

# Containing Systemic Risk

## Paradigm-Based Perspectives on Regulatory Reform

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## Abstract

Financial crises can happen for a variety of reasons: (a) nobody really understands what is going on (the collective cognition paradigm); (b) some understand better than others and take advantage of their knowledge (the asymmetric information paradigm); (c) everybody understands, but crises are a natural part of the financial landscape (the costly enforcement paradigm); or (d) everybody understands, yet no one acts because private and social interests do not coincide (the collective action paradigm). The four paradigms have different and often

conflicting prudential policy implications. This paper proposes and discusses three sets of reforms that would give due weight to the insights from the collective action and collective cognition paradigms by redrawing the regulatory perimeter to internalize systemic risk without promoting dynamic regulatory arbitrage; introducing a truly systemic liquidity regulation that moves away from a purely idiosyncratic focus on maturity mismatches; and building up the supervisory function while avoiding the pitfalls of expanded official oversight.

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**Containing Systemic Risk:  
Paradigm-Based Perspectives on Regulatory Reform<sup>1</sup>**

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## 1. Introduction

The surge of proposals for regulatory reforms aimed at containing systemic risk in the wake of the subprime crisis has been accompanied by an equally impressive burst of research on the drivers of financial crises. Crisis interpretations can be classified into four broad economic paradigms with very distinct and often contradictory implications for regulatory reform and the role of public policy. By clarifying the alternative conceptual underpinnings of policy, the exploration of these paradigms can help frame the debate and illuminate the underlying trade-offs.

The paradigms emerge in a world of incomplete markets from a simple taxonomy that reflects the particular friction or market failure that is considered to dominate. Thus, financial bubbles and crises can happen when: (a) nobody really understands what is going on, and bad surprises lead to catastrophic mood reversals (the collective cognition paradigm); (b) some understand better than others, and they take advantage of their superior knowledge (the asymmetric information paradigm); (c) everybody understands what is going on, yet no one can do anything about it because occasional bubbles and crises occur naturally in a world with enforcement costs, agent heterogeneity and asymmetric market access (the costly enforcement paradigm); or (d) everybody understands what is going on, yet no one does anything about it because private interests do not coincide with those of society (the collective action paradigm).<sup>2</sup>

This paper argues that these four paradigms have markedly different prudential policy implications. At one extreme, the costly enforcement (CE) world is one of constrained optimality. Hence, while policy might possibly help smooth financial ebbs and flows by facilitating market completion, there is no role for prudential regulation and supervision. The pure asymmetric information (AI) paradigm carves out a limited role for official prudential oversight. The regulator-supervisor needs to be a dedicated representative for the uninformed and a promoter of market discipline for the informed. In contrast, the pure collective action (CA) paradigm opens up a much richer array of responsibilities for the regulator, who now needs to contain free-riding incentives, induce agents to internalize externalities, help coordinate market participants toward a socially preferable outcome, and have in place a systemic mechanism for putting out the occasional fires when they happen. The pure collective cognition (CC) paradigm further expands the supervisor's role to include informing, educating, and guiding market participants, as well as calming their frayed nerves by absorbing some of the risk faced by individuals under events that threaten the group as a whole.

These policy roles often collide head-on, and the historical piecemeal approach to prudential regulation bears the direct traces of this conflict. In the United States, for example, a lender of last resort (namely, the U.S. Federal Reserve) and deposit insurance (after the Great Depression) were introduced to address widespread collective action failures in the form of bank runs, but they exacerbated the problems of asymmetric information (especially moral hazard) that were the main culprit behind the savings and loan crisis in the late 1980s and early 1990s. The subsequent efforts of regulators to mitigate moral hazard—by tightening prudential regulation around commercial banks while letting other intermediaries be disciplined by market

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<sup>2</sup> We complete the taxonomy presented in De la Torre and Ize (2010) by adding a fourth paradigm obtained by splitting the agency paradigm into a costly enforcement paradigm and an asymmetric information paradigm.

forces—magnified collective action failures outside commercial banking. This approach led to the rapid growth of the shadow banking system and its collapse in the subprime crisis. It severely undermined the prevailing view that markets know best and that there is little or nothing that the supervisor can add to collective action and collective cognition failures, except to promote transparency.

Looking forward, overcoming the piecemeal approach to regulation in order to find a more harmonious balance between the paradigms will be key to a successful regulatory reform. This is easier said than done, as the difficulties resulting from the inherent policy inconsistencies across paradigms are compounded by complex measurement and calibration problems. However, we discuss in this paper three crucial sets of regulatory reform issues whose resolution could accomplish a great deal toward finding such a balance. The rest of this introduction presents a succinct summary discussion of these three issues, which is then elaborated in detail in the main body of the paper.

