Indian Institute of Management Calcutta

Working Paper Series

WPS No. 803
December 2017

Recent Trends in Macro-financial Policies: The Toolkit and Early Warnings

Partha Ray
Professor, Indian Institute of Management Calcutta
D. H. Road, Joka, P.O. Kolkata 700 104

A. Vasudevan
Former Executive Director, Reserve Bank of India

Recent Trends in Macro-financial Policies:
The Toolkit and Early Warnings

Partha Ray
Professor, Indian Institute of Management Calcutta
Email: pray@iimcal.ac.in

A. Vasudevan
Former Executive Director, Reserve Bank of India
Email: vasudevanasuri@gmail.com

Abstract: Since the brewing up of the global financial crisis, macro-financial policies have entered the toolkit of macroeconomic policy makers in a big way. In particular, Central bankers all over the world have taken a keen interest in adopting macro-financial tools for containing systemic financial risks. In some sense the relationship between macro-financial policies and monetary policy is complementary in nature. In this backdrop this paper looks into four related issues: (a) meaning or understanding of what systemic risks mean; (b) measurement of financial linkage; and (c) policy tools for containing systemic risks; and (d) development of early warning exercise. Admittedly, identification of systemic risks are far more difficult than adopting traditional counter-cyclical stance of the standard monetary and fiscal policies. Nevertheless, in the days to come, the macroeconomic policymaker can afford to be oblivious to macro-financial policies only at their risk and peril.

Recent Trends in Macro-financial Policies:
The Toolkit and Early Warnings

1   Introduction

It is not an exaggeration to say that financial policies have a near-insignificant role in the traditional toolbox of macroeconomics.[1] There are perhaps three explicit reasons for such neglect. First, finance is in the periphery in the standard macroeconomic work horse like IS-LM model or even in later versions of aggregate demand (AD) - aggregate supply (AS) model (both in new classical as well as new Keynesian tradition and perhaps distinguishing between the short-run and long-run AS curve).[2]   The role of finance is put under the carpet in the IS-LM model via a catch-all financial asset called "bonds". It was John Maynard Keynes who used bonds as representing finance. To be fair to Keynes, this view is reflective of the fact that most economies in the world of his times had relatively few financial assets and limited trading of such assets. Bonds, however, have been pushed to the background quickly with the application of Walras Law that placed emphasis on the fact that if n-1 markets are in equilibrium, then the market which is residual by implication, must also be in equilibrium. This perception is defended on the ground that there cannot be excess demand or supply of goods or money. More specifically, under the Walrasian scheme, there would be three markets (*viz*., goods, money and bond) wherein attention needs to be paid to only two, viz., goods and money. There will be automatic adjustments towards equilibrium in the goods and money markets through a process of groping, the *tatonnement*, in which buyers and sellers respond positively to the prices quoted by the agent—the auctioneer (Patinkin, 1957).

Second, in the standard growth model of economics *a la* Robert Solow, there is hardly any role for finance. The capital in Solowian aggregate production refers to physical capital, like machines. While more contemporary endogenous growth models attempt to incorporate finance in determining the per capita GDP growth of a nation, the role of finance in such models is confined to easing of the liquidity constraint of an investor and is akin to lubricant that makes a machine well-oiled so that the efficiency of the production process gets enhanced (e.g., Bencivenga and Smith, 1991; Greenwood and Jovanovic, 1990).

---

[1] Interestingly while financial policies have predominantly been in periphery (or even outside) of macroeconomic policies, there has been a parallel literature whereby financial repression in emerging and developing economies could hurt growth in these countries and, financial liberalization therefore should be a key ingredient of Washington Consensus and desired structural policies. See Fry (1988) for details.

[2] Tobin and Brainard (1963) is an exception; they discussed some of the issues of instability among the financial intermediaries and sought to solve the problems through introduction of reserve ratios.

Third, even in the finance literature there is emphasis on the 'invisible hand' via the application of 'efficient market hypothesis' whereby stock prices reflect and incorporate all relevant information. Implicitly therefore the role of financial policies would turn out to be superfluous (Fama, 1970).

The situation changed quite drastically after the emergence of the global financial crisis. There was wide spread perception that the policy makers' negligence of financial factors has been costly. Accordingly, there been an enkindling of interest in handling financial risks within the macro policy structure.[3] What have been the contours of such emergence of interest? How do we measure the build-up of system-wide risk in the financial sector? How do we mitigate such risks? The present paper delves into some of these questions. Two issues are important in particular: (a) how to measure the financial sector linkage / vulnerability and the associated systemic risks? and (b) having identified the sources of financial vulnerability, how to mitigate them?[4]

The rest of the paper is organized as follows. Section 2 discusses the context for taking macro-financial policies much more seriously. While issues relating to identification and measurement of systemic risks are taken up in section 3, section 4 looks into the specific measures that are applied to mitigate such risks. Section 5 takes up the issue of early warning exercise in this context. Section 6 concludes.

2   Taking Macro-financial policies seriously: The Context

The Existing Literature

Notwithstanding the negligence of financial factors in economic policies, there has been no dearth of financial crises both in the developed economies as well as emerging markets and developing economies. There are at least two leading economists viz., Charles Kindleberger (1978) and Hyman P Minsky (1972), who studied the genesis, impact and nature of such financial crises in great detail. Studying financial crises like the Dutch Tulip Bulb Bubble of 1636 or the US stock price bubble 1927–29, Kindleberger pointed out that manias or bubbles have tended to occur in the markets following unexpected good news. He

---

[3] Mr Amando Tetangco, Governor of the Central Bank of the Philippines, has noted recently that an advanced search in Google Scholar for articles on macro-financial linkages during the period 1980–1999, yields 82 articles, while for the period 2000–2016, the number of articles increases dramatically to 2,700, see Tetangco (2016) for details.

[4] For all practical purpose, the three terms 'macro-financial risks', 'financial vulnerability' and 'systemic risks', are used interchangeably in this paper.

arrived at this conclusion by relying on Minsky's model of financial instability. To be more specific, displacement, overtrading, monetary expansion, revulsion and discredit characterized the nature of capitalist economies. Minsky's "financial instability hypothesis" argued that bank loans tend to go through three distinct stages, viz., the Hedge, the Speculative and the Ponzi stages. In the hedge stage both banks and borrowers are cautious whereas in the speculative stage banks begin to extend loans in which the borrower can only afford to pay the interest. In the Ponzi stage, even payment of interest becomes difficult. Nevertheless, because of the reasons referred to earlier, such contributions to the emergence of financial crises have mostly been relegated to the background and have hardly been included in mainstream literature on economic policies.

While financial factors have been largely neglected in the mainstream literature, there have, however, been some notable exceptions in recent times. Illustratively, Bernanke and Gertler (1989) have tried to incorporate the so-called financial accelerator and established the role of borrowers' balance sheet on business cycles. Later, Kiyotaki and Moore (1997) constructed a model in which durable assets play a dual role – both as factor of production as well as collateral for loans. The dynamic interaction between credit limits and asset prices in their model turned out to be "a powerful transmission mechanism by which the effects of shocks persist, amplify, and spill over to other sectors … (and) small, temporary shocks to technology or income distribution can generate large, persistent fluctuations in output and asset prices". More recently, Christiano et. al. (2003) developed a standard monetary business cycle model with a banking sector, and financial frictions and showed that "a liquidity preference shock played an important role in the contraction phase of the Great Depression."

