



## Peer Review Report

TIØ4317 Empirical and Quantitative Methods in Finance

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# Summary of Contents

In this report, the empirical relationship between Norwegian banks' return on equity (ROE) and the Norwegian central bank's policy rate is explored. Quarterly financial data is gathered from Bankenes Sikringsfond, which publishes accounting figures for all banks in Norway, and historical interest rates are retrieved from Norges Bank. By constructing a dataset that averages ROE across all Norwegian banks each quarter, the analysis minimizes the influence of individual bank decisions and governance. Two central questions are addressed in the report: (1) to what extent the policy rate influences the banks' ROE, and (2) whether changes in the rate can be used to forecast future ROE using empirical and AI-based models.

To investigate these questions, the study applies both a traditional ARIMAX model and various machine learning techniques. The machine learning models that are applied are XGBoost, Random Forest and Support Vector Machines (SVM). The ARIMAX model incorporates the policy rate as an exogenous variable, and proved to be the most effective model. It achieved a root mean squared error (RMSE) of 0.85 and outperformed the machine learning approaches. The results confirm a measurable correlation (a coefficient of 0.5) between monetary policy and ROE, supporting the hypothesis that rising policy rates can improve bank profitability. The report concludes that this indicates that banks are able to forecast their ROE based on the expected policy rate.

## Strengths of Report

One of the strengths of this report is the clear and well-defined research question. The group has chosen a topic that has clear real-world relevance, namely investigating the relationship between Norwegian bank's return on equity (ROE) and the central bank's policy rate. By focusing on this, the report offers useful insights for multiple stakeholders, such as regulators, investors, and financial analysts.

Another strength is how the group reflects on the limitation of the data they used in this project. They are aware that ROW can be influenced by other macroeconomic factors than the policy rate, and they are able to point out how this might affect their results. It limits their research to focus only on the impact of the policy rate on ROE, rather than trying to forecast ROE as accurately as possible using all available factors. This shows that the group is thinking critically about their work, and it helps make their analysis more trustworthy.

The technical part of the project is also a strength. The group uses both time series modeling with ARIMAX and various machine learning methods. This allows them to compare different approaches, giving them a broader perspective on the problem. An interesting result is that the ARIMAX model outperformed the machine learning methods, by giving better predictions. This shows that in this case, a more traditional method worked better, which is a helpful insight. It

also provides a direction for further work if the project were to be continued. Their comparative approach shows the group's ability to critically evaluate their results.

Overall, the report combines a clear research question, critical thinking about the data and methods used, and a solid technical analysis. The group shows both good understanding and an ability to reflect on their results.

## Suggestions for Improvement

The main room for improvement, as per our group's assessment, is the lack of explanations with regards to visualizations and the data used. The report presents ACF and PACF plots with a specific number of lags on a differenced dataset with no explanations. Here we would like an intuition for why these plots are included and what they show, as well as some implications for the regression models.

Additionally, the data is plotted using the mean ROE, but the only data that is being used is the differenced ROE. More detail regarding the specific data usage would make it easier for the reader to follow the report. This extends into the further sections as well.

Furthermore, the lag components are only tested for up to 5 AR and MA terms, but we are given no intuition as to why these numbers were chosen. This should be linked to a larger evaluation of ACF and PACF. We are also presented with Q-plots and actuals vs predicted values for the models, but none of this is explained in detail. We are interested in *what* the plots show, and the *implications* of them. A discussion as to why the model may perform better in certain scenarios or the semantics of it would be preferable.

Finally, the report does not explain intuitively why the XGBoost model is only trained using lagged values of the policy rate, whilst the other models have the current rate as an exogenous variable. The way our group sees this, is that evaluating the performance of two separate models is only insightful if they make predictions based on the *same amount of information* at the given point in time. Predicting the weather tomorrow is obviously easier if one knows the current weather, not just the weather yesterday. The results might have been a little different if this was the case.