Monetary Unions with Heterogeneous Fiscal Rules[‡]

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Abstract

Fiscal rules are quintessential for the effectiveness of monetary unions, especially in the absence of formal fiscal unions. Using the euro area as an empirical laboratory, this paper begins by documenting novel facts on the spatial transmission of ECB monetary policy shocks. First, monetary policy has heterogeneous effects on eurozone regions. Second, between-country differences account for 70% of those heterogeneous effects. Third, we estimate country-level fiscal policy rules and find substantial differences in the degree of *counter-cyclicality* of national fiscal stances. Fourth, fiscal rule heterogeneity across the euro area explains an important fraction of the documented variation in local responsiveness to monetary shocks. To interpret our empirical facts, we develop a general equilibrium macroeconomic model of a monetary union with flexible heterogeneity in fiscal rules across member countries. With a sufficient-statistic approach, the model quantifies the impact of the distribution of national fiscal stances on the effectiveness of ECB policies. This paper contributes to the ongoing policy-relevant debate surrounding the potential reform of fiscal policy rules by the European Union.

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Fiscal and monetary policies must go hand in hand, and if there is to be an optimum policy mix, they should have the same domains. (Kenen, 1969)

We need fiscal rules that are fit for the challenges of this decade. The new rules will help reduce high public debt levels in a realistic, gradual and sustained manner. (Von der Leyen, 2023)

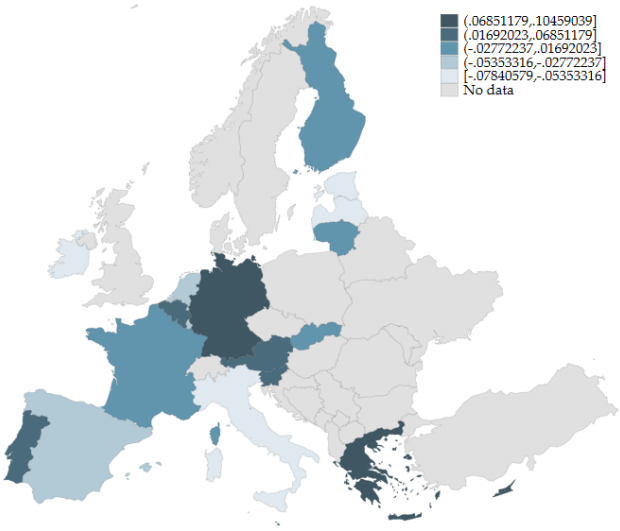
1 Introduction

How do fiscal rules influence the transmission of monetary policy? This question is relevant for at least two reasons. First, it is crucial for policy-making, particularly in the context of currency unions that are not accompanied by fiscal unions, as is the case for the euro area. Second, the fiscal rule has been emphasized as an important channel shaping the effectiveness of monetary policy in stabilizing the macroeconomy in the recent literature analyzing macroeconomic models where Ricardian equivalence fails (Bilbiie, 2008, Galí et al., 2007, Kaplan et al., 2018, Debortoli and Galí, 2018, Auclert et al., 2023). However, monetary and fiscal policy tend to be deeply interlinked (Sargent and Wallace, 1981). As a result, analyzing the effect of the fiscal stance on the transmission of monetary policy is usually a challenging task. In this paper, we plan to make progress on this important question by using the euro area context as a unique laboratory setting. In fact, members of the eurozone (henceforth, EZ) share a common monetary authority, while maintaining relative fiscal independence. We thus leverage cross-sectional variation in the national fiscal stance to shed light on the role of fiscal policy for the transmission of ECB monetary shocks.

2 Three Stylized Facts on the Transmission of Monetary Policy across the Euro Area

In this section we present three stylized facts on the transmission of monetary policy across the euro area. First, we show that there is vast heterogeneity in the transmission of monetary policy to real activity across EZ countries. Second, we document that 70% of this heterogeneity is driven by between-countries differences. Third, and finally, we build on the seminal work of Galí and Perotti (2003) and estimate fiscal rules for EZ countries. We show that the cross section of national fiscal stances correlates strongly with country-specific responses to ECB monetary shocks, a finding which is in line with theoretical predictions.

