Macroeconomic Adjustments Under the Pitfalls of Quantitative Easing in the EU: Balancing Economic Growth and Inflation Across Monetary Regimes

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Institutional governance, along with economic development, plays a pivotal role in ensuring the effective transmission of quantitative easing (QE). This research aims to evaluate the efficiency of QE in stimulating gross domestic product (GDP) while simultaneously considering the impact on prices in the EU from a trade-off perspective over the 2014Q1-2023Q1 time horizon. The research is based on macro-panel data differentiating EU countries from the angle of monetary autonomy: EZ members (Austria, Belgium, France, Germany, Netherlands, Italy, and Spain) and emerging monetary autonomous EU economies (Czech, Hungary, Poland, and Romania). Empirical findings are based on the framework of non-stationary, heterogeneous, dynamic panels using a Pooled Mean Group (PMG) estimator to test whether QE's impact on GDP is strong enough to elevate prices. Our findings suggest that monetary convergence guaranteed EZ members stable economic conditions through adjustment and discipline. In contrast, the monetary flexibility of autonomous countries resulted in higher prices which subsequently hindered economic growth.

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1 Introduction

European integration led to trade liberalization, which was characterized by capital and monetary integration, culminating in the establishment of the European Central Bank (ECB). The underlying principles of this process catalyzed higher development, particularly for lower-income and Central and Eastern European (CEE) countries. This transformation entailed a shift from their previous economic systems to institutional democratization, leading to increased capital investment. The objective was establishing an inclusive framework of robust institutions that would foster economic stability and growth (Horvath & Voslarova, 2016; Blanchard et al., 2016). Despite the moderate success of integration, institutional divergences persisted at the EU level. In monetary terms, one group of countries retained their monetary autonomy, while others adopted fixed exchange rates and a single currency. This divergence had significant implications for monetary policy responses during crisis conditions among EU countries. Since the EU is a heterogeneous union, the lack of fiscal consolidation deepens policy coordination challenges. Additionally, a monetary union like the EZ leads to asymmetrical policy problems, particularly between the core and peripheral countries (Beker Pucar & Glavaški, 2021; Glavaški et al., 2023). The objective of this research is to highlight the trade-off associated with economic expansion and inflation through the lens of institutional governance of quantitative easing (QE) policy and adjustments across different monetary regimes.

This paper is structured as follows: after the introduction section, the following part of the paper presents a literature overview, while the third part of the paper explains methodological framework through the panel ARDL model (PMG and MG estimators). The fourth part of the paper presents research results while fifth discusses empirical findings concerning relevant issues.

2 Literature review

There is a rich literature that examines the dynamics between GDP and inflation from a trade-off perspective. The conventional approach was enlightened by the Philips curve, which established an inverse relationship between inflation and unemployment (Philips, 1958). Including QE in the analysis further complicates

dynamics, as unconventional monetary policy impacts both macroeconomic phenomena. The institutional framework remains crucial in shaping the outcomes of this trade-off, as controlling excessive expansion is essential for avoiding elevated prices. As suggested by Bernanke (2020), monetary decisions play a pivotal role in maintaining economic stability. Disciplined policy guidance helps prevent the occurrence of increased prices that adversely impact the economic outlook. In their study, Stojkov et al. (2024), suggest that QE policy in the EU increased inflation more than it depreciated currency resulting in real exchange rate appreciation. Some research papers (Christiano et al., 2005) imply that inflation-targeting policy can cause trade-off but the effects are negligible. Ferdinandusse et al., (2020), analyzed inflationary QE effects across different economic regimes confirming that lowering long-term interest rates increases prices. Conversely, QE plays a pivotal role in influencing GDP through asset prices, thereby triggering the wealth effect and stimulating consumption. Additionally, the QE policy will foster the demand for long-term bonds, leading to their increased prices and reduced returns. This phenomenon can, in turn, increase the consumption of asset holders, ultimately resulting in a boost in production. Furthermore, QE can help reduce economic uncertainty, thereby fostering a stable macroeconomic environment. This, in turn, can eventually lead to an increase in aggregate consumption (Hohberger et al., 2019; Hesse et al., 2018).

