

In this book we will:

- Provide a new framework for risk and policy analysis using quantitative risk-based tools for:
 - evaluation of financial institution risk and financial system stability;
 - improving ratings and vulnerability analysis for firms, banks, and sovereigns;
 - reserve, fiscal, and debt management;
 - assessing benefits of risk mitigation policies and transfer contracts;
 - linking macroeconomics with finance in a more unified framework.
- Apply modern risk management and finance techniques to the macroeconomy so as to better assess country vulnerability, and the valuation of debt, contingent liabilities, equity, and other contingent claims on sector assets.
- Analyze the impact of shocks, both domestic and external, on the macroeconomy using a framework based on the analysis of risk-adjusted, interlinked balance sheets of the major economic sectors. The new framework measures non-linear risk transmission between the sectors of the economy and from abroad.
- Provide a new framework for relative valuation, investing, and trading, including sovereign capital structure arbitrage and cross-sector and cross-country arbitrage. The framework allows for analysis and management of sovereign wealth funds and the design of new instruments and contracts to control or transfer sovereign risk.

The fields of macroeconomics and finance have both experienced great innovations during the past thirty-five years. Unfortunately, some of the most important advances during that period are only just beginning to percolate between the two fields. Despite their apparent differences in subject matter, the two fields have a substantial natural area of overlap. Both are concerned with interest rates and the determination of prices. Finance focuses on the prices of assets, whereas macroeconomics focuses on the prices of goods. The major entities that make up the economy – households, governments, firms, and banks – hold portfolios consisting of both types of assets, however, and must be concerned with both asset and goods prices.

Moreover, the entities in the economy are linked by the fact that the assets of one entity form part of the assets of other entities. Changes in the value of assets induce changes in the fair value of the liabilities backed by those assets, and this, in turn, changes the market value of the assets and liabilities of the entity that owns those liabilities. These *valuation linkages* are crucial in the macroeconomy, especially when default on liabilities is a real possibility. Most current macroeconomic models, and especially those used for policy analysis, however, routinely ignore both valuation linkages and the possibility of default. One major goal of this book is to provide a framework that can be used to help overcome these limitations in our analysis of the macroeconomy.

The directionality of our contribution in this book, in theoretical terms, will be first from finance and risk management to macroeconomics. As we will see later in the book, the integration of these two fields provides new insights for financial activities – investing, trading, risk mitigation, and risk transfer arrangements. The results we believe will be of interest to finance professionals and macroeconomists alike. Our framework is based on the method of *contingent claims*, which was pioneered by Robert Merton in the early 1970s. The “Merton model”, as it is popularly known in finance, is a structural model of the firm built upon the observation that the value of a firm’s liabilities, whether debt or equity, is linked directly to the value of the firm’s assets. Debt and equity are different types of claims, and because of their different payoff structures, will share differently the value of the firm’s assets, depending on the level and volatility of those assets, the interest rate, and the face value of the debt, among other factors.

Adapting risk management and contingent claims analysis to the sectors of the macroeconomy, and linking it with macroeconomics, requires considerable work; to do it properly requires nothing less than a book. With that said, the reader will see clearly that several parts of what follows contain a variety of ideas for future research. Our goal in this work is to lay out the basics of the “macrofinance” approach, as we like to call it, in a very clear way that can be adapted for policy-making, for a course on this or a related subject in economics departments, and for courses in business schools.

We believe that an analytical framework that takes into account both balance sheets and risk exposures is a necessary part of any analysis of macroeconomic and sectoral vulnerability. We make the argument on a theoretical and empirical level that such an analytical platform is well suited to explaining a variety of past crises, and could be invaluable in anticipating and diffusing new ones.