Meanwhile, over the years, in the policy circles it was realized that banks are highly leveraged organizations and that laissez-faire banking is prone to bankruptcy, which could turn out to be very costly. Hence there has been clamour for making banks safe. Two major routes have been advocated. First, it was felt that adoption of deposit insurance would make banks safer (Diamond and Dybvig, 1983). Second, it was believed that once banks hold adequate capital, they can manage their credit risks. These norms (commonly known as Basel I norms) emanating from the initiatives of Basel Committee of Banking Supervision (BCBS)[5] emphasised the need for maintaining a pre-assigned ratio of bank capital as a percentage of a

---

[5] Basel Committee on Banking Supervision was established in 1974 by the central-bank governors of the G10 countries comprising Belgium, Canada, France, Germany, Italy, Japan, Luxemburg, Netherlands, Spain, Sweden, Switzerland, the UK, and the US.

weighted sum of bank's assets (with weights reflecting the extent of riskiness of the assets).[6] Subsequently these capital adequacy norms were extended to include capital for accommodating risks covering credit, operations and markets to form what is commonly known as Basel II norms.

Notwithstanding such policies of capital adequacy norms and deposit insurance the sub-prime crisis of US residential mortgage market that started in 2007 did turn into a full-fledged global financial crisis and went on to haunt the global economic and financial scenario till date. In fact, it is now widely believed a single-minded focus of many of the central banks on inflation and associated low inflation rate and low output variability, popularly called the "great moderation" gave a false sense of complacency to macroeconomic policy makers in general and central bankers in particular with respect to financial stability and growth. In retrospect it appears that there were five elements of such a complacent policy environment: (a) gearing of monetary policy towards inflation targeting; (b) exclusion of stabilization of asset prices and exchange rate from the standard macroeconomic policy space; (c) accepting the contribution of low inflation to low output variability; (d) relegating fiscal policy to the back seat; and (e) an implicit assumption of efficiency in the financial markets whereby banks, shadow banks (like hedge funds, private equity funds, mortgage lenders and others), and spectacular growth in the derivative market and financial innovations would not pose any threats to financial stability (Solimano, 2010). But realities are widely different. The global financial crisis forced the authorities to revisit the elements that led to the belief in the sustainability of the 'great moderation'. Basle II norms were further strengthened resulting in the carving out of Basle III norms.

Emergence of Macro-financial Policies

The crisis contributed to the questioning of conventional ideas and forced the need for putting in place reality checks to the existing tool box of the macroeconomic policies. Along with a sense of helplessness among economists, the necessity of taking financial policies seriously perhaps dawned upon economic policy makers. This has been captured succinctly by Grace, Hallissey and Woods (2015):

> "Although the topics of financial stability or macro-prudential analysis are not new, the recent crisis revealed significant deficiencies in both the analytical framework and the policymaker's capacity to mitigate emerging system-wide vulnerabilities. Macro-financial linkages were not fully appreciated and the transmission of risk across the financial system was severely underestimated. Before the crisis, some

---

[6] BCBS (1988) distinguished Tier 1 and Tier 2 capital While Tier 1 capital would include paid-up capital, and disclosed reserves, Tier 2 capital would comprise undisclosed reserves; asset revaluation reserves; general provisions; hybrid instruments; and subordinated debt.

macro-prudential policymakers relied on soft tools such as communication and market discipline to influence the behaviour of individuals and institutions and to ensure financial stability. The global crisis changed this view and a consensus emerged that hard policy measures (e.g., higher capital requirements) were required to tackle systemic risk concerns. *Consequently, macro-prudential policymakers have begun to consider the need for policy instruments to build resilience, initially within the banking sector, and to reduce the volatility of the credit cycle. Although the origins of future crises remain unknown, these measures aim to reduce the probability and long-term costs of such events*" (emphasis added).

Thus, by the time the sub-prime crisis in the US residential mortgage market got exacerbated into a global financial crisis, it was realised in economic policy circles that macroeconomic policies need to take a look at the systemic risk, a risk that standard monetary and fiscal policies have been unable to address in a sufficiently robust manner.

Towards Defining Systemic Risks

But how do we define systemic risk? Indicating that while systemic risk is widely used but difficult to notice, IMF (2009) commented, "it is often viewed as a phenomenon that is there "when we see it." Thus, such risks reflected some sort of broad-based breakdown in the functioning of the financial system and are normally realized by a large number of failures of FIs (usually banks).

The idea of systemic risk, however, is not new. The Group of Ten in its 2001 Report had provided with the following working definition of systemic risk:

> "Systemic financial risk is the risk that an event will trigger a loss of economic value or confidence in, and attendant increases in uncertainly about, a substantial portion of the financial system that is serious enough to quite probably have significant adverse effects on the real economy. Systemic risk events can be sudden and unexpected, or the likelihood of their occurrence can build up through time in the absence of appropriate policy responses. The adverse real economic effects from systemic problems are generally seen as arising from disruptions to the payment system, to credit flows, and from the destruction of asset values".

The European Central Bank (ECB) on the other hand has tried to give a specificity to the understanding of systemic risk as, "the risk that financial instability significantly impairs the provision of necessary financial products and services by the financial system to a point where economic growth and welfare may be materially affected" (ECB, 2009). This view is reflected also in Caruana's depiction of what systemic risk means. Following the work of the IMF, the FSB and the BIS for the G20, systemic risk has been defined as "a risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy" (Caruana, 2010). More recently, the IMF was much more open in advocating the need for use of macroprudential policy as primarily as a prudential tool to limit systemic risk (IMF, 2013).

The commonality among the above depictions or definitions is perhaps the all-pervasive nature of systemic risks and their ultimate adverse effects on the real growth,

employment and welfare. Increasingly, analysis of financial sector vulnerabilities has turned out to be extremely important for stability of an economy including its real sector. Seen from this standpoint, the policy tool kit of an economic policy maker needs to include policies to handle such risks. It is, thus, no wonder that in the aftermath of the global financial crisis, there has been spurt in research as well as policy interest in macrofinancial policies.

Relation with Monetary Policy

Before we proceed further it is important to understand the relationship between such macrofinancial and monetary policies. In no way macrofinancial policies negate the role of monetary policy – rather, macrofinancial policies complement the role of monetary (and in some cases fiscal as well) policies in promoting and fostering financial stability considerations. In fact, the combination of monetary and macrofinancial policies aims at achieving the objectives of attaining price stability and financial stability together (Figure 1).