3 Methodology

Investigating the ramifications of QE policy on economic growth necessitates considering its expansionary effects on inflation. This is particularly important, as elevated prices resulting from increased aggregate consumption may hinder economic growth and potentially negate initial positive effects. To address this, we employ two distinct panel ARDL models, incorporating three key variables of interest: central bank's balance sheet assets (measured as a logarithmic function of central bank's assets (*lnqe*)); nominal gross domestic product (*ngdp*) and harmonized consumer price index (measured as price rate instead of index (*dhcpi*)). To avoid inflationary pressures and maintain positive economic outcomes, a robust institutional framework is essential, complemented by developed capital markets. An effective institutional design should provide transparent policy guidance, optimize economic objectives, and swiftly adapt to economic shocks. To differentiate

monetary regimes, and account for variations in monetary adjustment process to shocks, the sample is divided into two groups of countries. EZ members (Austria, Belgium, France, Germany, Netherlands, Italy, and Spain) and emerging monetary autonomous EU economies (Czech, Hungary, Poland, and Romania).

To shed light on the trade-off between GDP and inflation induced by QE policy, as well as differentiate adjustment mechanisms between two institutional and monetary frameworks, the authors use techniques based on non-stationary heterogeneous dynamic panels (Pesaran & Smith 1995). Consequently, since the time dimension in the sample is T=37 for both models in 11 EU economies (N=11), heterogeneous, non-stationary panels with cross-sectional dependence were utilized. Techniques introduced by Pesaran et al., (1999), offer estimation of dynamic panels where parameters are heterogeneous across the group: the Mean-Group (MG) and Pooled Mean-Group (PMG) estimator. PMG estimator is based on pooling and averaging coefficients resulting in one homogeneous long-run relationship along with short-run heterogeneous coefficients. MG estimator provides heterogeneous long-run relationships for each country in the sample but also heterogeneous short-run coefficients. Both estimators include the error-correction term (ECT) which explains adjustment dynamics to long-run equilibrium relationship for each country. Hausman specification test (Hausman, 1978) provides a decision on which model is more efficient in distinguishing if the long-run restrictions are true in the PMG model. For the null hypothesis, the homogeneous long-run relationship is true, PMG is more efficient and vice versa. The baseline model can be determined as:

$$\Delta y_{it} = \phi_i(y_{it-1} - \theta_i X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}\, \Delta y_{it-1} + \sum_{j=0}^{q-1} \delta_{ij}\, \Delta X_{it-j} + \mu_i + u_{it}$$

where the cross-section units are represented by i = 1, 2, . . . , N; the number of periods t = 1, 2, . . . , T; X_{it} is a k ×1 vector of explanatory variables; ϕ_i is error-correction parameter, which presents adjustment mechanism toward long-run equilibrium relationship for each monetary autonomous and nonautonomous EU economy, error-correction parameter is expected to be negative under the assumption that long-run relationship exists and variables converge to long-run equilibrium, in contrast, $\phi_i = 0$ means that there is no long-run equilibrium; θ_i is long-run equilibrium relationship between variables; λ_{ij} is coefficient of lagged dependent

variable, δ_{ij} is short-run coefficient for each panel unit (EU economy), μ_i represents individual effects and u_{it} stochastic disturbance term. In this research, nominal gross domestic product (*ngdp*) represents the dependent variable investigated in relation to the impact of central bank balance sheet expansion policy (*lnqe*). Thus, our specification is:

$$\Delta ngdp_{it} = \phi_i(ngdp_{it-1} - \theta_i lnqe_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}\, \Delta ngdp_{it-1} + \sum_{j=0}^{q-1} \delta_{ij}\, \Delta lnqe_{it-j} + u_i + u_{it}$$

In our second model, testing the trade-off perspective, the dependent variable is the harmonized consumer price index (*dhcpi*) while the independent variable is the central bank's balance sheet expansion policy (*lnqe*). We can estimate the following model:

$$\Delta hcpi_{it} = \phi_i(dhcpi_{it-1} - \theta_i lnqe_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}\, \Delta dhcpi_{it-1} + \sum_{j=0}^{q-1} \delta_{ij}\, \Delta lnqe_{it-j} + u_i + u_{it}$$

4 Results

In order to obtain final estimation results regarding short-run and long-run relationships certain empirical steps were performed. First, testing cross-sectional dependence (CSD) with the null hypothesis of cross-sectional independence among highly integrated EU economies is expected to be rejected (Pesaran, 2007). Second, the Panel unit root test is investigated (PURT) with Pesaran's second-generation stationarity test accounting for cross-sectional dependency. Third, the Westerlund cointegration test is performed, with the null hypothesis suggesting the absence of a long-run cointegrated relationship between variables (Persyn & Westerlund, 2008). Finally, choosing which model is more efficient between MG and PMG estimators of the panel ARDL model is concluded with the Hausman test. In the following section, results of the panel ARDL model are presented.

Table 1 presents baseline estimation results using MG and PMG estimators, analyzing the positive dynamics between QE and GDP. The results indicate homogeneous coefficients, assuming a consistent long-run relationship across all 11 EU countries.

