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EXTERNALITIES AND MACROPRUDENTIAL POLICY

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Externalities and Macprudential Policy

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EXECUTIVE SUMMARY

The recent financial crisis has led to a reexamination of policies for macroeconomic and financial stability. Part of the current debate involves the adoption of a macroprudential approach to financial regulation, with an aim toward mitigating boom-bust patterns and systemic risks in financial markets.

The fundamental rationale behind macroprudential policies, however, is not always clearly articulated. The contribution of this paper is to lay out the key sources of market failures that can justify macroprudential regulation. It explains how externalities associated with the activity of financial intermediaries can lead to systemic risk, and thus require specific policies to mitigate such risk.

The paper classifies externalities that can lead to systemic risk as:

1. *Externalities related to strategic complementarities*, that arise from the strategic interaction of banks (and other financial institutions) and cause the build-up of vulnerabilities during the expansionary phase of a financial cycle;
2. *Externalities related to fire sales*, that arise from a generalized sell-off of financial assets causing a decline in asset prices and a deterioration of the balance sheets of intermediaries, especially during the contractionary phase of a financial cycle; and
3. *Externalities related to interconnectedness*, caused by the propagation of shocks from systemic institutions or through financial networks.

The correction of these externalities can be seen as intermediate targets for macroprudential policy, since policies that control externalities mitigate market failures that create systemic risk.

This paper discusses how the main proposed macroprudential policy tools—capital requirements, liquidity requirements, restrictions on activities, and taxes—address the identified externalities. It is argued that each externality can be corrected by different tools that can complement each other. Capital surcharges, however, are likely to play an important role in the design of macroprudential regulation.

This paper's analysis of macroprudential policy complements the more traditional one that builds on the distinction between time-series and cross-sectional dimensions of systemic risk.

I. INTRODUCTION

The 2007-08 financial crisis and the ensuing Great Recession have led to a profound reexamination of macroeconomic policy and financial regulation. At the heart of this reexamination is the realization that financial stability has a critical bearing on macroeconomic outcomes (Blanchard et al., 2010). The renewed focus on financial stability has sparked important regulatory reforms. The new Basel III accord envisions more stringent capital regulation, as well as the introduction of new tools, such as liquidity requirements. Other reforms, affecting banks' activities, the shadow banking system, and changes in the institutional infrastructure, are underway in various jurisdictions.

Beyond traditional microprudential regulation, the crisis has led to a new focus on "macroprudential" policy, which aims to address systemic risk, that is, "the risk of developments that threaten the stability of the financial system as a whole and consequently the broader economy" (Bernanke, 2009).² The proposed tools range from adaptations of standard microprudential measures (such as capital surcharges that are countercyclical or systemic risk-based) to taxes and restrictions on intermediaries' assets and liabilities (FSB, 2011a and 2011b; IMF, 2011a; Shin, 2011). Many countries have announced the adoption of macroprudential policies, and some have already implemented versions of such policies with early evidence as to their effectiveness (see Crowe et al., 2011; IMF, 2011b; Lim et al., 2011).

The focus on macroprudential policy is motivated by the fact that microprudential regulation is necessary but not sufficient to deal with systemic risk. Microprudential regulation (such as Basel I and II capital accords) tends to view financial institutions in isolation and aims mainly to ensure that each is individually solvent. Yet solvency of individual institutions is not a sufficient condition for the stability of a system as a whole, for two main reasons. First, the focus on individual institutions neglects risks that are of systemic rather than individual nature, such as correlation risk (Acharya, 2009). Second, certain aspects of microprudential regulation, while aimed at protecting individual institutions, may at times destabilize the system as a whole (Hanson et al., 2011). For example, microprudential capital requirements that become binding following a negative shock to banks' assets can turn individual deleveraging into a system-wide credit crunch. Given these limits, the purpose of macroprudential regulation is to focus on the financial system as a whole, with an ultimate objective of limiting systemic risk.³

This paper aims to advance the debate on macroprudential policy by focusing on its economic rationale, that is, the correction of market failures that give rise to systemic risk. To do so, we identify three externalities: a) externalities related to strategic complementarities,

²The term "macroprudential" was first put into use by Crockett (2000) and Borio (2003). Galati and Moessner (2011) provide a review of the recent literature on macroprudential policy.

