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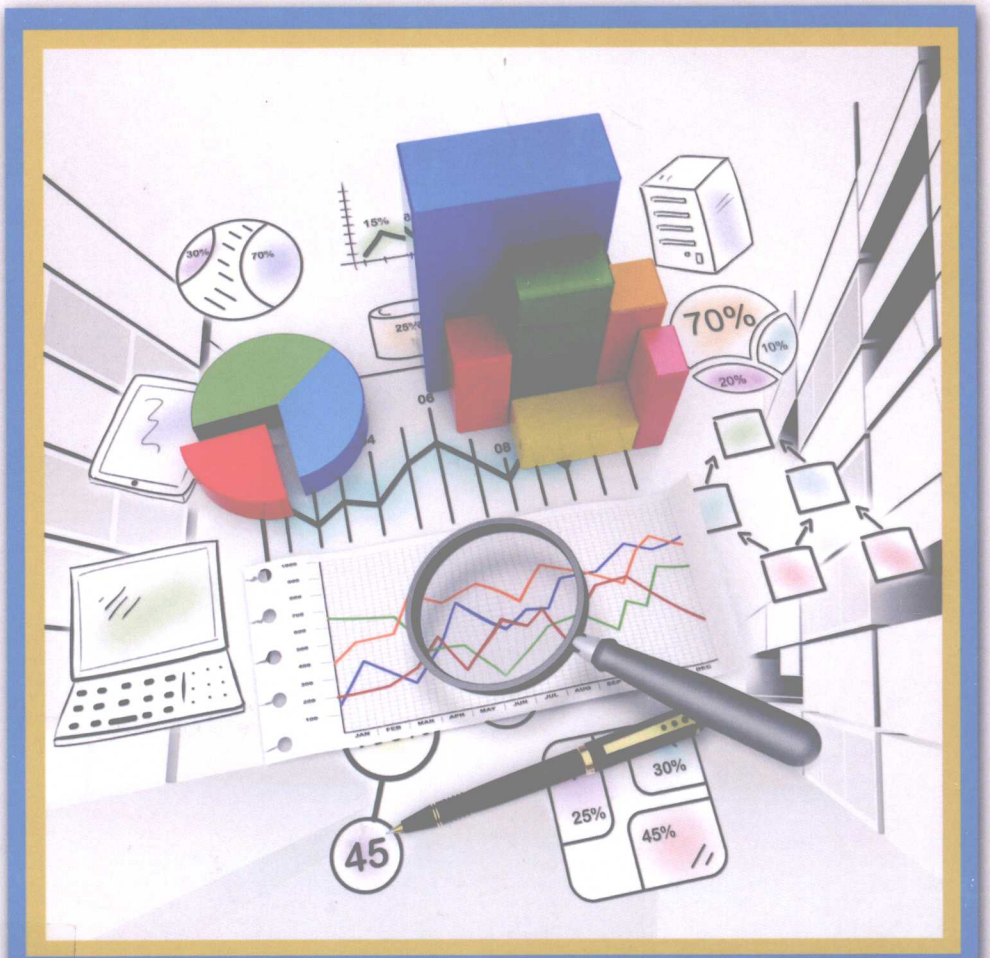
Methods and Applications



Ying Yirong · Jeffrey Yi-Lin Forrest

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Preface

Capital account liberalization has always been accompanied by a large number of international capital flows and can easily lead to volatility in the prices of financial assets. History has clearly shown the fact that major international financial crises, the related contagions, the frequent occurrence of the crises, and the depth, breadth, and speed of the contagions have been growing over time, and each of these issues has found clear connections with the flows of international hot money. The existing literature also indicates that capital account liberalization and financial instability, as well as financial crises and contagions, are closely related. However, capital account liberalization is the inevitable development trend of the world. At the present moment, developed countries have realized their currency convertibility, while some of the most developed economies have literally opened their capital accounts and had their currencies converted freely in open markets. Relatively speaking, the more developed a country is, the higher the degree of opening to the outside world, and, likewise, the higher the level of capital account opening and currency convertibility.

Capital account liberalization is of far-reaching significance, which has been mainly shown in three respects in terms of modern China. First, capital account liberation will contribute to China's economic integration with the global economy and to the promotion of the opening of China to the outside world. The implementation of capital account liberalization in China will be conducive to the implementation of the nation's macroscopic strategy of economic development and international trades, leading to the establishment of an open Chinese economy. Not only will it consist of extensive international exchanges of goods, services, and ideas, but it will also be beneficial for the continuous expansion of the international economy and cross-cultural, technical cooperation. Second, it will bring dynamic economic benefits to China's industries in general and the financial industry in particular because the pressure from foreign competition will force Chinese financial institutions to constantly improve their quality of service, to vary their modes of operation, and to best reduce their operating costs in order to adapt to the greater environment of the international financial market. Finally, capital account liberation can accelerate the establishment of the market economic

system in China. The implementation of capital account liberalization is conducive to the rational formation mechanism of the renminbi (RMB) exchange rate; it will further promote the opening of the Chinese capital market to the outside world. Consequently, the standardized operation of Chinese capital market and its efficiency will be greatly improved.

