The Application of Factor Model under High-bit Data in Macroeconomic Forecasting

Qizheng Wu

University of Western Australia, 10 Halvorson Rd Morley Perth, 6062, Australia

wqz112729@gmail.com

Keywords: Macroeconomic forecasting; High-bit data; Factor model; Model construction and application

Abstract: With the increasing importance of macroeconomic forecasting, high-bit data factor models have received widespread attention as predictive tools. Models have received widespread attention as predictive tools. Although high-bit data contains rich macroeconomic information, traditional prediction models often find it difficult to effectively handle its high dimensionality and complexity. Based on this, this paper delves into the application of high-bit data factor models in macroeconomic forecasting. Firstly, the challenges of macroeconomic forecasting and the importance of high-bit data were analyzed; Secondly, the theoretical foundation and key technologies of factor models were introduced; Then, it elaborates on how to construct and apply high-bit data factor models for macroeconomic forecasting, and explores their potential value in policy evaluation. Research has found that the proposed high-bit data factor model has significant advantages in prediction accuracy and efficiency, and plays an important role in improving the accuracy of macroeconomic forecasting and guiding policy formulation. This study not only provides a new perspective and method for the application of high-bit data in macroeconomic forecasting but also provides a scientific basis for relevant policy decisions.

1. Introduction

With the increasing importance of macroeconomic forecasting, high-data factor models have received widespread attention as predictive tools. Although high-bit data contains rich macroeconomic information, traditional prediction models often find it difficult to effectively handle its high dimensionality and complexity. Based on this, this paper delves into the application of high-bit data factor models in macroeconomic forecasting.[1] Firstly, the challenges of macroeconomic forecasting and the importance of high-bit data were analyzed; Secondly, the theoretical foundation and key technologies of factor models were introduced; Then, it elaborates on how to construct and apply high-bit data factor models for macroeconomic forecasting, and explores their potential value in policy evaluation. Research has found that the proposed high-bit data factor model has significant advantages in prediction accuracy and efficiency, and plays an important role in improving the accuracy of macroeconomic forecasting and guiding policy formulation. This study not only provides a new perspective and method for the application of high-bit data in macroeconomic forecasting but also provides a scientific basis for relevant policy decisions.

2. Research background of high-bit data factor models based on macroeconomic forecasting

2.1 The importance and challenges of macroeconomic forecasting

Macroeconomic forecasting is a concept in modern economics that has developed in parallel with empirical analysis. It is imbued with the concept of future orientation, highlighting the forward-looking orientation of economic decision-making and reflecting the forecasting strategies of economists on economic cycle fluctuations since the 20th century. However, when we attempt to construct the definition and essence of macroeconomic forecasting using certain statistical and econometric standards, it is still difficult to achieve a unified understanding.

  DOI: 10.25236/iemetc.2024.019

2.2 The role of high-bit data in macroeconomic forecasting

High-bit data is an important criterion for macroeconomic forecasting and a quantitative expression of the complexity of economic activities.[2] Statisticians and macroeconomists have discussed the different definitions of high-order data from the perspective of time series analysis. Some scholars believe that high-bit data refers to the degree of economic information richness or the multidimensional nature of economic activities. It is precisely because high-bit data has more predictive value to some extent that it belongs to the decision-making science aimed at macroeconomic forecasting. The analysis history of high-bit data can even be traced back to the early 20th century, and its main activities include collecting, processing, and interpreting economic data. The concept and importance of high-bit data are closely related to the predictive goals of macroeconomics. Through high-bit data, economists and policymakers have an important responsibility to understand economic trends. The main contribution of macroeconomic theory in the mid-20th century was the development of mathematical models for predicting economic fluctuations. Therefore, the concept of high-bit data initially focused primarily on predictive metrics based on statistical and econometric standard attributes.

