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The Rhyme and Reason for Macroprudential Policy

Four Guideposts to Find Your Bearings

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Abstract

This paper explores the conceptual foundations of macroprudential policy. It does so within a framework that gradually incorporates and interacts two types of frictions (principal-agent and collective action) with two forms of rationality (full and bounded), all in the context of aggregate volatility. Four largely orthogonal rationales for macroprudential policy are identified. The first *(time consistency macroprudential)* arises even in the absence of externalities, not to prevent financial crises but to offset the moral hazard implications of (efficient but time inconsistent) post-crisis policy interventions. The second *(dynamic alignment macroprudential)* protects the less sophisticated (boundedly rational) market participants by maintaining principal-agent incentives continuously aligned along the cycle and in the face of aggregate shocks. The third *(collective action macroprudential)* responds to the socially inefficient yet rational instability resulting from uninternalized externalities. The fourth *(collective cognition macroprudential)* aims at tempering non-rational mood swings where credit-constrained rational arbitrageurs fail. Finding the right policy balance is complicated by the fact that the four dimensions face policy trade-offs and their relative importance is state-dependent, hence shifts over time.

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The Rhyme and Reason for Macroprudential Policy: Four Guideposts to Find Your Bearings

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1. Introduction

In the wake of the recent global financial crisis, macroprudential policy proposals have flourished and experimental implementation is in full swing. However, the conceptual underpinnings of this new policy are still at an embryonic stage. While macroeconomic modeling with financial frictions—a research agenda most suitable to macroprudential policy development—has made impressive progress over the last fifteen years (to the point where, arguably, finance is no longer a "veil"), the gap between theory and policy remains large.[1]

In particular, the literature all too often fails to distinguish *constrained inefficient* equilibria and dynamics, where hands-on macroprudential regulation (aimed at influencing systemic risk buildup in financial markets) may improve the outcome, given the constraints, from *constrained efficient* equilibria and dynamics, where regulators cannot directly improve the outcome and, hence, financial policy can only help indirectly (if at all) by easing the constraints (i.e., by providing public goods that help improve the market-enabling environment). Nor does the literature systematically distinguish *policy-induced inefficiencies*—arising from bad policies or the unintended consequences of good policies and calling in all cases for prudential policy adjustments—from *market-induced inefficiencies*—where prudential policy may or may not be called for and the suitable policy response varies depending on the nature of the failure.

To help bridge these gaps, in de la Torre and Ize (2013) we sort out the conceptual foundations of macroprudential policy by systematically reviewing the theoretical literature on financial frictions. We do so within a framework that gradually incorporates into the Arrow-Debreu world two basic types of frictions (principal-agent vs. collective action), two types of risk (idiosyncratic vs. aggregate), and two forms of rationality (full vs. bounded), thereby obtaining eight domains with specific dynamics that call for specific policy responses.[2] This paper is a streamlined version of that broader paper. The main arguments are presented here in more succinct form and focus exclusively on the four domains where there is aggregate volatility, i.e., where there are the minimum grounds needed to justify macroprudential policy.[3]

Our analysis leads to the identification of four distinct (largely orthogonal) rationales for macroprudential policy, as summarized in Table 1. Each arises within a

[1] Brunnermeier, Eisenbach and Sannikov (2012) provide an excellent recent technical survey of the theoretical literature on the macroeconomic impact of financial frictions. Bank of England (2009), Borio (2011) or Galati and Moessner (2012) provide broad overviews of macroprudential policy proposals. A small but growing literature, such as Hanson, Kashyap and Stein (2011), Longworth (2011) or De Nicolo, Favara and Ratnovski (2012), attempts to connect the two strands of literature.

[2] Our paper covers much of the same ground as Brunnermeier, Eisenbach and Sannikov (2012). However, it does so based more on intuition and the preponderance of reasons rather than on mathematical proofs.

[3] We posit that aggregate risk is the key factor separating the realms of micro and macroprudential oversight. Without it, it is difficult to conceive how financial markets could be systemically unstable. In de la Torre and Ize (2013), we also explore the foundations of microprudential oversight, based on four analogous domains to the ones indicated in Table 1 for macroprudential oversight, but where risk is purely idiosyncratic.