Figure 1: Macro-prudential Policy and Monetary Policy: Relationship

Source: Smets (2013)
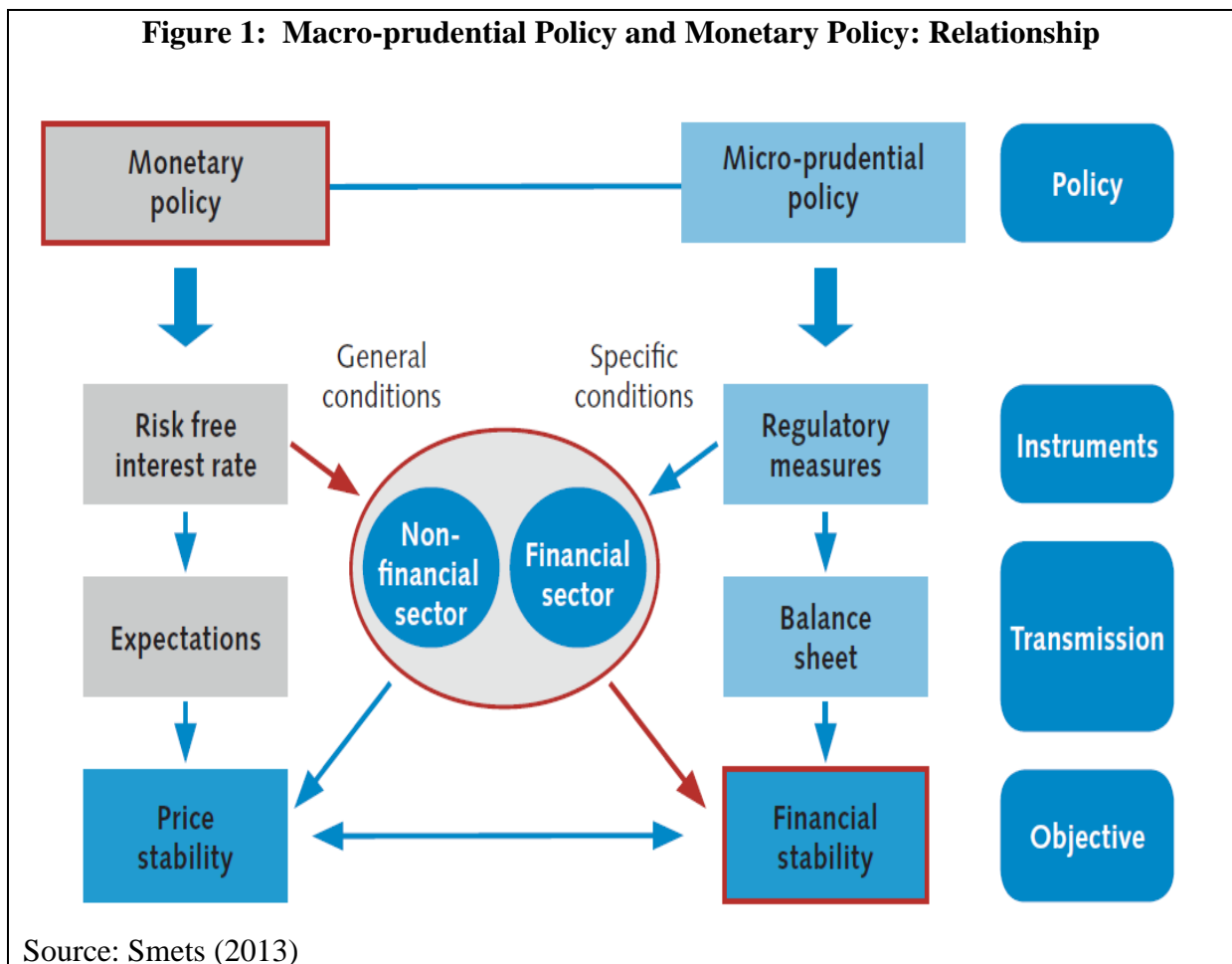
Global Initiatives

A major problem of today's financial system is that financial system is global in its reach and impact whereas its regulation is local / national. This was one of the key lessons from the global financial crisis that the world has learnt. In fact, much of the initiatives for macrofinancial policies came from a supra-national level. In its first meeting in 2009, the G20 launched a programme of financial sector reforms to increase the resilience of the global financial system. This was to be coordinated through the Financial Stability Board. Subsequently in November 2010, G20 Leaders called on the FSB, the IMF and the BIS to do, "…. work on macroprudential policy frameworks, including tools to mitigate the impact of excessive capital flows". The G20 further noted that "these frameworks should take into account national and regional arrangements" and looked "forward to a joint report which should elaborate on the progress achieved in identification of best practices, which will be the basis for establishing in the future international principles or guidelines on the design and implementation of the frameworks." This has been continuously emphasised by the G20 in its various summits.[7] Notwithstanding such emphasis, the third Annual Report on "The Implementation and Effects of the G20 Financial Regulatory Reforms" (released on 3 July 2017) noted uneven progress in implementation across the four core areas: (a) building resilient financial institutions (such as, Implementation of Basel III capital and liquidity standards); (b) ending the fallacy of the idea of 'too-big-to-fail' (c) making derivatives markets safer; and (d) transforming shadow banking into resilient market-based finance (FSB, 2017).

3   Measuring Financial Linkages

Birth and death of a firm are essential elements of the Schumpeterian process of 'creative destruction' that is a distinguishing feature of capitalism. Financial firms should be no exception to this general rule. However, two features of financial firms make their bankruptcy particularly costly. First, these firms are highly leveraged and hence their bankruptcy costs are higher. Second, these firms are often hugely interlinked with other financial firms; as a consequence, these firms become hugely interlinked (and often too big to fail). Seen from another angle, such financial linkages give an idea to the policy maker about

---

[7] Even the G20 Leaders' Communique of the Hangzhou Summit held during 4-5 September 2016 recognized the importance of effective macroprudential policies in limiting systemic risks and welcomed "the joint work by the IMF, FSB and Bank for International Settlements (BIS) to take stock of international experiences with macroprudential frameworks and tools and to help promote effective macroprudential policies."

the extent of systemic risk and the related macro-financial risks. Thus, measurement of the extent of interlinkage among these firms is of paramount importance.
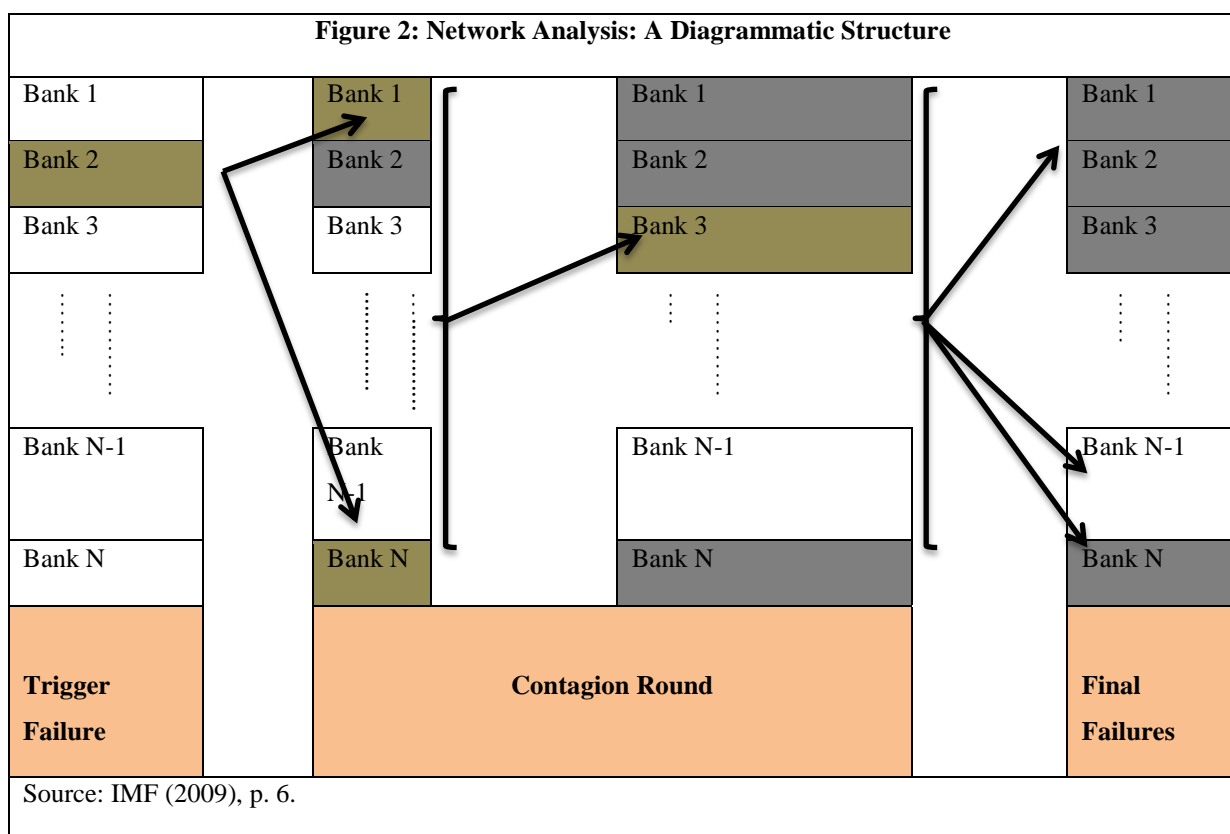
Besides, in the traditional textbook setting of macroeconomics, financial intermediaries are largely seen as conduits of moving finance from households (and in some case rest of the world) to firms (and to government). This conceptualization of financial intermediaries largely neglects the intra-sectoral flows within the financial intermediaries. Over the years such intra-sectoral flows within the financial intermediaries have experienced a quantum jump. Besides, there are number of advanced countries where GDP on account of finance too has registered a huge spurt. A large financial sector (perhaps disproportionate to the real sector of the economy) requires that the macro-financial risks need to be taken seriously.