³Brunnermeier et al. (2009) frame the distinction between micro and macroprudential regulations as a "fallacy of composition": safeguarding the components of the financial system is not a sufficient condition to safeguard the system.

which lead banks (and other financial institutions) to take excessive or correlated risks during the upswing of a financial cycle; b) externalities related to fire sales, arising from a generalized sell-off of financial assets that causes a decline in asset prices and impairs the balance sheet of intermediaries during the contractionary phase of a financial cycle; and c) externalities related to interconnectedness, caused by the propagation of shocks from systemic institutions or through financial networks.

Correcting these externalities can be seen as intermediate targets for macroprudential policy, since policies that control externalities mitigate market failures that create systemic risk. This approach may help policymakers select the most effective instruments for macroprudential policy. It also complements the traditional classification of macroprudential policies based on the distinction between time-series and cross-sectional dimensions of systemic risk (Borio, 2009; Bank of England, 2011).

While it would be desirable to derive from first principles the optimal policies that correct these externalities, this paper takes a “narrower” approach. It discusses how the main proposed macroprudential policy tools—variations of capital requirements, liquidity requirements, restrictions on activities, and taxes—may address the identified externalities.

The main finding is that the three externalities identified may be corrected by various tools, and each tool has benefits and limitations. As a result, policies addressing the same externality are best seen as complements. For example, both capital requirements and limits on bank asset allocation can correct the externalities associated with strategic complementarities. However, since capital requirements may become less effective in booms (when capital ratios increase due to buoyant asset prices), direct quantity restrictions, such as debt-to-income (DTI) or loan-to-value (LTV) ratios, can be useful complements. Similarly, capital and stable funding measures can be seen as complements in addressing the risk of fire sales, since they focus on vulnerabilities on different sides of a financial intermediary’s balance sheet. Also capital surcharges can weaken the incentives of banks to become systemic and ensure they dispose of a larger buffer in case of distress, whereas restrictions on the composition of bank assets (as envisioned e.g., by the Volcker rule) may limit banks’ exposure to excessive risk.

Despite these complementarities, one conclusion that emerges from the analysis is that capital surcharges are likely to play an important role in any macroprudential framework. The reason is that time-varying and systemic risk-based capital surcharges address any of the three identified externalities that lead to systemic risk, in contrast to the other policy tools. Moreover, they are closely linked to microprudential regulation and are already part of the Basel III accord.

This paper also highlights that a key challenge for the design of macroprudential policy is to acquire more evidence on the effectiveness of alternative policy tools. While policymakers have so far relied on “rule of thumb” considerations, it is necessary to acquire evidence on the effectiveness of interventions in order to make the macroprudential policy design more precise and, at the same time, avoid regulatory discretion.

Since the focus of this paper is on the *ex-ante* regulation of financial intermediaries, other important challenges related to macroprudential policy are not studied. In particular, this paper does not discuss issues related to the supervision of financial intermediaries; it takes as given the imperfect mechanisms to resolve distressed financial institutions (Claessens et al., 2011); and it abstracts from the systemic risk implications of capital flows and monetary and fiscal policies (Ostry et al., 2011; De Nicolò et al. 2010; Mooij, 2011).

The structure of the paper is as follows. Section II reviews the rationale for micro and macroprudential regulation. Section III discusses the three externalities that lead to systemic risk. Section IV links these externalities to macroprudential policy tools and highlights the main policy design challenges. Section V summarizes the conclusions.

II. MICRO AND MACROPRUDENTIAL REGULATION

The prevailing economic rationale for microprudential regulation rests largely on a standard moral hazard argument. Shareholders of leveraged firms have incentives to engage in risky activities, since they reap the benefit of the upside, but not the costs of failure, which are borne by creditors. This classical risk-shifting problem is exacerbated for banks because of public safety nets. Deposit insurance, intended to prevent bank runs and panics, worsens the incentives of depositors to monitor bank risk strategy. Similarly, the expectation of a government bailout, which may be necessary to limit the *ex-post* cost of financial distress, reduces the monitoring incentives of uninsured creditors.