"domain" where aggregate risk (G) interacts with different constellations of frictions and forms of rationality, as denoted by the three capital letters that we use to label each of the four cells ("domains") in the table.[4] The information in Table 1 is additive. That is, the second column adds collective action frictions (C)—leading to uninternalized externalities, coordination failures, free riding, etc.—to the principal-agent frictions (A) whose market failure manifestations—limited pledgeability, private moral hazard, adverse selection, etc.—dominate the first column. Similarly, to the fully rational world (F) of the first row, the second row adds cognitive frictions (or deviations from neoclassical utility postulates), leading to boundedly rational players (B).

Table 1: Macroprudential Policy Map
*(Aggregate volatility (**G**) permeates all cells)*

	Agency Frictions (A)	**Agency + Collective Frictions (C)**
Full Rationality (F)	**GFA** Private Sector - Public Sector Wedge ***Time Consistency Macroprudential*** Correcting incentive distortions due to the expectation of post-crisis interventions	**GFC** Individual - Social Wedge ***Collective Action Macroprudential*** Internalizing externalities (controlling crowds and curbing adverse spillovers)
Full + Bounded Rationality (B)	**GBA** Sophisticated - Unsophisticated Wedge ***Dynamic Alignment Macroprudential*** Aligning principal-agent incentives on behalf of the unsophisticated	**GBC** Collective Perception - Reality Wedge ***Collective Cognition Macroprudential*** Tempering irrational mood swings where rational arbitrageurs fail

The rest of this paper is organized as follows. Sections 2-5 discuss the rationales behind each of the four types of macroprudential policy appearing in Table 1—*time consistency, dynamic alignment, collective action, and collective cognition*—and characterize their dynamics as well as the policy response that best suits them. Section 6 concludes with some reflections on policy tensions and tradeoffs, issues in macroprudential policy design, and priorities for the research agenda lying ahead.

[4] Bounded rationality may result from cognitive (information processing) frictions or from deviations from the postulates of neo-classical utility theory. In either case, it gives rise to unsophisticated depositors (in the agency world) or momentum traders (in the collective world).

2. Time consistency macroprudential

The first distinct type of macroprudential policy, which we label *time consistency macroprudential*, arises in the GFA domain not to prevent systemic crisis but to offset the incentive distortions that arise from post-crisis policy interventions. Despite full rationality and the absence of collective action failures, financial volatility in this domain can be substantial because the interaction of sufficiently large aggregate shocks with agency frictions, magnified by endogenous dynamics, can give rise to persistent, non-linear amplification effects (large responses to small variations in the agency constraints) that may well end up in painful crises. For example, a positive aggregate shock (e.g., a financial innovation) can significantly relax collateral constraints, thereby amplifying a leveraged credit expansion, while a negative aggregate shock (e.g., some quirky macroeconomic turn of events) can so destroy financial intermediaries' net worth and tighten collateral constraints as to magnify persistency effects and downward spirals marked by massive fire sales and deleveraging.[5]

However, such (potentially large and pro-cyclical) volatility is constrained efficient, hence does not warrant any preventive macroprudential policy. There are two basic reasons for this. On the one hand, in the absence of uninternalized externalities and given full rationality, risk taking by individual market participants is socially optimal. On the other hand, official regulators do not have an obvious comparative advantage, whether informational or in enforcement, in dealing with the underlying principal-agent frictions that are driving the show. Thus, they cannot do any better than markets in circumventing or easing the associated constraints. This implies that at least part of the real world volatility in financial markets should be constrained-efficient because it corresponds to tail risk events akin to 100 hundred-year floods.[6] A central planner would not set prudential buffers high enough to totally eliminate the risk of such events because the costs would outweigh the benefits.

By contrast, the state has clear comparative advantages over markets in speeding up the post-crisis recovery (hampered by heightened agency frictions and long-lasting persistence effects) because its taxation capacity allows it to resolve collective action problems by providing public goods (Bianchi, 2013), to issue (risk free) debt (Holmstrom and Tirole, 1998), and to spread risk more finely, including across generations (Arrow and Lind, 1970). This allows the state to fill up aggregate liquidity shortages, undertake lender-of-last-resort operations (LOLR), redistribute assets from the rest of the economy to financial intermediaries, absorb risk through risk-absorption-of-last-resort operations

[5] *Persistence effects* linked with asset prices were first identified by Bernanke and Gertler (1989) and Carlstrom and Fuerst (1997); *amplification effects* linked to convex adjustment costs and asset fire sales were analyzed by Bernanke, Gertler and Gilchrist (1999) and Kiyotaki and Moore (1997). More recent strands of literature have focused on financial accelerator effects (Adrian and Shin, 2009) and the role of precautionary liquidity and liquidity spirals (Brunnermeier and Pedersen, 2009; He and Krishnamurthy, 2012; Brunnermeier and Sannikov, 2012a).

