

MACRO-PRUDENTIAL POLICY AND SYSTEMIC RISK: A STRUCTURAL APPROACH

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Abstract

The aim of this paper is to provide a structural review by analysing aspects of the relationship between prudential policy and systemic risk. It addresses the current research challenges associated with a lack of macro-prudential policy formalisation, guidance regarding its implementation and effectiveness measurement. Given the rising levels of interconnectedness between financial markets, the paper addresses the potential contagion or spill-over effects that foster change in systemic risk, especially in the case of market size differences. Finally, the paper discusses challenges associated with macro versus micro-prudential policy implementation, addressing difficulties in the measurement of systemic risk.

KEY WORDS: systemic risk, macro-prudential policy, financial stability, contagion.

Anotacija

Straipsnyje siekiama struktūriškai aptarti riziką ribojančios politikos ir sisteminės rizikos santykių aspektus. Aptariamos atliekant tyrimą kilusios problemos, susijusios su formalios makrolygmens riziką ribojančios politikos, jos įgyvendinimo gairių ir vertinimo veiksmingumo trūkumu. Atsižvelgiant į didėjantį finansų rinkų susietumą, straipsnyje analizuojami galimo rizikos išplitimo ir šalutinio poveikio padariniai, galintys lemti tam tikrus sisteminės rizikos pokyčius, ypač esant skirtingo dydžio rinkoms. Be to, aptariami iššūkiai, susiję su makro- ir mikroriziką ribojančių politikų įgyvendinimu bei sisteminės rizikos įvertinimo sunkumais.

PAGRINDINIAI ŽODŽIAI: sisteminė rizika, makroriziką ribojanti politika, finansinis stabilumas, rizikos plitimas.

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Introduction

In the last decade, the challenges to financial stability and the origination of systemic risk climbed to the top of international policy agendas (Borio, 2003). The recent financial crisis further fuelled a significant amount of attention and concern regarding regulatory practices, potentially underlying the need for a different approach to financial supervision (Käfer, 2014).

The concept of financial stability is still heterogeneous, and remains flexible even among financial regulators. Traditionally, authors focused on the contrasting notion of financial instability, suggesting analysing the origin of contagion, and, for example, the origin of bank runs (Sarlin, 2014). More recently, academia and policymakers have been refocusing on financial stability, which is widely referred to as a feature, or state of a financial system, which comprises the efficient allo-

cation of resources by managing financial risk, divided by its correctional mechanisms (Apatachioae, 2013). The key features of a financially stable state include assisting the improvement of economic performance, and supporting the elimination of endogenously caused imbalances of unanticipated events (Borio, 2003). As the concept implies, the interaction between agents results in financial market sensitivity towards such operations. Financial stability appears to be a highly dynamic feature of a financial system, using auto-regulatory mechanisms to recover from its non-optimal state (Apatachioae, 2013).

It is important to note that financial stability does not necessarily lead to an absence of crises; it rather acts as a complex of mechanisms and processes correcting imbalances, and might lead to certain economic costs. As in the extreme example proposed by Eichengreen (2004) in discussing the case of China's tight control over its financial markets in order to restrict potential speculation over its currency, this policy may have prevented major financial instability, but might have resulted in restricted operation in the financial sector that is usually followed by a sharp decline in output.

Given the potential cost of excessive controls on financial development at the expense of economic growth, the key to optimal financial policies might be balancing the trade-off between stability and growth. Therefore, mechanisms ensuring financial stability should focus on monitoring and preparing for potential downturns, reducing the effects of potential costs that a crisis would generate. At the same time, the policies put in place would need to allow for controlled risk-taking in the economy, to foster financial development and the growth of the financial system/markets themselves.

The aim of this paper is to provide a structured review of current research and policy challenges associated with analysing the relationship between prudential policy and systemic risks in the financial sector. Thus, the remainder of the paper pursues the following objectives:

1. To analyse and present a systematic overview of the effects of prudential policy on systemic risk by defining the differences between micro and macro-prudential approaches in terms of risk comprehension – chapter 1;
2. To provide a methodological approach to determine macro-prudential policy and the ways it might affect systemic risk – chapter 2;
3. To highlight the importance of interbank linkages, as an externality that might serve as a potential source of contagion/spill-over affecting systemic risk – chapter 3;
4. To analyse and discuss the challenges associated with the implementation of macro-prudential policy and systemic risk measurement – chapter 4.