For this reason, and given the crucial role that debt plays in the capital structure of banks, capital requirements have been a central feature of microprudential regulation. Equity increases the shareholders' "skin in the game," forcing them to bear a greater share of the cost associated to excessive risk-taking.⁴

The recent financial crisis has shown, however, that solving the moral hazard problem at each individual institution is not a sufficient condition to ensure the stability of the financial system as a whole. One lesson from the crisis is that interconnectedness among banks and other financial institutions can generate externalities with adverse effects on the real economy. A common source of such externality is contagion—the possibility of one distressed bank affecting the stability of others. But the links can be more subtle and involve, for example, pecuniary externalities through asset prices (asset liquidations that result in price declines impairing the balance sheets of other institutions) or strategic interactions among banks that lead them to take correlated risks *ex-ante*. Indeed, the crisis has brought to the fore the idea that the risk in a financial system is not simply the aggregation of individual risks, but is mostly endogenous risk, resulting from the collective behavior of financial institutions and agents.

⁴A complementary view of prudential regulation and capital requirements is that because small and inexperienced depositors are unable to monitor bank manager behavior, regulation is needed to guarantee that banks act in the interest of depositors (Dewatripont and Tirole, 1994).

Another lesson of the crisis is that microprudential regulation is not always suited to address systemic risk. In fact, ensuring the stability of each institution individually can at times destabilize the system as a whole. For example, capital ratios set independently of the business cycle may be a source of systemic risk. Since it is costly to raise new capital in downturns, banks hit by a negative shock may prefer to delever instead of increasing equity to satisfy the binding capital ratios. In aggregate this collective behavior may cause a credit crunch and a generalized drop in asset prices, exacerbating the initial negative shock.

In the presence of such externalities microprudential regulation needs to be supplemented with tools designed to safeguard the financial system as a whole. It is common to refer to such tools as macroprudential policies, although there is no general agreement on their definition and objectives. The standard view is that macroprudential policies address the time and cross-sectional dimensions of systemic risk in the financial system. This classification implies that the objective of macroprudential policies is to smooth financial and credit cycles, in order to prevent systemic crises and provide cushion against their adverse effects.

In this paper, we take the alternative view that regulation needs to be justified by market failures. This approach clarifies that macroprudential policies are justified by the need to correct market failures, and not simply because the financial system is “fragile.” It also provides a justification for specific forms of regulation, and a framework to analyze the economics behind recent policy proposals.

III. EXTERNALITIES

The recent financial crisis, and the debate it spurred in the literature, highlighted three main sources of market failures that may require a response in the form of macroprudential regulation. These are externalities related to strategic complementarities, fire sales, and interconnectedness, which operate between financial institutions, and therefore cannot be fully addressed by microprudential policies that view institutions in isolation.⁵ In principle, there may be other externalities that require a macroprudential policy response; the scope of our discussion is confined to these three types of externalities, reflecting the current state of knowledge.⁶

A. Externalities Related to Strategic Complementarities

Historical experience suggests that financial intermediaries tend to assume exposure to common credit and liquidity risk in the upswing of a business cycle, amplifying credit and liquidity cycles and contributing to asset price volatility.

⁵Externalities have welfare effects in the presence of asymmetric information or market incompleteness (Greenwald and Stiglitz, 1986). The papers reviewed in this section identify externalities in the financial system in the presence of such market frictions.

⁶Allen and Carletti (2011), Bank of England (2011), and Schoenmaker and Wierts (2011) provide alternative classifications of the same market failures.

One reason why banks and other financial intermediaries choose to correlate their risk is because of *strategic complementarities*, meaning that the payoff from a certain strategy increases with the number of other agents undertaking the same strategy. Some complementarities are driven by the simple market interactions of rational agents; others arise from the optimal *ex-ante* response of agents to *ex-post* government intervention in the event of a financial crisis. We refer to the effects of these strategic complementarities as externalities.

One source of strategic complementarities is related to increased competition in boom times, which may affect economy-wide credit standards. In the presence of imperfect information, banks' incentives to assess borrower risk depend on their strategic interaction. In booms, banks have fewer incentives to screen potential borrowers due to lower rents prompted by fiercer competition. As a result, they reduce screening intensity and increase lending. This causes a worsening of the pool of borrowers, which is reversed through lower credit origination and milder competitive pressures once the business cycle's contractionary phase sets in (Ruckes, 2004; Dell'Ariccia and Marquez, 2004; Gorton and He, 2008).