Figure 1: Between-Country Variation in the Response to ECB Monetary Policy Shocks



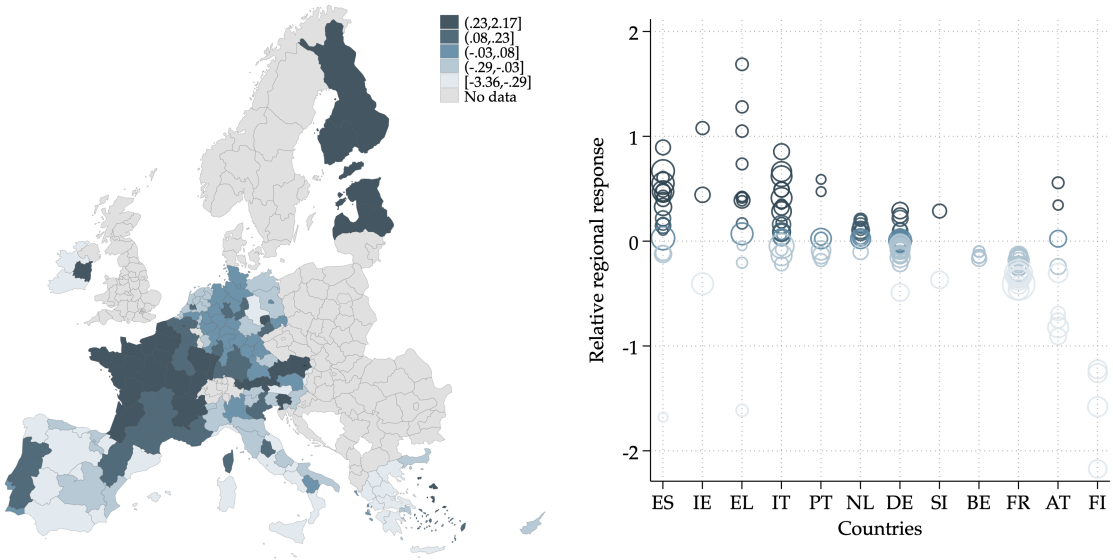
Note: we plot the country-specific 2 years ahead cumulative response of the unemployment rate to a 1 standard deviation contractionary monetary policy shock, identified as in Almgren et al. (2022). See (A.1) in Appendix A for more details on the econometric specification.

Fact 1: monetary policy has heterogeneous effects across EZ countries There is vast heterogeneity in the extent to which different euro area countries are impacted by ECB's monetary policy decisions. Figure 1 shows this heterogeneity by plotting the country-specific 2 years ahead cumulative response of the unemployment rate to a one standard deviation contractionary monetary policy shock, identified using the high frequency approach as in Almgren et al. (2022).[1] This cross-sectional heterogeneity is also quantitatively relevant. In fact, in response to the same 1 standard deviation monetary tightening average unemployment across the euro area increases by around .1 percentage points. Appendix A provides more details on the econometric specification.

Fact 2: between-country differences account for 70% of the total heterogeneous effects Fact 1 above showcases the heterogeneity in the response of real activity to monetary policy across members of the euro area. We now further dissect this heterogeneity, by characterizing the response at a more granular level, namely at the level of NUTS2 regions. This exercise allows us to understand to what extent the cross-country differences in the response to monetary shocks are driven by country-specific determinants or, alternatively, whether they arise from differences in the regional compositions of nations. So far, the literature has remained silent on the extent to which between vs within-country

[1]There appears to be a consensus in the literature that this fact is robust, as this finding has been previously shown also in Slacalek et al. (2020), Corsetti et al. (2021), Almgren et al. (2022), Hauptmeier et al. (2023), and Pica (2023).

Figure 2: Within- and between-country variation in the response to monetary policy shocks



(a) NUTS2 specific response

(b) Within-between variation

Note: Panel (a) plots the 2 years ahead NUTS2-specific cumulative unemployment responses to a 1 standard deviation contractionary monetary policy shock $\beta_{j,24}$, estimated from the panel local projection (A.2) in Appendix A. The coefficients are in percentage points and represent deviations from the (population weighted) average response. Panel (b) reports the NUTS2-specific coefficients for each country, where countries are ranked in decreasing order of their average response.

heterogeneity matters in explaining the different transmission of shocks across the Euro zone.