The first regulatory reform issue is that of the regulatory perimeter (that is, the boundary of prudential regulation—who and what to regulate). The views from the vantage point of each paradigm are clearly contrasting. From a costly enforcement perspective, no boundary is needed. From an asymmetric information (AI) perspective, the current line in the sand between the regulated commercial banking world of the uninformed, on the one side, and the unregulated world of well-informed professional managers and sophisticated investors, on the other, is about right. Instead, from a collective action (CA) perspective, such a boundary is clearly unacceptable. It needs to be redrawn to ensure that the wedge between private and social risks and costs is evenly narrowed across the financial system. Finally, from a collective cognition (CC) perspective, the boundary needs to include financial innovations whose implications are the least known but that could have devastating systemic impacts.

The lessons of the subprime crisis strongly support redrawing the boundary in a way that at least partly accommodates the concerns of a CA supervisor and perhaps also of a CC supervisor. There are, however, two very different approaches for doing that. The first is specific and adaptive.<sup>3</sup> It maintains the license-based regulatory silos (banking, securities, insurance, etc.) and sorts out within the same silo those institutions that are deemed to be systemically important from those that are not. Prudential regulation needs to be continuously adjusted as the forces of regulatory arbitrage lead unregulated institutions to grow into systemically important ones (individually or as a group) and their risks to evolve. The second approach is universal and emphasizes a level playing field. All institutions that borrow from the public are similarly regulated under a universal license focused on risk-based prudential rules. Once the regulation has been set, financial intermediaries can specialize and evolve endogenously toward different risks and ways of managing them. While the second approach would initially be more demanding than the first, it has a better chance of avoiding a repeat of a subprime-type debacle in which the forces of dynamic regulatory arbitrage cause havoc before the regulators have any real chance to act (or even become aware of the problem).

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<sup>3</sup> This approach seems to be currently dominating. See, for instance, Brunnermeier and others (2009), Acharya and Richardson (2009), Group of Twenty (2009), and the Warwick Commission on International Financial Reform (2009).

This second approach can be usefully married to a couple of complementary proposals. The first is to establish a two-tier regulatory system in which prudentially unregulated intermediaries are allowed to operate freely, provided that they only fund themselves with equity (rather than debt) or borrow only from the regulated intermediaries. This avoids having to directly regulate and supervise everything that moves, effectively delegating the supervision of the smaller, unregulated intermediaries to the larger, regulated intermediaries. An attractive midway option is thus introduced between the regulate-it-all solution of the CA paradigm and the regulate-only-the-core solution of the AI paradigm. Also, by facilitating entry, this two-tiered regulatory system can enhance innovation and competition. Another complementary proposal would address the concerns of the CC supervisor by bringing complex financial innovations under some form of careful scrutiny before they are mainstreamed.

The second regulatory reform issue is that of systemic liquidity regulation. Again, each of the paradigms brings a very distinct perspective on the role of policy. For a CA regulator, freely allowing intermediaries to leverage themselves with overnight wholesale funding, while good for individual intermediaries, is bad for the system and it thus urgently needs to be fixed. Other supervisors would disagree, however. For the CE supervisor, while the quest for liquidity can result in financial crises, such crises are the unavoidable counterpart to the benefits of increased intermediation, which a systemic liquidity regulation could unnecessarily depress. The AI supervisor would go even further: the quest for liquidity and occasional related bank runs are a key channel of market discipline. The CC supervisor would fall somewhere in between these two, not only recognizing the dangers of short funding as a channel of transmission of collective cognition failures (such as pronounced mood swings), but also emphasizing the need for systemic liquidity in an uncertain world.

We agree with recent proposals for internalizing externalities through Pigouvian taxation (thus at least partly meeting the concerns of the CA supervisor). The question, however, is how to define the tax base and the tax rate. Important proposals have been made to tax maturity mismatches at the level of individual institutions.<sup>4</sup> This is a remnant of purely idiosyncratic thinking that does not take externalities into account. In effect, matching short lending with short funding is good for an intermediary in isolation, but bad for the system as a whole. Systemic liquidity regulation should reward longer-term funding on either side of an intermediary's balance sheet, thus turning the maturity mismatch principle partly on its head.