The paper finishes with conclusions and comments.

1. Systemic risk and prudential policy: a macro versus a micro approach

Prudential supervision has been reshaped by the entry into force of the Basel III regulation. The traditional micro approach has been complemented with a macro-prudential dimension designed to deal with systemic risk as well.

However, the definition of macro-prudential policy, as well as its objectives, still differs across strands of literature, as it is widely associated with financial stability. The common view defines macro-prudential policy as a set of tools and processes that try to limit the risks and costs of systemic crises, although the form and the extent of the limitation differ (Galati & Moessner, 2011).

In terms of focus areas, macro-prudential policy concentrates on the whole portfolio loss, while micro-prudential policy addresses the loss of each individual security, if, to make an analogy, we assume the financial system is a portfolio, and the securities represent the corresponding banks (Borio, 2003).

Finally, these two approaches treat risk differently: macro-prudential policy assumes that risk is endogenous, as institutions as a whole can affect the prices of financial assets and quantities. This may consequently impact the overall state of the economy, and, in a feedback effect, provide different conditions for institutions individually. On the contrary, a micro-prudential approach would not take a feedback effect into consideration, as individually, financial institutions may not have significant weight to influence the overall economy. Therefore, this approach considers risk to be exogenous to the financial system.

The traditional approach regarding financial policy before the recent financial crisis was to focus on micro-prudential supervision, concentrating on the soundness of individual financial institutions (Villar, 2017). However, the recent financial turmoil underlined the potential limitations of the micro-prudential approach itself, even when combined with stable output and inflation (Arslan & Upper, 2017).

Green et al. (2011) point to a fallacy of composition, where, while the level of risk of individual institutions might seem low, the same would not necessarily apply to the financial system as a whole. This may occur, as the authors suggest, because of the overall concentration in banks' portfolios of similar investments, which increase their exposure to a common risk, even though individually they might seem diversified to the desired extent. Similarly, if an individual bank level of risk is measured during times of economic expansion, it may consequently lead to the omission of imbalances, which, piling up, may create a serious threat in times of financial distress. As suggested by Schoenmaker and Wierds (2015), this is precisely what happened during the recent financial crisis, as the imbalances occurring through excessive risk-taking or 'too-big-to-fail' effects made the overall financial system fragile.

Micro-prudential limitations may additionally arise from seemingly efficient implementations of micro-prudential supervision that might lead to adverse incentives for agents, and hence work as potential destabilising factors. For instance, the introduction of complex model-based capital regulations was meant to adopt stronger risk management practices and increase the stability of the financial sector (Behn, Haselmann, & Vig, 2016). However, such regulation, along with a certain level of flexibility in model application, might lead to different unpredicted externalities, such as the adoption of more optimistic internal risk models by banks to bypass capital requirements, and thus potentially higher instability than expected (Colliard, 2014).

These limitations have thus underlined the relevance of introducing a macro-prudential approach in policies pursued by regulators. It is important to note, anyhow, that these two dimensions might complement each other, by addressing the risks that are usually not within the scope of their primary effect. For instance, micro-prudential supervision might be concerned with systemic risk factors, while a macro approach might involve particular attention to an individual risk factor for systemically important institutions (National Bureau of Economic Research, 2012).

2. Macro-prudential policy and its challenges: market externalities

Putting macro-prudential policies in place does not, however, address all the systemic risk limitations of micro-prudential policies. One of the greatest challenges to the effectiveness of macro-prudential policies is externalities. A formulation of externalities that fosters increases in systemic risk was first presented by Brunnermeier et al. (2009). For a detailed classification of externalities, see De Nicolò et al. (2012) (also Schoenmaker & Wierts [2011] and Claessens [2014]):

Strategic complementarities – a set of externalities that arise from the strategic choices of financial intermediaries, resulting in payoff increases for agents, as the number of those who undertake similar strategy increases. For instance, in an economic boom, the competition between financial intermediaries tends to increase, creating favourable conditions for neglecting credit standards in the whole economy (Claessens, 2014). Assuming imperfect information, the banks tend to reduce borrower screening, while increasing their lending capacity. Eventually, this strategy may lead to unaccounted risks, which, in hand with the collective adoption of such a strategy, produce a destabilising force during downturns (Gorton & He, 2008) (see also Ruckes [2004] and Dell’Ariccia & Marquez [2006]).