In Figure 2a we plot the response of NUTS2 european regions to monetary shocks. It is immediately clear from the map how the between-country heterogeneity in the response to monetary policy is much more pronounced than the within-country heterogeneity, as the country contours get traced out. Figure 2b further visualizes how the bulk of the variation in the regional response is driven by country-specific characteristics, by means of a scatter plot. We now turn to quantifying the share of variance in the response across NUTS2 regions which is explained by within vs between countries variation. To do so, we rely on the well-known variance decomposition formula:

$$\underbrace{\text{Var}(\beta_j)}_{\text{total variation}} = \underbrace{\mathbb{E}\left[\text{Var}(\beta_j|country)\right]}_{\text{within variation}} + \underbrace{\text{Var}\left[\mathbb{E}(\beta_j|country)\right]}_{\text{between variation}} \tag{1}$$

When applying (1) to our estimates from Figure 2a we find that 69% of the variation in the NUTS2-level responses to monetary shocks is driven by between-country variation, with

the remaining 31% coming from variation within countries, i.e. across local regions.[2]

To the best of our knowledge, we are the first to document this potentially important fact. This observation can be important because it could help rule out spatial characteristics from the zoo of potential candidates to explain the cross-section of regional responses to monetary shocks in the EZ. In other words, country-level or national characteristics are more important to understand distributional effects of ECB policies, a point to which we now turn below.

Fact 3: fiscal rules explain the between-country heterogeneity Previous studies have tried to rationalize the heterogeneous transmission of monetary policy across euro-area countries by focusing on the role of housing markets (Calza et al., 2013, Corsetti et al., 2021, Pica, 2023) and financial constraints (Almgren et al., 2022). However, both the share of households with a mortgage as well as the degree to which households are financially constrained vary substantially *within* countries. Instead, Fact 2 above has shown how the bulk of the variation in the response to monetary shocks across members of the euro area comes from *country-specific* characteristics. National policies thus stand out as a natural candidate to account for this variation between countries.

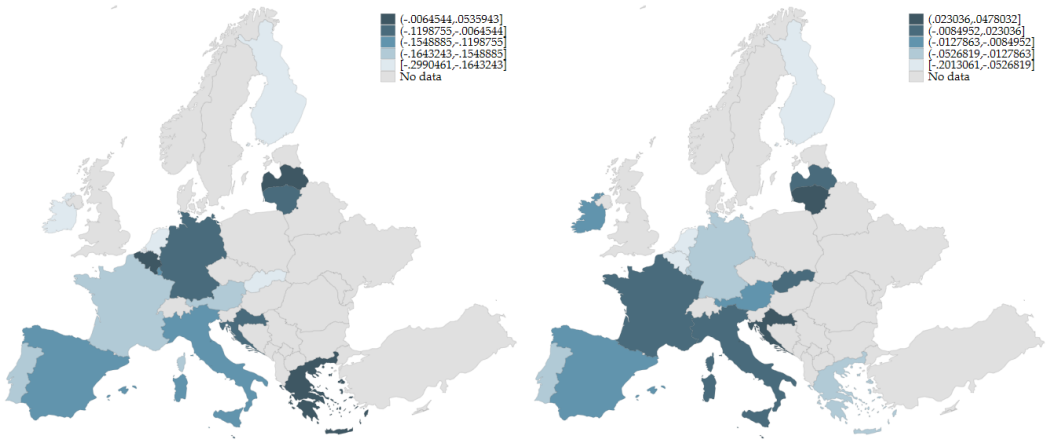
There is a growing body of literature emphasizing how the rule followed by fiscal authorities matters for the transmission of shocks in environments where Ricardian equivalence fails (Debortoli and Galí, 2018, Kaplan et al., 2018, Alves et al., 2020). Guided by theory, we now examine the extent to which heterogeneity in fiscal rules across EZ countries can explain the different transmission of monetary policy documented in Fact 1. To do so, we estimate fiscal rules for euro area countries, building on the work of Galí and Perotti (2003). We follow Alves et al. (2020) and estimate country-specific fiscal rules based on the following specification:

$$\Delta \log B_{jt+1} = \kappa_j^Y \Delta \log Y_{jt} + \kappa_j^r \Delta \log E_{jt} + \kappa_j^B \Delta \log B_{jt} + u_{jt} \tag{2}$$

where B_{jt} is the total stock of public debt, Y_{jt} is GDP, E_{jt} denotes total interest expenses on public debt, and $\Delta \log X_{jt} \equiv \log X_{jt} - \log X_{jt-1}$ represents the change in variable X in country j between periods $t-1$ and t in log-points. Figure 3 plots our estimates for the country-specific $\hat{\kappa}_j^Y$ and $\hat{\kappa}_j^r$ across the euro area. Negative values for $\hat{\kappa}^Y$ are associated with counter-cyclical fiscal policy, with the fiscal authority responding to recessions by increasing debt rather than raising taxes or cutting public spending. In the modern class of macroeconomic models where Ricardian equivalence fails this type of policy typically

[2]We exclude countries that only contain a single NUTS2 region: Estonia, Latvia, Cyprus, Malta, Luxembourg.

Figure 3: Fiscal rules across the euro area



(a) $\hat{\kappa}_j^Y$ (b) $\hat{\kappa}_j^r$

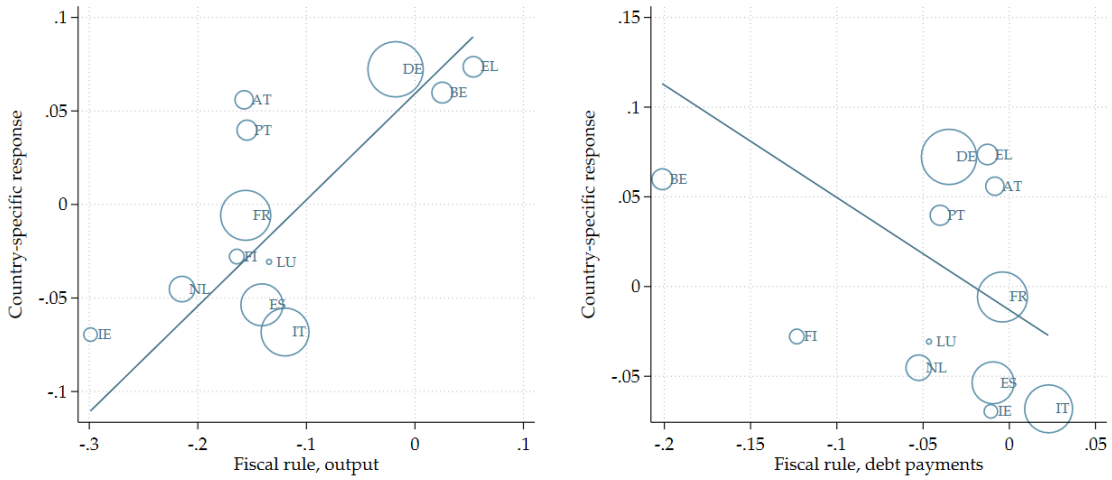
Note: country-specific estimates of $\hat{\kappa}_j^Y$ and $\hat{\kappa}_j^r$ from Equation (2).

translates into milder responses of aggregate economic activity to monetary policy shocks (and aggregate shocks more in general). Similarly, a positive $\hat{\kappa}_j^r$ implies that in periods in which interest rates are high fiscal policy accommodates large interest expenses by increasing the level of debt, rather than raising taxes or cutting public spending. As a result, countries characterized by larger values of $\hat{\kappa}_j^r$ are going to show smaller responses to monetary shocks, as the fiscal authority acts to dampen the monetary impulse coming from the central bank.

