Edited by
Alexander Karminsky · Mikhail Stolbov

Systemic Financial Risk

An Emerging Market Perspective

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PREFACE

The book aims to comprehensively study the sources and facets of systemic financial risk, which has turned into a salient feature of international finance and risk management since the Global Financial Crisis (GFC). Initially associated with advanced economies, currently systemic financial risk is underpinned to a significant extent by the financial sectors of major emerging market economies (EMEs). Nonetheless, the peculiarities of systemic risk in the EMEs have not been studied extensively. This collective monograph seeks to partly fill this research gap.

Apart from the focus on the EMEs, the novelty of our study consists in examining emerging forms and manifestations of systemic risk. Some of them can be originated in the non-financial sector, though significantly impacting financial institutions and eventually the economy as a whole. Against this backdrop, the monograph does not only cover well-entrenched issues related to systemic risk, but also includes chapters dealing with the emerging topics, e.g. catastrophic risk modeling, ESG-related risks, the systemic impact of airlines' insolvency, etc.

In Part 1, there is a collection of chapters considering emerging research issues in risk assessment and management. Namely, new approaches to measuring financial development, trends and prospects of green finance, and cross-country financial spillovers are discussed. Also, this part contains the findings of the research highlighting the relationships between ESG and systemic risk, household income dynamics and overall financial stability.

Part 2 casts a more nuanced look at the quantitative models and methods adopted in risk assessment and risk management, putting in the spotlight such issues as measuring catastrophic risks, liquidity mismatches as well as modeling probabilities of default and the impact of macroeconomic fundamentals on capital adequacy ratios in the Russian banking sector.

Finally, Part 3 pins down a number of new regulatory challenges dealing with risk assessment and risk management. Namely, macroprudential policies which have proved efficient to mitigate systemic risk are investigated. The international experience of the banks undertaking financial resolution/recovery is presented. Last but not least, the nature of digital systemic risk in the Russian financial sector is discussed.

Since the book encapsulates diverse research questions, one can obtain a comprehensive picture of the challenges which EMEs are facing in the field of systemic financial risk assessment and management. In most cases, the challenges are discussed in the context of elaborated models and policy responses, which are based on the up-to-date theoretical contributions and empirical evidence from various fields, i.e. financial econometrics, international finance, macroeconomics, risk management, etc. Therefore, we believe this eclectic approach in terms of the themes covered and methodologies used presents a significant advantage and value added of the collective monograph.

Thanks to the innovations in the topic coverage and rigorous methodological underpinning of all the chapters, the book can be of interest for both academics and practitioners. Namely, for university professors, Ph.D. and M.A. students, it offers a novel research perspective on systemic financial risk in the EMEs, whereas policymakers, central bankers, risk managers and even private investors may be interested in testing/implementing the models and policy implications discussed in its chapters.

Moscow, Russia

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Mikhail Stolbov

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We acknowledge the efforts and dedication of many people involved in working on this collective monograph. The ideas presented in the book largely build on the fruitful discussions during the annual workshop “Systemic risks in the financial sector” hosted by the National Research University Higher School of Economics since the year 2018. We are also grateful to those who helped us design the monograph, in particular to Andrey Egorov, Ekaterina Seryakova and Ella Khromova. We are indebted to the authors of the chapters as well as to the Dean of the Faculty of Economic Sciences at NRU HSE, Sergey E. Pekarsky, who has contributed to the organization and overall success of the workshop on systemic risks since its inaugural edition. We thank immensely the Palgrave Macmillan publishing team for their assistance and expert advice. In particular, we are grateful to Tula Weis for her patience and guidance. We cannot but also mention our partners, i.e. universities, banks, financial regulators where the contributing authors and editors of the monograph work: NRU HSE, Moscow State Institute of International Relations (MGIMO University), the Bank of Russia.

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PART I

New Trends in International Financial Development and Risk Assessment

CHAPTER 1

Adapted Approaches to Measuring Financial Development

Konstantin Krinichansky

1.1 Introduction

Financial markets and financial intermediaries play an increasingly significant role in today's economy. This chapter is devoted to finding arguments supporting the importance of finance for the economy. However, this importance will actually surface when we observe politicians' actions. This can be supported by the example of the sectoral sanctions introduced against the financial sectors of such countries as Iran, Venezuela, and Russia.