In fact, following the global financial crisis measurement of the extent of financial linkage and the consequent measurement of the extent of systemic risk has emerged as a major research area. While a full treatment of various models is beyond the scope of this paper, we confine our attention to three major methods for their ease and universality of application - (a) network approach; (b) co-VaR model; and (c) distress dependence matrix (IMF, 2009).[8]

Network Approach

Any network analysis begins with the construction of a "matrix of inter-institution exposures" that includes *gross* exposures among financial institutions. Depending upon the degree of openness - such a matrix can be constructed domestically or at cross- country levels. Even if banks used to report their broad exposures to the regulators, granular data is often difficult to get. However, as and when banks start collecting these data, even if these are not made public, propriety data can be used to arrive at a structure of the network to understand the extent of exposure and vulnerability within it (Figure 2).

---

[8] For example, Bisias, Flood and Lo (2012) in a US Treasury paper surveyed 31 quantitative measures of systemic risk.

Figure 2: Network Analysis: A Diagrammatic Structure

| Bank 1 | Bank 1 | Bank 1 | Bank 1 |
Bank 2	Bank 2	Bank 2	Bank 2
Bank 3	Bank 3	Bank 3	Bank 3
⋮	⋮	⋮	⋮
Bank N-1	Bank N-1	Bank N-1	Bank N-1
Bank N	Bank N	Bank N	Bank N
Trigger Failure	**Contagion Round**		**Final Failures**

Source: IMF (2009), p. 6.

While a major difficulty of constructing such a matrix of inter-linkage lay in the lack of reliable data, in recent years a number of central banks, based on propriety returns have started publishing network structure of their banking systems. Illustratively, Figure 3 reproduces the network structure of Indian banking system as of September 2016 as reported in their December 2016 Financial Stability Report.[9] The diagrammatic representation of the network of the banking system reveals a tiered structure, "where different banks have different degrees or levels of connectivity with others in the network". In the diagram, based on their level of relative connectivity, the most connected banks are at the centre – followed by banks in the mid core, outer core and finally in the periphery (the respective concentric circles around the center in the diagram).[10]

---

[9] Note that for its implications on financial stability, no bank has been named in Figure 2.

[10] Each ball represents a bank and they are weighted according to their net positions vis-à-vis all other banks in the system. The lines linking each bank are weighted on the basis of outstanding exposures.

Figure 3: Network structure of the Indian banking system – September 2016

Net Payable Net Receivable In-Core Mid-Core Out-Core Periphery
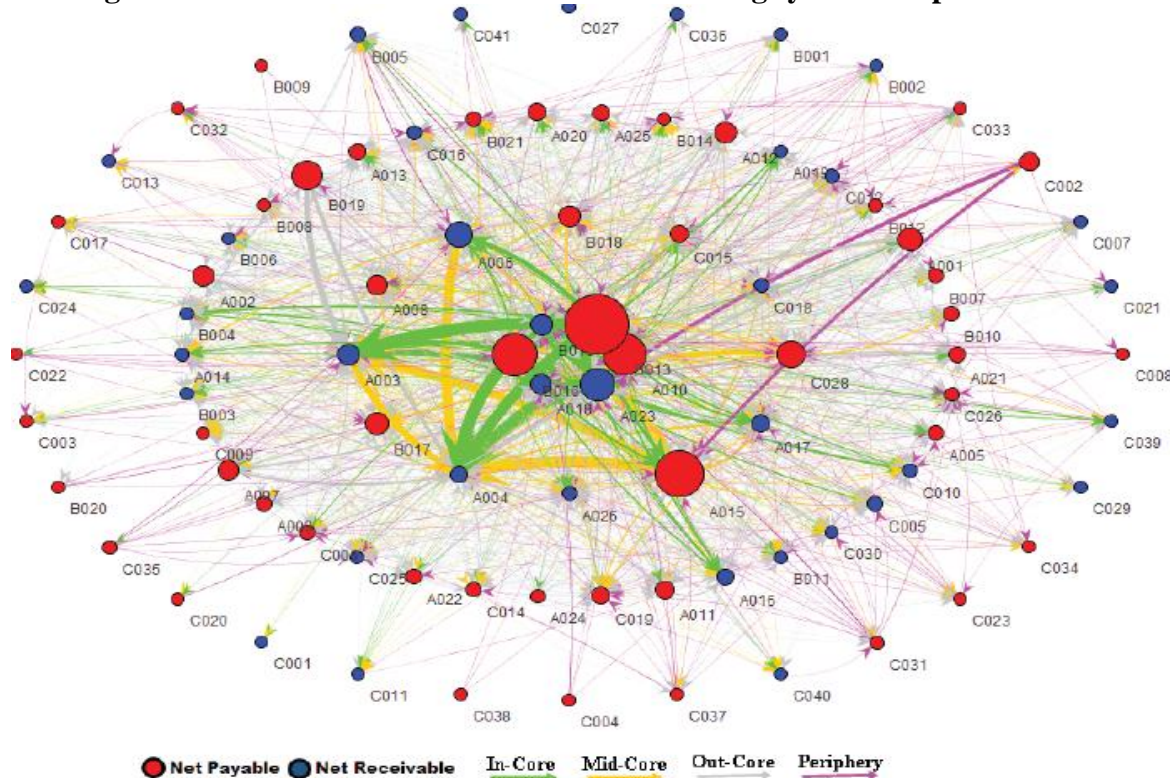
Source: Financial Stability Report, RBI, December 2016.