Another source of strategic complementarities may be due to reputational concerns and the incentives structure of bank managers. When bank managers care about the market perception of their ability, their credit policies may be influenced by those of other banks (Rajan, 1994). Benchmarking creates externalities across banks because a bank reporting poor performance due to losses will be evaluated more leniently by the market if many other banks suffer loan losses at the same time. Banks have therefore incentives to hide losses or maintain risky lending until the buildup of bad loans forces them to "coordinate" to a strategy of loss recognition and credit contraction.

The prospect of a government bailout in the event of financial distress can be another source of strategic complementarities, as it may lead banks to engage *ex-ante* in correlated asset choice. Anticipating that simultaneous bank failures trigger a bailout (to prevent a financial meltdown), banks may find it optimal to correlate risk, to maximize the probability that any failure is a joint failure (Farhi and Tirole, 2011; Acharya and Yorulmazer, 2007). As firms mimic each others' strategy, vulnerabilities in the financial system increase.

Complementarities can affect banks' asset choices or generate excessive maturity/exchange rate mismatches (Ratnovski, 2009; Allen and Carletti, 2011). The upshot of these mechanisms is that banks become exposed to the same type of risk and the quality of their portfolios worsens in a boom, creating vulnerabilities that lead to or deepen the downside of a financial cycle.

B. Externalities Related to Fire Sales

Fire sales typically arise in downturns and amplify financial distress through a pecuniary externality. A fire sale occurs when a financial institution is forced to liquidate an asset at a time when potential buyers are also troubled. Given limited potential buyers, the asset is sold at a price below its fundamental value, causing losses to the seller (Shleifer and Vishny 1992; Allen and Gale 1994). Not only does this asset fetch a lower price, but also similar assets held by other banks may decline in value. This reduces the capital ratios of these banks and

their ability to post assets as collateral, forcing them to liquidate underpriced assets. The new round of selling triggers further losses, new selling, etc. A fire sale can thus bring multiple banks to financial distress and, through this, to trigger a credit crunch with adverse real consequences.⁷

The forced sale condition is an obvious possibility for banks because one of their main functions is to issue liquid liabilities to fund investments in illiquid assets. This maturity transformation exposes banks to the risk of having to liquidate investments prematurely in case of a sudden withdrawal of funding. Although government guarantees, such as deposit insurance and liquidity facilities (discount window) reduce the likelihood of fire sales, their effectiveness is limited when banks also rely on wholesale funding, or when other important players in the intermediation process, such as broker-dealers and ‘shadow banks,’ do not (formally) benefit from such government guarantees and liquidity support.⁸

Even though the externalities associated with fire sales manifest themselves in a downturn, the imbalances that sow the risk of fire sales are often built up in booms. The reason is that atomistic agents take prices as given, but in aggregate the equilibrium price depends on their joint behavior. As a result, private agents may overborrow, leading to excessive leverage and inflated asset prices, because they do not internalize the effects that a generalized fire sale may have on the *ex-post* borrowing capacity of other agents (Caballero and Krishnamurthy, 2003; Lorenzoni, 2008; Korinek, 2011; Stein, 2012).

C. Externalities Related to Interconnectedness

Banks operate in an interconnected system, and as a result distress or failure of a bank can affect other institutions. Spillovers can arise because of asset price movements (as discussed in the previous section), bilateral interbank market exposures (Allen and Gale, 2000; Diamond and Rajan, 2005), or feedback from the real economy (Bebchuk and Goldstein, 2011).

Banks can reduce but not entirely eliminate contagion risk for two reasons. First, the shape of interconnectedness in the financial system is beyond the individual bank’s control.⁹ Second, interconnectedness may arise as a result of mutual hedging and diversification motives (Wagner, 2011; Allen et al., 2012), when they do not internalize the implications of their own actions on systemic risk (Acemoglu et al, 2012), or when they ‘neglect’ the possibility of rare

⁷There are two additional channels through which fire sales can undermine investment. First, if the price dislocation is extreme and asset prices drop extensively, then banks may find it convenient to use spare financial capacity to buy the extreme underpriced assets instead of lending to firms (Shleifer and Vishny, 2010). Second, the prospect of an *ex-post* fire sale may lead banks to take precautionary measures and hold *ex-ante* liquid assets instead of lending (Diamond and Rajan, 2012).