Obviously, finance is used as a weapon in the case; the imposed restrictions are aimed at weakening the economies of the sanctioned countries. Unlike the above example, the economic literature that studies the relationship between finance and growth is still far from reaching a consensus on a number of issues: the nature of this relationship (Owen & Temesvary, 2014), the direction of causality (Guptha & Rao, 2018; Levine et al., 2000), the transmission channels (Cournede et al., 2015; Krinichansky &

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Sergi, 2019), etc. With all the discussion that has been held, no one questions the benefits and opportunities financial development can bring (Ang, 2008; Arestis et al., 2015; Greenwood et al., 2013; Levine, 2005). At the same time, much uncertainty and contradiction arise when scholars try to answer the following: "What circumstances matter for these benefits and opportunities to outweigh the related risks and costs?" (Hassan et al., 2011; Henderson et al., 2013; Langfield & Pagano, 2016; Matei, 2020). The modern discussion is developing around such issues as the optimal financial structure (Beck et al., 2013; Benczúr et al., 2019; Chu Khan, 2020; Xu, 2021), safeguarding financial stability (Ehigiamusoe & Samsurijan, 2021; Hodula & Ngo, 2020; Law & Singh, 2014), and monetary conditions for financial development (Andolfatto et al., 2019; Champ & Boyd, 2006; Krinichansky & Annenskaya, 2020).

One should, however, note that despite the high theoretical and methodological level of the ongoing discussions, there remains a problem. It is about operationalizing and measuring financial development. It is this issue that our paper addresses. We explore the following null hypothesis: the characteristics of the relationship between financial depth and economic growth are stable and do not depend on the method of calculation of the financial depth.

The rest of this chapter is organized as follows. In Sect. 2, we undertake an overview of approaches to measuring financial development. Section 3 provides our view of the vulnerabilities of some of the approaches available. We also outline ways to mitigate these vulnerabilities. Section 4 presents an empirical analysis of the relationship between financial development and growth, in which we show the benefits of using adapted financial depth metrics eliminating some of the vulnerabilities of existing depth indicators. Section 5 summarizes our study.

1.2 APPROACHES TO MEASURING FINANCIAL DEVELOPMENT

Efforts to derive accurate measures of financial development have been going on for over 50 years. The starting point is Raymond Goldsmith's seminal work "Financial Structure and Development" published in 1969. Prof. Goldsmith introduced an indicator of the value of financial intermediary assets divided by GNP assuming that the size of financial intermediaries is positively correlated with the quantity of financial services provided (Goldsmith, 1969). Robert King and Ross Levine offered a more sophisticated approach to such assessment. The authors didn't adopt the asset indicator and proposed 4 alternative metrics that are more suitable for measuring the dynamics of financial development. These indicators really approximate 3 dimensions of financial development fairly well, for example, expansion of financial systems accompanied by credit growth relative to GDP and others shown in Table 1.1.

The approach of King and Levine in terms of measuring the depth of financial system is still recognized as basic and is used to measure the financial development of individual countries and in cross-country studies related to the "finance – growth" nexus.

Later papers expanded the investigated statistics and the spectrum of financial development studied. Thus, in the work of R. Levine and S. Zervos (1998), the emphasis is on the indicators of the stock market that characterize its size, liquidity, and volatility. Their list is presented in Table 1.2

The novelty of Levine and Zervos's study is as follows. The indicators ceased to be predominantly built according to the depth model. Besides depth, the researchers became equipped with indicators that lay up claim to assess the efficiency of financial systems and their stability. They are designed to detect differentiation of markets in such parameters as turnover, liquidity, pricing efficiency, and excessive stock price volatility.

In the 1990s and 2000s, the number of studies utilizing financial development metrics grew exponentially. Various systematizations of such metrics were also proposed.