The third regulatory reform issue concerns the redefinition of the role of the supervisor. Again, the view from the vantage point of each paradigm is starkly contrasting. The CE supervisor would remain largely uninvolved. Once effective accounting and disclosure arrangements are in place, the AI supervisor would only keep an eye on the limited subset of intermediaries he is delegated to monitor on account of the uninformed. Instead, the CA supervisor would remain on call to watch the crowds and head up the firefighting effort at the first sign of trouble. The CC supervisor would remain fully on duty, bearing the weight of the world on his shoulders.

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<sup>4</sup> See Brunnermeier and others (2009).

Again, the weight of the subprime evidence suggests the need to accommodate, at least partially, the concerns of the CC supervisor. However, doing so would imply a radical rethinking that would be difficult to implement. For starters, the CC supervisor would forcibly argue for discretion over rules, directly colliding with the views of the AI and CA supervisors—the first seeing rules as necessary to avoid regulatory capture and the second as necessary for an effective coordination and control of crowds. We argue that a combination of countercyclical provisioning rules and judgment-based capital adjustments (with the latter set within a decision-making process similar to that used for monetary policy) could go a long way toward finding an acceptable balance.

Three other aspects of supervision will be fundamental to a successful reformulation of the supervisor’s role. The first is an effective marrying of the prudential views coming from the field (bottom-up) with those emanating from an overall view of macroeconomic conditions and systemic dynamics (top-down). The second is the need for an equally effective marrying of on-site and off-site supervision. The third concerns the need for (and difficulties of) reframing supervisors’ backgrounds and mindsets toward a very different vision of the world, one that gives greater priority to the endogenous risks to which a financial system is exposed.

This paper expands on some of our earlier work, which focuses on explaining the subprime crisis from the vantage point of each of the paradigms.<sup>5</sup> Here, we focus instead on policy and only refer to the subprime crisis when it has fundamental implications for regulatory reform. This paper thus helps bridge the gap between academics and practitioners by reviewing some key issues in the policy agenda from a paradigm-based perspective.

The rest of the paper is structured as follows. The next section presents and discusses the four paradigms, their impact on financial architecture, their policy tensions, and their complementarities. Based on this conceptual framework, the remaining sections discuss each of the three regulatory reform issues introduced above. The final section concludes.

## **2. Financial Paradigms**

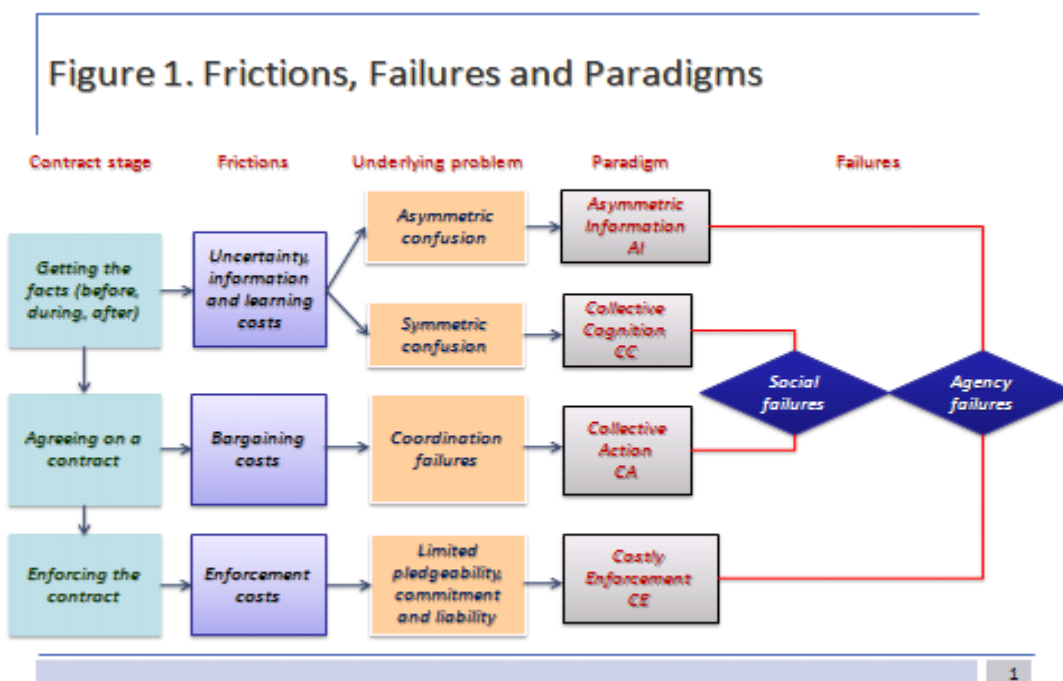
Financial transactions—whether financing or risk sharing—distinguish themselves from other transactions by the fact that they exchange a payment today against a promise of repayment (or risk coverage) tomorrow, thus requiring a contract. Such contracts are exposed to two types of risk: idiosyncratic risk, which is specific to the counterparty, the counterparty’s incentives, and the project to be undertaken; and aggregate risk, which depends on the economic environment in which the counterparty will be immersed during the life of the contract and which will affect the capacity to deliver. In the frictionless Arrow-Debreu world of complete markets, these risks are fully and efficiently internalized in the contract. Agents can buy and sell consumption at any time in the future, contingent on all possible states of the world.

