a "price puzzle" that is frequently reported in empirical studies. However, the effect is weak given that the response of inflation is almost flat and insignificant. Elbourne and de Haan (2006) and Castelnuovo and Surico (2010) point out that the non-responsiveness of inflation to monetary policy emerges when the dataset includes structural shifts. In this regard, the zero lower bound period included in our sample can be deemed as such a shift.

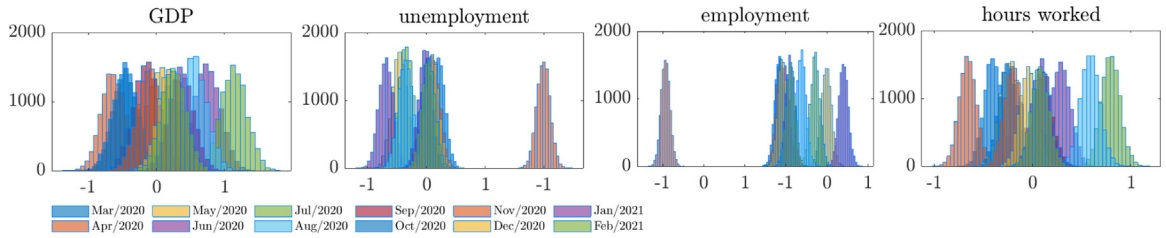

Fig. 3. Histograms of the intercept plus the time dummies from March 2020 to February 2021, of output and labour market variables.

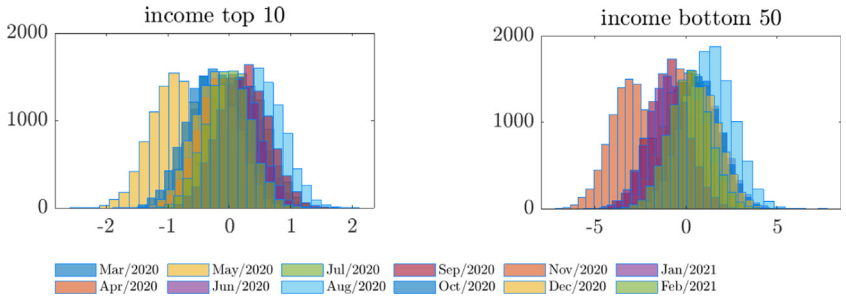

Fig. 4. Histograms of the intercept plus the time dummies from March 2020 to February 2021, of income inequality.

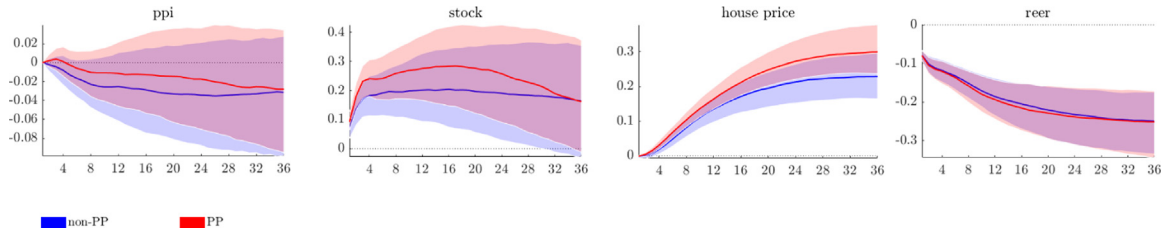

Fig. 5. Impulse responses to 1 sd monetary policy expansion: producer price index, stock and house prices and reer, over a 36-month horizon. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

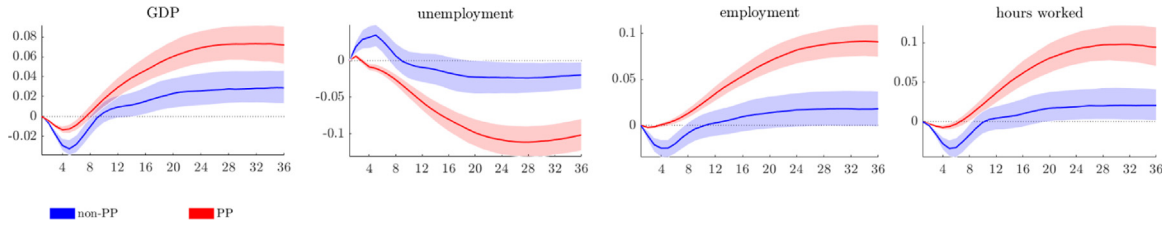

Fig. 6. Impulse responses to 1 sd monetary policy expansion: output and labour market variables over a 36-month horizon. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

much milder increase by 0.025% in the non-PP setup. In the same vein, the PP setup delivers a sharp fall in unemployment by 0.13% which would have been missed if we had ignored the particular behaviour of this extreme episode.

