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Review of the doctoral dissertation of

Mr Abhishek Anand, M.A.

entitled

Procyclical effect of credit risk of banks – econometric analysis for EU financial system

written under the scientific supervision of Prof. dr hab Mateusz Pipień,

Cracow University of Economics

The legal basis for preparing the review is the letter no. RDC.600.49P.2025 from 28 January 2025, signed by Prof. Stanisław Popek, the Director of the Doctoral School of the Cracow University of Economics, with a request to evaluate the above-mentioned doctoral dissertation (based on art. 190 par. 2 of the Law of 20 July 2018 on Higher Education and Science, Dz. U. 2020, item 85, with later amendments).

The purpose of the review is to assess whether the submitted doctoral dissertation meets the requirements necessary to award the degree of doctor. Considering that the doctoral dissertation should be an original solution to a scientific problem and demonstrate the candidate's general theoretical knowledge, I adopted the following criteria when assessing the doctoral dissertation: originality and contribution, importance of research question and objectives, assessment of theoretical and methodological framework, empirical analysis and results, discussion and policy implications.

1. Originality and contribution

The dissertation addresses a highly relevant and timely issue at the intersection of macroeconomic dynamics and banking sector stability. This study focuses on the procyclicality in the banking sector, which refers to the tendency of financial activities—such as lending, asset pricing, and risk assessment—to amplify economic cycles (Landau 2009). The Author uses quantitative methods to analyse this phenomenon. Understanding procyclicality is essential for designing effective prudential regulations, monetary policies, and macroprudential frameworks that mitigate excessive economic fluctuations and systemic risk. The global financial crisis

showed that a lack of financial stability can induce significant adverse effects on price and output. Therefore, several versions of the leaning against the wind policy rules have recently been introduced and analysed intensively. The Basel Committee on the Global Financial System recommends several macroprudential tools as countercyclical instruments (cf. Committee on the Global Financial System, 2010). The research topic addressed in this dissertation may influence the designing of macroprudential policies such as asset-side tools (e.g., loan-to-value ratio), or capital-based tools (e.g., capital buffers and capital requirements) (see, e.g., Basel III, Borio, Furfine, and Lowe 2001, Cerutti, Claessens and Laeven 2017).

Empirical studies on the phenomenon of procyclicality have overwhelmingly focused on individual economies. The Author thus joined a massive group of scientists and practitioners trying to understand the phenomenon of procyclicality in the banking sector, focusing on the empirically less exploited problem of cross-country heterogeneity of links between the real economy and the banking sector. Given the increasing concerns about the financial sector's procyclicality, this research contributes to academic discourse and policy discussions. First, it presents a detailed review of the evolution of economic thought on business and financial cycles. Second, by employing relatively new econometric tools, the Author can derive original empirical findings that enhance our understanding of the role of economic growth, unemployment and inflation in describing banking assets, credit risk and regulatory capital fluctuations. Finally, the thesis yields two findings:

F1: It provides empirical evidence that the response of banking sector variables to macroeconomic indicators varies significantly across countries. By accounting for cross-country heterogeneity, the study may offer a foundation for designing regulatory frameworks that effectively balance financial stability and economic growth—particularly in interconnected and diversified economies such as the EU.

F2: The study also demonstrates the effectiveness of the seemingly unrelated regression model (SUR model) as a robust analytical tool for examining procyclicality and cross-country heterogeneity. The findings confirm its empirical validity and highlight its advantages over traditional panel regression methods, reinforcing its relevance for financial stability analysis.

2. Research question and objectives

In the introduction, the Author clearly states the primary aim of the dissertation:

"Empirical analysis of the procyclicality in the banking sector and cross-country heterogeneity with Seemingly Unrelated Regression Equation system for selected European Union countries."

The Author outlines five specific and relevant research objectives:

O1: To present and discuss the concept of procyclicality and its theoretical relationship with the banking sector.