[6] This is indeed what Bianchi (2011) concludes: "*it is socially optimal to experience a crisis in some unfortunate states of nature*". Allen and Gale (2007) present views along broadly similar lines.

(RALR), and inject capital where needed to facilitate re-intermediation.[7] Note that, rather remarkably, these post-crisis policy interventions can be justified without recourse to uninternalized externalities.

These interventions create a clear conundrum, however. It is not optimal for financial authorities to intervene ex ante, through prudential regulation, to prevent a crisis. Yet, it is optimal for them to intervene vigorously ex post in the event of a crisis. The state may thus follow time inconsistent policies, for it cannot credibly commit not to intervene in a crisis (Jeanne and Korinek, 2012). However, this commitment problem does not of itself weaken market discipline. In effect, if post-crises interventions could be strictly and systematically targeted only to solvent institutions, they would not bail out bank shareholders or creditors, hence would not distort ex ante risk taking behavior. However, just as any other market participant, the state has difficulties in assessing solvency problems (and distinguishing them from pure liquidity problems), particularly in the midst of a crisis when information asymmetries tend to intensify. Therefore, post-crises interventions via LOLR and RALR operations cannot in practice fully prevent bailouts. While a countercyclical monetary policy can improve targeting—by benefitting the most the intermediaries with the better (quality of) assets (Farhi and Tirole, 2011)—such a policy amounts to a put option provided free of charge. When anticipated, this option may induce market participants to take more risk and hold less liquidity than would be socially desirable, thereby increasing the likelihood of a crisis and the concomitant use of a monetary policy that is ex post optimal (given the crisis) but ex ante undesirable. Thus, in practice, the government's inability to commit drives an ex ante wedge between the interests of private financial market players and those of society (taxpayers).

Some combination of ex post interventions and an ex ante macroprudential policy aimed at curbing the public moral hazard associated with the expectation of ex post interventions is thus generally called for (Bianchi, 2013). For this, time consistency macroprudential policy needs to act on two fronts. First, it must improve the efficiency of post-crisis interventions and reduce their bail-out component, especially by enhancing the failure resolution framework for systemically important financial institutions (SIFIs) so that private capital can be quickly brought into (or reshuffled among) financial intermediaries and disciplining haircuts can be applied as needed to shareholders and creditors.[8] Second, the LOLR and RALR facilities must be priced ex ante in a way that discourages public moral hazard—including through systemic liquidity requirements that

[7] Post-crisis aggregate liquidity shortages may arise in the GFA domain if firms with excess liquidity are prevented by collateral and information asymmetry constraints to lend to firms with liquidity gaps (as in Woodford, 1990); or if, as a result of a large aggregate shock, all firms find themselves on the demand side of the market, i.e., in need of liquidity (as in Holmström and Tirole, 1998). Countercyclical monetary policy in the midst of a financial crisis can perform what Brunnermeier and Sannikov (2012b) call "stealth recapitalizations"—the lowering of interest rates redistributes wealth by providing windfall gains to financial intermediaries. As argued by Farmer (2012), RALR operations—whether through government-led asset purchases or targeted recapitalizations—are particularly effective in an overlapping generations setting.

[8] The current proposal in financial policy circles to require financial intermediaries to hold significant amounts of "bail-inable" liabilities is particularly germane in this respect.

limit the scope for free riding (Farhi and Tirole, 2011) or ceilings on leverage that reduce the benefits of bailouts (Chari and Kehoe, 2013).

3. Dynamic alignment macroprudential

The southwest domain in Table 1 (GBA) adds boundedly rational (unsophisticated) players to the GFA mix. Even in the absence of aggregate risk, the presence of unsophisticated players can justify microprudential regulation and limited deposit insurance. Because they cannot make efficient use of information, even when available at no cost, the unsophisticated can be taken advantage of by the sophisticated and discouraged from financial transacting. To prevent this, the unsophisticated can ask someone (presumably a fully rational agent) to represent their interests. But since the state has a comparative advantage in resolving such collective action problems, it is best habilitated to assume this function, as a public good. An official supervisor can thus represent the unsophisticated and act on their behalf to ensure—through microprudential policy—so that the incentives of agents and principals remain aligned.[9] At the same time, a limited deposit insurance can be used as a further guarantee of protection, including from inappropriate actions of the state whose own regulatory failures could lead to unforeseen bank failures.