Last, as shown in Fig. 7, the limited number of extreme observations during the pandemic underscores the importance of using the PP setup to assess the impact of monetary policy on income inequality, particularly for the bottom 50% of the population. Specifically, the non-PP setup implies a rise in income inequality, as the income share of the bottom half falls in response to the shock. In contrast, the PP setup predicts a significant reduction in income inequality, consistent with previous studies by Coibion et al. (2017), Chang and Schorfheide (2022), and Ma (2022). Our analysis further shows that the redistributive impact of monetary policy varies across different income percentiles. Specifically, the results from the PP model indicate that the bottom half of the income distribution experiences a significantly positive effect from monetary policy, while the impact on the upper end of the distribution is statistically insignificant. This finding suggests that expansionary monetary policy benefits low-income households more than high-income ones.

To evaluate whether the pandemic observations may have similarly distorted earnings and wealth inequality, we re-estimate two versions of our baseline setup using the respective inequality indices. The online Appendix reports that the improvement in labour income conditions for the bottom 50% accounts for most of the reduction in income inequality, while the decline in labour income for the top 10% has a smaller impact. Finally, we find that any impact of monetary policy on wealth inequality is driven by the top 10% of the distribution.

Robustness checks

Our findings are robust to various changes in the baseline specification of the BVAR with PP. Particularly, we replicate the following alternative versions of the baseline model: (i) the lag

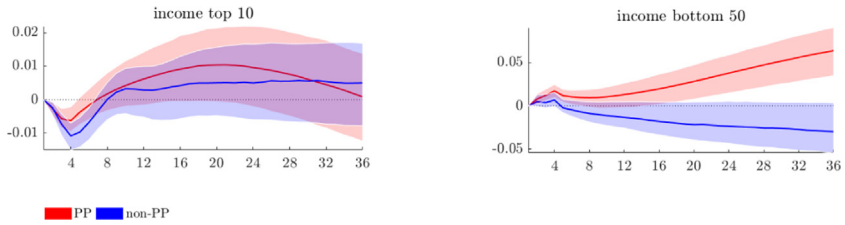

Fig. 7. Impulse responses to 1 sd monetary policy expansion: income inequality variables over a 36-month horizon. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

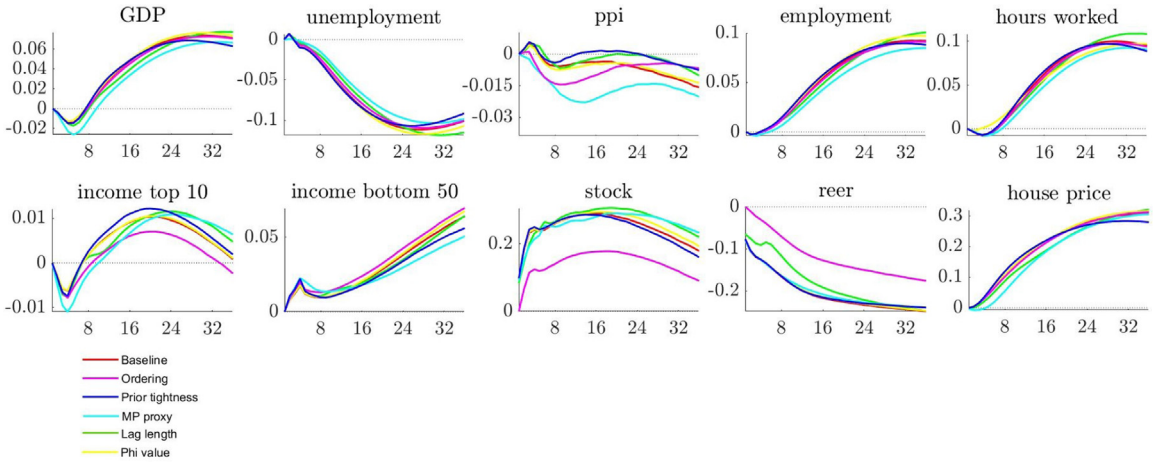

Fig. 8. Robustness checks: Baseline, different ordering, prior tightness, MP proxy, different lags, different ϕ value. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

length is set to 6 lags, (ii) a looser overall prior tightness λ is adopted, that is, $\lambda = 0.3$, (iii) a different ordering is used where the shadow rate is ordered last reflecting that monetary policy does not influence all variables (including the financial time series) contemporaneously, (iv) a lower value of $\phi = 0.01$ is chosen to reflect the idea that the PP soaks up more of the variance of the pandemic period, and (v) an alternative shadow rate series as defined in Krippner (2013) is used to proxy the monetary policy shock. For definitions of λ and ϕ, refer to the online Appendix.

The results are depicted in Fig. 8. The posterior median impulse responses for each alternative specification are shown with coloured lines, and the baseline response is depicted with a red solid line. The main result is that the responses of all the variables to the monetary policy shock do not substantially differ qualitatively and quantitively from the baseline.

4. Conclusion

This paper contributes new insights into the effectiveness of monetary policy by taking into account the Covid-19 pandemic as an extreme event in a Bayesian VAR framework. Our results provide robust evidence that expansionary monetary policies have stronger and more persistent effects on labour variables, and highlight the importance of treating pandemic observations as outliers to avoid producing distorted estimates that mislead policymakers when it comes to understanding the effects of monetary policy on labour markets and income inequality. Future work could further investigate the empirical evidence on the effects of monetary policy on the labour market by following the more recent literature and identifying monetary policy shocks through high-frequency proxies (Miranda-Agrippino and Ricco, 2021; Bauer and Swanson, 2023).