Another angle regarding potential aspects of strategic complementarities is represented by the interaction of reputational challenges and bank managers’ incen-

tive structures. When managers care about the perception of their abilities vis-à-vis the market, their credit policies might be influenced by those of other banks (Rajan, 1994). By copying each other's behaviour, banks tend to assume that the recognition of failure would be more lenient if all the other market players act in the same way, creating some form of cooperative strategy, when the consequences of excessive risk-taking do not leave any other option (Allen & Saunders, 2003).

Institutional supervision may also cause such externalities. These may be caused by either market-to-market (fair value accounting) or requirements to use similar Value-at-Risk models or behavioural models (Claessens, 2014). The latter include potential investment opportunism, by neglecting the possibility of large shocks, or being sensitive to system-wide exposure (for this, see also Barberis [2013], Shleifer [2000] and Gennaioli et al. [2013]).

Finally, central banks acting as lenders of last resort generate incentive mechanisms for banks to align their risk strategies, and consequently undertake riskier projects (Acharya & Yorulmazer, 2007) (see also Farhi & Tirole [2012] and Dam & Koetter [2011] for a game theory-based model).

The above-mentioned externalities, as a consequence, might impact bank asset quality, create additional sources of maturity and exchange mismatches, and generate an overall imbalance of the financial system (Allen & Carletti, 2011).

Fire sales – and credit crunches represent externalities that result in panic on financial markets in the form of sudden asset liquidation at a time when potential buyers are also troubled (De Nicolò et al., 2012). In these circumstances, asset prices drop drastically, making it even more challenging for investors to obtain liquidity, which is scarce (Allen & Gale, 1994).

In such scenarios, contagion effects take place, with similar assets held by other market participants also declining in value, possibly resulting in fire sales (Shleifer & Vishny, 1992 and 2011). Hence, such a self-reinforcing chain effect of declines in value eventually leads to downward spirals for the net worth of other market participants as well (Brunnermeier & Pedersen, 2007). This, therefore, would potentially increase the systemic risk, and might lead to financial market crashes.

Banks that hold such assets experience a deterioration in their balance sheets, and might therefore cut their lending, making collaterals less valuable. This, consequently, might limit final borrowers' capacity to borrow, worsening the real economy (Goldstein et al., 2013).

Despite fire sales and credit crunch externalities appearing during downturns, a build-up of such risks and imbalances is usually generated during times of economic expansion (De Nicolò et al., 2012). As market players take asset prices as given individually, they do not anticipate and internalise potential externalities linked to fire sales on future borrowing, leading to overborrowing, and potentially

distorting asset prices and causing excessive leverage (Caballero & Krishnamurthy, 2003; 2004; Stein, 2012; Manconi et al., 2012).

3. A second kind of challenge to macro-prudential policy: interbank linkages

Externalities related to banking interconnectedness – macro-prudential policies face challenges linked to another class of externalities, namely those associated with increasing systemic risk due to the tight interconnectedness of the banking system, and its dependency on strategies and the health of competitors.

One of the main characteristics of banks in acting as financial intermediary is maturity transformation, which implies that they face a mismatch between issuing long-term loans financed by short-term deposits. Banks may access interbank lending markets and balance out a temporal shortage of liquidity, thus reducing the risk of distress (Diamond & Dybvig, 1983). Nonetheless, exposure towards other banks might lead to an additional channel of contagion in the economy (Sarlin, 2014). This phenomenon is widely discussed in the Allen & Gale (2000) model, indicating that even a small liquidity shock in one particular region can instantly spill over to the overall financial system through interbank exposure. When one region is suffering from financial turmoil, the rest of the system may face a loss in the form of a drop in the value of claims (Allen & Gale, 2000). If the effect of the spill-over is strong enough, it leads to the financial instability of other regions via a contagion effect, as the authors suggest.

Bank spill-overs can also appear because of price movements, as in cases of fire sales and because of the feedback effects from the aggregated economy (Bebchuk & Goldstein, 2011). While banks may pursue different strategies in order to reduce the risks associated with interconnectedness, these risks cannot be eliminated entirely.

