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A monetary policy perspective of threshold effects in interest rates in the Euro-area.

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Abstract

This paper examines the impact of euro-area monetary policy on the banking industry. We provide a dynamic threshold panel model that endogenously identifies the low threshold of monetary policy rate. And we also provide insights of the long vs the short run impact of unconventional monetary policy on bank level resilience. Results show that there is a negative relationship between low rates and bank risk. Dynamic threshold methodology identifies threshold effects and two regimes in the underlying data generating process. Policy implications are of interest in the current conjecture that there are voices for hikes in the interest rates despite the anemic euro-area recovery and the geopolitical tensions.

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1. Introduction

We are interested in investigating whether a threshold of interest rate could be identified endogenously by employing euro-area bank level data. We hypothesise, based on literature (Altunbas et al., 2014; Claessens, et al. 2018; Gambacorta et al. 2014; Lyonnet and Werner 2012) that unconventional monetary policy (UMP) could have short run effects that are heterogenous to the long run effects (see also Moramarco 2022). So, our contribution in a nutshell is as follows: rather than imposing what is threshold interest rate, treating also for endogeneity. Robustness analysis could provide other channels, such as consumption and savings, mis allocation of resources. It is also of interest to investigate the risk-taking of banking industry as the result of QE (Altunbas et al., 2014; Claessens, et al. 2018; Gambacorta et al. 2014; Lyonnet and Werner 2012). We explore in depth the underlying causality among monetary policy, including UMP, and risk. The relationship between UMP and bank risk-taking has not been settled (Beck et al., 2013; Boyd and De Nicolo, 2005; Jiménez et al., 2013; Tabak et al., 2015). Owing to the variations in the details of the regulatory environment and interpretations of risk in different jurisdictions, a single risk factor may vary in scope across countries (Menezes et al., 2014; Foden & Nguyen, 2013; Scharf & Barac, 2016). Other research demonstrates an inverse relationship between bank competition and bank risk taking (Bertrand and Meyer, 2004; Gertler et al., 2007; Li et al., 2011).

2. Methodology: Dynamic Panel Threshold Model.

The starting point of our analysis is Claessens, et al. (2018) model that studies the association of the dependent variable, y_{ijt}, the net interest margin NIM (or return on assets ROA) of bank i in country j in year t with the independent variables, z_{ij}: yearly average 3-month government bond yield ($3MonthRate_{jt}$ is); the spread between the 10-year government bond yield and 3-month government bond yield ($RateSpread_{jt}$). For completion, we also include the GDP growth as exogenous macroeconomic variable. The above model is applied in a panel of countries that are classified as Low or High based on whether their yearly average 3-month yield is above or below 1.25 percent, respectively.

In some detail, the threshold model takes the following form:

$$y_{ijt} = \mu_i + \beta_1 z_{ijt} I(r_{ijt} \leq \gamma) + \beta_2 z_{ijt} I(r_{ijt} > \gamma) + \varepsilon_{ijt}, \quad (1)$$

where subscripts $i = 1, \ldots, N$ represent the bank, $j = 1, \ldots, M$ country, and $t = 1, \ldots, T$ index the time. y_{ijt} is the NIM or ROA of bank i in country j in year t. μ_i is the country-specific fixed effect, and the error term is $\varepsilon_{ijt} \sim^{iid} (0, \sigma^2)$. $I()$ is the indicator function indicating the regime defined by the threshold variable r (rate in our case), and the threshold level γ. z_{it} is a m-dimensional vector of explanatory regressors. The vector of explanatory variables is partitioned into a subset z_{1ijt} of exogenous variables uncorrelated with ε_{ijt}, and a subset of endogenous variables z_{2it}, correlated with ε_{ijt}. In addition to the structural equation, the model requires a suitable set of instrumental variables x_{ijt} including z_{1ijt}.

Note that the above can further be transformed so as the central rate could be the threshold variable and the regime dependent regressor. That transformation would allow to examine the long-term impact of the rate on, for example, NIM.

$$y_{ijt} = \mu_i + \beta_1 r_{ijt} I(r_{ijt} \leq \gamma) + \delta_1 I(r_{ijt} \leq \gamma) + \beta_2 r_{ijt} I(r_{ijt} > \gamma) + \varphi z_{ijt} + \varepsilon_{ijt}, \quad (2)$$

where z_{ijt} is the vector of other endogenous control variables. Note that slope coefficients are regime independent.