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2023.111241.

References

Anderl, C., Caporale, G.M., 2022. Shadow rates as a measure of the monetary policy stance: Some international evidence. Scott. J. Political Econ..
Baíbura, M., Giannone, D., Reichlin, L., 2010. Large Bayesian vector auto regressions. J. Appl. Econometrics 25 (1), 71–92.
Bauer, M.D., Swanson, E.T., 2023. A reassessment of monetary policy surprises and high-frequency identification. NBER Macroecon. Annu. 37 (1), 87–155.
Blanchet, T., Saez, E., Zucman, G., 2022. Real-Time Inequality. Technical Report, National Bureau of Economic Research.
Cantore, C., Ferroni, F., León-Ledesma, M., 2021. The missing link: monetary policy and the labor share. J. Eur. Econom. Assoc. 19 (3), 1592–1620.
Carriero, A., Clark, T.E., Marcellino, M., Mertens, E., 2022. Addressing COVID-19 outliers in BVARs with stochastic volatility. Rev. Econ. Stat. 1–38.
Cascaldi-Garcia, D., 2023. Pandemic Priors. International Finance Discussion Paper # 1352, Federal Reserve Board.
Castelnuovo, E., Surico, P., 2010. Monetary policy, inflation expectations and the price puzzle. Econ. J. 120 (549), 1262–1283.
Chang, M., Schorfheide, F., 2022. On the Effects of Monetary Policy Shocks on Earnings and Consumption Heterogeneity. CEPR Discussion Paper No. DP17049.
Christiano, L.J., Eichenbaum, M., Evans, C.L., 1999. Monetary policy shocks: What have we learned and to what end? In: Handbook of Macroeconomics, Vol. 1. Elsevier, pp. 65–148.
Christiano, L.J., Eichenbaum, M., Evans, C.L., 2005. Nominal rigidities and the dynamic effects of a shock to monetary policy. J. Polit. Econ. 113 (1), 1–45.
Ciminelli, G., Rogers, J., Wu, W., 2022. The effects of US monetary policy on international mutual fund investment. J. Int. Money Finance 102676.
Claus, E., Claus, I., Krippner, L., 2018. Asset market responses to conventional and unconventional monetary policy shocks in the United States. J. Bank. Financ. 97, 270–282.

Coibion, O., Gorodnichenko, Y., Kueng, L., Silvia, J., 2017. Innocent Bystanders? Monetary policy and inequality. J. Monetary Econ. 88, 70–89.
Colciago, A., Samarina, A., de Haan, J., 2019. Central bank policies and income and wealth inequality: A survey. J. Econ. Surv. 33 (4), 1199–1231.
Cortes, G.S., Gao, G.P., Silva, F.B., Song, Z., 2022. Unconventional monetary policy and disaster risk: Evidence from the subprime and COVID–19 crises. J. Int. Money Finance 122, 102543.
Elbourne, A., de Haan, J., 2006. Financial structure and monetary policy transmission in transition countries. J. Comp. Econ. 34 (1), 1–23.
Evgenidis, A., Fasianos, A., 2021. Unconventional monetary policy and wealth inequalities in Great Britain. Oxf. Bull. Econ. Stat. 83 (1), 115–175.
Krippner, L., 2013. Measuring the stance of monetary policy in zero lower bound environments. Econom. Lett. 118 (1), 135–138.
Lenza, M., Primiceri, G.E., 2020. How to Estimate a VAR after March 2020. Technical Report, National Bureau of Economic Research.
Ma, E., 2022. Monetary policy and inequality: How does one affect the other? Internat. Econom. Rev..
McKay, A., Wolf, C.K., 2023. Monetary policy and inequality. J. Econ. Perspect. 37 (1), 121–144.
Miranda-Agrippino, S., Ricco, G., 2021. The transmission of monetary policy shocks. Am. Econ. J.: Macroecon. 13 (3), 74–107.
Rebucci, A., Hartley, J.S., Jiménez, D., 2022. An event study of COVID-19 central bank quantitative easing in advanced and emerging economies. In: Essays in Honor of M. Hashem Pesaran: Prediction and Macro Modeling, Vol. 43. Emerald Publishing Limited, pp. 291–322.
Schorfheide, F., Song, D., 2021. Real-Time Forecasting with a (Standard) Mixed-Frequency VAR During a Pandemic. PIER Working Paper No. 20-039, National Bureau of Economic Research.
Sims, C.A., Zha, T., 1999. Error bands for impulse responses. Econometrica 67 (5), 1113–1155.
Sznajderska, A., Haug, A.A., 2023. Bayesian VARs of the US economy before and during the pandemic. Eurasian Econ. Rev. 1–26.
Wu, J.C., Xia, F.D., 2016. Measuring the macroeconomic impact of monetary policy at the zero lower bound. J. Money Credit Bank. 48 (2–3), 253–291.