Aggregate volatility adds a dynamic and systemic dimension. To maintain incentives continuously aligned in an ever-evolving environment, the regulator must now calibrate and recalibrate prudential oversight as needed over time in response to cyclical fluctuations or aggregate shocks (for example, a financial innovation or an unexpected shift in monetary policy). This is the core rationale for a second variant of macroprudential policy, which we label *dynamic alignment macroprudential*. As in the case of microprudential policy, the macroprudential regulator continues to focus on principal-agent incentives and individual financial intermediaries rather than on systemic interactions. Yet, this policy can legitimately be defined as macroprudential because it must respond to an aggregate volatility that can eventually undermine the soundness of the system as a whole. In effect, since banks are subject to similar shocks, they may end up following similar dynamics that, in the absence of a proper regulatory response, can lead them all to fail at the same time.[10]

Remarkably, the justification for dynamic alignment macroprudential oversight is the unavoidable consequence for the state of having engaged in microprudential oversight. Once the regulator has made the choice of representing the unsophisticated in a world of purely idiosyncratic risk, he becomes automatically responsible for continuing to assume

[9] This is consistent with Dewatripont and Tirole's (1994) theory of "delegated supervision."

[10] An early discussion of the role of macroeconomic factors in banking crises can be found in Gavin and Hausmann (1996). Focusing on Latin America's macro-financial volatility, they find that banking crises are more often than not preceded by credit booms and argue that the excessive lending in good times reflects information problems, whereby "good times are bad for learning." Allen and Gale (2000) present an early model of moral hazard-induced asset bubbles that derive from aggregate risk in a pure agency world. Borio (2003) provides a first integrated discussion contrasting the micro and macro prudential perspectives to regulation.

this function effectively and proactively in a world of aggregate risk. Thus, constrained inefficient financial volatility in the GBA domain is a manifestation of policy failure (a regulator that falls asleep at the wheel), rather than market failure.

The GBA domain gives public moral hazard a further boost. Instead of monitoring and leaving in droves as soon as the intermediary takes excessive risk following the regulator's failure to adjust regulation optimally over time, the sophisticated are better off staying put and taking one-sided bets. As long as the going remains good, they benefit from the upside. But when the bad times come, they can walk away with their profits by exiting early. In turn, they can do this because the smaller depositors, being covered by the deposit insurance, have no reason to run (Huang and Ratnovski, 2011). Thus, although the sophisticated investors are not directly covered by the deposit insurance, they can appropriate it to their benefit if it is not properly priced.

A policy toolkit congenial to dynamic alignment macroprudential oversight would thus include a mix of rules-based countercyclical (or through-the-cycle) capital or provisioning requirements and state-contingent, discretionary oversight (regulatory activism). Given the emphasis on principal-agent incentives, this mix needs to be supported by mark-to-market accounting, forward-looking provisioning requirements, and longer-term oriented compensation systems for asset and bank managers. It may also include cycle-oriented macro-prudential tools such as a countercyclical capital buffer, contingent capital, and mandatory capital insurance. Such a broad regulatory agenda is indeed at the core of Basel III.

In addition, to combat public moral hazard and align the interests of the sophisticated financial market participants with those of the taxpayer, the regulator needs to appropriately price the deposit insurance or replace it with other forms of insurance or capital requirements. However, doing this right is not likely to be easy (Kahsyap, Rajan and Stein, 2008). The bar is raised even higher because the regulatory requirements (for example capital requirements) that optimally align the interests of the principals with those of their agents (i.e., that eliminate *private* moral hazard) have no reason to necessarily coincide with those that optimally align the interests of market participants with those of the state (i.e., that eliminate *public* moral hazard).

4. Collective action macroprudential

The northeast domain (GFC) in Table 1 adds collective frictions to the GFA mix, while keeping the assumption of full rationality. Uninternalized externalities dramatically boost amplification effects (via fire sales, deleveraging, margin calls, etc.) and cause the invisible hand to fail, as rational market participants do not take into account the systemic consequences of their individual actions. Thus, financial fluctuations can become excessive from the social point of view, reflecting a basic market failure rather than a policy failure. At the same time, the social costs of crises, which now include the adverse effects of uninternalized externalities (e.g., the destructive ripple effects of bank and payment system failures), strengthen the grounds for post-crisis LOLR and RALR policy interventions.

