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INSIGHTS

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INVESTMENT, FINANCIAL SYSTEM, REAL OUTPUT AND MACRO-RISK MANAGEMENT

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Loan underwriting standards and quantitative easing are examples of macro-risk management tools that affect the financial sector, which in turn affects real sector outputs. And therefore asset returns, real sector outputs, financial sector, and macro-risk management are interrelated. This paper shows that investors need to understand these relationships to enhance investment performance.

Recently, a macro-financial model (Ho et al., 2012, 2013; Ho and Lee, 2015a, 2015b) suggests that financial regulations must be dynamic to ensure optimality of real sector outputs while maintaining safety and soundness of the financial system. Since the real output exhibits a decreasing marginal increase in real growth with an increase in real output risk, an optimal macro-financial leverage exists, given risk and return preference of an economy. Macro-risk management is important to a dynamic economy.

This paper suggests a framework for policy makers to implement macro-risk management and for investors to incorporate changing financial regulations in their investment process.

1 Introduction

Currently, many countries are evaluating the design of their financial systems, financial regulations, and implementing macro-risk management. After the 2008 financial crisis, the US has introduced the Dodd–Frank Financial Reform Act, quantitative easing, revised capital ratio standard; European Union has introduced Basel III; China is considering deregulating interest rate and RMB convertibility; and Hong Kong, Singapore, and Korea are evaluating their roles in the global financial network.

A financial sector encourages growth in an economy by allocating resources efficiently. Yet, when

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a financial market fails, the financial sector may also impose significant cost to the society, economically, socially, and politically. This is one of the reasons for the current focus on changing financial systems with global regulations.

Yet, our current understanding of the impact of macro-risk management on a society remains largely unexplored. A coherent description of the dynamic relationships among the real sector output, financial sector, and regulations is still in its infancy in research. The purpose of this paper is to review a macro-financial theory that deals with these issues. Using these model results, we will propose an approach to macro-risk management and its implications on investments.

2 A macro-financial theory

2.1 Financial sector and real economy

Ho *et al.* (2013) introduce a dynamic stochastic macro-financial model by describing the real sector as to having one consumption basket, with the production subject to uncertainties, called the *production risk*. In this economy, consumers/investors are endowed with an initial consumption basket, called assets. All the consumers/investors together are referred to as the *household*. The household consumes portions of their allocated consumption basket and invests the remaining part for production, whose outputs, called *real outputs*, will be used for future consumption and investments.

The financial system is a network that enables these consumers/investors to create financial contracts, which are financial assets and financial liabilities, based on the consumption basket to borrow or lend from each other. The financial network enables the flow of funds from the investors to the borrowers passing through the financial markets and, likewise, this financial network also allows for the flow of risk, the default risk, flowing through the financial system from the borrowers to the investors, in a reversed direction. The aggregate household financial asset must be equal to the aggregate household financial liability. But the household assets are separated into two classes: capital and investments. The default cost would pass from the aggregate household liability to the capital. Capital, or margins, plays an important role in collateralization of financial liability to minimize the informational cost in a financial transaction.

Financial intermediation lowers the credit funding rate by minimizing informational costs. Ho *et al.* (2013) define the ratios of total liability to the total aggregate asset and total liability to the capital to be *household leverage* and *financial leverage*, respectively. Then the financial leverage is shown to increase when financial credit contracts are introduced, lowering the borrowing cost. The lower borrowing cost increases the demand for credit funding, leading to a higher household leverage. The increase in total credit outstanding would lead to higher real output along with a rise in expected bankruptcy cost, a deadweight loss to the economy. A balance of cost and benefit of increases in leverages leads to their optimal levels.

They also show that the changes in the leverages affect the real outputs inducing a positive feedback loop to the real outputs. When the total aggregate asset increases after a positive production is realized, the borrowing capacity will also increase. The economy can then take on more positive net present value projects, adding value to the economy's total aggregate asset. When the total aggregate asset contracts, then the reverse of the feedback effect would occur.[1] The effect is referred to as the *feedback effect*. Ho and Lee (2015a) estimated this feedback effect to be 33% of the production risk of the previous cycle,

showing the significance of the impact of the credit market on the real sector performance.

The feedback loop also affects the real output risks. Since the real sector risk flows to the credit market and back to itself, the model shows that as financial leverage increases, the real output risk also increases. Policy makers should take the impact of a change in financial leverage on the real sector output risk.

2.2 Dynamic nature of financial sector, real sector, and regulation

Regulations, real economic growth, and financial sector growth are all interrelated. The regulatory framework must be continually changing adjusting to the changing market-environment. As a result, macro-risk management becomes an essential function to attain real output optimality.