2.3 The application of factor models in high-bit data analysis

Compared with traditional macroeconomic forecasting methods, factor models emphasize more on the interrelationships between economic variables and can handle the characteristics of high-bit data. Although some scholars question that factor models may not have a direct relationship with macroeconomic forecasting, most scholars advocate that factor models can provide a rational evaluation of the correlation between economic variables. Statisticians and others proposed a classic model for factor analysis that includes common factor elements.[3] Since then, this model has become a typical tool for high-bit data analysis, thus developing the concept of factor models. These scholars believe that factor models have dimensionality reduction and are a simplified representation of macroeconomic variables. Only when factor models can capture the main trends in data can macroeconomic predictions be more accurate. Therefore, the factor model is the result of high-bit data analysis. Some scholars have also summarized factor models into two types, namely statistical-based factor models and economic-based factor models. The former focuses on the statistical characteristics of data, while the latter focuses on economic theory, even if the model has stronger explanatory power. Although factor models have experienced some practical failures, from the perspective of high-bit data analysis, they can improve the accuracy and efficiency of predictions. As a result, the application concept of factor models has gradually become a consensus in macroeconomic forecasting research and practice.

3. Research Fundamentals and Key Technologies of Factor Models Based on High Order Data

3.1 Characteristics and processing methods of high-bit data

The essence of the concept of high-bit data focuses on data processing issues in macroeconomic forecasting. High-bit data is the application of big data thinking in the field of macroeconomics. To overcome the shortcomings of traditional data analysis, it has entered the research field as a new alternative model - the high-bit data framework. The basic idea of this framework is that data analysis should ensure the effective implementation of macroeconomic forecasts; Set professional standards for data analysis output; Capture the relationships between economic variables through techniques such as data mining; Use statistical analysis methods to measure the multidimensional characteristics of economic activities. The high-bit data framework reconstructs the methodology of data analysis, emphasizing the need to enhance the reliability of data and construct the accuracy, efficiency, stability, and sustainability of macroeconomic forecasts.[4]

3.2 Principle and classification of factor models

Factor models are the main tool for analyzing high-bit data, emphasizing the common factors between variables and directly reflecting the intrinsic structure and correlation of the data by

extracting common factors.[5] Some components of the development of factor models are gradually taking shape, and factor extraction and various evaluation systems are also receiving increasing attention. However, from a practical application perspective, the practice of some factor models is still in the theoretical stage, and there are still contradictions with the logical framework and generation mechanism of high-bit data, which leads to issues of model applicability and effectiveness.

3.3 Construction and estimation methods of high-order data factor models

From the perspective of high-bit data analysis, the construction and estimation of factor models are the fundamental steps in macroeconomic forecasting and the core manifestation of model effectiveness. Therefore, the high-order data factor model is mainly generated by factor analysis. Factor extraction is the main task of model construction and an essential step in model estimation. At present, researchers are strengthening the control of model estimation methods from a statistical perspective, mainly in three forms: first is exploratory factor analysis. Clarify the implementation mechanism of factors between data dimensionality reduction and variable correlation; The second is confirmatory factor analysis. By establishing standards for factor loading and quantity, and disclosing these standards to researchers, standardized control of factor model parameters can be achieved; The third is the internal process reengineering of factor models. In recent years, statistical software and programming languages have used algorithmic optimization methods to improve the accuracy of factor extraction and improve the efficiency of model prediction. However, compared with the ideal model, the applicability and accuracy of the current high-order data factor model still need to be further improved.[6]