3. Data and Results

The data sample consists of banks in 19 countries of the Euro-area for the 2007-2023 period. All bank-specific variables are obtained from Bankscope, at annual frequency, and in thousand USD. There are 28,334 observations of 3,229 banks specialised as commercial, investment, savings, and real estate banks. Regarding UMP, there are three proxies from the ECB Statistical Data Warehouse (Gaekwad & Barnett, 2024). The first proxy (APP&LTRO) is the amount of asset purchases for the whole Eurosystem and LTROs. The value is computed by adding all the amounts of different asset purchase programmes (APPs, since 2009, reported as a total figure under the '*Securities Held for Monetary Policy Purposes*' in the ECB's annual balance sheets) and the Longer-Term Refinancing Operations (LTROs, also available from the ECB's annual balance sheets). This variable is constructed in a similar way to how Bluwstein, Canova (2016) calculate their UMP variable. APPs comprise the Securities Market Program (SMP, effective from 05/2010 to 09/2012), the Covered Bond Purchase Programs 1 and 2 (CBPP 1, CBPP 2, terminated), and the current Asset Purchase Program. The breakdown of the expanded APPs includes the CBPP 3, Asset-backed Securities Purchase Program, Public Sector Purchase Program, and Corporate Sector Purchase Program.

These ECB's asset purchase programs operate through a combination of well identified transmission channels (see Gambacorta et al. 2014) that affect bank risk in different ways. The portfolio rebalancing channel encourages shift out of the assets purchased by the ECB and into assets with higher yields, such as corporate bonds or equities. For banks, this can ease funding conditions but may also induce greater exposure to riskier segments of the market. The liquidity channel alleviates market dysfunctions by improving trading conditions and reducing fragmentation, particularly in stressed sovereign bond markets. This in turn lowers liquidity risk for banks holding these assets. Finally, the risk-taking channel reflects the incentives created by a low-yield environment, whereby banks may expand credit supply to lower-rated borrowers or increase leverage, with potential consequences for financial stability if risks are not adequately managed. Taken together, these channels highlight that the institutional design of individual programmes, whether they target sovereign debt, covered bonds, or corporate securities, determines not only the scale of monetary stimulus but also the distribution of risks across the banking sector and the broader euro area financial system (Altavilla, et al. 2015).

In a cross-country study of UMP, Gambacorta et al. (2014) use the central bank assets to represent the UMP instrument. As Lyonnet and Werner (2012) argue, central banks can use both sides of the balance sheet to exert the impact of asset purchases. While the asset side provides an alternative source for private financial intermediation through outright purchase of credit products, the liability side captures a cushion for funding liquidity risk. Following the literature, we include two additional proxies for UMP, namely the ECB's assets and excess reserves, available from the ECB Statistical Data Warehouse. Excess reserves are the total excess reserves of credit institutions subject to minimum reserve requirement in the euro area. As bank-specific variables are in thousand USD, we opt for the EUR/USD exchange rate from Bankscope to convert the UMP data from million EUR to thousand USD. Cour-Thimann, Winkler (2012) emphasise that ECB's non-standard measures complement key interest rate

decisions rather than acting as a substitute. To account for conventional monetary policies (CMPs), we use the marginal lending facility (MLF) rate, the deposit facility rate (DF), and the main refinancing rate (MR). These variables are available from the ECB's website.

Z-score is the dependent variable representing bank stability, computed as $Z_{it} = (ROA_{it} + Capital\,ratio_{it})/\sigma ROA_{it}$, which shows the number of standard deviations below the average return on assets that will lead to insolvency due to liquidity shocks (Beck, De Jonghe, Schepens, 2013). The method to obtain this measure is provided in the next section. Bank specific variables include size, asset diversification, liquidity, and revenue diversification.[1] Size is the natural logarithm of total assets (Beck et al., 2013;).

In the identification we control for revenue diversification measured as the ratio of non-interest income to total operating income (Beck et al., 2013), assets diversification represented by the ratio of securities to assets (Beck et al., 2013), and liquidity which is defined as liquid assets[2] to total assets (Beck et al., 2013). GDP growth is included to reflect the influence of macroeconomic environmen. Data for GDP growth are available from World Bank database and IMF Statistics.