The information content of the Figure may also be summarized with the help of simple summary statistics. Illustratively, as an aggregate measure, the degree of interconnectedness in the banking system can be measured by the "connectivity ratio" (measuring the extent of links between the nodes relative to all possible links) or the "cluster coefficient" (measuring how interconnected each node is).[11]

Co-VaR (or Co-Risk) Model

One of the traditional tools of estimating the risk profile of a financial institution is what is called value-at-risk (VaR). It measures the potential loss in the value of a risky asset or a portfolio over a defined period for a given confidence interval. Thus, if the VaR on an asset of an institution is Rs. 100 crore at a one-month, 99% confidence level, there is a only a

---

[11] While the connectivity ratio is a global measure, the cluster coefficient is a local measure. Hence, these two statistics can provide conflicting signals. For example, the December 2007 Financial Stability Report of the RBI noted that the connectivity ratio between the banks has reduced over time, while the cluster coefficient remained stable during March 2012 and September 2016. More recently, Das (2016) applied a code for systemic risk networks to real world Indian data to produce daily maps of the Indian banking network.

1% chance that the value of the asset will drop more than Rs. 100 crore over any month. However, such a risk measure does not necessarily reflect the potential contribution of the institution to overall systemic risk particularly when the particular institution has exposure to others. To get rid of this lacuna, Adrian and Brunnermeier (2008 / 2014) proposed a new measure called the CoVaR that intends to capture "tail dependency and includes negative spillover dynamics in times of crises". The intuition behind the CoVaR model is simple. If the value-at-risk (VaR) gives an estimate of market perception of riskiness of a scrip / an institution, then "the difference between the conditional value at risk (CoVaR) of the financial system, conditional on an institution being in distress, and the CoVaR conditional on the median state of the institution" would capture the extent of systemic risk across the board.[12] While CoVaR model is quite data intensive in the days to come, it could emerge as a measure capturing the extent of system-wide financial risk.

Distress Dependence Matrix

Segoviano and Goodhart (2009) introduced this method for estimating a set of stability measures of the banking system (BSMs) in the form of constructing a distress dependence matrix (DDM). The DDM is constructed using the following steps: (i) the banking system is conceptualized as a *portfolio* of banks; (ii) estimates for probabilities of distress (PoDs) is obtained for each of the banks; (iii) the *banking system's (portfolio) multivariate density* (BSMD)[13] is arrived at from the individual banks' PoD; and (iv) finally, the banking stability measure (BSMs) is obtained from BSMD. Thus, not only these measures tend to capture the banks' inter-dependence of distress structure and non-linear distress dependencies among the banks in the system, it changes as banks' probabilities of distress (PoDs) change.

IMF (2009) estimated the pairwise conditional probabilities of distress of the institution in the row, given that the institution in the column falls into distress (Table 1).

---

[12] CoVaR estimates are still nascent in India. A recent contribution of Gupta and Jayadev (2016) used CoVaR technique and arrived at the following conclusion, "Private sector banks with larger income diversification tend to be associated with smaller systemic risk contributions in the current quarter and one quarter later". This could be indicative of the fact that "a diversification strategy reduces the likelihood of institutional failure and should thus benefit financial stability overall".

[13] This uses the methodology of Consistent Information Multivariate Density Optimization (CIMDO) (Segoviano, 2006).

Table 1 Distress Dependence Matrix: Pairwise conditional probability of distress

July 1, 2007	Citigroup	Bank of America	JPMorgan Chase & Co.	Wachovia Bank	Washington Mutual	Goldman Sachs	Lehman Brothers	Merrill Lynch	Morgan Stanley	AIG	*Row Average*
Citigroup	1.00	0.09	0.08	0.08	0.05	0.06	0.06	0.06	0.06	0.05	**0.16**
Bank of America	0.08	1.00	0.22	0.21	0.08	0.08	0.07	0.09	0.09	0.11	**0.20**
JPMorgan Chase	0.10	0.33	1.00	0.23	0.09	0.14	0.12	0.14	0.12	0.11	**0.24**
Wachovia Bank	0.08	0.27	0.20	1.00	0.08	0.08	0.07	0.08	0.08	0.10	**0.20**
Washington Mutual	0.14	0.25	0.18	0.20	1.00	0.10	0.10	0.13	0.11	0.12	**0.23**
Goldman Sachs	0.13	0.20	0.23	0.16	0.08	1.00	0.27	0.23	0.26	0.13	**0.27**
Lehman Brothers	0.16	0.24	0.25	0.19	0.11	0.35	1.00	0.29	0.26	0.14	**0.30**
Merrill Lynch	0.15	0.26	0.27	0.19	0.13	0.28	0.26	1.00	0.26	0.15	**0.30**
Morgan Stanley	0.15	0.25	0.23	0.19	0.10	0.30	0.23	0.25	1.00	0.12	**0.28**
AIG	0.05	0.11	0.07	0.08	0.04	0.05	0.04	0.05	0.04	1.00	**0.15**
Column average	*0.20*	*0.30*	*0.27*	*0.25*	*0.17*	*0.24*	*0.22*	*0.23*	*0.23*	*0.20*	*0.23*

Aug 15, 2008	Citigroup	Bank of America	JPMorgan Chase & Co.	Wachovia Bank	Washington Mutual	Goldman Sachs	Lehman Brothers	Merrill Lynch	Morgan Stanley	AIG	*Row Average*
Citigroup	1.00	0.32	0.32	0.23	0.13	0.28	0.23	0.23	0.25	0.21	**0.32**
Bank of America	0.20	1.00	0.42	0.24	0.09	0.24	0.17	0.19	0.21	0.19	**0.30**
JPMorgan Chase	0.18	0.37	1.00	0.20	0.07	0.25	0.17	0.18	0.20	0.15	**0.28**
Wachovia Bank	0.41	0.69	0.65	1.00	0.23	0.45	0.37	0.39	0.41	0.39	**0.50**
Washington Mutual	0.83	0.92	0.89	0.85	1.00	0.80	0.77	0.82	0.80	0.78	**0.85**
Goldman Sachs	0.21	0.28	0.34	0.19	0.09	1.00	0.28	0.26	0.32	0.18	**0.31**
Lehman Brothers	0.42	0.51	0.56	0.38	0.22	0.69	1.00	0.52	0.54	0.35	**0.52**
Merrill Lynch	0.39	0.52	0.58	0.37	0.21	0.61	0.48	1.00	0.53	0.35	**0.50**
Morgan Stanley	0.31	0.41	0.44	0.28	0.15	0.52	0.35	0.37	1.00	0.24	**0.41**
AIG	0.36	0.52	0.48	0.38	0.20	0.41	0.32	0.35	0.34	1.00	**0.44**
Column average	*0.43*	*0.55*	*0.57*	*0.41*	*0.24*	*0.53*	*0.41*	*0.43*	*0.46*	*0.39*	*0.44*

