LATENT DRIVERS OF RATES- AT- RISK IN THE BALTIC LENDING AND DEPOSIT MARKETS: INTEGRATING FACTOR ANALYSIS AND QUANTILE REGRESSION

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Abstract:

This study introduces an integrated empirical framework for bank lending and deposit rates in the Baltic States, combining factor analysis with quantile regression. Latent macro-financial factors — capturing monetary, banking-sector, and macroeconomic conditions — are first extracted from a comprehensive set of macroeconomic, financial market, and banking-sector indicators. These latent factors are subsequently incorporated into conditional quantile regression models to estimate downside and upside Rates-at-Risk for lending and deposit rates. The proposed framework provides a comprehensive assessment of how monetary, banking, and macroeconomic factors shape bank interest rate risk, enabling get deeper insights into monetary policy transmission and financial stability in the Baltic region.

Keywords: Lending rates, deposit rates, factor analysis, quantile regression, Baltic States

INTRODUCTION

Lending and deposit rates constitute one of the principal channels through which central banks transmit monetary policy to the real economy, influencing credit allocation, investment and consumption decisions, and ultimately overall economic activity and inflation. Consequently, understanding the determinants of bank rates and their dynamics remains an essential topic in monetary economics and banking research.

The issue of heterogeneous monetary policy transmission has attracted renewed attention following the European Central Bank's monetary tightening cycle during 2022-2023. Although policy rates increased simultaneously across the euro area, bank lending and deposit rates responded differently across member states, banking sectors and individual banks, reflecting complex interactions among numerous macro-financial variables.

Moreover, attention should be paid not only to the levels of lending and deposit rates but also to their sharp and asymmetric movements. These fluctuations provide valuable insights for assessing credit affordability, evaluating banks' pricing behaviour, and identifying potential risks to financial stability.

The existing empirical literature predominantly relies on pass-through regression models to analyse lending and deposit rate dynamics. Although these approaches have provided valuable insights into monetary policy transmission, they exhibit several limitations. The explanatory variables used in pass-through models are frequently highly correlated, which can result in multicollinearity, complicate the identification of their independent contribution and reduce the interpretability of regression results. Conventional regression models focus on conditional mean responses and therefore generally assume symmetric responses across the rate distribution.

To address these limitations, the study pursues three main objectives. First, it aims to identify latent macro-financial factors that summarize a broad set of macroeconomic, financial-market, and banking-sector indicators underlying lending and deposit rate dynamics in the Baltic States. Second, it examines how these latent factors influence the average dynamics of bank interest rates in the region. Finally, the study develops a Rate-at-Risk (RaR) measure to quantify the extent to which latent macro-financial conditions shape the downside and upside risks of lending and deposit rates, thereby providing a forward-looking assessment of interest rate vulnerability under different macro-financial environments.

For this purpose, the study proposes an integrated analytical framework that combines Exploratory Factor Analysis (EFA) with a Rate-at-Risk (RaR) approach. Factor analysis is employed to summarize a broad set of correlated macro-financial indicators into a small number of economically interpretable latent factors. These factor scores are incorporated into conditional quantile regressions to estimate lending and deposit Rates-at-Risk for the Baltic States. Integration of factor-extracted financial conditions with conditional quantile regression allows researchers to perform a more comprehensive assessment of the dynamics of bank interest rates while reducing the dimensionality of the explanatory variables.

The analysis is conducted in the empirical setting of the Baltic States – Estonia, Latvia, and Lithuania – small open economies with rapid financial integration and high sensitivity to external monetary conditions.

The study demonstrates an uneven influence of monetary, banking-sector, and macroeconomic factors on the dynamics of lending and deposit rates in the Baltic States. The findings could have implications for monetary transmission, financial stability, and bank risk management.

METHODOLOGY

To achieve the objectives of the study, several research questions are formulated. The first objective –identifying latent macro-financial factors – is addressed through three interrelated research questions. First, which macroeconomic, banking-sector, and monetary variables theoretically explain the dynamics of lending and deposit rates? This question establishes the theoretical foundation of the study by linking the existing literature on monetary policy transmission and banking to the empirical analysis. Second, which methodological framework is most appropriate for extracting the underlying latent factors? Addressing this question is essential for ensuring the robustness, reliability, and interpretability of the empirical results. Third, how can the extracted latent factors be interpreted in economic terms? This question is vital for translating statistical results into meaningful insights that can support the analysis of monetary transmission, macroprudential surveillance, and bank risk management.