⁸Institutions that make up the shadow banking system are money market mutual funds, repo-financed dealer firms, and securities lenders. Shadow banks commonly obtain short-term funding in wholesale markets, and invest these funds in longer-term financial assets, performing maturity transformation that is similar to that of banks (see, e.g., Gorton and Metrick, 2011, and Pozsar et. al., 2010).

⁹For example, a bank has no control over other interbank exposures of its counterparties (see e.g., Acemoglu et al, 2012 and Nier et al., 2007).

but large shocks for behavioral bias (Gennaioli et al., 2011). The growing financial networks literature (Allen and Gale, 2000; Allen and Babus, 2009; Gai et al., 2011) suggests that high interconnectedness mitigates the impact of small shocks by spreading them, but amplifies large shocks since they can reach more counterparties.

Externalities stemming from interconnectedness are particularly strong for systemically important financial institutions (SIFIs). Unlike smaller institutions, distressed SIFIs cannot be easily wound down, since they are complex, operate internationally, and play a role as backbones of the financial infrastructure.

Historically, most interventions in SIFIs were *de facto* bailouts, which have protected their shareholders and creditors from the full scale of distress-related losses. The anticipation of bailouts has the adverse effect of increasing risk-taking incentives. It also reduces market discipline and effectively subsidizes SIFIs, especially the riskiest ones (O'Hara and Shaw, 1990; Flannery, 2009; Ueda and Weder di Mauro, 2012). In addition, the near-certain government support to distressed SIFIs introduces a race among financial institutions to become systemically important, as this implies a lower cost of funding in normal times and a better protection against losses when in distress.

While historically “systemic importance” has been associated with institutions’ size, recent events suggest a more complex picture. The interconnectedness of a SIFI is also determined by its interbank market linkages, and its effects are amplified by high leverage (Drehmann and Tarashev, 2011a). Interconnectedness may also be present in nonbanks (e.g., hedge funds or money market mutual funds), or institutions that support market infrastructure, such as central clearing counterparties.

IV. POLICIES

The ultimate goal of macroprudential policy is to reduce “systemic risk”, that is, risks that threaten the stability of the financial system as a whole, and that can adversely impact the real economy. This broad definition of systemic risk is not, however, well-suited for the formulation of macroprudential policy because it does not highlight the sources of systemic risk: market failures.

The approach taken in this paper is to view macroprudential policy as a tool to correct externalities that create systemic risk. This approach gives more structure to the definition of systemic risk, and introduces economic rationale into the discussion of macroprudential policy.

Although it is desirable to derive from first principles optimal policies that correct the externalities, a comprehensive theoretical treatment is difficult. At least since Weitzman (1974), it has become clear that optimal corrective policies rest on assumptions regarding the set of instruments and information available to the regulator (Kaplow and Shavell, 2002). Heterogeneity of agents and their capacity to engage in moral hazard also play a role (Perotti and Suarez, 2011). For the financial sector, all four dimensions are complex. Information is often asymmetric, and its production requires effort by the regulator and market participants (Flannery, 1998). Instruments include not only taxes and (various) quantity restrictions, but

also hybrids: capital and liquidity requirements combine the properties of price (in liquid markets) and quantity tools (in illiquid markets) and provide buffers to offset losses in times of financial distress. Agents have different comparative advantages in their capacity to assess, monitor, diversify, and bear risks (Boot, 2000). And, finally, there is significant scope for regulatory arbitrage, risk concealment, and moral hazard (more generally). Incorporating all of these elements into a single framework in a meaningful way is likely impossible. Analytical treatment has to be selective, looking at specific contexts and tradeoffs.

For these reasons, this paper adopts a more “practical” approach. It considers the existing set of macroprudential policy proposals (see Bank of England, 2011, and Lim et al., 2011, for overviews) and assesses their advantages and disadvantages in correcting the three externalities discussed in Section III. Specifically, it maps externalities with the following macroprudential policy proposals: capital requirements, liquidity regulation, restrictions on bank activities and asset allocation, and taxation.¹⁰ Table 1 provides a simplified representation of this mapping.