3.1 Results Dynamic Panel Threshold Analysis

This section presents the dynamic panel threshold results and identify the presence of thresholds in the unconventional monetary policy (UMP) of the ECB (Moramarco 2022). We employ this econometric method setting as threshold variable the MRO (the main refinancing operation rate) or the UMP (for this paper we define UMP as the unconventional monetary policy calculated as the sum of the amount of asset purchases under the Securities Markets Program, Covered Bond Purchase Program 1 & 2, and Longer-Term Refinancing Operations). Our dynamic threshold analysis reveals a threshold value of MRO to be 0.153% (see Table 1 below). We estimate the dynamic panel threshold model using System GMM (Blundell & Bond 1998). Lagged levels and differences of the endogenous variables (Z-score, the UMP variable, bank size, liquidity and diversifications) are used as instruments. We apply collapse and limited lag depth to avoid instrument proliferation, ensuring robust inference. Validity and specification tests like the Hansen J-test indicates that our instruments are valid ($p = 0.27$), and there is no evidence of second-order serial correlation in the residuals (AR(2) test reports a $p = 0.43$). Interestingly our findings suggest that the MRO exerts an asymmetric effect on bank stability as in the high regime its effect is positive whilst on the low regime its effect turns negative on Z-score. There exists a negative association between risk of banks in the high (low) regime and the UMP. This suggests that for the low levels of MRO below 0.1097%, the relationship between UMP and bank resilience is negative. However, for the high levels of MRO, the relationship between UMP and bank resilience turns positive, and the monetary policy impact also has a higher in magnitude impact if compared to the low regime.

[1] It is understood that the capital to asset ratio is usually among the control variables as bank capitalisation affects bank risk. Nevertheless, we do not include it as by definition, Z-score takes into account the capital to asset ratio. Hence, there may exist a mechanical relationship between them.

[2] Liquid assets are also obtained from Bankscope.

Table 1. Dynamic Panel Threshold Analysis for the Risk-MRO Nexus.

Dependent variable		lnZ-score	
Threshold estimates		1.453	
95% confidence interval		[1.1071 2.1089]	
Impact of threshold variables		Est.	S.e.
Low regime		-0.0817***	0.0310
High regime		0.4315***	0.0277
Intercept		2.201***	0.0465
Impact of covariates			
UMP		0.0287***	0.0011
Size		0.0194***	0.0025
Asset diversification		-0.210***	0.0516
Liquidity		-0.099***	0.0231
Revenue diversification		0.058***	0.0070
GDP growth		0.0211***	0.0011
Obs in low regime	18051		
Obs in high regime	8160		

Notes: This Table reports results from the dynamic panel threshold analysis using the first lag of the endogenous variable as its instrument.

Nex, we examine the Risk-Unconventional Monetary Policy nexus. Our dynamic threshold analysis reveals a threshold value of UMP to be 616,662 mil EUR (see Table 2). Our findings suggest that the UMP exerts a strong negative impact on Z-score for both regimes. Moreover, both in low and high regimes we observe negative relationship between UMP and lnZ-score because an increase in UMP would decrease Z-score. Thus, we provide evidence that UMP reduces bank stability. In some detail, there exists a negative association between risk of banks in the high (low) regime and the UMP, as λ_2= -0.0578 (-0.0653). This suggests that for the low levels of UMP below 616,662 mil EUR, the relationship is negative and the coefficient estimate is somewhat higher than the coefficient of the high regime. This result illustrates that lower values of the UMP dampens bank risk somewhat more than the high regime.

Table 2. Dynamic Panel Threshold Analysis for the Risk-Unconventional Monetary Policy Nexus

Dependent variable	Z-score	
Threshold estimates	557,138 mil EUR	
95% confidence interval	[390,598 722,112]	
Impact of threshold variables	Est.	S.E.
Low regime	-0.0223**	0.0128
High regime	-0.0418*	0.0243
Intercept	0.0017	0.9486
Impact of covariates		
HHI	0.615***	0.0110
Size	0.0071	0.0316
Asset diversification	-0.2141**	0.0017
Liquidity	-0.337***	0.0291

Revenue diversification		0.0142***	0.0015
GDP growth		0.0311***	0.0011
Year Dummies	yes		
Obs in low regime	11128		
Obs in high regime	16176		

Notes: S.E.: standard error; Obs: number of observations. ***,**,*: significance at 1%, 5%, 10% levels respectively.

4 Conclusion

In this paper we examine the impact of UMP on bank risk in the euro-area. The main findings of our analysis show that asymmetry is present because in low regime we observe that an increase in MRO would decrease Z-score, increasing bank risk and reducing bank stability. However, in high regime we observe positive relationship between MRO and Z-score, insinuation that in high regime UMP enhances bank stability. Given this evidence, we demonstrate that there are thresholds in UMP and thereby cautious approach of the interpretation of UMP is warranted. Results demonstrate some uniformity here as both in short and long run UMP enhances bank stability. In addition, the current conjecture is of interest because there are voices for keeping high the interest rates despite the anaemic euro-area recovery and the global economic and geopolitical tensions.

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