Guided by these theoretical predictions, we now investigate to what extent heterogeneity in fiscal rules is able to explain the observed heterogeneity in the transmission of monetary policy across EZ countries. Figure 4 shows a strong correlation between the country-specific response to ECB shocks that we estimated in Figure 1 and the two fiscal rule parameters. We find that countries which increase debt by more following a downturn, i.e., for which $\hat{\kappa}_j^Y$ is more negative, exhibit milder employment responses to monetary shocks. Similarly, countries which increase debt by more following increases in debt servicing payments, i.e., for which $\hat{\kappa}_j^r$ is more positive, also exhibit smaller reactions to monetary tightenings.[3] Thus, our third fact documents how heterogeneity in fiscal rules across EZ countries is able to account for differences in the country-specific employment response to ECB's monetary policy.

[3]Note that each relationship still holds after controlling for the *other* fiscal rule coefficient. That is, the positive relationship between country-specific unemployment responses and $\hat{\kappa}_j^Y$ still holds if one controls for $\hat{\kappa}_j^r$, and vice-versa.

Figure 4: Fiscal rules and the response to monetary shocks



(a) κ_j^Y (b) κ_j^r

Note: in Panel (a), the correlation coefficient between $\hat{\kappa}_j^Y$ (x-axis) and the 18 months ahead country-specific unemployment response (y-axis) is 0.71 and statistically significant at the 1% level. In Panel (b), the correlation between $\hat{\kappa}_j^Y$ (x-axis) and the 18 months ahead country-specific unemployment response (y-axis) is -0.47 and statistically significant at the 10% level.

3 A Model of a Monetary Union with Fiscal Rule Heterogeneity

Guided by the 3 facts that we document above, we now build a model of a monetary union with heterogeneity in fiscal rules of member countries. Our model builds on the general framework of Bellifemine et al. (2023), which we extend to allow for heterogeneous fiscal policies across countries. We model members of the monetary union as small open economies à la Galí and Monacelli (2005, 2008), indexed by $j \in [0,1]$. We introduce within-country household heterogeneity according to the standard HANK structure with non-insurable idiosyncratic labor income risk and a borrowing limit. There is a non-tradable good and a tradable good, with ρ denoting the size of the tradable sector.

We differ from Bellifemine et al. (2023) substantially in that countries are symmetric except in their conduct of fiscal policy. Each national government administers a tax and transfer scheme and issues country-specific debt. The tax and transfer schemes consist of a country-specific lump-sum transfer T_{jt}, which is rebated equally to all households, together with a proportional tax rate $\tau_{jt} \geq 0$ on households' nominal labor income. The Government is the sole issuer of liquid assets in each country. These liquid assets are nominal bonds B_{jt} with a homogenous nominal return i_t set by the European Central Bank. Each Government's intertemporal budget constraint, expressed in nominal terms,

is given by:

$$B_{jt+1} + \tau_{jt} W_{jt} L_{jt} = (1 + i_t) B_{jt} + T_j \tag{3}$$

where W_{jt} and L_{jt} are the nominal wage and the labor supply in country j.

Using sequence-space methods and linearization techniques that are further detailed in Bellifemine et al. (2023), we can characterize the full general equilibrium response of union member-level employment to an exogenous, perfect-foresight path of real rates $d\boldsymbol{r}_j$ and a change in the union-wide demand for tradable goods $d\boldsymbol{C}^T$. Following Auclert et al. (2021), we denote the Jacobian of the consumption function $\mathcal{C}_t(\cdot)$, which translates the sequences of real household income and real rates into consumption at time t, with respect to aggregate real labor income $\boldsymbol{Z} \equiv (Z_0, Z_1, \dots)'$ by $\boldsymbol{M}$, which is a matrix whose element (t, s) is given by $\frac{\partial \mathcal{C}_t(\cdot)}{\partial Z_s}$. Similarly, we denote by $\boldsymbol{M}^r$ the matrix of elasticities of $\mathcal{C}_t(\cdot)$ with respect to the interest rate sequence $\boldsymbol{r} \equiv (r_0, r_1, \dots)'$, $\boldsymbol{M}^r_{t,s} \equiv \frac{\partial \log \mathcal{C}_t(\cdot)}{\partial r_{js}}$. We can show that the response of employment can be summarized by the following vector-valued equation:

$$d\boldsymbol{L}_j = \boxed{\underbrace{\rho \boldsymbol{M} d\boldsymbol{\tau}_j}_{\text{National Fiscal Response}}} + \underbrace{\rho \left(\boldsymbol{M}^r d\boldsymbol{r}_j + \boldsymbol{M} d\boldsymbol{L}_j \right)}_{\text{Int. Subst. and Multiplier}} + \underbrace{(1-\rho) d\boldsymbol{C}^T}_{\text{Tradable Demand}} \underbrace{- \frac{\nu}{\eta}(1-\rho) \left(d\boldsymbol{L}_j - d\boldsymbol{C}^T \right)}_{\text{Expend. Switching}} \tag{4}$$