Table 1: PMG and MG estimator results for 11 European economies in the period 2014Q1-2023Q1 (homogeneous coefficients)[1]

Sample: 11 EU economies; period 2014Q1-2023Q1						
Dependent variable: *ngdp*	Long-run equilibrium (θ)		Error-correction (Φ_i)		*Δlnqe*	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
MG	68540.63	0.000	-.2409987	0.000	-43312.87	0.000
PMG	28035.99	0.000	-.0934792	0.031	-21398.99	0.000
Hausman test statistic	4.15	0.2454				

Source: Author's estimations.

To account for institutional heterogeneity and country-specific dynamics, Table 2 reports heterogeneous PMG coefficient estimates for each of the 11 economies. The table enables insights into analysis of both short- and long-run monetary adjustments of GDP to QE at the individual country level.

Table 2: PMG estimator results for 11 European economies in the period 2014Q1-2023Q1 (heterogeneous coefficients)

Sample: 11 EU economies; period 2014Q1-2023Q1 Dependent variable: *ngdp*				
PMG Estimator	Error-correction (Φ_i)		*Δlnqe*	
EZ members	Coeff.	*p*-value	Coeff.	*p*-value
Austria	-.0264289	0.122	-4982.236	0.465
Germany	-.043228	0.549	-42148.15	0.387
France	-.456345	0.001	-94176.56	0.035
Belgium	-.0421972	0.085	-4954.867	0.571
Netherlands	-.139381	0.008	-21890.18	0.046
Italy	-.2701313	0.007	-50406.74	0.146
Spain	-.2644414	0.007	-49082.01	0.118
Monetary autonomous EU countries				
Czech	.0321324	0.289	-15206.39	0.843
Poland	.0434941	0.391	-28443.43	0.013
Hungary	-.0534862	0.075	-6908.552	0.059
Romania	.0379069	0.518	2814.386	0.689

Source: Author's estimations.

[1] Pre-estimation procedure can be additionally requested.

To investigate the inflationary consequences of QE, Table 3 summarizes the homogeneous results of the MG and PMG estimators where we analyze the dynamics between QE and inflation. The table showcases QE's effect on prices, controlling for convergence speed and long-run dynamics.

Table 3: PMG and MG estimator results for 11 European economies in the period 2014Q1-2023Q1 (homogeneous coefficients)

Sample: 11 EU economies; period 2014Q1-2023Q1						
Dependent variable: *dhcpi*	Long-run equilibrium (θ)		Error-correction (Φ_i)		*Δlnqe*	
MG	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
	2.779744	0.000	-.8582944	0.000	-2.086216	0.000
PMG	1.493432	0.000	-.790868	0.000	-1.380948	0.092
Hausman test statistic	3.59	0.0583				

Source: Author's estimations.

Finally, Table 4 offers a country-level breakdown of QE's influence on inflation, allowing us to contrast the adjustment dynamics and inflationary sensitivity between EZ and monetary autonomous EU members. The level of divergences is essential for identifying vulnerabilities related to institutional governance.

Table 4: PMG estimator results for 11 European economies in the period 2014Q1-2023Q1 (heterogeneous coefficients)

Sample: 11 EU economies; period 2014Q1-2023Q1 Dependent variable: *dhcpi*				
PMG Estimator	Error-correction (Φ_i)		*Δlnqe*	
EZ members	Coeff.	*p*-value	Coeff.	*p*-value
Austria	-1.060758	0.000	-3.821488	0.166
Germany	-.7736291	0.000	-1.1032	0.692
France	-.7589665	0.000	-1.12916	0.492
Belgium	-1.088509	0.000	-.7988119	0.821
Netherlands	-.5617581	0.002	6.671198	0.063
Italy	-1.676413	0.000	-8.220577	0.031
Spain	-1.505097	0.000	2.042845	0.554
Monetary autonomous EU countries				
Czech	-.5291965	0.021	-1.715685	0.739
Poland	-.2480151	0.054	-2.249097	0.486
Hungary	-.1246379	0.238	-2.050155	0.587
Romania	-.372567	0.007	-2.816295	0.255

Source: Author's estimations.