4. The modeling and application of macroeconomic forecasting based on high-bit data factor models are shown in Figure 1

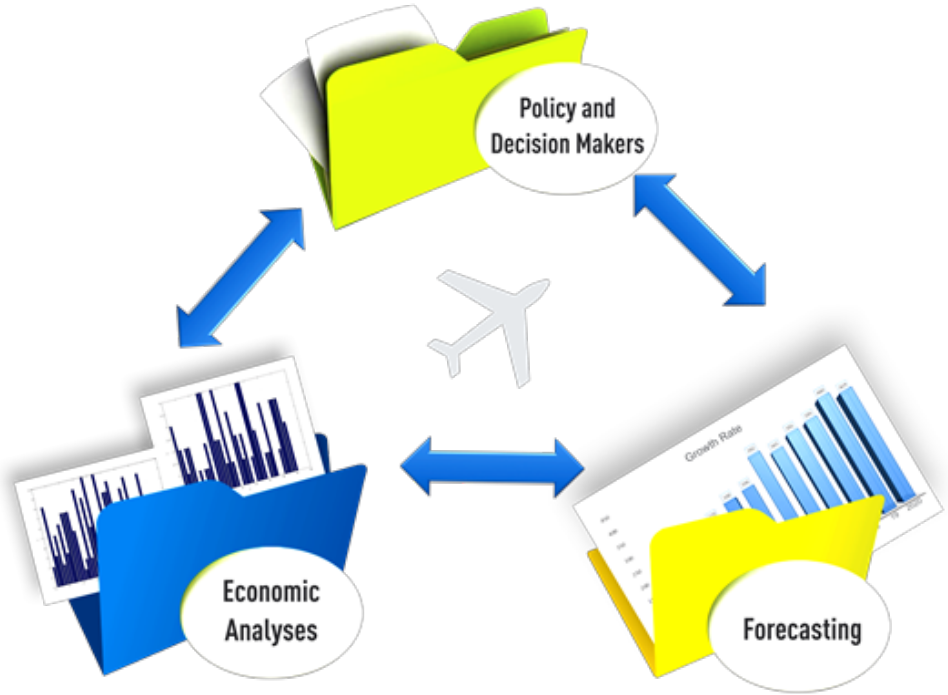

Figure 1 Application of Factor Models under High Bit Data in Macroeconomic Forecasting

4.1 Applicability analysis of high-bit data factor models in macroeconomic forecasting

The fundamental difference between high-bit data factor models and traditional macroeconomic forecasting models lies in their high-dimensional properties. The construction standards and estimation criteria of high-order data factor models are aimed at predicting accuracy, and their development mainly reflects the technological progress and theoretical innovation of data analysis.[7]

In the analysis framework of high-bit data, accurate extraction of factors, reasonable dimensionality reduction, effective correlation variables, and accurate prediction are the core values and highest criteria for model development. The diversity of current macroeconomic data and market differences lead to complex predictive models. Although the high data factor model has significant advantages, the estimation methods of the model are still not perfect enough, and the model itself lacks a self-optimization mechanism. Therefore, this creates a "weakness" in the application of the model, which affects the accuracy of macroeconomic forecasting.

4.2 Construction and selection of macroeconomic forecasting models

From the perspective of macroeconomic forecasting, traditional models cannot accurately provide the multi-dimensional information required for forecasting. Researchers mainly evaluate models in terms of predictive accuracy, but traditional models lack sufficient utilization of relevant information and internal structural mechanisms of high-bit data. The core of this problem may be the applicability of the model. In high-bit data analysis, factor models are often described as a simplified representation of data, and their correlation with economic variables directly reflects the accuracy of predictions. However, traditional models mostly focus on information such as a single variable, and their processing of high-bit data is relatively scarce. Usually, the common factors of variables are difficult to obtain or measure. Asymmetric information and imperfect models directly lead to obstacles in macroeconomic forecasting.

4.3 Empirical Analysis of High Data Factor Models in Macroeconomic Forecasting

From an empirical analysis perspective, the limitations of data have long constrained the ability of macroeconomic forecasting. Since the 20th century, factor models that combine theoretical and technological innovation have reshaped prediction methods through statistical analysis.[8] However, the shortcomings of traditional models still constrain the accuracy of predictions. Not only due to the simplified assumptions of the model but also due to the influence of external environmental changes, the factor model still needs to be improved. Under the premise of high-bit data, factor models are seen as a direct way to improve prediction accuracy. However, the practical role of factor models primarily based on statistical techniques in macroeconomic forecasting remains to be debated. Meanwhile, due to difficulties in data processing, the model lacks flexibility. Therefore, factor models do not always seem to achieve the predicted goals. It is evident that macroeconomic forecasting is not only a technical challenge but also faces the issue of theoretical applicability.