Equation (4) decomposes the total response into four intuitive blocks. The first term is the main novelty of the model: it showcases how differences in national fiscal reactions are going to generate heterogeneous employment responses to the monetary shock across countries j. The remaining three blocks capture the intertemporal substitution, the Keynesian multiplier, the tradeable demand, and the expenditure switching channels. Importantly, this framework can be easily extended to allow for heterogeneity in intertemporal MPCs –on top of fiscal rules– across European regions.[4]

Given (4), we can then define the union-wide response as $d\boldsymbol{L} \equiv \int_0^1 d\boldsymbol{L}_j dj$. We plan to derive an expression for the union-wide response in terms of a few sufficient statistics, capturing the distribution of the fiscal stance across European countries. We then plan to bring these sufficient statistics to the data. The main quantitative exercise of the paper will involve running structural counterfactuals in model economies with *homogenous* and *heterogeneous* fiscal rules, thus quantifying the role that fiscal rule divergence across European countries plays for the aggregate effectiveness of ECB's monetary policy. In doing so, we will establish a natural "as-if" representative-region benchmark and show whether

[4] In case of heterogeneous MPCs across regions, (4) would feature j dependency in the consumption Jacobians to real labor income and the real interest rate, which would then read $\boldsymbol{M}_j$ and $\boldsymbol{M}^r_j$.

- and if yes then how - fiscal rule heterogeneity helps the model to deviate from it.

4 Conclusion

A correct, model-consistent sufficient-statistic for quantifying the macroeconomic *elasticity* to aggregate shocks in a monetary union that lacks a fiscal union is perhaps not the *level* of national fiscal deficits but the degree of *conditional cyclicality* of national fiscal stances. We find that cyclicality of national fiscal stances is very heterogeneous across member-states of the euro area. Moreover, this cross section can explain an important share of the regional differences in local macroeconomic reactions to a common ECB monetary policy shock. Thus, we provide motivating evidence that the distribution of local fiscal stances may interact with the monetary transmission mechanism - a principle idea in the modern heterogeneous agent New Keynesian literature. However, a general equilibrium model is necessary in order to establish whether this is in fact likely to be true or not. In a calibrated equilibrium model of a monetary union with heterogeneous country-level fiscal rules we test this hypothesis with a compact set of measurable sufficient statistics. In doing so, we are contributing to the policy debate on the 2022-2023 proposal of the European Commission to reform fiscal policy rules in the EU.

References

Almgren, M., J.-E. Gallegos, J. Kramer, and R. Lima, "Monetary Policy and Liquidity Constraints: Evidence from the Euro Area," *American Economic Journal: Macroeconomics*, October 2022, *14* (4), 309–40.

Alves, F., G. Kaplan, B. Moll, and G. L. Violante, "A Further Look at the Propagation of Monetary Policy Shocks in HANK," *Journal of Money, Credit and Banking*, 2020, *52* (S2), 521–559.

Auclert, A., B. Bardoczy, M. Rognlie, and L. Straub, "Using the Sequence-Space Jacobian to Solve and Estimate Heterogeneous-Agent Models," *Econometrica*, 2021, *89(5).*

_ , M. Rognlie, and L. Straub, "The Intertemporal Keynesian Cross," *NBER Working Paper*, 2023.

Bellifemine, Marco, Adrien Couturier, and Rustam Jamilov, "The Regional Keynesian Cross," *CFM Discussion Paper*, 2023, *2023-11.*

Bilbiie, F., "Limited asset markets participation, monetary policy and (inverted) aggregate demand logic," *Journal of Economic Theory*, 2008, *140* (1), 162–196.