The model results suggest that the macro-risk management should not follow a Bayesian approach that uses the recent past performance to extrapolate the expected future performance and risk exposures. When an economy enters a growth phase, policy makers may infer that a higher financial leverage is warranted to allow for even higher economic growth rate. They do so by lowering financial regulatory constraints, allowing for the positive feedback effect to raise real sector outputs. But the higher financial leverage may lead to higher real output risk, resulting in market fragility.

A long history of many failures of Bayesian risk management has been experienced in risk management of securities trading over the past 30 years in the US. Despite significant progress made in risk management in trading, large trading losses continued. The cause remains the same: when traders show positive performance, senior management often gives the trader higher trading risk capital allowing the traders to take larger risk position. When the trading strategy fails, reversing the position can often be difficult. The root cause of the failure of the Bayesian risk management approach is that management cannot identify the reasons for the positive performance and their management decision is in part based on past performance.

Likewise, when macro-risk management cannot identify the reasons for the positive performance of the real outputs, their regulatory actions may lead to market failure. In sum, going forward, macro-risk management should follow the "best-practice" risk management imposed on banks, a more prospective approach as opposed to a retrospective approach.

3 A macro-risk management approach

Macro-risk management should begin with a cost–benefit analysis. The model shows that the real output exhibits a decreasing marginal increase in real growth with an increase in real output risk. This risk and return relationship ensures that an optimal financial leverage exists such that the marginal expected real output growth rate would balance the marginal increase in the real output risk for a given risk and return preference of an economy. Following the results reported in the previous sections, this macro-financial theory shows that policy makers can attain an optimal financial leverage by adjusting the aggregate capital in the financial sector. And the optimal balance between the expected value and volatility of real output growth rate can be determined by the social preference curve.

Given this cost–benefit framework, macro-risk management should then follow a risk management process that consists of: (1) measure the risk exposures and (2) monitor the risks.

3.1 Measure macro-risk exposures

The macro-financial model suggests that policy makers should measure macro-financial risk exposures. The risk exposures include household leverage, financial leverage, the aggregate capital ratio, and the production risk in the real economy. These measures would enable the policy makers to evaluate the impact of the financial sector on the real outputs and the potential cost of financial market failure to the economy.

3.2 Monitor macro-financial risk exposure

Macro-risk management should monitor the real sector performance in relation to, as opposed to isolation of, the financial sector. Financial services are not neutral to real outputs. As the discussion on Bayesian risk management in the previous section suggests, an observed positive real output is far from sufficient as a signal for an improved productive economy. For example, a positive growth rate attributed to the feedback effect is not sustainable. Attributions of the real output growth are important. Ho and Lee (2015a) provide a GDP growth rate attribution model and they have discussed the usefulness of the attribution model to macro-risk management using a sample period from 2000Q1 to 2013Q3. The results seem to support applicability of attribution analysis to macro-risk management. The quarterly GDP growth rate volatility unexplained is estimated to be 1.8% and the production risk and the feedback effect account for 21.6% of the GDP variations.

GDP attribution model is a retrospective analysis. Ho and Lee (2014) also suggest a prospective analysis. To the extent that the equity market is efficient in incorporating all market information and expectations into its valuation, the equity broad-based market indices should provide us the market expectation of the underlying factors of the real output growth. Their paper proposes an equity broad-based indices' return attribution model based on the risk factors of the GDP attribution model. The empirical results based on the sample period 2000Q1 to 2013Q3 seem to suggest that the attributions are useful for macro-risk management in that this approach offers a method to compare and contrast market expectations with the observed GDP performance. The results show that the variations in the estimated production risk and the implied forecasted production risk account for 71% of the S&P stock index quarterly volatility, showing the importance of the real sector performance on the equity returns.

4 Conclusions

Understanding the dynamic stochastic relationships among real output, financial sector structure, and regulations is important to investments. Asset returns depend on the real sector outputs. But the financial sector induces a feedback effect to the observed output. Therefore, to determine the sustainability of real sector growth rate, investors need to identify the underlying factors affecting the real output growth, based on an attribution model. And this attribution result should be compared with the equity market return attribution, in order to isolate any transient effect on the observed real sector growth rate.

Note

[1] The paper explains the feedback effect assuming the expected bankruptcy cost, instead of the changes in the positive net present value projects, negatively proportional to the changes in the aggregate total asset. Both ways in modeling the feedback effect are equivalent.

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