We identify four basic types of negative externalities: [11]

a. *Pecuniarity externalities*—the adverse impact on others via prices of the fire sales and credit crunches that take place during busts but are not internalized during booms.[12]
b. *Behavioral externalities*—coordination failures and herding effects that result in self-fulfilling attacks, whereby everybody runs to precipitate the collapse, or in Chuck Prince-type effects, whereby everybody stays to feed the bubble.[13]
c. *Informational externalities*—free riding that leads to the underproduction and perverse spillovers of information (the widespread use of the same risk management model, a run on a solvent bank because of signals stemming from the failure of another, etc.).[14]
d. *Interconnectedness externalities*—buildup of vulnerabilities in the network of financial contracting as players do not internalize the "socially excessive" costs of eventual network failures (disconnection of vital flows, chain reactions, financial gridlock, destruction of information, etc.).[15]

In all cases, uninternalized externalities expose various fallacies of composition—e.g., that the financial system as a whole is not just the sum of its components; that every individual institution can draw at the same time on a collectively supplied source of liquidity; or that the accumulation of individual insurance can actually make the system weaker. Externalities also erode the viability of a narrowly and sharply drawn perimeter for prudential oversight. While rational players outside the perimeter may discipline each other when coping with principal-agent frictions, they have full freedom to maximize private risk-return strategies without regard for their social implications. As prudential regulation within the perimeter may impose at least a partial internalization of externalities, a large wedge in returns between the regulated and unregulated spheres may

[11] De Nicolo, Favara and Ratnovski (2012) propose a rather similar typology, albeit with a somewhat different terminology and without including informational externalities.

[12] Pecuniary externalities have no significant welfare impact as long as there are no trading constraints because the welfare effects caused by changing market prices cancel out on both sides of the market. With a trading constraint, however, this is no longer the case, as constrained players may have higher marginal utilities than unconstrained players. Under such conditions, borrowers borrow too much during the booms because they do not internalize the fact that conserving more liquidity would be welfare improving as it would help relax everybody else's borrowing constraint during the busts (see Jeanne and Korinek, 2010; or Bianchi, 2011).

[13] Bank runs are of course the most familiar case of coordination failures (Diamond and Dybvig, 1983; Rochet and Vives, 2004). But many other forms of runs are analyzed in the literature (see for example Morris and Shin, 2003). Herding dynamics induced by reputational concerns are analyzed by Rajan (1994 and 2005), among others.

[14] Herds can result in socially inefficient and/or fragile equilibria, where a small piece of new information can lead to a radically different equilibrium (Banerjee, 1992; Chari and Kehoe, 2000). New signals can also lead to inefficient contagion (Gorton, 1988; Kodres and Pristker, 2002; Rochet and Vives, 2004).

[15] The literature on interconnectedness externalities is too vast to be reviewed here in any detail. Just to cite a few examples, the links between asset price, risk appetite, leverage, funding maturity and the length of intermediation chains are analyzed by Adrian and Shin (2008); the vulnerability of networks to contagion effects is discussed by Gai, Haldane and Kapadia (2011), Freixas and Parigi (1998) and Allen and Gale (2000); contagion through intermediaries' exposure to similar assets is discussed by Cifuentes, Ferrucci and Shin (2005); the interconnectedness of creditors that results from their exposure to the solvency constraint of the same financial institution is modeled by Brunnermeier and Oehmke (2010).

arise. By spurring the expansion of "shadow banking" and encouraging even the unsophisticated investors to abandon in droves the safe shores of the regulated world, this wedge can undermine consumer protection at its very core (de la Torre and Ize, 2010).

Once externalities interact with agency frictions in a context of aggregate volatility, public moral hazard can dramatically intensify and, interestingly enough, become ever more treacherous as financial systems develop. Thus, the negative externalities associated with bank failures can significantly increase, boosting the *social benefits* of bailing out insolvent institutions. In addition, herding effects can intensify, raising the *odds* that the state will conduct such bailouts or be induced to follow a post-crisis accommodative monetary policy. As a result, banks may have greater incentives to correlate their investment choices (Acharya and Yorulmazer, 2008; Farhi and Tirole, 2011) and become "too many to fail" or to grow bigger and become "too big to fail." Moreover, the deepening of finance quickened by information technology naturally raises the incentives for players to free ride on the liquidity and information provided by denser markets. This strengthens investors' bias in favor of liquid assets and reliance on "timely exit" rather than "monitoring" (Huang and Ratnosvki, 2011).