5 Discussion

Fundamentally, the primary objective of QE policy is to prevent recessionary pressures through indirect monetary channels. However, this mechanism can be hindered from a trade-off perspective if asset prices become elevated enough to slow down economic growth by increasing inflation. As presented in Table 1, the dynamics between GDP and QE are analyzed for the 11 EU economies during the 2014Q1-2023Q1 time horizon. Panel ARDL analysis in the short-run reveals a statistically significant inverse relationship between QE and GDP for 11 EU economies. This corresponds to the time lag effects of monetary phenomena, as policy effects require time to adjust for their long-run effects. To confirm the presence of lagged effects in the short run, the analysis shifts to the long-run, where it is observed that strong and significant positive effects are present between the variables. Both models confirm the initial policy intention of affecting real economic variables in crisis conditions. Hausman specification analysis presents results with a *p*-value of 0.24, indicating that the null hypothesis cannot be rejected. Consequently, the efficient estimator is PMG, while the ECT is significant and negative (-0.09), implying that GDP adjusts at a 9% speed of adjustment each quarter.

Analyzing Table 2, heterogeneous coefficients are presented for each economy in the sample, illustrating the effects of QE on GDP. Adjustment to the long-run relationship is detected in six economies, while short-run coefficients remain significant for two economies. Regarding the EZ members, adjustment to the long-run relationship is confirmed in general for all members except for Germany and Austria. As both countries are core EZ states, their lower need for monetary adjustment is evident in response to external shocks. Germany plays a pivotal role in shaping EZ economic policy, while Austria's close ties, similar institutional design, and reduced exposure to external capital flows diminish the necessity for adjustment. In contrast, for monetary autonomous EU countries, only Hungary exhibits statistically significant adjustment to the long-run relationship (10%). This suggests that coordinated economic adjustment of GDP expansion to the effects of QE is generally absent or low for monetary autonomous EU countries, potentially increasing risks of spillover to elevated prices and resulting in trade-off that hinder growth. In the short-run, the dynamics of EZ members hold significant implications for France and the Netherlands, which are heavily reliant on a robust banking sector

that facilitates prompt monetary transmission. Conversely, Poland stands alone as the only autonomous country with substantial short-run dynamics, primarily driven by its reliance on small and medium-sized enterprises in their aggregate consumption structure. Similar findings regarding GDP and QE dynamics are confirmed by Baumeister & Benati (2013), Weale & Wieladek (2016), and Chen et al. (2012).

Analysis of the QE and inflation dynamics for the 11 EU economies are presented in Table 3. The short-run indicates an inverse relationship for both models, while PMG coefficients are not statistically significant. In the long-run, confirmation of inflationary presence is confirmed since both models suggest high, significant, and positive coefficients. ECT is slightly higher for the MG model while in both cases statistically significant, suggesting an adjustment to the long-run relationship toward elevated prices is present.

As presented in Table 4, heterogeneous coefficients are exhibited for 11 EU economies in relation to QE and inflation dynamics. In the short-run, there is no evidence of significant QE influence on prices for all the economies in the sample (with the exception of Italy). This suggests that prices require a longer time period to adjust to increased aggregate consumption and GDP expansion. Shifting the focus to the long-run dynamics, it can be observed the significance of adjustment to monetary shocks for all EU members, exemplifying high levels of adjustment (Germany, France, and the Netherlands) or over-adjustment to elevated prices (Austria, Belgium, Italy, and Spain). Conversely, only Czech and Romania exhibit significant adjustment to the price dynamics of the autonomous countries. However, adjustment coefficients are significantly lower than those of EZ members. This can be attributed to the presence of a trade-off between GDP and inflation, as the institutional framework is less robust. Research conducted by Lenza et al., 2010 and Kapetanios et al., 2012 indicates a positive relation between asset purchases and increased prices. Flexibility in monetary policy allows for overheating through GDP expansion, which results in inflation hindering economic growth. In contrast, institutional governance in the EZ states adopts a more disciplined approach to controlling GDP expansion, thereby ensuring stable economic growth without excessive inflationary pressures.

6 Conclusions

This paper explores dynamics between QE, GDP, and inflation along with differences in institutional governance and adjustment mechanisms across monetary regimes in the EU. Conventional policy limitations required the introduction of unconventional monetary measures however, disciplined and robust institutional guidance is imperative for mitigating potential negative repercussions. Even with the common factor of European integrations for all countries, limitations in GDP adjustment leading to overexpansion reveal persistent divergences in policy reactions between institutional frameworks as well as monetary regimes.

The estimated, heterogeneous, dynamic, macro-panel of 11 EU economies in the period 2014Q1-2023Q1 helps us in analyzing short-run and long-run dynamics among the two groups of countries differentiated by monetary autonomy, level of development as well as institutional framework. The primary finding indicates that QE policy exerts a de facto significant role in mitigating crisis conditions. However, the discipline of institutional decisions determines whether the policy is implemented in a manner that avoids elevated prices affecting growth. For EZ members, the adoption of a policy framework provided support for economic activity while simultaneously adjusting for excessive expansion to prevent inflationary pressures. Conversely, autonomous countries granted flexibility in policy guidance, resulting in a trade-off between inflationary pressures and economic growth.