Sept 12, 2008	Citigroup	Bank of America	JPMorgan Chase & Co.	Wachovia Bank	Washington Mutual	Goldman Sachs	Lehman Brothers	Merrill Lynch	Morgan Stanley	AIG	*Row Average*
Citigroup	1.00	0.20	0.19	0.14	0.07	0.17	0.13	0.14	0.16	0.11	**0.23**
Bank of America	0.14	1.00	0.31	0.18	0.05	0.16	0.10	0.13	0.15	0.11	**0.23**
JPMorgan Chase	0.13	0.29	1.00	0.16	0.05	0.19	0.11	0.14	0.16	0.09	**0.23**
Wachovia Bank	0.34	0.60	0.55	1.00	0.17	0.36	0.27	0.31	0.34	0.29	**0.42**
Washington Mutual	0.93	0.97	0.95	0.94	1.00	0.91	0.88	0.92	0.91	0.89	**0.93**
Goldman Sachs	0.15	0.19	0.24	0.13	0.06	1.00	0.18	0.20	0.27	0.11	**0.25**
Lehman Brothers	0.47	0.53	0.58	0.43	0.25	0.75	1.00	0.59	0.62	0.37	**0.56**
Merrill Lynch	0.32	0.41	0.47	0.30	0.16	0.53	0.37	1.00	0.48	0.26	**0.43**
Morgan Stanley	0.21	0.28	0.29	0.19	0.09	0.40	0.22	0.27	1.00	0.14	**0.31**
AIG	0.50	0.66	0.59	0.53	0.29	0.54	0.43	0.49	0.47	1.00	**0.55**
Column average	*0.42*	*0.51*	*0.52*	*0.40*	*0.22*	*0.50*	*0.37*	*0.42*	*0.46*	*0.34*	*0.41*

Source: IMF (2009), p. 21.:

These default probabilities have calculated for three specific dates: (i) July 1, 2007; (ii) August 15, 2008; and a month before (August 15, 2008); and September 12, 2008. These probabilities indicate the state of systemic risks in the financial sector. Illustratively, the grand average of default probabilities has gone up from 0.23 in July 1, 2007 to 0.44 in August 15 2008, thereby indicating the deterioration in the brewing up of systemic risks in the financial system. More interestingly, in view of the fact that the probability of default of any other bank conditional on Lehman falling into distress went up substantially from 0.22 on July 1, 2007 to 0.37 on September 12, 2008 (column-average Lehman), it seems that the distress dependence matrix signalled that the market expected that a default of Lehman would cause significant disruptions to the system.

3   Macro-prudential Policies and Systemic Risks

Having identified (and perhaps measured) systemic risks, the next and the more key question is: how to mitigate such risks? Put differently what are the different policies that can be adopted to mitigate such risks? Before we seek for a menu of the policies that could be adopted, it is imperative to recognize that the standard monetary and fiscal policies are quite impotent in handling such risks. Hence, in the days following the global financial crisis this has been an issue of intense discussion both in the policy circles as well as the academia. Generically, these policies are being referred to as macro-financial or macro-prudential polices.

What is the rationale for macro-prudential policies then? IMF (2013) emphasised the presence of three sets of systemic externalities in this regard. These arise through: "(i) the tendency of the financial system to amplify adverse aggregate shocks; (ii) macro-financial feedback mechanisms that result in an overexposure to such adverse aggregate shocks; and (iii) linkages within the financial system that increase the vulnerability of the system to idiosyncratic or aggregate shocks".

Besides, it may be useful to look into the broad-based principles of macro-financial policy. Following Constâncio (2016) the following six principles can act as a useful starting point. First, like monetary and fiscal policies, macro-prudential policies need to be pre-emptive and counter-cyclical. Second, macroprudential policies need to be based on the concept of the financial cycle. Third, in view of vulnerability of the real estate, its role in the

financial cycle should be of a key focus.[14] Fourth**,** stress tests of the financial system in general and banking in particular must have a macroprudential dimension**.** Fifth**,** macroprudential policy needs to be complementary to monetary policy. Sixth, macroprudential policy should go beyond the banking sector and embrace whole of the financial sector, including the shadow banking sector.

Macroprudential Policy Tools

But what are the macroprudential policy tools? At the risk of generalization, one can adopt the following broad classification (Claessens & 2013; Grace & others, 2015).

Capital Tools: These pertain to capital of the banks / financial institutions and aim at increasing the resilience of the financial sector. It includes tools like (a) counter-cyclical capital buffer or dynamic provisioning, (b) leverage restrictions (such as imposition of a leverage ratio), and (c) sectoral capital restrictions.

Liquidity Tools: These tools aim at addressing the failure of banks' normal funding channels. Both quantity-based and price-based instruments may be applied. Quantity based instruments include tools like: (a) liquidity coverage ratio (LCR); (b) net stable funding ratio (NSFR); (c) loan-to-deposit (LTD) limits; or (d) loan-to-stable funding (LTSF) limits. Price-based instruments on the other hand would include: (a) general liquidity surcharge; or (b) liquidity surcharge for systemically important institutions.

Other Balance Sheet Tools: These would include tools such as, (a) exposure limits to reduce concentration; (b) sectoral disclosure requirements; and (c) second pillar of Basel II on supervisory review process.

Credit Rated Tools: These pertain to measures like restricting the borrowing relative to the value of the underlying collateral or imposing a loan to value (LTV) limit , or imposing a limit to the income of the borrower (a loan to income (LTI) or debt service to income (DSTI).

What has been the record of the application of such macroprudential tools? Claessens (2014) looked into the experience of 42 countries (comprising 28 emerging markets and 14 advanced economies) as of 2013 and found that loan-to-value ratio and debt-to-income ratio emerged as the two most popular macroprudential instruments. Interestingly while reserve requirements are in vogue in 10 out of 28 emerging market economies, these are not in use in

---

[14] Apart from real estate, perhaps other sensitive sectors like stock markets and commodities could form part of the focus.

advanced economies. Dynamic provisioning and counter-cyclical requirements have been used much less. Later, Cerutti, Claessens, and Laeven (2015) studied the usage of macroprudential policies for 119 countries over the 2000-13 period, covering 12 instruments and arrived at the conclusion that, "Emerging economies use macroprudential policies most frequently, especially foreign exchange related ones, while advanced countries use borrower-based policies more" (Table 2). Furthermore, their usage in their sample was generally associated with lower growth in credit, notably in household credit indicating their effectiveness to some extent. More recently, Lombardi and Siklos (2016) constructed an index of the capacity to deploy macroprudential policies for 46 major economies across the globe. Overall, they found that "economies that were the most directly impacted by the global financial crisis are also the ones that have built up the greatest macroprudential capacity". Their econometric results seemed to have suggested that success of policies for limiting credit growth depends hugely on their design.

Table 2: Usage of Macroprudential Instruments (%): 2000-2013						
	Total Countries	Advanced	Emerging Markets	Developing	Open	Closed
1. Cap on Loan-to-Value Ratio	21	40	20	6	29	14
2. Debt-to-Income Ratio	15	13	21	0	19	12
3. Dynamic Loan-Loss Provisioning	9	5	6	19	5	11
4. General Countercyclical Capital Buffer/Requirement	2	1	3	1	0	3
5. Leverage Ratio for banks	15	13	17	12	28	8
6. Capital Surcharges on Systemically Important Financial Institutions	1	1	1	1	1	1
7. Limits on Interbank Exposures	29	33	32	17	34	26
8. Concentration Limits	75	69	76	77	72	78
9. Limits on Foreign Currency Loans	14	9	16	13	10	16
10. Forex and/or Countercyclical Reserve Requirements	21	0	24	33	4	32
11. Limits on Domestic Currency Loans	12	0	11	26	9	14
12. Levy/Tax on Financial Institutions	14	14	14	11	17	12
Note: For each subgroup of countries, the frequency of use is the ratio of country-years using a given instrument to the total number of country-years using a macroprudential policy over the sample period 2000-2013. Source: Cerutti, Claessens, and Laeven (2015)						

The quest for adopting appropriate macroprudential polices to suit the economy specific condition seems to be still on.