In the real world, however, markets are incomplete, reflecting a variety of transaction costs and frictions, including information and learning frictions, enforcement frictions, and

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<sup>5</sup> See De la Torre and Ize (2010).

bargaining frictions.<sup>6</sup> These frictions affect each of the stages of a contract—from getting the facts to agreeing on a contract and enforcing it—and underpin four paradigms, which we label costly enforcement, collective action, asymmetric information, and collective cognition (see figure 1). Two of these paradigms (costly enforcement and asymmetric information) give rise to bilateral (agency) market failures while the other two (collective action and collective cognition) are associated with multilateral (social) market failures. At the same time, two paradigms (costly enforcement and collective action) are founded on full information and full rationality. Instead, the other two (asymmetric information and collective cognition) are based on informational and learning frictions, possibly leading to bounded rationality (see table 1).



**Table 1. A Simple Typology of Paradigms**

	Full information-Full rationality	Incomplete information-Bounded rationality
Bilateral focus	CE	AI
Multilateral focus	CA	CC

In the costly enforcement (CE) paradigm, contract enforcement costs limit financial transactions to those in which commitments are credible, and this typically boils down to transactions that can be effectively collateralized. By combining this enforcement problem with

<sup>6</sup> The incompleteness of financial markets is in turn what causes risk to become endogenous. Risk is no longer solely the expression of exogenous changes in states of the world but becomes instead shaped by the dynamic, endogenous interaction of market participants. See Danielsson and Shin (2003) and Majnoni (2010).



heterogeneous agents (who either live in different periods or live contemporaneously but with different preferences, particularly different aversions to risk), the CE paradigm generates models with a rich array of financial bubbles and crashes.<sup>7</sup> Yet, while market segmentation (that is, the absence of markets that fully connect the heterogeneous agents) clearly limits welfare, equilibria under this paradigm are constrained-efficient.<sup>8</sup> There is nothing prudential policy can do to improve on them. Instead, the role of policy is to help complete markets.<sup>9</sup>

In the collective action (CA) paradigm, the source of trouble is the conflict of interest between the individual and the group—that is, the wedge between private and social costs and risk-adjusted returns. Bargaining costs, deriving from a mix of transaction costs (communication and enforcement) and unrevealed preferences, limit the scope for negotiating away discrepancies between individual and social welfare, thereby limiting the practical application of the Coase theorem. This gives rise to three types of market failures, which further limit the scope for market completion and can be classified on the basis of the direction of interaction between the individual and the group: externalities (individual actions that do not internalize their effects on the group), free riding (the individual takes advantage at no cost of something produced by the group), and coordination failures (the group and the individual affect each other in uncoordinated ways that are detrimental to both). In all cases, individuals find themselves caught in a prisoner's dilemma in which they may recognize the potential benefits of coordinated behavior, yet bargaining costs prevent coordination.

Collective action failures result in a variety of inefficient outcomes, ranging from simple pecuniary externalities, in which agents do not internalize the social impact of their actions on market prices, to self-fulfilling and socially costly flights to liquidity, such as traditional bank runs or the more novel runs from wholesale funding observed during the subprime crisis.<sup>10</sup> Indeed, the quest for liquidity is central to the CA paradigm and covers all three failures: it gives rise to positive and negative externalities (network or price externalities), promotes free riding,

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<sup>7</sup> Geanakoplos (2009) presents a particularly simple model of bubbles and crashes in a world of heterogeneous but contemporaneous agents, in which asymmetric market completion allows optimists to dominate the market place. Overborrowing from the optimists throws the economy into a crisis when the pessimists withdraw in the event of bad news. Coval and Thakor (2005) present a somewhat similar model of financial intermediation with heterogeneous agents, albeit without crises. Farhi and Tirole (2009)—for the case of dynamically inefficient economies—and Martin and Ventura (2010)—for the opposite case of dynamically efficient economies—present models of rational bubbles and crashes with overlapping generations. In Martin and Ventura's model, the inability of future generations to contract with the present generation allows pyramid schemes to develop. Bubbles eventually burst in response to some exogenous shift in investor sentiment.