Table 1. Externalities and Macroprudential Policies

Externalities due to:	Can be addressed by:			
	Capital Requirements (Surcharges)	Liquidity Requirements	Restrictions on activities, assets, or liabilities	Taxation
<i>Strategic complementarities</i>	X		X	
<i>Fire sales</i>	X	X		X
<i>Interconnectedness</i>	X		X	X

Most of the instruments considered in this Table (e.g., capital or liquidity requirements, and restriction on assets and liabilities) are akin to tools already used in traditional microprudential regulation. What gives these instruments a macroprudential flavor is that they are not imposed to resolve agency conflicts within a bank, but rather to correct externalities that arise between banks. Consequently, these measures do not depend on bank characteristics taken in isolation (as for microprudential regulation), but are contingent on the aggregate behavior of all banks (e.g., the lending cycle) or the position of a bank within the financial system (e.g., systemic importance).¹¹

¹⁰Dynamic provisioning and leverage ratios—two commonly discussed macroprudential tools—may be considered as capital-based instruments. In our analysis, we omit the discussion of macroprudential policy tools that target market functioning and infrastructure, for example through-the-cycle margining, central clearing counterparties, and disclosure of risk.

¹¹It is worth noticing that some macroprudential tools may conflict with microprudential objectives. For example, macroprudential capital requirements are designed to be high in booms (to limit the accumulation of imbalances) and low in recessions (to avoid fire sales and deleveraging). In contrast, microprudential capital requirements become low in booms (when the volume of defaults is low) and high in recessions (when banks need more equity to absorb an increase in defaults). In downturns, pursuing solely a macroprudential objective

(continued...)

In what follows, it is explained how the instruments outlined in Table 1 can correct the three externalities. Although these instruments may be seen as substitutes, they often entail different advantages and limitations and thus become complementary tools in addressing the same externality.

A. Correcting Externalities Related to Strategic Complementarities

Of the policies considered in Table 1, two address the externalities related to strategic complementarities: capital requirements and restrictions on bank asset allocation. Both tools limit banks' expected gains from choosing correlated lending strategies: capital requirements induce banks to internalize more of the cost of engaging in risky lending; restrictions on asset allocation prevent banks from taking large risk exposures. By limiting asset growth in the upturn of the credit cycle, these tools can reduce the cost associated with adjustments in downturns.

Time-varying capital requirements, in the form of a capital surcharge linked to aggregate credit growth, are part of the new Basel III accord (Basel Committee, 2011). Basel III also allows for adjusting risk weights in order to control exposures to specific assets, such as real estate loans. The time-varying feature of this surcharge is new relative to standard microprudential regulation, and is meant to mitigate risk-taking during credit expansions.¹²

Several countries have also imposed restrictions on bank assets through caps to loan-to-value (LTV) or debt-to-income (DTI) ratios. These restrictions affect directly the asset side of banks' balance sheet and are meant to limit the fall in lending standards during boom times. Similar quantity restrictions have been used in the past as part of macro stabilization policies to control credit flows. Limits to LTV and DTI ratios have, however, a macroprudential purpose because they are designed to bind in expansions.

Although capital requirements and restrictions on assets can independently mitigate externalities associated with strategic complementarities, they have different drawbacks. Capital requirements are useful for incentives and as a buffer, but may become less effective in booms, when capital ratios increase due to high profitability and buoyant asset prices (Shin, 2011). In this instance, quantity restrictions, such as DTI and LTV ratios, can complement capital requirements by imposing direct constraints on asset allocation. They can also target specific risky borrowers and asset classes that raise macroprudential concerns.¹³

may thus lead to instability of individual banks, while a focus only on microprudential objective may lead to a deleveraging spiral at the system level.

¹²The economic effects of procyclical capital can also be replicated using dynamic provisioning, cf. Saurina (2009).

¹³Some tax-based measures, such as the reduction of tax shield on corporate debt and mortgages, and progressive income taxes, can also reduce banks' incentives to take excessive leverage and risk concentration (Blanchard, 2009; IMF, 2010a; Landier and Plantin, 2011). Although useful to reduce such risks, these tax instruments do not directly correct the source of the externality due to strategic complementarities, that is banks' incentives to benchmark or to reduce lending standards (see Section III.A).