Until recently, the traditional literature on bank runs and systemic failures did not factor bank interconnectedness and their heterogeneity into the models. For instance, the seminal Diamond-Dybvig model investigates the role of banks as providers of liquidity to the economy by allowing depositors with heterogeneous consumption time-preferences to maximise their utility in a multi-period world, but assuming one representative bank.

Relaxing the assumption of homogenous banks in the economy may provide insights into whether and how it might affect depositors' reaction to a shock, and hence the extent to which it can spread across the system (Saez & Shi, 2004). This approach, while still explaining how bank runs may occur, eliminates the issue of how a bank run on a single bank may spill over in a sector of heterogeneous institu-

tions, and/or across other markets. In order to address this limitation, some authors have suggested extensions to the Diamond-Dybvig model.

Chen (1999) includes a multi-banking assumption, and allows for depositors to be either informed or uninformed on the condition of health of the banking sector, creating the possibility for those with informational advantages to withdraw deposits first. With imperfect information and relying on conflicting information, uninformed depositors may generate a panic, and drive even healthy banks into trouble, fostering a spill-over effect in the whole system (Sarlin, 2014). Another extension of the Diamond-Dybvig model assuming the multi-banking environment was presented by (Temzelides, 1997), which investigated the frequency of bank panics, as well as the market structures able to reduce them. The author suggests that a decreasing number of banks increases the likelihood of a bank panic, also creating the real threat of contagion spreading not only regionally but also internationally.

Systemic importance, associated with the size of institutions, might also play a crucial role in resilience towards externalities related to interconnectedness (Claessens, 2014). Such institutions, while in distress, might be less sensitive towards smaller financial turbulence than smaller institutions that might get into trouble. The recognition of systemically important institutions as too-big-to-fail may, however, decrease their resilience by incentivising greater risk-taking and moral hazard in anticipation of government intervention in times of turmoil, and by relatively relaxing discipline among the creditors of such institutions (Flannery, 2009).

As events occurring to bigger banks may affect the system, and in particular smaller banks, similarly, in the case of financial systems of different sizes and great interconnectedness, turbulence can easily be transmitted from a bigger market to the smallest. In this sense, smaller markets might become dependent on economic fluctuations in the bigger markets.

Empirical evidence from cross-border banking supports the potential effects on stability linked to the presence of foreign-owned banks. For instance, the evidence suggests that foreign banks might have a stabilising effect on aggregate lending in times of financial distress (in Peek & Rosengren, 2000; Goldberg, Dages, & Kinney, 2000; García Herrero & Martínez Pería, 2007). More recent research by De Haas & Van Lelyveld (2006 and 2010) supports the idea of the positive effects of cross-border banking, suggesting that the existence of internal capital markets might serve as an emergency channel for liquidity in times of financial distress in a host country where the holding bank has subsidiaries.

However, if the bank's domestic market experiences a shortage of liquidity, it is likely that such a need would be covered at the expense of the host country. Assuming that the cross-border banks residing in a relatively small market are homogeneous according to one attribute or another, capital withdrawal might cause a threat,

increasing systemic risk. Empirical evidence from different geographical areas, such as the effects of the Japanese crisis on US credit markets between 1989 and 1996, discussed in Peek & Rosengren (2000), the case of the USA between 2007 and 2009 presented in Cetorelli & Goldberg (2013), or the case of Russia from 1992 to 2000 in Schnabl (2012), registers the negative spill-over effects through the above-mentioned interconnection channels.

While papers such as those by De Haas & Van Lelyveld (2006 and 2010) already shed a light on the relevance of cross-border banking externalities, it appears that from both a policymaking and an academic perspective, the topic still remains open to more detailed research and discussion.

4. Prudential policy tools and implications

The implementation of macro-prudential policies has been a recent development of post-financial crisis advanced economies. In 2013, the Single Supervisory Mechanism (SSM) conferred the task of formalising prudential policies for credit institutions on the European Central Bank (ECB) (European Central Bank, 2019). Nonetheless, the setting and implementation of macro-prudential measures, as well as the formal establishment of the measures themselves, remained primarily in the hands of the national authorities, subject to notification to the ECB.