Calza, Alessandro, Tommaso Monacelli, and Livio Stracca, "Housing Finance and Monetary Policy," *Journal of the European Economic Association*, 2013, *11* (s1), 101–122.

Corsetti, G., J. B. Duarte, and S. Mann, "One Money, Many Markets," *Journal of the European Economic Association*, 06 2021, *20* (1), 513–548.

Debortoli, D. and J. Galí, "Monetary Policy with Heterogeneous Agents: Insights from TANK models," *Working Paper*, 2018.

der Leyen, Ursula Von, "European comission proposes new economic governance rules fit for the future," 2023.

Galí, J. and T. Monacelli, "Monetary Policy and Exchange Rate Volatility in a Small Open Economy," *The Review of Economic Studies*, 07 2005, *72* (3), 707–734.

_ and _ , "Optimal monetary and fiscal policy in a currency union," *Journal of International Economics*, 2008, *76(1).*

_ , D. López-Salido, and J. Vallés, "Understanding the Effects of Government Spending on Consumption," *Journal of the European Economic Association*, 2007, *5(1).*

Galí, Jordi and Roberto Perotti, "Fiscal policy and monetary integration in Europe," *Economic Policy*, 07 2003, *18* (37), 533–572.

Hauptmeier, S., F. Holm-Hadulla, and K. Nikalexi, "Monetary Policy and Regional Inequality," *CEPR Discussion Paper 18319*, 2023.

Kaplan, G., B. Moll, and G. Violante, "Monetary Policy According to HANK," *American Economic Review*, 2018, *108(3).*

Kenen, P., "The Theory of Optimum Currency Areas: An Eclectic View," *In Monetary Problems of the International Economy, edited by Robert A. Mundell and Alexander K. Swoboda*, 1969.

Pica, S., "Housing Markets and the Heterogeneous Effects of Monetary Policy Across the Euro Area," *Working Paper*, 2023.

Sargent, Thomas J. and Neil and Wallace, "Some unpleasant monetarist arithmetic," *Federal Reserve Bank of Minneapolis Quarterly Review*, 1981, *5* (3), 1–17.

Slacalek, Jiri, Oreste Tristani, and Giovanni L. Violante, "Household balance sheet channels of monetary policy: A back of the envelope calculation for the euro area," *Journal of Economic Dynamics and Control*, 2020, *115*, 103879.

A Appendix

Econometric Specification for Figure 1 and Figure 2a Figure 1 plots the $\hat{\beta}_{jh}$ for $h = 24$ estimated from the following regression:

$$\Delta U_{j,t+h} = \alpha_{jh} + \delta_{th} + \beta_{jh} \times \varepsilon_t + \sum_{\ell=1}^{12} \gamma_{h\ell} \Delta U_{j,t-\ell} + v_{jht} \tag{A.1}$$

Where α_{jh} and δ_{th} respectively denote country and time fixed effects, ε_t is the ECB monetary policy shock as defined in Almgren et al. (2022), U_{jt} is the unemployment rate in country j month t, $\Delta U_{j,t+h} \equiv U_{j,t+h} - U_{j,t-1}$, and $\Delta U_{j,t-\ell} \equiv U_{j,t-1} - U_{j,t-\ell}$.

Figure 2a plots the $\hat{\beta}_{jh}$ for $h = 8$ estimated from the following regression:

$$\Delta U_{j,t+h} = \alpha_{jh} + \delta_{th} + \beta_{jh} \times \varepsilon_t + \sum_{\ell=1}^{4} \gamma_{h\ell} \Delta U_{j,t-\ell} + v_{jht} \tag{A.2}$$

Where α_{jh} and δ_{th} respectively denote region and time fixed effects, ε_t is the ECB monetary policy shock as defined in Almgren et al. (2022), U_{jt} is the unemployment rate in region j month t, $\Delta U_{j,t+h} \equiv U_{j,t+h} - U_{j,t-1}$, and $\Delta U_{j,t-\ell} \equiv U_{j,t-1} - U_{j,t-\ell}$. Because of data availability, our NUTS2-level regressions are performed at quarterly, rather than monthly, frequency.