5   Early Warning Exercises (EWE)

Since financial crises have been perceived to be costly, a major thrust of mitigating macrofinancial risks has been on their early detection. It is in this context that the EWEs gain importance. The purpose of the EWE exercise has been to detect the vulnerabilities of the economy / financial sector in terms of some indicators that can be tracked. In fact, the various financial crises since the 1990s seemed to have sprung various vulnerabilities and triggers (Table 3). Illustratively, in the Mexican crisis, government short-term external liabilities seemed to have exposed the country to a crisis. In the case of Thailand and Indonesia it was corporate sector external liabilities that seem to be responsible. However, all these are typical illustrations of crises in emerging economies. As a consequence, the IMF after the East Asian crisis has created an internal system of EWE for emerging economies.

Table 3: Vulnerabilities and Triggers of Select Financial Crises		
Crisis	**Vulnerability**	**Trigger**
Mexico (1994)	Government's short-term external (and foreign-exchange-denominated) liabilities	Tightening of U.S. monetary policy, political shocks.
Thailand (1997)	Financial and nonfinancial corporate sector external liabilities; concentrated exposure of finance companies to property sector	Terms of trade deterioration; asset price deflation.
Indonesia (1997)	Corporate sector external liabilities; concentration of banking system assets in real estate/property-related lending; high corporate debt-equity ratio	Contagion from Thailand's crisis; banking crisis.
Turkey (2000)	Government short-term liabilities; banking system foreign exchange and maturity mismatches	Widening current account deficit, real exchange rate appreciation, terms of trade shock; uncertainty about political will of the government to undertake reforms in the financial sector.
Finland (1991); Norway (1988); Sweden (1991)	Credit and house price booms, overheating, thin capitalization of banks, concentrated loan exposures, domestic lending in foreign currency, financial deregulation without strengthening of prudential regulation and supervision; weaknesses in risk management at the individual bank level.	Tightening of monetary policy, collapse of trade with the Council for Mutual Economic Assistance; exchange rate Depreciation
Source: Ghosh, Ostry, and Tamirisa (2009).		

However, the brewing up of global financial crisis in 2007 changed the scenario and the motivation of EWE. Beginning in 2009, the IMF and the Financial Stability Board (FSB) were tasked to undertake the EWE; its purpose was to "identify developing vulnerabilities within the global financial system". Thus, the EWE is intended to make an assessment of the "low-probability but high-impact risks" to the global economy (i.e., both advanced as well as emerging market economies) and devise appropriate policies. It, thus, integrates macroeconomic and financial perspectives on systemic risks (IMF, 2010). Thus, the basic aims of the EWE were three-fold: (a) to identify systemic vulnerabilities sufficiently in advance that corrective policies can be implemented; (b) to warn of imminent risks that suggest tail risks are about to materialize and suggest mitigating action; and (c) to prioritize policy recommendations and formulate contingency plans based on probability and impact (Robinson, 2014).

It may be noted that because of the potential contagion risk, the EWE remains a largely confidential exercise and it is disseminated through a confidential presentation of risks and vulnerabilities to the International Monetary and Financial Committee (IMFC). About one month prior to the IMF Annual and Spring Meetings, the early warning list (EWL) is finalized. The vulnerability exercises are done separately for Advanced (VEA) and Emerging Economies (VEE).[15]

A key imperative of the EWE is to arrive at the major vulnerabilities. But what are the components of vulnerabilities of EWE? Three kinds of sectoral vulnerabilities (viz., external sector, fiscal sector and corporate sector) and two kinds of market risks (viz., asset prices and financial market risk attitudes) have been emphasized (IMF, 2010). Each of these can further be attributed to further details (Table 4).

Admittedly, the EWE suffers from a number of limitations. There are issues relating to data quality and coordination between the IMF and the FSB (Robinson, 2014). Nevertheless, it has been aptly pointed out, "The EWE is among the most important innovations introduced after the crisis...That said, there is room to improve its effectiveness

---

[15] The VEA covers 32 countries: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Italy, Ireland, Israel, Korea, Japan, Luxembourg, Malta, New Zealand, Netherlands, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the U.K., and the U.S.
The VEE covers 56 countries: Algeria, Argentina, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Georgia, Guatemala, Hungary, Iceland, India, Indonesia, Israel, Jamaica, Jordan, Kazakhstan, Korea, Latvia, Lebanon, Lithuania, Macedonia, Malaysia, Mexico, Morocco, Pakistan, Panama, Peru, Philippines, Poland, Romania, Russia, Serbia, South Africa, Sri Lanka, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Venezuela, and Vietnam.

in a number of areas. Many senior policymakers are in practice unaware of the main takeaways from the EWE due to the restricted attendance and rather limited debriefing by the participants .... and it is difficult to find many concrete examples of follow up ...." (Robinson, 2014).[16]

Table 4: Sectoral and Market Vulnerabilities in EWE	
Source	**Vulnerabilities**
1. External Sector Risks & Vulnerabilities	• Cross-border capital flows • External financing gaps • External imbalances • Probability of an external crisis • Exchange rate misalignments
2. Fiscal Risks and Vulnerabilities	• Rollover and financing risks • Sensitivity of public sector debt to adverse shocks • Markets' perceptions of sovereign default risk • Contagion risk from fiscal distress • The required scale of fiscal consolidation • Probability of a fiscal crisis
3. Corporate Sector Risks and Vulnerabilities	• Leverage, liquidity, and profitability • Stock valuation and default probabilities
4. Asset Prices, Market Valuation and Bubble Spotting	• Real Estate Bubbles • Feedback loops between NPLs and • Equity Market Bubbles • macroeconomic performance
5. Financial Market Risk Attitudes	• Global Financial Stability Map • Asset and Market Volatility
Source: IMF (2010)	

6 Concluding Observations

In the aftermath of the global financial crisis, macrofinancial / macroprudential policies, aiming at maintaining and ensuring financial stability and geared towards mitigating systemic risks, have entered the toolbox of the policy maker. In some sense the relationship between macrofinancial policies and monetary policy is complementary in nature. Admittedly, identification of systemic risks is far more difficult than adopting traditional counter-cyclical stance of the standard monetary and fiscal policies. Methodologies of

---

[16] Initiated in 2011, recent Spillover reports of the IMF tried to address some of these limitations. These were initially focused on the external effects of domestic policies in five systemic economies (viz., China, the euro area, Japan, United Kingdom and the United States); since 2014 these Spillover reports shifted their attention to a more thematic approach.

identifying systemic risks and policies of mitigating these are still evolving - so are the techniques of making early warnings. Nevertheless, in the days to come, the macroeconomic policymaker cannot afford to be oblivious to macrofinancial policies and in case they overlook the need for such policies, it would be only at their risk and peril.

References

Adrian, Tobias and Markus K. Brunnermeier. 2008 / 2014. "CoVar". Federal Reserve Bank of New York Staff Report 348. Available at https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr348.pdf

Basel Committee on Banking Supervision (BCBS). 1988. "International convergence of capital measurement and capital standards", Basel: BCBS.