All of this sets the grounds for a third distinct type of macroprudential policy, which we label *collective action macroprudential*. It aims at correcting the failure of market discipline that leads to inefficient financial instability precisely where the state has a comparative advantage—by solving collective action problems. Hence, collective action macroprudential is oriented at the system rather than at its parts, and focuses on inducing players to internalize externalities. It also must appropriately price the financial safety net. The suitable macroprudential policy toolkit is, however, not independent of the type of externality.

Pigouvian taxes (aimed at, say, penalizing credit expansion based on non-core short-term funding) and/or *quantitative regulations*, such as higher capital requirements or systemically oriented liquidity requirements that penalize short-term wholesale funding, appear most suitable to deal with pecuniary externalities.[16] Crowd control-type measures, such as circuit breakers that suspend asset markets trading in extreme circumstances or systemic liquidity requirements, are arguably salient candidates to address behavioral externalities. Informational externalities, by contrast, put a premium on such actions as state-sponsored generation of systemic information (e.g., financial stability reports by central banks), disclosure requirements and monitoring incentives, and the official oversight of rating agencies. Finally, since the potential vulnerabilities of financial contracting networks are significantly associated with too-big-to-fail and too-interconnected-to-fail effects, interconnectedness externalities naturally point towards macroprudential policies that focus on financial structure—e.g., limits on the size and systemic footprint of financial intermediaries, functional segmentation (e.g., Volcker rule-type proposals that separate investment and commercial banking), and incentives to foster diversity (of actors, intermediaries, portfolio compositions) in the financial ecosystem.

[16] See Farhi, Golosov and Tsyvinski (2009) and Perotti and Suarez (2011).

5. Collective cognition macroprudential

Finally, the southeast GBC domain adds collective cognition frictions to the mix, thereby becoming the densest domain of Table 1. Bounded rationality effects are added to a world that is already complicated by principal-agent frictions, collective action failures, and aggregate risk. The fact that boundedly rational momentum traders engage in financial contracting alongside rational arbitrageurs should in principle promote trading and arbitrage (Milgrom and Stokey, 1982; Geanakoplos, 1992). However, rational arbitrageurs may not be able to dominate the market outcome because collateral and information asymmetry constraints may limit their capacity to borrow and thus engineer a successful leveraged attack (Shleifer and Vishny, 1997), or because they cannot coordinate due to lack of common knowledge (Abreu and Brunnermeier, 2003).

Thus, the less rational "noise traders" may end up dominating the markets through the momentum they impose on prices. By pushing prices away from fundamentals, they impose a negative perceptional externality on everyone else, thereby adversely affecting social welfare (De Long, Shleifer, Summers and Woldman, 1990). In the process, noise traders can generate massive and irrational mood swings, whereby bouts of exaggerated optimism and exuberance are followed by panic-driven downward spirals, without rational players being able to do much about it.[17] The amplitude of the mood swings is typically exacerbated by the presence of irreducible (Knightian) uncertainty. For example, with surprises boosting uncertainty, market participants may shift defensively from expected utility maximization to socially inefficient maximum loss minimization, triggering abrupt flights into cash and a collapse of market prices (Caballero and Krishnamurthy, 2008; Caballero and Kurlat, 2009).

In this world, equilibria are again constrained inefficient and justify a fourth distinct role for macroprudential policy, which we label *collective cognition macroprudential*. It is oriented at tempering irrational mood swings. Preventive macroprudential policy is in this case justified not because the regulators are smarter than rational market participants but because they can solve collective action problems where rational arbitrageurs cannot. Crucially, unlike in its previous roles, macroprudential policy no longer seeks to correct and align incentives, but instead to guide markets away from irrational, hence ultimately unsustainable, trajectories.

It is difficult to clearly identify the policy toolkit that is consistent with the role of collective cognition macroprudential. Such toolkit is likely to involve a "kitchen sink" approach that relies largely on judgment and rough, can-do, second-best instruments. Thus, the state may use judgment-based (discretionarily adjusted) macro-prudential regulation and tools (e.g., increases in reserve requirements or calibrations to maximum debt-to-income or loan-to-value ratios) so as to maintain financial activity within a reasonably safe

[17] Minsky (1974), Kindleberger (1978), and Shiller (2000) present broad-based perspectives consistent with fairly extreme versions of mood swings (irrational exuberance, manias and panics). De Grauwe (2008) analyzes milder varieties of mood swings and expectational biases within a traditional macro model.

path that does not contribute to feed the frenzy. Controls on financial innovation may also be needed to limit adverse cognitive spillovers.