4.4 Application of High Data Factor Models in Macroeconomic Policy Evaluation

Undoubtedly, high data factor models cannot avoid the requirement of "accuracy" as analytical tools in macroeconomic policy evaluation. In policy evaluation mechanisms, factor models are standard and effective statistical analysis tools that play an important role in predicting economic trends. It also makes the factor model not only a theoretical concept but also a practical concept. Therefore, factor models based on "high-bit data" have become the core mechanism for policy evaluation. The practical deduction of factor models is generally an evaluation path gradually formed based on statistical analysis, although this path involves attempts at empirical analysis. From data collection to model construction, factor models closely revolve around macroeconomic forecasting from beginning to end. Although the model should strive to improve prediction accuracy to meet the requirements of policy formulation. However, when the complexity of the data is magnified, this also brings a dilemma, which is the adaptability phenomenon of the model. Overall, there is still room for improvement in the high-bit data factor model in policy evaluation and other aspects, and its predictive performance needs further improvement, which is also an important task for future research.

5. Conclusion

High-bit data analysis has become the key to macroeconomic forecasting, posing new challenges and requirements for statisticians and macroeconomists. High-bit data is not only a symbol of the complexity of data analysis, but also an important means of macroeconomic forecasting. It is an

urgent need to achieve accuracy in economic forecasting and maintain economic stability, fundamentally reflecting the inherent requirements of macroeconomics. The factor model has constructed a theoretical analysis framework and practical mechanism for macroeconomic forecasting under the guidance of high-bit data. In recent years, modern information technologies such as big data have driven the development of high-bit data analysis, empowering macroeconomic forecasting through statistical analysis and improving the accuracy and scientific nature of forecasting. Its value aligns with the inherent logic of macroeconomics. Therefore, factor models based on high-bit data have also provided a new path for macroeconomic forecasting. In summary, the sustainable improvement and development of high-data factor models contribute to a better understanding of economic trends and facilitate the formulation and evaluation of macroeconomic policies.

References

[1] Skoufis A, Chatzithanasis G, Dede G, et al. Technoeconomic assessment of an FTTH network investment in the Greek telecommunications market[J]. Telecommunication Systems, 2023, 82(2): 211-227.

[2] Lurin P A. Business Planning for Managers: How to use powerful techniques to write better business plans[M]. BoD–Books on Demand, 2010.

[3] Gorsuch R L. Factor analysis: Classic edition[M]. Routledge, 2014.

[4] Fairchild D G. Convergence of traditional telephony, enhanced telecommunications, private data networking, and the internet into hypercommunications: implications of the new economy of the network for Florida agribusinesses[M]. University of Florida, 2000.

[5] Décréau P M E, Fergeau P, Krannosels' Kikh V, et al. WHISPER, a resonance sounder and wave analyser: Performances and perspectives for the Cluster mission[J]. Space Science Reviews, 1997, 79(1): 157-193.

[6] Larour E, Seroussi H, Morlighem M, et al. Continental scale, high order, high spatial resolution, ice sheet modeling using the Ice Sheet System Model (ISSM)[J]. Journal of Geophysical Research: Earth Surface, 2012, 117(F1).

[7] Hiran K K, Dadhich M. Predicting the core determinants of cloud-edge computing adoption (CECA) for sustainable development in the higher education institutions of Africa: A high order SEM-ANN analytical approach[J]. Technological Forecasting and Social Change, 2024, 199: 122979.

[8] Wu J H, Wang S C. What drives mobile commerce? An empirical evaluation of the revised technology acceptance model[J]. Information & management, 2005, 42(5): 719-729.