<sup>8</sup> Papers following this paradigm generally strive to incorporate a policy component, which often does not flow naturally from the model. While market incompleteness per se has been shown to be a justification for policy intervention (Geanakoplos and Polemarchakis, 1986), this insight has not led to practical policy recommendations.

<sup>9</sup> This can be achieved by reducing the costs of private contracting, for instance, through improvements in informational and contractual infrastructures. Alternatively, private contracting can be complemented with public contracting. By using the tax system to collect payments and spread risks over a wider population, public guarantees or public debt issues can limit transaction costs and facilitate enforcement, including across generations. See, for example, Holmstrom and Tirole (1998) and Saint-Paul (2005).

<sup>10</sup> Lorenzoni (2007) in a closed economy and Korinek (2008) in an open economy provide illustrations of excess borrowing and crisis caused by the failure of individual borrowers to internalize pecuniary externalities.

and triggers runs driven by coordination failures.<sup>11</sup> But collective action failures can also be unrelated to liquidity. For example, marginal lenders can sour markets and increase other lenders' vulnerability to a default by overextending credit during upswings and overcontracting it during downswings. Alternatively, individual lenders may fail to coordinate a slowdown in the midst of a credit boom, unnecessarily prolonging the boom.<sup>12</sup> As we show below, by hindering the learning process, collective action failures also play a fundamental role in the collective cognition paradigm.

In the world of the CA paradigm, the scope for market self-correction is quite limited. This clearly calls for intense prudential oversight and public sector involvement, both *ex ante* (to enhance systemic efficiency and help prevent crises) and *ex post* (to limit the social costs of a crisis and help bring the financial system back into operation as quickly as possible). *Ex ante*, the main tasks of the CA regulator are to induce the internalization of externalities and discourage free riding through Pigouvian taxes, as well as to encourage coordination through regulatory constraints that guide collective behavior toward socially desirable outcomes or, by assuming a catalytic role, to help stakeholders find mutually beneficial rules of play. However, because it is likely to be socially too expensive to establish prudential buffers that can fully fend off crises, the risk of occasional systemic crises (or hundred-year floods) will persist.<sup>13</sup> Hence, the CA regulator-supervisor must also activate an *ex post* safety net to preserve liquidity in times of systemic stress and restore the system to soundness after a crisis through efficient resolution mechanisms.

In contrast, the distinctive feature of the asymmetric information (AI) and collective cognition (CC) paradigms is that both let go of the assumption of full information, but they do so differently. In the AI paradigm, one party in the contract (the principal) knows less than the other (the agent). This familiar problem of information asymmetry includes several types of market failures, classified according to the timing of the failure with respect to the timing of the contract: namely, adverse selection (before), moral hazard and shirking (interim), and false reporting (*ex post* state verification). Incentive distortions arising from unchecked moral hazard (the heads-I-win-tails-you-lose syndrome) are a main source of trouble, inducing market participants to take on too much risk with the expectation of capturing the upside, exiting on time, and leaving the downside with someone else.<sup>14</sup>

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<sup>11</sup> There is a vast literature showing that liquidity has public-good features that liquidity providers cannot fully appropriate. Everyone counts on everyone else for support, but no one adequately internalizes the systemic benefits and risks of such mutual support (see Diamond and Dybvig, 1983; Holmstrom and Tirole, 1998; Diamond and Rajan, 2000; Kahn and Santos, 2008). Network externalities are typically transmitted through the interconnectedness of balance sheets resulting from the web of financial transactions that link market participants bilaterally.

<sup>12</sup> See Abreu and Brunnermeier (2003).

<sup>13</sup> The social costs of inducing an *ex ante* full internalization of externalities would be too high (relative to the social benefits) in a strong sense if the private and public costs and benefits of *ex ante* prevention versus *ex post* rescues were ranked as follows: social *ex post* cost and private *ex ante* benefit < social *ex ante* benefit < public and private *ex ante* cost. Under these circumstances, any attempt to induce private agents to internalize the externality would be higher than the *ex ante* social benefit, making it preferable to focus only on an efficient *ex post* safety net provided by the public sector.

<sup>14</sup> For an example of moral-hazard-caused deviations of asset prices from their fundamental values, see Allen and Gale (1998).