6. Policy tensions and tradeoffs: It is all about finding the right balance

Much progress has been (or is on the verge of being) achieved in incorporating into prudential oversight the main lessons of the recent global financial crisis. However, many gaps remain. Keeping track of progress in terms of our conceptual framework, a simple scorecard would report the following. Ranked by order of where the most progress has been achieved, dynamic alignment macroprudential oversight should probably be listed first. In effect, Basel III has made important contributions to making prudential norms less pro-cyclical and introducing more forward-looking regulations, particularly as regard provisioning (where perhaps less has been achieved thus far is as regard cyclically adjusted compensation). As regard collective action oversight, Basel III has made some progress on systemic liquidity requirements, and the US authorities on SIFI regulation. Much remains to be done on issues related to the regulatory perimeter, however. And as for Pigouvian taxation, it remains for the most part "terra incognita". As regard collective cognition, progress has been made on institutional matters (financial stability councils and the like), which should help set the grounds for a more pro-active, judgment-based style of oversight. However, there are as yet no tested macroprudential tools to dampen moods in deep financial systems. Finally, as regard time consistency macroprudential oversight, nothing of substance has yet been achieved. Even on the seemingly most straightforward matter of revisiting deposit insurance and its pricing, all remains to be done.

To a good extent, this uneven state of affairs reflects the fact that most progress to date was achieved where there was the least radical departure from the pre-crisis state of regulation, as indeed was the case of dynamic alignment oversight.[18] However, as the macroprudential policy agenda incurs into less charted territories—say the internalization of externalities through Pigouvian taxes—the more strenuous further progress is likely to become. And the more likely it is that progress will be conditioned to satisfactorily bridging the gap between theory and practice through better identification of the main frictions and failures at work. For example, externalities will need to be more formally incorporated in theoretical modeling, in a way that provides a reasonable feel for their welfare impact, i.e., the extent to which they condition the results of the models. It is at present all too often the case that models of financial volatility combine frictions (or sources of volatility) of various types without making a conscious effort to sort out their relative contribution. This effort of attribution will of course also need to be accompanied by parallel empirical efforts to estimate and calibrate the net impact of regulations, while at the same time gauging their unintended side effects.[19]

[18] In addition, in the advanced economies, financial systems are still in the deleveraging process and the unwinding of massive post-crisis interventions (particularly, quantitative easing) is still pending. This reduces the incentives to introduce deeper reforms in macroprudential policies since these are, by definition, of a preventive nature.

[19] The same effort of attribution can of course also be usefully applied to the history of financial crises. For example, the S&L 1982 crisis was a clear case of dynamic alignment policy failure. The bank panics of the 19th century can be similarly attributed to pure agency frictions, albeit the evidence there is somewhat less clear-cut (Calomiris and Gorton, 1991). On the other hand, as noted by De la Torre and Ize (2010), it is difficult to understand

By providing a detailed roadmap, our conceptual framework should be of help. The central point of our analysis is that macroprudential policy needs to be built around four basic, largely orthogonal dimensions, each of which has its own logic and dynamics and emphasizes different drivers of systemic financial instability and crises. In the GFA domain, crises are tail events triggered by large exogenous shocks magnified by nonlinear, endogenous responses to the tightening of principal-agent frictions. By contrast, crises result from the gradual buildup of policy failure-induced incentive misalignments in the GFA domain; un-internalized externalities in the GFC domain; and seemingly self-fulfilling perceptional biases in the GBC domain. Given that similar symptoms can reflect very different underlying forces, suitable policy responses require a reasonable sense of what is behind the observed financial turbulence, when and to what extent such dynamics are constrained inefficient so that it makes sense to act, whether the inefficiencies are mainly driven by policy failures or market failures and, in the latter case, whether the relevant market failures reflect mainly public moral hazard, substantial externalities that rational players do not internalize, or irrational mood swings driven by noise traders.