O2–O4: To empirically test the procyclicality of loan supply, loan loss provisions (LLPs), and capital buffers in the banking sector, and to assess their heterogeneity across EU countries.

O5: To apply the Seemingly Unrelated Regression Equations (SUR) methodology for analyzing procyclicality and cross-country heterogeneity.

In addition, the Author formulates five associated research hypotheses. However, the formulation of these hypotheses raises some concerns. Constructing scientific hypotheses requires clearly defining their temporal and spatial scope. A hypothesis should be framed in a way that enables it to be tested and either confirmed or rejected based on the evidence gathered. It should also clarify whether it refers to a single event, a regularity observed within a specific context, or a universal pattern.

Unfortunately, in this work, the hypotheses are not formulated with sufficient precision. For example, the first hypothesis states: "Loan supply of banks is procyclical."

This statement lacks clarity, as procyclicality itself is not uniquely defined and may vary depending on the economic context. Moreover, the hypothesis does not specify the time period or the geographic scope to which it applies. Without further elaboration, it is difficult to determine the Author's intended interpretation. Therefore, a more coherent and comprehensive reflection on the nature and scope of the hypotheses would strengthen the methodological foundation of the study.

That said, the introduction nonetheless provides a satisfactory and structured entry point into the research topic, outlining its motivation, objectives, and relevance.

3. Summary and assessment of literature review and theoretical background

3.1 Summary

The dissertation submitted for review consists of 192 pages and is organized into five chapters, including three empirical chapters (Chapters 3, 4, and 5), one theoretical-methodological chapter (Chapter 1), and a section devoted to conclusions and policy recommendations.

Chapter 1 addresses the theoretical foundations of business and financial cycles, leading to the concept of procyclicality. It covers the origins and development of this concept and includes an extensive literature review of theoretical and empirical studies related to procyclicality in the banking sector.

Chapter 2 presents the empirical model used to test the procyclicality hypotheses. It outlines the theoretical assumptions underlying the Seemingly Unrelated Regression Equations (SURE) system and discusses the estimation techniques employed. The chapter also demonstrates how the model is applied to test the procyclicality of various banking indicators.

Chapters 3, 4, and 5 contain the empirical analyses of procyclicality in, respectively, credit supply, loan loss provisions, and capital buffers within the EU banking sector. Each chapter discusses the determinants of the respective variables, including both macroeconomic and bank-specific factors. The analysis is conducted using two benchmark econometric models—the fixed effects panel data model and the pooled regression model—as well as the SUR model, which is central to the dissertation's methodological approach. Each empirical chapter concludes with a discussion of the results.

The structure of the dissertation is appropriate and logically organized. The introduction clearly presents the research framework, including the rationale for the study, the main research objective, the research questions and hypotheses, data sources, and applied methodologies.

The layout of the study is also clearly explained, providing the reader with a coherent overview of the dissertation's scope.

3.2 Literature review and theoretical background

Chapter 1 of the dissertation presents a comprehensive and well-structured theoretical framework, which I value highly. It offers a thorough review of the literature and a detailed account of the evolution of thought on economic and financial cycles, culminating in the development of the concept of procyclicality.

In this chapter, the Author defines procyclicality and procyclical variables, drawing particularly on the work of Jean-Pierre Landau (2009). According to Landau's definition, procyclicality entails feedback loops between the real economy and the financial system, whereby each amplifies fluctuations in the other. The Author argues that loan supply exhibits procyclical characteristics and, following Landau, concludes that a certain optimal degree of procyclicality is both necessary and desirable. The chapter also references the post-crisis regulatory changes introduced under the Basel III framework in 2010, aimed at curbing excessive procyclicality—a phenomenon widely regarded as a key contributor to the global financial crisis.