One of them is the 3 × 2 matrix, implicitly presented in the World Bank working paper of 2008 (Beck et al., 2008). The indicators used are

Table 1.1 Three dimensions of financial development

Topic	*The name of financial development indicator*	*Financial development dimension*
Depth	Liquid liabilities of the financial system/GDP	Expansion of lending
Structure	Deposit money bank domestic assets/ deposit money bank domestic assets plus central bank domestic assets	The growing role of commercial banks in comparison with the role of central banks
Depth	Claims on the nonfinancial private sector/GDP	The growing role of loans to private sector

Source King and Levine (1993)

Table 1.2 Stock market development indicators

Topic	*The name of financial development indicator*
Depth	Value of listed domestic shares/GDP
Efficiency	Value of the trades of domestic shares on domestic exchanges/value of listed domestic shares (Turnover)
Depth	Value of the trades of domestic shares on domestic exchanges/GDP (Value Traded)
Stability	Volatility of stock returns (Volatility)
Efficiency	International integration measures

Source Levine and Zervos (1998)

divided into 2 categories: those related to financial institutions and those related to financial markets. It is in that paper that the classification is proposed that uses such types of indicators as depth, efficiency, and access to finance. Later, this classification laid the foundation for working out the Financial Development Index by the IMF and the corresponding set of sub-indices (Svirydzenka, 2016).

An extended classification of indicators of financial development is a 4 × 2 matrix from the work of M. Čihák and his co-authors (Čihák et al., 2012, 2013), built, in turn, on the basis of the World Bank Economic Review article (Beck et al., 2010). Here, the indicators used are also split into the categories of financial institutions and financial markets[1] and also into topics, including "stability" in addition to depth, access, and efficiency. This classification is used to label indicators in the World Bank's Global Financial Development Database (GFDD).[2] Let's look at some of the characteristics from the recent version of this database, which was published on September 22, 2022.

The database contains the indicators of depth, access, efficiency, and stability of financial systems with reference to the groups "financial institutions" or "financial markets". The total number of indicators of access is 37, depth—30, efficiency—11, stability—8, 20 indicators belong to "others" group. Compared to the previous version of the dataset (published in 2019), the following changes occurred in the new version:

---

[1] In fact, in both cases we deal with markets: in the first case—financial services markets; in the second one—capital markets.

[2] World Bank (2022). Global Financial Development Database. https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database.

- Six indicators were adjusted. For example, the indicator measuring the gross portfolio equity assets to GDP was replaced by a similar indicator, the numerator of which takes into account assets not only in the form of corporate shares, but also in the form of investment funds shares (Gross Portfolio Equity & Investment Fund Shares Assets/GDP);
- For 23 indicators, the calculation procedure was changed. Thus, the calculation of the depth indicators was carried out in this edition of the GFDD without using the deflation method.
- The 3 new indicators appeared (see Table 1.3), including financial depth indicator such as the volume of loans provided by fintech and big tech companies to GDP (it's measured as a flow variable).[3]

Table 1.4 provides a set of the GFDD indicators. The first two lines include two types of measures—access and depth.

Table 1.3 New concepts of Global Financial Development Database

Topic	*Indicator's name*	*Short definition*	*Sources*
Depth	Credit flows by fintech and bigtech companies to GDP (%)	New lending provided by fintech and big tech companies over a calendar year, normalized by nominal GDP	Cornelli et al. (2020)
Other	Foreign bank assets among total banks assets (%)	Percent of the banking system's assets was in banks that were foreign-controlled (i.e., where foreigners owned 50% or more equity)	World Bank Bank Regulation and Supervision Survey
Other	Government bank assets among total bank assets (%)	Percent of the banking system's assets was in banks that were government-controlled (i.e., where government owned 50% or more equity)	World Bank Regulation and Supervision Survey

Source World Bank (2022). Global Financial Development Database

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[3] Available data on fintech and big tech credit volumes for a large number of countries around the world were collected by (Cornelli et al., 2020).