B. Correcting Externalities Related to Fire Sales

The externalities associated with fire sales arise because banks fail to internalize the consequences of not taking precautionary measures in normal times, and thus need to adjust by shedding assets *ex-post* in the event of a negative aggregate shock. Time-varying capital requirements that are higher in upturns alleviate these externalities, by mitigating the incentives for risk-taking in booms. They also provide a buffer to offset losses and reduce the risk of selling assets at fire sale prices in downturns.¹⁴

But, fire sales can also be triggered by disruptions to bank funding markets. As witnessed during the recent financial crisis, bad news about asset values can trigger run-like reactions of creditors that stop rolling over short-term funding, forcing banks to shrink balance sheets. Accordingly, Basel III proposals to impose liquidity and stable funding requirements can be thought of as tools to limit the risk of fire sales stemming from bank reliance on short-term debt. A related way to limit the use of short-term debt is to rely on taxes calibrated to the cost difference between long- and short-term funding (Huang and Ratnovski, 2011; IMF, 2010a; Perotti and Suarez, 2011).

Capital and funding measures can be seen as complements, since they affect fire sale risks on different sides of a financial institution's balance sheet. Less obvious is the optimal choice between liquidity requirements and the taxation of unstable funding. Basel III gives preference to liquidity requirements, but there are sound arguments for taxing bank funding risk. Taxes can be easily calibrated to reflect the price difference between stable and unstable funding, and offer more flexibility during stress periods, when banks have to "eat into" minimal liquidity or accept less stable funding.

C. Correcting Externalities Related to Interconnectedness

The incentives of banks to become systemically important and to take excessive risk can be addressed through effective resolution mechanisms. However, resolution procedures remain imperfect, especially for systematically important cross-border banks (Claessens et al., 2010, 2011). Accordingly, an *ex-ante* regulatory response that aims to reduce the probability of SIFIs' distress is necessary. Three of the regulatory tools reported in Table I can achieve this objective: capital surcharges, restrictions on asset composition, and taxation.

Capital surcharges linked to a measure of systemic importance (BIS, 2011) aim to reduce incentives to become systemically important, as they increase the cost of funding.¹⁵ They also generate an additional buffer that a SIFI can use in case of distress. A downside of capital surcharges as a tool for dealing with the systemic risk created by SIFIs is that they are hard to calibrate because it is difficult to map surcharges to SIFI contributions to systemic risk.¹⁶ In

¹⁴For nonbank financial institutions engaged in market-based activities, macroprudential regulations can take the form of procyclical margin requirements (see, e.g., Geanakoplos, 2009; Gorton, 2009; Gorton and Metrick, 2010).

¹⁵This effect can be offset when a designation of an institution as systemically important lowers the required return on its debt and equity

¹⁶See IMF (2010b) for a discussion of the calibration of systemic risk-based capital surcharges.

addition, by making the list of SIFIs public, the surcharges can weaken creditor discipline, exacerbating the SIFI problem.

Complementary tools are restrictions on the composition of bank assets, as envisioned by the Volcker rule to limit proprietary trading or by the recommendations of the UK Independent Commission on Banking (the so called Vickers Commission) to sever links between retail and investment banking operations. These tools are intended to limit the implicit subsidy of SIFI funding and to provide a firewall protecting systemically important bank operations from risky activities. The key challenge in implementing restrictions on activities is that it is difficult to determine the optimal scale and scope of a bank. As a result, restrictions on activities target only the most evident sources of risk, and can, at best, only complement capital requirements.

The academic debate has also suggested that systemic risk can be addressed through Pigouvian taxes. Such taxes, based on a measure of systemic risk externalities, can force a SIFI to internalize the systemic risk it creates. While theoretically appealing, the implementation of Pigouvian taxation is complicated because it is difficult to measure with sufficient precision the systemic risk contribution of financial institutions (IMF, 2010a; Kocherlakota, 2010; see also Section IV E).

D. The Central Role of Capital-Based Tools

The discussion so far suggests that the instruments highlighted in Table 1—capital requirements, liquidity requirements, restrictions on bank activities, and taxes—have distinct properties, and tend to complement each other in addressing the same externality. Accordingly, no single instrument is *a priori* a “silver bullet.” A combination of instruments may seem, instead, more appropriate to correct the same externality.

Nevertheless, it appears that capital requirements are likely to play a key role in the design of macroprudential regulation. As discussed above, tools based on time-varying and systemic risk-based capital surcharges can play a role in addressing any of the three externalities leading to systemic risk. Moreover, capital-based tools are closely linked to microprudential regulation and are part of the Basel III accord.