Following the financial crisis of the recent years, the world economy has recovered slowly. The impact of the debt problems of some European countries has become increasingly visible. While the quantitatively loose monetary policy of the United States continues, the international hot money is flooding into the emerging economies, which have been developing faster than then developed countries, so that the external environment for the economic and financial development of most countries is full of uncertainty, increasing the possibility for a new financial crisis to break out. Along with the current trend of economic and financial globalization, when a new financial crisis breaks out, it is imperative to prevent the rapid spread of capital along the flow path provided by various capital account liberalizations. Not only will the rapid spread of capital lead to greater economic losses, it will also seriously disrupt the global economic order and create a breeding ground for the next round of global financial crises and infections. Therefore, this book focuses on the research of the contagious power, status, effects, and other relevant issues of financial crises along with more and more capital accounts being liberated. We attempt to establish a theoretical analysis framework that can be used to effectively analyze the contagion phenomenon of financial crises along with financial market volatility under capital account liberalization.

The management of international capital flows is a key issue facing the international economy. Along with the development of economic globalization, many countries have begun to relax their controls on their capital accounts. However, the financial crises in Latin American countries and Mexico and the exchange rate crises in the Southeast Asian countries have shown that there is a major risk associated with capital account liberalization. Therefore, how to fully understand the benefits and risks of capital account liberalization and how to take an open-door policy at the appropriate time in order to reduce the risk to the lowest possible level have become an important problem for many emerging market economies. However, the existing literature on this has been limited to the investigation of certain policies, especially on capital controls. In fact, the management of international capital flows is a problem of systems science and systems engineering. Besides capital controls, it compromises problems of macroeconomics and finance. Therefore, it is impossible to employ just a single policy to effectively manage a sudden surge of capital inflows. The main reasons for this impossibility include the following.

First, although there are theories on the management of international capital flows, they are merely on the influence mechanism of international capital flows and the understanding of associated risks. Here, the influence mechanism includes that of exchange rates, asset pricing, wealth effects, the reputation, and the policy effect. International capital inflows bring to the host country not only the economic

benefits but also the risks of the macroeconomic and financial stability. If the risks are not managed appropriately, the economy will become more vulnerable. Once an external shock appears or an unexpected change occurs, this vulnerability will be materialized, leading possibly to a systemic financial crisis. Second, the situation of the Asian countries has become more specific after the 1997 financial crisis. When the international capital inflows are massive, the host country may be sterilized in the short term, and in the long term, the country will be forced into such a regime that allows the exchange rate to be flexible, to enhance its macroeconomic policies and perfect its financial system. But as the cost of sterilization increases, it is inevitable for the country to face the dilemma of whether to keep the interest rate or the exchange rate stable. However, the effects of reforming the exchange rate and perfecting the financial system take a long time to unfold. So the host country may well choose to use capital control measures in the short and medium terms to make up for the shortfall of the two measures. Finally, this book analyzes the challenge and the future of the management of international capital flows after the recent global financial crisis. This financial crisis has had a great impact on the import and export trade of Asia and affects the economic growth of the region. Because of the uncertainty in the external economic conditions, the management of international capital flows in Asia confronts many unprecedented challenges.

This book includes six chapters together with an introduction and a conclusion. The main contents are organized as follows.

In Chapter 1, we establish a complete mathematical analysis framework for the study of the problem of capital account liberalization. Specifically, a few important models developed for the study of capital account liberalization, which must be solved by using different methods, are introduced. These models deal with such problems as follows:

- Capital control and monetary independence
- Long-term optimal capacity levels of investment projects
- Capital controls
- Capital flows and the real exchange rate
- The optimal model about capital flows
- The limit cycle theory in the studies of population

For instance, to estimate the impact of capital controls on macroeconomic variables, we introduce a vector error correction model that includes the index of industrial production as constructed by the national statistics agency (Colombia: National Administrative Department of Statistics [DANE]), a multilateral real exchange rate as constructed by the Central Bank of Colombia (Banco de la República), total capital inflows as reported by the Colombian Central Bank, an important index of terms of trade as constructed by the Central Bank, and the global emerging markets bond index spread as constructed by JP Morgan to control changes in global financial conditions.

In Chapter 2, we research the influence of capital account liberalization on the stability of the financial market by greatly expanding the scope of ordinary differential equation theory to the analysis of local stabilities.

In this chapter, we investigate optimal trade-offs between growth and instability of open economies based on their policy preferences about the risky growth opportunities offered by international capital flows. Policy choices of many countries often force these countries to pay close attention to the potential economic instability because of their financial vulnerability when seeking high rates of growth via risky capital flows. This chapter reveals the *c*-effect of capital flows. This concept indicates that in a widely open economy with lower risk aversion but without a sound financial sector, a great instability must be endured in exchange for a high rate of growth. This chapter also establishes the *b*-effect, which implies that high instability is an inevitable price paid for having rapid growth if the host country permits wide opening of its capital market without first strengthening its financial sector.