Bencivenga, Valerie, Smith, Bruce. 1991. "Financial Intermediation and Endogenous Growth". *Review of Economics Studies*. 58, 195-209.

Bernanke, Ben S., and Gertler, Mark. 1989. "Agency Costs, Net Worth, and Business Fluctuations." *American Economy Review*. 79: 14-31.

Bisias, Dimitrios, Mark Flood and Andrew W. Lo. 2012. "A Survey of Systemic Risk Analytics". Office of Financial Research (US Department of the Treasury), Working Paper #0001, available at http://bigdata.csail.mit.edu/sites/bigdata/files/sites/Lo%20abstract%20and%20paper%20-%20Systemic_OFR1_final.pdf

Caruana, Jaime. 2010. "Systemic risk: how to deal with it?". BIS Working Paper. Available at http://www.bis.org/publ/othp08.htm#P01

Cerutti, Eugenio, Stijn Claessens, and Luc Laeven**. 2015. "**The Use and Effectiveness of Macroprudential Policies: New Evidence". IMF Working Paper No. WP/15/61.

Christiano, L. J., Motto, R., Rostagno, M. 2003. "The Great Depression and the Friedman-Schwartz hypothesis". *Journal of Money, Credit And Banking.* 35: 1119- 1197.

Claessens, Stijn, Swati R. Ghosh, Roxana Mihe. 2013. "Macro-prudential policies to mitigate financial system vulnerabilities". Journal of International Money and Finance. 39: 153–185.

Claessens, Stijn. 2014. "An Overview of Macroprudential Policy Tools". IMF Working Paper No. WP/14/214.

Constâncio, Vítor. 2016. "Principles of Macroprudential Policy". Speech by the Vice-President of the ECB, at the ECB-IMF Conference on Macroprudential Policy, Frankfurt on 26 April 2016. Available at https://www.ecb.europa.eu/press/key/date/2016/html/sp160426.en.html

Das, Sanjiv Ranjan. 2016. "Matrix Metrics: Network-Based Systemic Risk Scoring", (2016). *Journal of Alternative Investments* (Special Issue on Systemic Risk). 18: 33-51.

Diamond D. W, and P H Dybvig. 1983. "Bank runs, deposit insurance, and liquidity". *Journal of Political Economy*, **91,** 401–419.

Fama, Eugene F. 1970. "Efficient capital markets: A review of theory and empirical work." *Journal of Finance*. 25, 383-417.

Financial Stability Board (FSB). 2017. "Implementation and Effects of the G20 Financial Regulatory Reforms: 3rd Annual Report". Available at http://www.fsb.org/wp-content/uploads/P030717-2.pdf

Fry, M. 1988. *Money, Interest and Banking in Economic Development*. Baltimore: Johns Hopkins University Press.

Ghosh, Atish R., Jonathan D. Ostry, and Natalia Tamirisa. 2009. "Anticipating the Next Crisis: What can early warning systems be expected to deliver". *Finance & Development*. September: 35 – 37.

Grace, Therese., Niamh Hallissey, and Maria Woods. 2015. "The Instruments of Macro-Prudential Policy". *Central Bank of Ireland Quarterly Bulletin*. 01: 90-105.

Grace, Therese., Niamh Hallissey, and Maria Woods. 2015. "The Instruments of Macro-Prudential Policy". Quarterly Bulletin, Central Bank of Ireland. Available at https://www.centralbank.ie/docs/default-source/financial-system/macroprudential-policy/gns-2-1-1the-instruments-of-mpru.pdf?sfvrsn=2

Greenwood, Jeremy, Jovanovic, Boyan. 1990. "Financial Development, Growth, and the Distribution of Income". *Journal of Political Economy*. 98, 1076-1107.

Group of Ten. 2001. Report on Consolidation in the Financial Sector. Available at https://www.imf.org/external/np/g10/2001/01/Eng/pdf/file1.pdf

Gupta, Rohit and Jayadev M. 2016. "Business Strategy and Systemic Risk - Evidence from Indian Banks". Indian Institute of Management Bangalore Working Paper No. 503, available at http://iimb.ac.in/research/sites/default/files/WP%20No.%20503.pdf

IMF. 2010. "The IMF-FSB Early Warning Exercise: Design and Methodological Toolkit", available at http://www.imf.org/external/np/pp/eng/2010/090110.pdf

International Monetary Fund (IMF). 2009. "Chapter II: Assessing the Systemic Implications of Financial Linkages", in *Global Financial Stability Review*. April 2009. Available at http://www.imf.org/en/Publications/GFSR/Issues/2016/12/31/Responding-to-the-Financial-Crisis-and-Measuring-Systemic-Risks

International Monetary Fund (IMF). 2013. "Key Aspects Of Macroprudential Policy." Policy Paper. Available at http://www.imf.org/external/np/pp/eng/2013/061013b.pdf

Kindleberger, C. P. 1978. *Manias, Panics, and Crashes: A History of Financial Crises*, New York: Basic Books (revised and enlarged, 1989; third edition, 1996).

Kiyotaki, Nobuhiro and John Moore. 1997. "Credit Cycles". *Journal of Political Economy*. 105: 211-248.

Lombardi, Domenico, and Pierre L. Siklos. 2016. "Benchmarking macroprudential policies: An initial assessment". Journal of Financial Stability. 27: 35-49.

Minsky, Hyman P. 1972. "Financial Instability Revisited: The Economics of Disaster." *Reappraisal of the Federal Reserve Discount Mechanism*. 3, 97-136.

Patinkin, D. 1957. Money, Interest and Prices, New York, Row & Patterson.

Robinson, David J. 2014. "The IMF Response to the Global Crisis: Assessing Risks and Vulnerabilities in IMF Surveillance". IEO (IMF) Background Paper, No. BP/14/09.

Segoviano, Miguel A. and Charles Goodhart. 2009. "Banking Stability Measures". IMF Working Paper WP/09/4. Available at https://www.imf.org/external/pubs/ft/wp/2009/wp0904.pdf

Segoviano, Miguel. 2006. "The Consistent Information Multivariate Density Optimizing Methodology." Financial Markets Group, London School of Economics, Discussion Paper 557.

Smets, Frank. 2013. "Financial Stability and Monetary Policy: How Closely Interlinked?". Paper presented at Riksbank Conference on "Two Decades of Inflation Targeting: Main Lessons and Remaining Challenges", held in Stockholm on 3rd June 2013. Available at www.riksbank.se/Documents/Rapporter/POV/.../rap_pov_artikel_4_131122_sve.pdf

Solimano, Andres. 2010. "An overview of IMF's Research on Macrofinancial Linkage", Working Paper, International Centre of Globalization and Development. Santiago Chile. Available at http://www.andressolimano.com/andressolimano/wp-content/uploads/2012/06/revised_imf-macro-financial_linkages__may_10_2010.pdf

Tetangco, Amando M Jr. 2016. "Macro-financial linkages – looking back to look ahead". Speech by Governor of the central bank of the Philippines at the opening ceremony of the 6th BSP International Research Conference, Manila, 21 September 2016. Available at http://www.bis.org/review/r160104i.pdf

Tobin, James and William C. Brainard. 1963. "Financial Intermediaries and the Effectiveness of Monetary Controls." *American Economic Review*. 53, 383-400.

✳✳✳✳✳✳