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ECONOMETRIC MODELING OF FINANCE

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Annotation: the article deals with the modelling of the financial market as the most prominent example of economic studies that use econometric findings.
Key words: asset, financial market, modeling, investor.

In the modern economy, various types of securities with a market value determined usually during exchange trading. To securities, in particular, relate:
a) bond – a debt security under which the issuer undertakes
pay the investor a fixed amount and a certain percentage in
future within a specified time frame.
Bonds are issued by corporations and
government organizations;
b) a share is a security whose holder receives rights
to participate in the management of the corporation.
Promotions most common
among other types of securities;
c) forward and futures contracts - obligations for
performing some specific operation at some
a certain point in time.
There are also such types of securities as: options, bills, checks and others. Studying financial market modeling is impossible without knowledge the following terms. An asset is any security that trades on a financial market.

Transactions are acts of buying and selling an asset in the financial market. Investors are entities performing transactions on the market (private individuals, corporations, government transactions). Any financial transaction is associated with the concepts of possible profit - profitability and the possibility of an unsuccessful outcome of the operation - risk. In most cases, investors strive to maximize profitability and risk minimization. As a result, the least risky As a rule, assets turn out to be the least profitable and vice versa. The relationship in preferences between profitability and risk determines individual tactics of investors in the financial market. Among the available assets, the least risky ones are bonds, and the riskiest ones are stocks. Typically, an investor handles different types of assets. The set of securities that an investor owns is called a portfolio valuable papers.

Mathematical modeling is an important direction for financial market research, which is used to analyze connections between its structural elements, and predictions are made dynamics of prices of financial assets.

The Financial Macro-econometric Model (FMM) introduced in this paper is a two-sector model comprising the macroeconomic and financial sectors. The macroeconomic sector has a

simple Keynesian framework, while in the financial sector we capture the actual risk management behavior of banks. That is, we use a financial sector model in which bank credits are influenced by credit costs, the capital adequacy ratio, and other considerations. Micro-data on individual banks are used to quantify such banking activity in estimated behavioral equations. This modeling strategy gives the FMM a feature that is rarely observed in this type of model. To the best of our knowledge, only a few financial supervisory authorities and central banks are equipped with similarly developed models. The Bank of Japan has released a number of macro- econometric models, namely, the dynamic stochastic general equilibrium (DSGE) model by Sugo and Ueda (2008) as well as the hybrid models, such as the Quarterly Japanese Economic Model (Q-JEM), developed by Ichiue, et al. (2009) and Fukunaga, et al. (2011), all of which combine a theoretical model with a time-series model. The primary purpose of these models is to measure the macroeconomic effects of exogenous shocks generated by overseas economies, monetary policies, and other considerations.

The FMM is a medium-sized structural model comprising the financial sector and the macroeconomic sector. The FMM's most distinctive feature is in its financial sector, which models the actual risk management behavior of banks. That is, the financial sector is so designed that banks' credit supply is affected by credit costs, the capital adequacy ratio, and other factors (Figure 1). Macroeconomic conditions influence the amount of bank lending and the credit ratings which, in turn, impact credit costs and bank capital. Further, these financial sector changes are passed on to the macroeconomic sector, affecting household expenditures and business fixed investments. These macroeconomic fluctuations are then fed back into the financial sector.

The business fixed investments of firms vary according to macroeconomic sector variables (the expected growth rate and corporate profit margin) in addition to financial sector variables (the lending interest rate and corporate lending volume). When the expected growth rate increases, the business fixed investments are expanded. A rise in the corporate profit margin increases retained earnings, leading to an increase in business fixed investments. An increase in the lending interest rate raises companies' funding costs, thus inducing them to cut back on business fixed investments due to reduction of investment profit. In the improved funding environment of greater corporate lending, companies are encouraged to boost their fixed investments.

A comprehensive shock simulation is conducted to observe how model variables behave when different shocks derived from historical data are applied to individual endogenous variables simultaneously. The shocks are stochastically applied to endogenous variables to show the kind of path the economy might follow in the future in terms of probability distribution. This distribution is usually called a fan chart. A relevant fan chart is created as follows. First, the difference between the model prediction and the actual data (namely, the prediction error) is calculated for each period to find the standard deviation. Then a shock is generated stochastically from a normal distribution with this standard deviation. Finally, the shock is applied to the corresponding behavioral equation to perform the final simulation. A fan chart is obtained by applying the process to all the endogenous variables simultaneously and repeating it many times, 10,000 times in this paper. Had a micro-based credit cost function been used, it would take a number of days to complete the simulation.

Impact of Econometrics on Financial Modelling

Econometric techniques have become indispensable tools for financial modelling, providing a rigorous framework for analyzing financial data and forecasting future trends. These models are used by financial professionals to:

1. **Evaluate investment opportunities:** Assess the potential returns and risks associated with different investments, aiding in informed investment decisions.

2. **Manage portfolio risk:** Quantify and manage various types of financial risk, such as market risk, credit risk, and operational risk, to optimize portfolio performance.

3. **Develop pricing strategies:** Determine the appropriate prices for financial assets, such as stocks, bonds, and derivatives, based on their underlying value and risk characteristics.

4. **Forecast market trends:** Analyse historical data and economic indicators to predict future movements in asset prices, interest rates, and other financial variables.

Impact of Econometrics on Decision-Making

Econometrics has permeated the decision-making processes of financial professionals, enabling them to make informed choices under uncertainty. Its impact is evident in various areas of finance:

1. **Asset allocation:** Determine the optimal allocation of assets within a portfolio, considering factors such as risk tolerance, investment horizon, and return expectations.

2. **Risk management strategies:** Develop and implement risk management strategies to mitigate and hedge against various types of financial risks.

3. **Corporate finance decisions:** Assess capital structure decisions, dividend policies, and mergers and acquisitions strategies, considering financial implications and risk profiles.

4. **Monetary policy:** Inform monetary policy decisions by central banks, such as setting interest rates, to achieve economic objectives and maintain financial stability.

Conclusion. The enduring impact of econometrics on financial modelling and decision-making is undeniable. The field has provided a rigorous and quantitative framework for analyzing financial data, modelling economic relationships, and making informed decisions under uncertainty. The contributions of James Stock and Mark Watson, along with countless other econometricians, have been instrumental in shaping the modern financial landscape. As financial markets continue to evolve and data becomes increasingly complex, econometrics will remain an indispensable tool for financial professionals and policymakers alike.

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