However, for information asymmetries to start driving the show, the expected upside benefits should dominate the expected downside costs (that is, losing one's capital or reputation). This can occur when an innovation opens a world of new opportunities (the upside widens) or when a macroeconomic systemic shock suddenly wipes out a large part of the intermediaries' capital (the downside shrinks).<sup>15</sup> The AI paradigm is self-contained in that it carries the seeds of its own demise. Once participants have taken the plunge, they may have little to lose by taking on additional risk. A naturally unstable dynamic can thus be unleashed that pushes bets higher and higher as less risky investment opportunities become gradually exhausted.<sup>16</sup>

The AI regulator-supervisor fulfills two main roles. The first is to put in place the necessary apparatus for markets to conduct their monitoring role effectively. Provided the informed (and aware) principals can verify that the agents have enough skin in the game, risk taking can be maintained within socially optimal bounds, and markets can deliver efficient price signals that function as early smoke detectors.<sup>17</sup> The main tasks associated with this official oversight role are therefore transparency promotion and, residually, fraud policing. The second role of the AI supervisor is to represent the uninformed (or unaware) parties—that is, the small depositors—in the financial contracting process. While the latter may not understand the intricacies of financial contracting, they are smart enough to realize (perhaps based on painful experiences) that unless their interests are protected, they are going to be systematically holding the short end of the stick. To ensure their participation in financial contracting, the AI regulator-supervisor must insure their deposits and hold the other party in the contract accountable through prudential regulation (to ensure that they have sufficient skin in the game) and active compliance checking (to ensure that they maintain adequate buffers at all times).<sup>18</sup>

While the AI paradigm focuses on idiosyncratic risks arising from information asymmetries in bilateral relationships, the CC paradigm focuses on aggregate risk and the (symmetric) collective difficulty of understanding how changes in the environment will affect the value of financial contracts. This breeds two types of market failures: inefficient informational equilibria, such as herds and cascades, and mood swing-driven bubbles and crises.<sup>19</sup> These failures may reflect full rationality but poor information, bounded rationality and

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<sup>15</sup> The sudden opening of profitable new business opportunities that set the cycle's upswing into motion is what Fisher (1933) called a displacement. In the case of the subprime crisis, it was the discovery of new instruments and intermediation schemes (namely, securitization and shadow banking) that set the process in motion. By contrast, the savings and loan crisis was driven by deregulation and the rise in interest rates that effectively decapitalized the system (a reduction of downside risks), unleashing the subsequent rounds of betting for survival.

<sup>16</sup> Leamer (2008) argues that during the subprime crisis, there was a gradual shift from hedge finance to speculative finance and finally outright Ponzi finance.

<sup>17</sup> In a pure AI world, financial crises are the healthy manifestation of market discipline at work (see Diamond and Rajan, 2000, or Allen and Gale, 2005). Thus, there is an important literature that questions the need for (and optimality of) capital requirements imposed from the outside (see, for example, Kim and Santomero, 1988, or Berger, Herring, and Szego, 1995).

<sup>18</sup> On the representation view of financial regulation, see Dewatripont and Tirole (1994).

<sup>19</sup> The argument that mood swings play an important role in financial bubbles and panics is rooted in Keynes's animal spirits (1936) and Minsky's (1975) writings on financial crises; it was popularized by Kindleberger and Aliber (1996) and Shiller (2006).

heuristic learning, or some form of behavioral irrationality of the type emphasized in the behavioral finance literature.<sup>20</sup>

As in the AI paradigms, financial innovation also plays a crucial triggering role under the CC paradigm, but for less sinister reasons. The creation of new instruments and forms of intermediation can exceed market participants' ability to fully understand their systemic implications and capacity to handle the associated risks and uncertainty. The opacity, complexity, and hidden interconnectedness of new instruments are seen in the CC paradigm as bad side effects of financial innovation, but side effects that are either unintended or, if intended, not maliciously pursued.<sup>21</sup> Faced with the world of the new and unknown, market participants no longer have a steady frame of reference. On the way up, they find themselves in a truly new and wonderful territory, which fuels a mood of optimism and exuberance. On the way down, any significant dissonance can trigger a violent mood reversal as participants question the adequacy of their previous market assessments. Moods can suddenly shift from euphoria to acute Knightian uncertainty, causing risk aversion to swell in response to fear of the unknown.<sup>22</sup>