The book is organized into five parts. Part I begins with Chapter 2, which lays out an overview of macroeconomics and finance. It discusses how shocks and volatility are handled in macroeconomic models but not uncertainty and risk. A conspicuous omission in macroeconomic models has been risk exposures, in particular default risk, as well as risk transmission between sectors and the behavioral nonlinearities to which these features give rise. Finance, and the closely related field of risk management, contain the appropriate tools to quantify and measure risks in the macroeconomy, as well as risk transmission within and between economies. It points out the need for a new generation of macrofinance models that combine the two types of models into an integrated system – a system of equations which are part macroeconomic equations and part finance/option-based equations. Chapter 3 provides an exposition of three types of models that are instrumental for evaluating macroeconomic policies. The three models are the IS-LM model of the closed economy, the Mundell–Fleming model of the open economy, and a dynamic macroeconomic model, which is a simplified DSGE model used to guide monetary policy in many central banks today. We will make reference to these models later in the book, in the generalized macrofinance framework incorporating stochastic interest rates, and when discussing ways to incorporate the outputs of the macrofinance framework into monetary policy models.

Part I then proceeds to explain basic analytical tools used in finance, including stochastic processes, the Black–Scholes–Merton option pricing formula, and related concepts in Chapter 4. Chapter 5 describes the contingent claims theory that will be used throughout the book. The contingent claims approach provides a framework for formulating risk-adjusted balance sheets of interlinked sectors in an economy and a way to measure risk exposures and risk transmission. It overcomes the limitations of statistical crisis prediction models in

the policy arena that rely heavily on “vulnerability ratios”, such as debt-to-GDP or debt-to-exports, that are drawn from the national accounting and income statements published by country authorities. We make the analogy between these sorts of measures and the well-known accounting-based Altman Z-score measures developed in the 1960s by Edward Altman to aid in the prediction of firm bankruptcies. Over the last two decades, since the early 1990s, the cutting edge of finance has moved forward to the commercial adaptation of the Merton model to assess default probabilities of firms and financial institutions around the world (commercial applications were pioneered by KMV in the 1990s, and KMV has since been bought by the rating agency Moody’s to form Moody’s-KMV). Chapter 6 describes extensions and applications of the contingent claims approach, which is in widespread use for credit risk modeling, vulnerability assessment, and relative value capital structure investment strategies. The benefits of this structural method are harnessed throughout the book to produce better results in the analysis of macro risk, vulnerability of economies, and valuation.

Part II begins with Chapter 7, which lays out the basic macrofinance framework with contingent claims balance sheets of key sectors (sovereign, financial, corporate, and household) and the risk transmission between sectors. The rest of Part II is then devoted to a closer examination of various important aspects of the framework. Chapter 8 provides a closer look at the sovereign balance sheet, how sovereign contingent claim balance sheets can be calibrated, and the calculation of useful credit risk indicators for sovereign foreign currency and local currency debt, as well as other public sector risk exposures. It describes how this new tool can be used for policy and vulnerability analysis (debt and reserves management as well as fiscal policy). Chapter 9 discusses the relationship between models of interest rates in macroeconomics, as in the Taylor rule in macroeconomic policy models, and term structure models of interest rates in finance, with a view towards reconciling these different approaches. Chapter 10 focuses on the analysis of financial sector risk and linkages to firms and households. Financial stability indicators are developed, which can be used for vulnerability assessments and which will be linked into macroeconomic models in following chapters. Chapter 11 discusses the adaptation of the macrofinance framework to fixed and floating exchange rate regimes for the sovereign, and looks at the impact of capital flows and problems that can arise from the use of quasi-public entities to hide contingent liabilities on the sovereign balance sheet.

Part III contains three chapters, each of which treats one facet of how to relate the macrofinance framework to the framework of macroeconomics. Chapter 12 discusses sovereign reserve, debt, and wealth management from the macrofinancial risk perspective. Chapter 13 shows how to relate the risk-adjusted, contingent claims balance sheets of macrofinance to the standard flow-of-funds and national accounting balance sheets used in macroeconomic analysis. Among other things, we show how the traditional budget constraint of macroeconomics can be derived as a special case of contingent claims pricing relationships when volatility goes to zero. Chapter 14 discusses several ways to link macrofinance outputs to monetary policy models, DSGE models, and macroeconomic vector autoregression (VAR) models.

The four chapters that comprise Part IV focus on distress and crisis in economies. Chapter 15 provides a relatively brief, guided tour of the economics literature on financial crises that highlights the recognition that balance-sheet-based vulnerabilities have been crucial in past crisis episodes. More generally, this chapter also takes care to discuss why an explicit accounting for crucial nonlinear effects in economic models is necessary if those

models are to be reasonable crisis models. The models in the crisis literature make clear that this is so, and we note the relationship of our work to that literature.