The second objective – explaining the dynamics of lending and deposit rates with the extracted latent factors – is addressed through the following research questions. What effects do the extracted latent factors have on lending and deposit rates in the Baltic States? Then, how do these estimated effects differ across countries, lending and deposit categories, and maturity segments? Addressing both questions provides valuable insights into the dynamics of bank interest rates in the Baltic States and demonstrates how the extracted latent factors can be applied in practice to explain variations in lending and deposit rates.

The third objective – developing a Rate-at-Risk measure for lending and deposit rates- is investigated by means of several additional research questions. At the outset, how do the extracted latent factors influence the downside and upside tail risk of lending and deposit rates in the Baltic States? Subsequently, how can the estimated conditional quantiles be translated into a coherent and interpretable Rate-at-Risk measure? Ultimately, how has the Rate-at-Risk of lending and deposit rates evolved over time, particularly during the European Central Bank's 2022-2023 monetary tightening cycle, compared with earlier periods? This analysis makes it possible to identify and evaluate the effects of latent macro-financial conditions not only on the expected level of bank interest rates but also on the likelihood of extreme interest-rate outcomes under different economic environments.

The proposed methodological framework consists of two stages: extraction of latent financial-condition factors using Exploratory Factor Analysis, and estimation of Rate-at-Risk using conditional quantile regression. The methodology combines the advantages of dimension reduction and tail-risk analysis, addressing both multicollinearity among explanatory variables and potential nonlinearities and asymmetric responses of bank interest rates.

In the first stage, exploratory factor analysis is applied to a broad set of monetary, banking-sector, and macroeconomic indicators such as inflation, GDP growth, unemployment, ECB policy rates, Euribor rates, sovereign and corporate spreads, non-performing loans, capital adequacy ratios, liquidity coverage ratios, credit growth, and bank profitability measures. Prior to factor extraction, all variables are standardized and tested for stationarity. The number of factors is determined using eigenvalues, scree plots, and the economic interpretability of the resulting factor structure. The resulting latent factors summarize the common variation among the observed indicators while reducing the dimensionality and multicollinearity present in the raw data.

In the second stage, the estimated latent factors serve as predictors in conditional quantile regression of lending and deposit rates, and for comparison also in ordinary least squares regressions. Quantile regression allows to examine how the estimated latent financial-condition factors influence the entire conditional distribution of bank rates, rather than only the mean. Rate-at-Risk (RaR) is defined as the projected 5th and 95th percentiles of the rate distribution conditional on current factor values. The RaR methodology adapts the quantile-based risk modelling framework initially established for tail-risk assessment of macro-financial variables (Anrian& Brunnermeier, 2016; Adrian, Boyarchenko, & Giannone, 2019) to bank interest rates. This approach enables the identification of factors associated with heightened rate risk.

The empirical analysis is based on the data obtained from official European institutions, including the European Central Bank, Eurostat, the European Banking Authority, and national central banks.

FINDINGS

The study identifies several economically meaningful latent macro-financial factors that determine lending and deposit rate dynamics in the Baltic States. These factors capture the monetary policy environment, banking-sector strength, and other macroeconomic and financial market conditions. The extracted latent factors account for a substantial share of lending and deposit rate variation across all three Baltic states.

The estimated quantile regressions demonstrate that macro-financial conditions strongly influence the upper tail of lending rates, reflecting asymmetric risk-pricing behaviour by banks during periods of financial stress. At the same time, deposit-rate risk are comparatively more stable than lending-rate risk, as deposit rates usually adjusts more slowly in retail banking markets. The study reveals differences in how the latent factors affect lending and deposit rates across the Baltic States, which could be explained by structural characteristics of national banking sectors and their competitive environments.

The preliminary results suggest that Rate-at-Risk provides early warning signals, as sharp increases in this measure for lending rates coincide with periods of tightening financial conditions and rising credit risk.

CONCLUSIONS

The contribution of this study to the empirical literature encompasses the integration of dimension reduction of explanatory variables with a Rate-at-Risk measure of bank rates. The proposed methodology allows both the identification of the principal macro-financial forces affecting bank interest rates and the assessment of their influence on extreme interest-rate outcomes.

From a policy perspective, the proposed framework may have essential implications for monetary policy, macroprudential regulation, and bank risk management. Policymakers can use the study to enhance understanding of monetary policy transmission in small open economies, while banks can incorporate RaR into pricing and risk-management strategies.

The study is subject to some limitations. The approach relies on aggregate banking-sector data, limiting the investigation of bank-specific heterogeneity. Moreover, the analysis may be constrained by limited data availability for Estonia, Latvia, and Lithuania, negatively affecting the precision of estimates. This could be avoided by extending the framework either to bank-level datasets or to all euro-area member states. Nevertheless, the proposed framework offers a promising approach for understanding the latent drivers of bank interest-rate risk and their implications for monetary policy transmission.

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