In Chapter 3, the combined effect of multiple factors, especially the dynamic effect, is investigated by employing the theory of partial differential equations. On the basis of option pricing, we carefully analyze the problem of currency substitution. With capital account liberalization, investors will naturally choose different currency assets according to the corresponding returns, costs, and preferences of risk, and the possibility of currency substitution will be strengthened because of the free movement of capital. Extraordinarily active currency substitution can be easily transformed into financial crises, and the large context of the phenomenon of currency substitution combined with increased international capital flows will lead to an inevitable contagion of financial crises. Introducing the concept and formula of relative risk preference coefficient under the condition of the exponential utility function, we analyze the need to balance foreign currencies and the domestic currency in terms of the optimal portfolio choice; we establish four propositions and discover that there are four tendencies for investors to hold the optimal ratio of foreign currency assets.

In Chapter 4, although the theory of limit cycles is a complex theory, where some problems such as Hilbert's 16th problem have not been solved as of this writing, we creatively apply it to the study of problems related to capital account liberalization and discuss the contagion of financial crises among the financial markets of different countries. We build a transmission-based model that can identify the contagion between the financial markets of two countries. We then identify the *regulatory power*, the *investor confidence cohesion*, and the *immunity* of an affected country as the main reasons for causing the nonlinear fluctuations in the stock returns of the two countries after the crisis. By using limit cycle theory, we conclude that the financial contagion goes through three stages shortly after the outbreak of the crisis: the instability and obstruction of an initial and weak infection followed by a limited and controlled oscillation of the infection and then a short-term uncontrolled strong infection.

In Chapter 5, many problems related to capital account liberalization are formulated as optimization models, showing the fact that much broader economic issues can be solved by employing optimization methods. After comparing five classic economic cases, we solve a few special cases of the Verdier equation and provide the financial interpretations of the corresponding cases.

In this chapter, we focus on the discussion of the Venison optimization model, whose objective function takes an integrated form. By analyzing the capital accumulation model, we come to the conclusion that an optimal control problem with a lagging term can be converted into an optimal model without any lagging term, namely, the Venison optimal model. We also discuss applications of the Venison optimization model in three typical markets represented as bullish, bearish, and equilibrium market. We obtain the constraining condition and the optimal solution of the objective function of the integral form for the three markets, namely, the optimal overseas investment strategy of qualified domestic institutional investor (QDII) after capital account liberalization. Overall, we conduct the analysis on the benefit and risk of QDII and also probe into its current state and future development.

Additionally, in this chapter we introduce the Verdier optimal model to research the capital flow by discussing the origin and analytic solutions of the model with different constraining conditions and conducting the optimization analysis of several special cases. Consequently, we successfully derive the optimal solution of free capital flows. At the end, we analyze the current stage of capital account liberalization in China as a case study and come to the conclusion that the basic prerequisites of openness have already been met. And we also look into the future on the basis of all our analyses presented and recognize that there will be no priority order in the series of reforms to be taken in the future; namely, interest rate liberalization, exchange rate reformation, the internationalization of RMB, and the liberalization of capital account can be promoted coordinately at the same time.

In Chapter 6, by using shareholder variance and risk (SVAR) models and the impulse response analysis, we compare the contagion effect of financial markets between nations with a relatively high degree of openness and those with a moderate degree of openness. There is a major difference between the global financial contagion triggered by the U.S. subprime mortgage crisis and past financial contagions. That is a nonsystemic risk of a single country or local area turning into a risk of the global financial system along the tracks of *globalization*, *integration*, and *freedom*. The contagion is more complex, the infection intensity is greater, and different nations experience different states of infection corresponding to their individual levels of capital account liberalization.

Ying Yirong
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After several years of dedicated work on this manuscript, we are delighted to see the final product take its shape. We hope that it will be a joy for anyone to read through the pages of this book as either a reference or a source of inspiration for future research. If you have any comment or suggestion, please contact us at yingyirong@sina.com (for Ying Yirong) and at jeffrey.forrest@sru.edu (for Jeffrey Yi-Lin Forrest).

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- *Capital Account Liberation in the Post Financial Crisis Era.* Shanghai: Press of Shanghai University, 2012
- *Econometrics.* Shanghai: Press of Shanghai University, 2012
- *Applied Statistics.* Shanghai: Press of Shanghai University, 2013

Additionally, Dr. Yirong has published more than 50 research papers in various professional journals, such as *Kybernetes*, *Advances in Systems Science and Applications*, *Annals of Differential Equations*, *Journal of Management Science*, *Journal of System Management*, *Journal of Chang'an University*, *Chinese Journal of Engineering Mathematics*, *International Journal of Research in Business and Technology*, and *International Journal of Engineering, Mathematics, and Computer Sciences.*

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Contents