A lack of a structural approach in defining macro-prudential policies to mitigate the externalities discussed in this paper still persists. As proposed by De Nicolò et al. (2012), most of these externalities might be addressed by implementing capital requirements that are already set by traditional micro-prudential regulation. However, such tools should not be perceived only as a means to resolve agency conflicts within the banks, but rather to tackle the externalities arising from banks (Claessens, 2014). Therefore, the interpreted measures need to be dependent on aggregated values representing the behaviour of all the banks, rather than following an institution-specific approach, such as the one pursued by micro-prudential policies. Time-varying capital requirements were addressed by the Basel accords, where the latest, in 2011, suggested additional requirements linked to aggregated credit growth. The Eurozone equivalent of this approach is represented by the Capital Requirements Directive (CRD IV) regulatory tools (counter-cyclical, systemic risk buffers, etc), Capital Requirements Regulation (CRR) (risk weights for real estate and intra-financial exposure, capital conservation buffer, own fund level), and other measures, such as setting a leverage ratio (European Central Bank, 2019). In addition, the ECB imposes borrower-based measures that include loan-to-value (LTV) or loan-to-income (LTI) caps. These measures affect the asset side of banks' balance sheets, and are designed to avoid lower lending standards in times of eco-

conomic success. As capital restrictions become less useful in good times, due to high profitability, tools such as LTV caps can complement them, by putting direct constraints on asset allocation (De Nicolò et al., 2012).

It is important to note, however, that some macro-prudential policies might conflict with micro-prudential intuition (De Nicolò et al., 2012). For instance, macro-prudential capital requirements are constructed to be high in an economic boom, in order to avoid the accumulation of imbalances, while in a micro-prudential approach they tend to be low, as the risk of default is lower compared to a downturn. The same inconsistency might be observed in times of economic downturn, while from a macro-prudential perspective, capital regulation should be low in order to avoid fire sales and deleveraging, while a micro-prudential policy would require higher buffers, as banks need more equity to tackle an increase in defaults. Therefore, macro and micro approaches should be aligned or not depending on the goal set, for pursuing a macro approach may cause individual banks to experience increases in instability; while focusing solely on a micro approach might cause a deleveraging spiral at all system levels (Osiński, Seal, & Hoogduin, 2013).

Incentivising banks to take preemptive measures during economic expansion can include capital requirements, liquidity requirements and taxation (Claessens, 2014). These measures allow advance preparation for potential downturns, mitigating incentives for excessive risk taking in upturns. When applied to systemically important banks, this would, in turn, help minimise the risk of contagion and prevent spill-over across banks.

It is important to note, however, that these measures would be hard to calibrate, as it is challenging to determine an institution's contribution, by being systemically important, to systemic risk as such (International Monetary Fund, 2010). Additionally, labelling institutions as systemically important might lead to a lack of market discipline, as creditors and the bank itself would perceive themselves as 'too-big-to-fail' and less risky.

Another set of tools to deploy in order to reduce the risk arising from 'too-big-to-fail' banks, as discussed by Claessens (2014) and De Nicolò et al. (2012), includes restrictions on asset composition and Pigouvian taxes, pushing systemically important institutions to internalise the systemic risk. It would, however, be hard to calibrate the specific volume of the risk that such an institution would create, while again potentially relaxing banks' discipline by the identification of such institutions (Kocherlakota, 2010).

Taxation, nonetheless, may still help to strengthen banks' resilience, and reduce the risk of negative interbank spill-overs. Perotti & Suarez (2011) propose imposing a tax that would compensate the maturity mismatch between banks' long-term investment and short-term funding, which would decrease the dependence

on short-term funding. De Nicolò et al. (2012) highlight the fact that even though Basel III tries to address this issue through the use of the liquidity ratio (like the ECB through CRR tools), taxes are easier to adjust to reflect the price difference between stable and unstable funding. In addition, taxation can be more flexible during turmoil, especially once banks have no choice but to comply with minimal liquidity benchmarks, or to accept less stable funding. However, as fiscal policies remain at a state level, and are used as a political tool to get a consensus, the implementation of these measures appears to be challenging.