This means that banks—especially the systemic ones and more so during booms—may have to maintain significantly higher capital buffers than it is required today. But what are the costs of higher capital requirements? The prevailing view in the literature is that, in the long-run, the impact of higher bank capital on the cost of loans is likely to be small (Kashyap et al., 2010; Admati et al., 2010; Herring, 2011; Mehran and Thakor, 2011). The transition to higher capital may, instead, be more costly, unless higher capital requirements are introduced

gradually, allowing banks to use retained earnings and to time the market for any new equity issuance.¹⁷

E. Externalities and Systemic Risk Measurement

Systemic risk is a multi-faceted phenomenon. As such there are a variety of metrics that help either signal the gradual buildup of imbalances or flag the concentration of risk within the system (Borio and Drehmann, 2009; Bisias et al., 2012).

Each of these metrics captures some of the contribution to systemic risk of the externalities considered in this paper. For example, deviations from trend (gaps) in the credit-to-GDP ratio, property prices, risk premia, or leverage can be used to identify externalities related to strategic complementarities or imbalances that lead to fire sales in downturns (Drehmann et al., 2011; IMF, 2011b; Dell’Ariccia et al., 2012). Similarly, measures of systemic risk contribution, such as CoVaR (Adrian and Brunnermeier, 2011) and systemic shortfall (Acharya et al., 2010; Drehmann and Tarashev, 2011b) can proxy externalities related to interconnectedness. The degree of interconnectedness can also be captured by stress-tests (Brunnermeier et al., 2010; Duffie, 2011) and forward-looking risk indicators (Capuano, 2008; Gray and Jobst, 2011).

Although useful to highlight vulnerabilities, these metrics are not sufficient to formulate a policy response. The reason is that some of these measures can proxy for more than one source of externality, for which an adequate response may require policy tools with possibly conflicting objectives. For example, high mortgage credit growth may be caused by a deterioration of lending standards or more simply signal the buildup of excessive risk in the mortgage market. Accordingly, the optimal tools to address the two underlying problems might be different.

Another major challenge is the calibration of macroprudential policy instruments. There is recent evidence that some tools are useful in reducing systemic vulnerabilities, but too little is known quantitatively.¹⁸ So far, policymakers have framed macroprudential policy on “rule of thumb” considerations. But, to make the policy design more precise, it is necessary to gain evidence on the effectiveness of macroprudential policy tools. For example, it is far from clear how high should capital surcharges be or what should be the optimal level of an LTV ratio. Further fundamental and applied research on the optimal choice and calibration of macroprudential policy tools is required in order to justify policy intervention and avoid regulatory discretion.

¹⁷See De Nicolò et al. (2012) and Repullo and Suarez (2012) for model-based estimates of transition and steady-state impact of higher capital requirements. Flannery (2009) and French et al. (2010) argue that the tax shield costs of higher equity can also be offset using convertible instruments such as contingent capital.

¹⁸See, for example, Crowe et al. (2011), Lim et al. (2011), and Dell’Ariccia et al. (2012) for evaluations of the effectiveness of some macroprudential policy tools.

V. CONCLUSIONS

This paper has argued that the first step in the economic analysis of macroprudential policy is the identification of market failures that contribute to systemic risk. Externalities are an important source of such market failures, and macroprudential policy should be thought of as an attempt to correct these externalities.

Building on the discussion in the academic literature, the paper has identified externalities that lead to systemic risk: externalities due to strategic complementarities, which contribute to the accumulation of vulnerabilities during the expansionary phase of a financial cycle; and externalities due to fire sales and interconnectedness, which tend to exacerbate negative shocks especially during a contractionary phase.

The correction of these externalities can be seen as an intermediate targets for macroprudential policy, since policies that control externalities mitigate market failures that create systemic risk. This paper has studied how the identified externalities can be corrected by the main macroprudential policy proposals: capital requirements, liquidity requirements, restrictions on bank activities, and taxation. The main finding is that even though some of these policies can complement each other in correcting the same externality, capital requirements are likely to play an important role in the design of any macroprudential framework.

It has also been argued that although externalities can be proxied through a variety of risk measurements, the accumulation of evidence on the effectiveness of alternative policy tools remains the most pressing concern for the design of macroprudential policy.

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