Chapter 1 offers a historical perspective on the development of economic cycles and procyclicality theories, beginning with the foundational work of Thomas Malthus (1836) and Clément Juglar (1860). It explores competing schools of thought, including the Keynesian paradigm and the Austrian business cycle theory advanced by Friedrich A. von Hayek. The Keynesian view emphasizes fluctuations in aggregate demand and advocates for countercyclical government intervention to mitigate downturns. In contrast, Austrian theory—represented by Ludwig von Mises and Friedrich Hayek—attributes boom-bust cycles to artificial credit expansion and monetary intervention by central banks.

The chapter further compares Austrian views with those of Keynesian and Monetarist schools and includes references to key macroeconomic frameworks such as the neoclassical growth model (Cass, 1965; Koopmans, 1965; Solow, 1957; Hicks, 1965) and Real Business Cycle (RBC) theory (Kydland and Prescott, 1980). These models emphasize supply-side factors, rational expectations, and market efficiency, thereby offering a contrasting explanation to demand-driven cycles. The discussion then leads the reader through to later developments, including Lucas's equilibrium business cycle theory, Minsky's Financial Instability Hypothesis, and contemporary New Keynesian models, particularly those with the "financial accelerator" proposed by Bernanke, Gertler, and Gilchrist, and the Kiyotaki-Moore.

The chapter also touches upon the issue of cycle dating, noting that researchers continue to debate the optimal methodology for identifying turning points in economic cycles. However, only the Bry-Boschan algorithm is discussed, while other prominent approaches, such as Markov-switching models, are mentioned but not elaborated upon.

In the second part of the chapter, the Author shifts focus to the financial cycle, concluding—based on the literature—that business and financial cycles are distinct phenomena. Notably, recessions are significantly deeper when they coincide with the contraction phase of the financial cycle. The Author clearly outlines the differences between the two cycles, particularly in terms of amplitude and duration: while business cycles typically last between 2 and 8 years,

financial cycles can span up to 20 years. Table 1 summarizes various definitions and indicators of the financial cycle (Ng, 2011; Borio, 2012; ECB, 2017; Filardo et al., 2019), including housing and asset prices, credit aggregates, financial risk measures, and financial conditions.

The final sections of the chapter provide an in-depth review of empirical research on the procyclicality of financial variables, organized around three key categories: credit growth, credit risk, and regulatory capital. The mechanisms through which procyclical effects operate are also discussed. The Author rightly notes that empirical results in the literature are mixed, thereby justifying the need for further research—an objective the dissertation aims to fulfill.

However, one notable omission is the absence of references to business tendency surveys conducted by statistical agencies and the output gap, which is a crucial variable in business cycle analysis. The output gap, widely used by central banks, statistical offices, the OECD, and the European Commission (e.g., within the EUCAM model), is essential for assessing the economic cycle and used as response variable in monetary and macroprudential policy rules. Incorporating this variable into the empirical models could have enriched the analysis by linking economic fluctuations more directly to credit sector dynamics.

Additionally, the well-developed review would benefit from including of Michał Kalecki's contributions. Kalecki formulated the first dynamic macroeconomic model in 1935 (see Franke, 2018), which anticipated the multiplier-accelerator principle later popularized by Samuelson (1939) and Hicks (1950). Kalecki's model was mathematically rigorous and introduced the concept of an investment gestation lag—the delay between investment decision and implementation—an empirically relevant phenomenon still discussed in modern macroeconomic literature.

4. Assessment of methodological framework

The dissertation employs classical panel data models to examine three key banking sector indicators—loans to total assets, loan loss provisioning to total assets, and capital buffers—across 15 European economies over the period 2005–2020. The benchmark models include the fixed-effects panel data model and a system of unrelated regression equations, while the primary model is the seemingly unrelated regression model, based on the seminal papers of Theil (1961) and Zellner (1962).

The scope of the analysis is broad and praiseworthy. In particular, collecting and processing panel data for 15 countries demonstrates the doctoral candidate's strong research competence and methodological readiness in economics and finance.

The econometric tools selected for hypothesis testing and meeting the research objectives are appropriate and generally well-justified. The presentation of the SUR model and the procedure for testing procyclicality are found in Chapter 2. The SUR framework enables linkages across equations through correlated error terms, common regressors, or cross-equation parameter restrictions, which can be particularly useful in capturing complex interdependencies in banking sector data.