5. The challenges of systemic risk measurement

The implementation of effective macro-prudential policies also clashes with how systemic risk can be perceived. In this situation, the academic literature suggests a variety of measurements and modelling frameworks in order to tackle specific challenges. One of the best-known measurements is CoVar, proposed by Adrian & Brunnermeier (2011). This indicator is based on Value-at-Risk (VaR) applied to a stressed financial system. The difference between CoVar and unconditional VaR determines the individual contributions of institutions to systemic risk. Similar measurements proposed by Acharya et al. (2010) and Huang et al. (2010) are also based on CoVar; however, these measurements do not differentiate between the size of systemic events by weighing their magnitude, but only suggest them being bivariate. These approaches, nonetheless, might proxy externalities related to interconnectedness in line with stress tests (Brunnermeier et al., 2010) and forward-looking risk indicators (Gray & Jobst, 2011).

The externalities produced by strategic complementarities or imbalances leading to fire sales may be proxied by measures of property prices, risk premia, deviations/gaps from trends in credit-to-GDP ratio, or leverage (De Nicolò et al., 2012) (for this, see also Drehmann et al. [2011], Dell’Ariccia et al. [2012]). These measurement tools, however, may capture multiple externalities at the same time, thus leading to policies with potentially conflicting objectives (De Nicolò et al., 2012). Another relevant limitation regarding systemic risk measurement is that efficient proxies are hard to calibrate, such as, for example, determining the optimal level of loan-to-value measurements or effective capital requirements (Crowe et al., 2011). Therefore, quantitative analyses aiming at measuring the effectiveness of macro-prudential policy tools need to be complemented by qualitative analyses that would help to set the perimeters and the main goals of the policies pursued.

Conclusions

The recent financial crisis fuelled a significant amount of attention and concern for prudential regulatory practices. It underlined the potential inability of micro-prudential measures to ensure stand-alone financial stability. Only recently, the first attempts to formalise macro-prudential policy and its tools have taken place, shedding a light on disputable aspects of both supervision and the policy itself. Therefore, this paper aims to contribute by providing a structured approach to the topic of macro-prudential policy by concluding that:

1. Micro and macro-prudential policies differ in their objective, focus and perception of the risk, as is suggested by Borio (2003). A macro-prudential approach aims to limit episodes of financial distress by addressing its cost to the economy and losses caused by financial institutions collectively, while micro-prudential policies concentrate on addressing the risk of the failure of specific individual institutions, as well as the costs associated with it. Consequently, a macro-prudential policy perceives the risk as endogenous, assuming that institutions collectively may affect the prices of financial assets and quantities, and thus affect the state of the economy. A micro-prudential policy, on the other hand, would not consider such a feedback effect, and perceives the systemic risk as exogenous.
2. A macro-prudential policy might be approached by means of externalities that could potentially contribute to increasing systemic risk levels. This approach was suggested by De Nicolò et al. (2012), and includes externalities related to strategic complementarities, fire sales and interconnectedness. This approach, however, is especially useful in understanding and evaluating the potential effects of macro-prudential policy and the impact of clustering policy by addressing these groups of externalities.
3. Interbank linkages may work as a contagion channel transmitting turmoil from one region to another. The theoretical model suggested by Allen & Gale (2000) shows that even a small liquidity shock in one particular region can instantly spill over to the overall financial system through interbank exposure. Empirical studies on cross-border banking emphasise the potential effects on financial systems through interbank linkages, underlining the importance of such channels. Finally, the effects of interconnection are of great interest to small open economies, especially those dominated mainly by homogenous banks.
4. The perception of the evaluation of prudential policy might also be approached through externalities. Along with traditional methods of capital requirements that are already in use, it is necessary to highlight the importance

of its systemic view. But micro and macro-prudential policies may have different goals when it comes to the implementation of policy; therefore, it is vital to align these policies when approaching systemic risk. Finally, the measurement of the effects of prudential policy and the effectiveness of the tools appears to be a challenging task, leaving open the door to further academic research and discussion.

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MACRO-PRUDENTIAL POLICY AND SYSTEMIC RISK: A STRUCTURAL APPROACH

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Appendix 1

Table 1. A comparison of the micro-prudential and macro-prudential approach

	Macro-prudential	Micro-prudential
Proximate objective	limit financial system-wide distress	limit distress of individual institutions
Ultimate objective	avoid output (GDP) costs	consumer (investor/ depositor) protection
Characterisation of risk	seen as dependent on collective behaviour ('endogenous')	seen as independent of individual agents' behaviour ('exogenous')
Correlations and common exposures across institutions	important	irrelevant

Source: Borio (2003)