In the CC paradigm, the scope for market self-correction is limited. As in the CA paradigm, risk is systemic and dynamic, but uncertainty now dominates risk. Instead of the usual tail risks that can ultimately be modeled, market participants undergo alternative bouts of euphoria and despair that further complicate risk pricing.<sup>23</sup> To be sure, price bubbles have an internal logic and are path dependent, which should make their dynamics broadly detectable and predictable to well-trained observers. However, separating bubbles from fundamentals and identifying potential vulnerabilities are not easy tasks, and systemic risk analysis is unlikely to arise spontaneously as a profitable market activity. These tasks should therefore be viewed mostly as a public good.<sup>24</sup>

The CC regulator-supervisor has a central role to play, not on the basis of being smarter than the others (by construction, everybody is equally confused), but because the others do not

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<sup>20</sup> For a recent review of fully rational but inefficient informational equilibria (herds and cascades), see Vives (2008). Caballero and Krishnamurthy (2008) and Caballero and Simsek (2009) present related models of financial intermediation, informational cascades, and flights to liquidity based on complexity, uncertainty, and information costs. With regard to mood swings, one needs to carefully distinguish between mood swings caused by the realization of rationally expected events (a bad draw, as in the bad news of Fostel and Geanakoplos, 2008, or Geanakoplos, 2009) and mood swings resulting from truly unexpected events (reflecting imperfect information) or the adjustment of beliefs (reflecting improved information). We would classify the former (bad, but expected draws) under the CE paradigm and the latter (surprising events or informational improvements) under the CC paradigm. The CC paradigm also encompasses the case of Knightian uncertainty in which individuals deviate from the Bayesian model and hold multiple priors (as in Epstein and Wang, 1994, or Routledge and Zin, 2009), because it involves a basic cognition problem. Abandoning the assumption of full rationality opens up the wide world of behavioral finance (Barberis and Thaler, 2003) and heuristic behavior (De Grauwe, 2008).

<sup>21</sup> In the subprime crisis, information got lost through the so-called chain of complexity, and banks became exposed to heavy pipeline risk in the process (Brunnermeier, 2008; Gorton, 2008).

<sup>22</sup> In the subprime crisis, uncertainty aversion came on top of (and interacted with) increased volatility (Brunnermeier, 2008).

<sup>23</sup> See Danielsson and Shin (2003).

<sup>24</sup> Nonetheless, it might be possible to outsource part of the systemic monitoring activity through mandatory private insurance arrangements.

have the means or incentives to peer deeper into the unknown. As in the CA paradigm, the underlying problem is again one of collective failure. However, rather than a failure to act in the best collective interest under a world of full information, the failing in the CC paradigm arises from insufficient information on the workings of the system as a whole, combined with learning and cognition shortfalls in an uncertain world. The CC regulator-supervisor's role varies slightly according to how one interprets the underlying market failure, whether it reflects imperfect information under full rationality, bounded rationality under excessive complexity and uncertainty, or outright irrationality. In the first case, the supervisor needs only to inform; in the second case, to inform and educate; and in the third case, to inform, educate, and guide. The boundary between rationality and irrationality in an uncertain world is necessarily a grey one, however. A behavior that plainly appears to be irrational under improved information may be rational given the information available at the time the decision was taken.

Before we conclude this section, two important observations are in order. First, financial systems help agents to bridge the various frictions associated with each of the paradigms, but in different ways and through various channels. Financial structure is therefore shaped by the relative success with which each channel is able to address these frictions. In the CE paradigm, financial intermediation arises from the mutual benefits derived from connecting heterogeneous agents. Collateral (including real estate) is used to address the problem of market incompleteness resulting from enforcement costs. In the AI paradigm, financial intermediation arises as a means for principals to benefit more efficiently from the services of the better-informed agents. The asymmetric information gap is bridged by markets through hard public information (arms-length lending) and by banks through soft private information (relationship lending), debt contracts (a disciplining device), and capital (skin in the game). In the CA and CC paradigms, financial intermediation provides a means to benefit from the positive externalities associated with financial activity (including market liquidity) and financial innovation. Investors' natural preference for having ready access to their funds is handled by markets through the ability to trade financial contracts easily in deep secondary markets and by banks through the offering of deposits (debt contracts) redeemable at par and on demand, a commitment they back by holding capital and liquidity buffers.