However, I consider Chapter 2 to be the least developed and in need of refinement. There are several unnecessary repetitions of formulas—for example, Equations (3) to (6) essentially describe the same model. In such cases, it would be more effective to retain only the essential

versions (e.g., equations (3) and (6)). The notation is not entirely consistent: for instance, the random components and matrices in Equations (6) and (8) are denoted differently, which may confuse the reader. Moreover, the Author adheres to a somewhat outdated assumption regarding the non-randomness of regressors, rather than adopting the modern assumption of (strict) exogeneity. These issues, combined with the overall structure of the chapter, suggest that it would benefit from reorganization. For instance, the Generalized Least Squares estimator formulas could have been introduced earlier, particularly in Section 2.1.

There are also concerns regarding the model specification for analysing procyclicality. Autoregressive components are introduced in Equation (23) without adequate discussion. This raises important questions about the assumptions of exogeneity. A lagged dependent variable correlated with the error term introduces endogeneity, which biases GLS estimators. To address this, using instrumental variables—such as lagged values—or estimators specifically designed for dynamic panel data, such as the Anderson-Hsiao or Arellano-Bond estimators, would have been more appropriate. Furthermore, Equations (23) and (25) exhibit simultaneity, as the same variables appear as regressors and dependent variables across equations, giving rise to classical endogeneity issues.

A further limitation lies in the selection of the SUR model. It was adopted as the primary model without a formal statistical comparison to the alternatives. The thesis does not report any goodness-of-fit statistics or model selection tests—such as the Breusch-Pagan (1980) test for diagonality or likelihood ratio tests—to justify the SUR model's superiority. Consequently, the assumption that its results are more reliable than those of the benchmark models remains insufficiently substantiated.

Additionally, the method for detecting procyclicality appears to rest solely on testing the significance of SUR model parameters. This approach might not fully capture true procyclicality, which, as defined in Chapter 1, implies the existence of feedback loops between financial variables and real economic activity. A more comprehensive approach—one that considers endogenous dynamics of GDP growth—would be needed to confirm such interactions.

A notable limitation of the dissertation is the restricted range of econometric models employed. This is somewhat surprising given the Author's familiarity, as demonstrated in the literature review, with more advanced models such as (panel) structural vector autoregressions (SVARs). For example, Marcucci and Quagliariello (2008) use SVARs to capture interactions and identify shocks. These models are particularly well-suited for studying procyclicality, as they allow for the simultaneous and dynamic analysis of multiple endogenous variables. Although the choice of annual data likely limits the feasibility of such approaches due to the low number of time points, such data constraints should have been explicitly discussed in the dissertation.

In conclusion, the questions and concerns raised here are intended not as criticisms of the validity of the work but rather as suggestions to strengthen and refine the methodological approach. Addressing these issues would make the already valuable results of the dissertation more robust and resistant to future critique. They also offer a compelling direction for future extensions or refinements of the study's quantitative methods.

5. Empirical Analysis and Results

Chapters 3 to 5 of the dissertation empirically investigate the procyclicality of the banking sector across selected EU countries, using a panel dataset of macroeconomic and banking sector indicators spanning the period 2000–2020. The Author focuses on three core aspects of banking activity: loan supply, loan loss provisions (LLPs), and capital buffers, which respectively reflect the size, risk, and regulatory stance of the banking sector. The selection of these categories is well-justified and demonstrates a strong familiarity with the relevant literature and theoretical backgrounds. The primary econometric approach employed is the Seemingly Unrelated Regression Equations method, which is used to estimate the responsiveness of the selected banking indicators to macroeconomic variables such as GDP growth, inflation, and unemployment rates. The analysis also assesses cross-country heterogeneity in these relationships. Three separate models, each incorporating control variables specific to the banking sector, are estimated—each corresponding to one of the three banking indicators. The results are presented on a country-by-country basis.