These findings underscore the paramount importance of further institutional integration at the EU level, which will provide enhanced coordination among member states in monetary policy responses. By reducing divergences among countries, we can enhance the resilience of economic reaction to external shocks and foster sustained economic growth.

References

Baumeister, C., & Benati, L. (2013). Unconventional Monetary Policy and the Great Recession: Estimating the Macroeconomic Effects of a Spread Compression at the Zero Lower Bound. *International Journal of Central Banking, 9*(2), 165-212.

Beker Pucar, E., & Glavaški, O. (2021). Non-stationary heterogeneous panel approach of current account adjustments in the Euro-area. *Economic Computation and Economic Cybernetics Studies and Research*, *1*(55), 185–199. DOI: https://doi.org/10.24818/18423264/55.1.21.12.

Bernanke, B. (2020). The new tools of monetary policy. *American Economic Review*, *110*(4), 943–983. DOI: https://doi.org/10.1257/aer.110.4.943.

Blanchard, O., Ostry, D. J., Atish, R. G., & Chamon, M. (2016). Capital flows: Expansionary or contractionary? *The American Economic Review*, *106*(5), 565–569. DOI:https://doi.org/0. 1257/aer.p20161012.

Chen, H., Curdia, V., & Ferrero A. (2012). The Macroeconomic Effects of Large-scale Asset Purchase Programmes. *The Economic Journal*, *122*(564), DOI: https://doi.org/10.1111/j.1468-0297.2012.02549.x

Christiano, L.J., Eichenbaum, M., & Evans, C. (2005). Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy, *Journal of Political Economy*, *113*(1), 1-45, DOI: https://doi.org/10.1086/426038.

Ferdinandusse, M., Freier, M., & Ristiniemi, A. (2020). Quantitative easing and the price liquidity trade-off, *European central bank working paper series*, 2399.

Glavaški, O., Beker Pucar, E., Beljić, M., & Stojkov, S. (2023). Coordination vs. Competitiveness of Effective Average Tax Rates in Relation to FDI: The Case of Emerging EU Economies. *Sustainability* 15, No. 227, DOI: 10.3390/su15010227.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, *46*(6), 1251–1271.

Hesse, H., Hofmannn, B., & Weber, J. M. (2018). The macroeconomic effects of asset purchases revisited. *Journal of Macroeconomics*, *58*, 115–138. DOI: https://doi.org/10.1016/j.jmacro.2018.05.010.

Hohberger, S., Priftis, R., & Vogel, L. (2019). The macroeconomic effects of quantitative easing in the euro area: Evidence from an estimated DSGE model. *Journal of Economic Dynamics and Control*, *108*, 103756. DOI:https://doi.org/10.1016/j.jedc.2019.103756.

Horvath, R., & Voslarova, K. (2016). International spillovers of ECB's unconventional monetary policy: The effect on central Europe. *Applied Economics*, *49*(24), 2352–2364. DOI: https://doi.org/10.1080/00036846.2016.1237764.

Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K. (2012). Assessing the Economy-wide Effects of Quantitative Easing. The Economic Journal, 122(564), DOI: https://doi.org/10.1111/j.1468-0297.2012.02555.x

Lenza, M., Pill, H., & Reichlin, L. (2010). Monetary policy in exceptional times. Economic Policy, 25(62), 295-339. DOI: https://doi.org/10.1111/j.1468-0327.2010.00240.x

Persyn, D., & Westerlund J. (2008). Error-correction based cointegration tests for panel data. *The Stata Journal*, *8*, 232–241.

Pesaran, M. H. (2007). A simple panel unit root test in the preference of cross section dependence. *Journal of Applied Econometrics*, 22, 265–312.

Pesaran, M. H., & Smith, R. P. (1995). Estimating long-run relations from dynamic heterogeneous panels. *Journal of Economics*, *68*, 79–113.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, *94*, 621–634. DOI: https://doi.org/10.2307/2670182.

Philips, A.W. (1958). The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. *Economica*, *25* (100).

Stojkov, S., Beker Pucar, E., & Sekulić, A. (2024). Real Exchange Rate Channel of QE Monetary Transmission Mechanism in Selected EU Members: The Pooled Mean Group Panel Approach. *Journal of Risk and Financial Management*, *18*(1), DOI: https://doi.org/10.3390/jrfm18010012.

Weale, M., & Wieladek, T. (2016). What are the macroeconomic effects of asset purchases? *Journal of Monetary Economics*, *79*, 81-93. DOI: https://doi.org/10.1016/j.jmoneco.2016.03.010