Chapter 16 discusses four important “destabilization mechanisms”, or potentially dangerous interactions of nonlinear effects, that can cause crises to occur in the context of the macrofinance model. These theoretical mechanisms rely on the valuation formulas of contingent claims analysis applied to the macroeconomic sectors, and in particular to the sovereign, and, as such, are contributions to the theory of financial crises.

Chapters 17 and 18 are devoted to an application of the macrofinance model to the Asian crisis of 1997–98, and the more recent crisis episode in Brazil in 2002, respectively. We discuss how, in both of these episodes, the destabilization mechanisms analyzed in Chapter 16 are real and can be very important in provoking or exacerbating crises.

Part V, which concludes the book, applies the insights of the macrofinance approach to three topics highly relevant to international financial institutions, finance ministries, and international investors. Chapter 19 focuses on the new international global environment and the potential impact of international shocks and risk transmission using the macrofinance model. It looks at the impact of both high-frequency shocks and low-frequency shocks. Chapter 20 looks at alternative policies, contracts, and tools that can be used to transfer and mitigate risk on the sovereign balance sheet. Chapter 21 lays out several ideas for corporate and sovereign investment and capital structure arbitrage using the relative value tool of the contingent claims and macrofinance model. This is written in particular for those in the private sector who may be interested in using our ideas to generate trades and investment

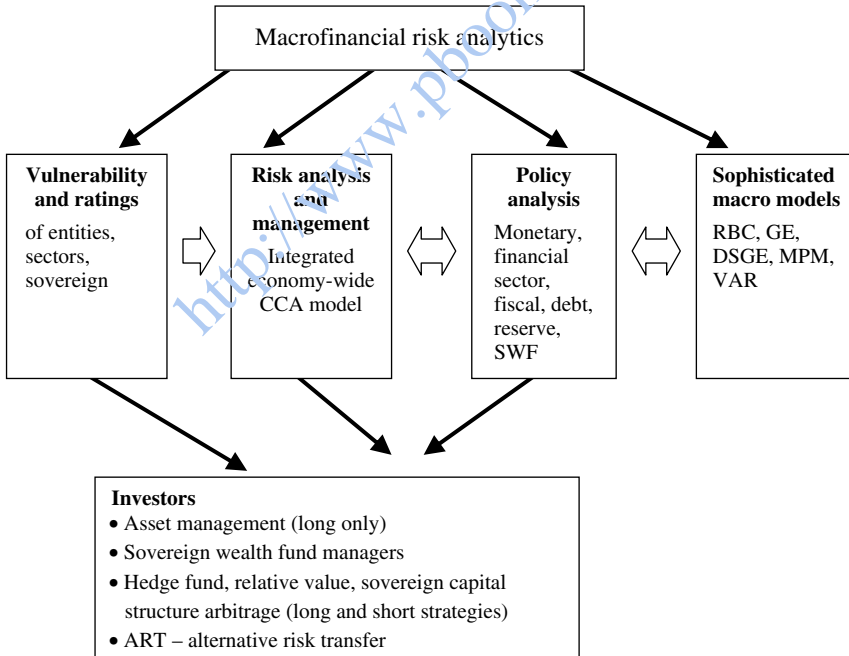


Figure 1.1 Applications of the tools provided by the macrofinance perspective. SWF – sovereign wealth funds; RBC – real business cycle; GE – general equilibrium; DSGE – dynamic stochastic general equilibrium; MPM – monetary policy models; VAR – vector autoregression

strategies. Chapter 22 closes the book with a look at the “bigger picture” surrounding macrofinance, and lays out a summary of the book accessible to a wide audience, along with several suggestions for future research ideas based on the material, which we hope will be of interest to those working in both macroeconomics and finance.

The main applications of the tools provided by the macrofinance perspective are summarized in Figure 1.1. The ability of macrofinancial risk analysis to improve vulnerability analysis, risk management, and policy is also highly relevant to investors, whether those on the asset management side or hedge fund managers interested in taking advantage of arbitrage opportunities based on assessments of relative value. In addition, the outputs of the macrofinance model have the potential to inform and improve the state of the art of macroeconomic and macroeconometric modeling.

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