The presentation of results is structured into three distinct chapters, each dedicated to one of the banking indicators. While this structure enhances clarity, it also leads to unnecessary repetition. For example, the descriptive statistics in Tables 7 and 17 are identical, and editorial improvements are needed—such as scaling the variances and covariances reported in Tables 15, 25, and 35 to provide meaningful interpretation.

The empirical analysis presents evidence of both procyclical and countercyclical behaviour across all three dimensions, although the magnitude and direction of these effects vary considerably between countries. The SUR model reveals that the loan supply ratio tends to expand during economic booms and contract during downturns in several countries—Austria, Belgium, France, Germany, Luxembourg, the Netherlands, and Portugal—suggesting a procyclical amplification of economic fluctuations. In contrast, Sweden is the only country where a countercyclical loan response to GDP growth is observed, while in other cases (including Poland), the relationship is statistically insignificant.

Regarding loan loss provisions, evidence of procyclicality—manifested as a decline in LLPs during upturns—is observed in Denmark, France, Luxembourg, and the Netherlands, likely reflecting income-smoothing behaviour or delayed recognition of credit risk. Conversely, four countries (Belgium, Portugal, Spain, and Sweden) show a positive relationship between LLPs and GDP growth, indicating countercyclical risk provisioning. For Poland, no significant relationship is found.

With respect to capital buffers, only two countries (the Netherlands and Spain) exhibit countercyclical behaviour, whereby capital buffers increase with GDP growth, suggesting a potential stabilising role during expansions. On the other hand, procyclical capital buffer responses are found in Belgium, Denmark, France, and Sweden—raising potential concerns for financial stability and calling for regulatory attention.

The study convincingly shows that the SUR model effectively captures cross-equation correlations and interdependencies among banking sector variables. Key strengths of the

empirical chapters include a clear alignment between objectives and methods, appropriately specified models, and findings that are policy-relevant. The use of GDP growth as a proxy for the business cycle is well-motivated and grounded in economic theory. Each chapter is logically structured, with clear delineation between research questions, methodology, empirical results, and interpretation.

Importantly, the SURE methodology enhances estimation efficiency by accounting for correlation in error terms across equations, and the country-level approach reveals significant heterogeneity in banking sector behaviour—challenging the presumption of uniform regulation across the EU. The findings have clear implications for macroprudential policy, highlighting the need for country-specific responses to financial sector cyclicalities.

Nevertheless, there are areas where the empirical analysis could be substantially strengthened. The dissertation would benefit from the inclusion of robustness checks, formal model diagnostics, and a more critical reflection on methodological and data limitations. For example, there is limited discussion of data quality, differences in coverage across countries, or the impact of structural breaks, such as the Global Financial Crisis or the COVID-19 pandemic. While estimates are reported by country, no formal statistical tests are provided to assess whether cross-country differences in coefficients are significant—limiting the strength of comparative inferences. Furthermore, no diagnostic tests for the SUR model are presented. The justification for choosing SUR over other models—such as fixed-effects panel regressions, dynamic panel models, or structural VARs—is not adequately defended through comparative model fit statistics or residual diagnostics. The robustness of findings could also be reinforced by testing alternative model specifications, including: excluding crisis periods, introducing lag structures, or incorporating alternative macroeconomic indicators (e.g., output gaps) and financial sector variables (e.g., credit growth, loan-to-value ratios, liquidity ratios like the Net Stable Funding Ratio or Liquidity Coverage Ratio).

Additionally, the presentation of results relies on tables. A graphical representation of the findings—such as coefficient plots, confidence intervals, or cartograms—would improve both readability and interpretability. While empirical patterns are described, the discussion would benefit from a more in-depth engagement with theoretical mechanisms, such as the role of risk-based capital regulation, income-smoothing incentives, or market discipline in shaping banking sector behaviour.