Table 1.4 Financial institutions and financial markets indicators balance

	Financial institutions	*Financial markets*
Access	• Bank accounts per 1,000 adults • Bank branches per 100,000 adults • Small firms with a bank loan or line of credit (%) • Saved any money in the past year (% age 15+) • Made digital payments in the past year (% age 15+) • Investments financed by banks (%)	• Value traded excluding top 10 traded companies to total value traded (%) • Market capitalization excluding top 10 companies to total market capitalization (%) • Nonfinancial corporate bonds to total bonds and notes outstanding (%)
Depth	• Private credit by deposit money banks to GDP (%) • Deposit money banks' assets to GDP (%) • Nonbank financial institutions' assets to GDP (%) • Domestic credit to private sector (% of GDP)	• Stock market capitalization to GDP (%) • Stock market total value traded to GDP (%) • Outstanding domestic private debt securities to GDP (%) • Corporate bond issuance volume to GDP (%) • Corporate bond average maturity (years)
Efficiency	• Bank net interest margin (%) • Bank lending-deposit spread • Bank noninterest income to total income (%) • Bank overhead costs to total assets (%) • Bank return on assets (%, after tax) • Bank return on equity (%, after tax)	• Stock market turnover ratio (%)
Stability	• Bank Z-score • Bank nonperforming loans to gross loans (%) • Bank capital to total assets (%) • Bank regulatory capital to risk-weighted assets (%) • Liquid assets to deposits and short-term funding (%)	• Stock price volatility

Source World Bank (2022). Global Financial Development Database

Access indicators have an important advantage over the other groups of measures, since, in fact, they directly indicate the level of financial development. Depth indicators are often misleading, as, for example, some developing countries which do not have a long history and enough experience in the development of financial markets enjoy higher depth indicators than more developed ones. Access indicators are free of such distortions.

For example, it is doubtful that China's rapidly increasing financial depth, ahead of many developed economies today, is a boon for the country's long-term economic growth. At least, the recent actions of the People's Bank of China increasingly testify to the fact that the regulator sees a threat in the overheating of some sectors and seeks to cool the market, although so far this does not lead to a decrease in its depth indicators.

Another advantage of access indicators is that they are convenient for tracking the overcoming of frictions that hinder financial development and, as a result, impede growth. In addition, access indicators are convenient for tracking the rate of adoption of financial innovations by economies. It is among the access indicators that the indicators related to the development of fintech appear for the first time.

Rows 3 and 4 of Table 1.4 contain some proxies for assessing financial systems' efficiency and stability from the GFDD. There is a kind of imbalance between pools of measures for financial institutions and financial markets, namely, when characterizing financial markets there is just one indicator of efficiency and one indicator of stability. Analyzing the literature that served as a basis for the formation of the GFDD, it can be noted that the World Bank doesn't use some of the indicators contained in the papers that appeared before the GFDD was created (in particular, one can mention [Čihák et al., 2013]). So, there were 8 efficiency indicators related to financial markets in that paper. World Bank didn't include in the GFDD the following indicators:

- Price synchronicity (co-movement)
- Private information trading
- Price impact
- Liquidity/transaction costs
- Quoted bid-ask spread for government bonds
- Turnover of bonds (private, public) on securities exchange
- Settlement efficiency.

Thus, a number of important indicators that characterize debt market as well as those that assess the efficiency of the settlement infrastructure are overlooked. Also, the indicator of stability related to financial markets is the only measure in this database. This is the stock market volatility. The other nine of the previously proposed indicators are not included in the considered database, among them volatility of sovereign bond index; two skewness coefficients applying to stock index and sovereign bond index; vulnerability to manipulation of profit when calculating the P/E ratio; duration; ratios of short-term to total bonds (domestic and international); share of short-term debt in the total amount of bonds issued; etc.

Besides, the disadvantages of approaches followed by international financial organizations to measure financial development include the fact that the set of metrics they propose does not contain the metrics tracking the state of a financial structure and the way it tends to change. We leave the issue of the development of structural measures of financial development for the next stage of our study.

1.3 Distortions of Financial Development Assessments

This section discusses some broader challenges of using indicators of financial development. An analysis of the available literature reveals the following. The first issue is that the conclusions the authors draw on the basis of theoretical models, i.e., that financial sector development has a positive impact on output growth, are not always supported by empirical studies. In particular, a large number of empirical works find a negative relationship between finance and growth. For example, Ram (1999) found that the correlation between financial development and economic growth was weakly negative or insignificant. Similar patterns are observed when regression analysis is performed for each individual country and for each sample grouped by growth rate. Garretsen et al. (2004) found that once the Levine and Zervos (1998) model is extended by adding the regressors that proxy legal and social factors, the positive relationship between stock markets and economic growth disappears. Rioja and Valev (2004) and Gründler (2021) have shown that the impact of financial development on economic growth varies for different groups of countries with different levels of financial development.

It is noteworthy that as far as the relationship between financial development and economic growth is concerned, different researchers have