Knowing where (in which domain) a financial system finds itself matters all the more because financial systems wander, so to speak, from domain to domain. While all the frictions and sources of aggregate volatility contained in the densest (GBC) domain of Table 1 are present in real-life, not all have first-order effects in every place and at all times. Thus, financial systems may shift from one domain to another, depending on the stage of economic and financial development, structural and institutional peculiarities, intensity of financial innovation, nature of the business cycle, configuration of relevant policies, etc. Hence, identifying the approximate domain in which financial systems find themselves is crucial to adequately tailoring macroprudential policy.

Finding a proper balance in macroprudential policy is further complicated by tensions and trade-offs in policy impacts across domains. For example, penalizing short-term wholesale funding may be good to deal with collective action failures (it induces the internalization of externalities associated with systemic runs and liquidity risk) but can exacerbate agency failures (it weakens the ability of principals to discipline agents by holding them on the "tight leash"). Mark-to-market requirements can have similarly conflicting impacts—they help markets cope with principal-agent frictions but can magnify contagious runs or spur irrational mood swings. Likewise, while limits on the size of SIFIs can significantly reduce efficiency in a GFA-type domain, they are desirable to induce the internalization of interconnectedness externalities in a GFC-type domain, but they are ineffective to deal with irrational mood swings in a GBC-type domain.

Moreover, macroprudential policies aimed at addressing systemic risks in a collective action domain can act as a common factor (or as an aggregate shock) inasmuch as they affect financial intermediaries and financial contracts across the board. Hence, offsetting the incentives distortions that these policies can produce in the agency domains

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the recent global financial crisis in all its manifestations and complexity without recurring to a mix of all four macroprudential dimensions.

may require countervailing macroprudential policies. For example, a Pigouvian tax or liquidity requirement that penalizes short-term funding under a collective-action rationale may undermine market discipline under a dynamic-alignment rationale, thereby requiring an offsetting boost in capital requirements.

The policy balance will also depend on the type of error one wishes to minimize. Policy makers that perceive credit dynamics and market forces to be strongly self-stabilizing, might prefer to minimize type I error—i.e., avoid over-regulating markets or undermining market discipline, even if that implies an occasional systemic crisis. However, policy makers that perceive a large scope for collective action and cognition failures might prefer to minimize type II error—i.e., prevent devastating systemic crises, even if that implies sacrificing financial market discipline and efficiency.

Given these constraints, two broad macroprudential policy options may be envisaged. One option is to assemble an "all-terrain" regulatory framework, a hybrid of a little bit of all the elements drawn from the four different domains. However, this may lead to policy inconsistencies and regulatory arbitrage, and end up being too inflexible to deal with large and relatively rapid changes in systemic risk buildup. The alternative is to develop a state-contingent (bi-modal) regulatory framework that focuses in normal times on market discipline and the classic agency frictions but shifts in exceptional times (of bubble formation or bubble bursts) to a focus on systemic risk and the destabilizing role of collective action and cognition frictions.[20] This option presupposes, however, that the normal-times oversight is effective enough to detect fault lines in the financial system before it is too late, and that the regulator is sufficiently independent, objective, and agile to switch to exceptional-times prudential oversight when warranted.

A concomitant key challenge will be to gradually fill in some crucial knowledge gaps. In particular, more research will be needed to *map some key cross-domain boundaries*. One such boundary—between the agency frictions-driven dynamics of the GFA domain and the externalities-driven dynamics of the GFC domain—deserves particular attention.[21] Even when externalities are hard to disentangle, knowing the contours of the GFA/GFC boundary (i.e., *where externalities are internalized*) is essential when setting prudential requirements because it conditions the Value-at-Risk type tolerance level (i.e., the level of tail risk beyond which *it is no longer socially optimal to protect the system against*).

[20] This is consistent with the findings in Bianchi (2011) that a Pigouvian tax is most effective in an intermediate ("high externality") region where leverage is neither so low that pecuniary externalities are not relevant (the "low externality" region), nor so high that further borrowing is already heavily constrained and a crisis is de facto already under way.

[21] For example, Brunnermeier and Sannikov (2012a) identify (and stress) the presence of welfare-relevant pecuniary externalities in their model (agents take prices as given). However, they do not formalize these externalities and, hence, do not quantify their effects. It is thus impossible to distinguish between inefficient crisis dynamics driven by uninternalized externalities and efficient crisis dynamics driven strictly by agency frictions. The authors indeed recognize that a full-fledged welfare analysis of financially constrained equilibria is still some way off into the future.

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