In conclusion, despite some methodological and presentational weaknesses, this empirical study is a solid and relevant contribution to the literature on banking sector procyclicality. The methodology is broadly appropriate, and the findings offer original and policy-relevant insights. The key strength of the work lies in its comparative, country-specific approach, which enhances its value for academic and regulatory audiences alike.

6. Discussion and Policy Implications

The empirical findings of the dissertation yield several important insights. There is evidence of procyclicality in the EU banking sector: key indicators—including loan supply, loan loss

provisions, and capital buffers—exhibit significant procyclical patterns in many member states. However, the magnitude and direction of these effects vary considerably across countries. Some economies show signs of countercyclical capital buffer behaviour, reflecting more prudent responses during downturns. These findings challenge the prevailing assumption of homogeneous banking behaviour and regulatory responses across the EU.

Several policy implications emerge. First, the heterogeneity of procyclical responses underscores the need for country-specific prudential regulation. A one-size-fits-all regulatory framework may fail to address the structural and institutional differences among member states. Therefore, macroprudential policies should be tailored to national contexts, while maintaining coordination at the EU level. Second, to mitigate the financial sector's tendency to amplify economic fluctuations, authorities should actively employ macroprudential tools. These include countercyclical capital buffers, dynamic provisioning, and other instruments designed to enhance systemic resilience across different phases of the business cycle. Third, the findings suggest a need to rethink the EU-wide regulatory architecture. A more flexible regime—one that maintains coordination at the EU level while allowing for national specificity—would likely be more effective in promoting financial and macroeconomic stability.

Finally, the dissertation highlights the importance of strengthened monitoring of credit risk and macro-financial linkages. Policymakers should invest in developing robust early warning systems and focus on the dynamic interactions between the banking sector and the real economy. These measures are crucial for ensuring responsive and adaptive financial supervision in an increasingly complex economic environment.

7. Conclusion

To conclude, the Author has successfully addressed the research questions posed in the dissertation and achieved the stated objectives of the study. Particular commendation is due to the excellent literature review and strong theoretical foundation presented in Chapter 1. The preparation and processing of macroeconomic and banking sector data for 15 European Union economies demonstrate a high level of analytical rigour and are worthy of recognition. The empirical results are carefully discussed and thoughtfully interpreted in each case. The Author effectively demonstrates that the Seemingly Unrelated Regression model is well-suited for capturing cross-country interdependencies and for analysing the procyclicality of banking sector variables. Accordingly, despite the critical comments and suggestions noted earlier in this review, the research presented in the dissertation is both valuable and original, making a meaningful contribution to the literature on the modelling of banking sector procyclicality in the EU. Importantly, none of the minor shortcomings or contested elements raised in this review diminish my overall positive assessment of the dissertation. The thesis constitutes an original and substantive solution to a significant scientific problem: the empirical investigation of banking sector procyclicality, with a particular emphasis on the underexplored issue of cross-country heterogeneity. The work encompasses both theoretical and empirical analysis to a substantial extent. The dissertation demonstrates the PhD Candidate's broad and deep theoretical knowledge in the fields of economics and finance, particularly in the areas of macroeconomic fluctuations and banking sector stability. Given the quality of the empirical analysis, the scale of the research effort, and the sound interpretation of the findings, I am

convinced that the Candidate has shown the ability to conduct independent and high-quality scientific research.

Therefore, I conclude that the doctoral dissertation of Mr Abhishek Anand, M.A., entitled "Procyclical Effect of Credit Risk of Banks – Econometric Analysis for EU Financial Systems", prepared under the supervision of Prof. Mateusz Pipień, meets the formal requirements for doctoral dissertations as set out in Article 187, paragraphs 1 and 2 of the Act of 20 July 2018 on Higher Education and Science (Journal of Laws 2020, item 85).

Accordingly, I recommend to the Council of the Discipline of Economics and Finance of the Cracow University of Economics that Mr Abhishek Anand, M.A., be admitted to the next stage of the proceedings for the award of the doctoral degree.

Mateusz Pipień