By interposing their balance sheet between borrowers (through illiquid assets whose underlying value is uncertain and fluctuates with economic conditions) and investors (through liquid liabilities whose value is fixed by contract), banks and other financial intermediaries become exposed to systemic risk, making financial intermediation inherently fragile. They may fail to address the associated risks in a socially optimal way, as a result of market failures that map the same four generic frictions and paradigms. Thus, financial intermediaries may not have socially optimal incentives to hold capital and liquidity buffers because they are exposed to moral hazard and other information asymmetry distortions, do not internalize the social benefits of liquidity and the social costs of a run, or are vulnerable to mood-swing-induced bouts of excessive credit expansions followed by excessive credit contractions. Managing these risks in a socially desirable manner provides the key justification for prudential oversight.

Second, while each paradigm can provide a broadly plausible interpretation of bubbles and crises, richer interpretations are possible when the paradigms are interacted. For example, in the CE paradigm, crises can occur when a market equilibrium characterized by market

asymmetries and heterogeneous agents unravels in the face of bad news or when rational bubbles burst following a shift in investor sentiment, but the dynamics underlying these market asymmetries or changes in investor sentiment are left unexplained. In the CA paradigm, while the failure to internalize systemic risks can understandably lead to a more fragile system, this paradigm in and of itself lacks the inherent dynamics needed to throw the system into a crisis. Agents should continue to rationally manage their risk, adjusting it to what is privately optimal and then holding at that level. The crisis trigger must therefore come from outside the system—an exogenous act of God. The pure AI paradigm posits an unyielding, long-lasting asymmetry between those in the know and those who are being taken advantage of, which is hard to fathom in a marketplace where tips, news, and information are produced by the ton every minute. Finally, in the pure CC paradigm, mood swings are endogenously generated through cognition failures, but the violence of the swings, particularly on the downside, is difficult to explain within the strict confines of this paradigm.

In contrast, integrating the paradigms produces explanations that are more consistent with the multi-dimensional world in which we live. For example, the puzzling market asymmetries and changes in market sentiment under the CE paradigm, as well as the missing crisis trigger of the CA paradigm, are easily accounted for by the heads-I-win-tails-you-loose dynamics of the AI paradigm or the endogenous dynamics of the CC paradigm. The CC paradigm also provides an explanation for the enduring information asymmetries and abusive practices of the AI paradigm, as some participants (the insiders) naturally react faster than others (the outsiders) in a complex world. Bilateral monitoring failures (a key AI problem) are often the result of CA failures such as free riding.<sup>25</sup> In turn, failures to prevent CC-driven bubbles can be the result of contract enforcement costs of the CE paradigm or the information asymmetries of the AI paradigm, which limit the scope for rational arbitrage.<sup>26</sup> Finally, while the CC paradigm endogenizes crisis dynamics, the virulence of the downturns can be more convincingly explained through CA-type runs fueled by self-preservation dynamics.<sup>27</sup>

The multi-dimensional nature of the world calls for a multi-paradigm approach. This simple recognition complicates matters immensely, because the financial policy and regulatory reform prescriptions of the paradigms differ radically and are often inconsistent. This makes regulatory reform a difficult balancing act.

We address these issues in the next section, with a focus on the CA and CC paradigms. While AI issues such as governance, compensation, and skin in the game are clearly essential for the reform agenda, they have already been extensively debated. In this paper, we center our discussion on the implications of the CA and CC paradigms, not only because they have arguably been less debated but also because they directly challenge conventional views on prudential oversight and are hence likely to meet with some resistance.

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<sup>25</sup> While the banking literature initially stressed the bright side of wholesale finance, according to which small depositors benefit from the monitoring provided by the larger investors (Calomiris and Khan, 1991), the more recent literature has shown that there is also a dark side, wherein wholesale investors may choose to free ride on the deposit insurance provided to the small depositors. They may choose to limit their monitoring efforts, instead investing short and running early when public information shows potential signs of trouble (Huang and Ratnovski, 2010).

<sup>26</sup> See Shleifer and Vishny (1997).

<sup>27</sup> See Brunnermeier and Pedersen (2008).

### 3. Redefining the Perimeter of Prudential Oversight

The current regulatory architecture caters mainly to the AI paradigm, while the current safety net architecture mainly accommodates the CA paradigm. Combined, they rest on three pillars: (a) prudential norms that seek to align principal and agent incentives ex ante (an AI concern); (b) an ex post safety net aimed at enticing small depositors to join the banking system (also an AI concern), as well as forestalling contagious runs on otherwise solvent institutions (a CA concern); and (c) a so-called line in the sand separating the world of the prudentially regulated (mainly commercial banking) from that of the unregulated (another AI concern). The latter pillar assumes that in the absence of government-led bailouts, financial markets outside the perimeter will self-regulate because informed investors will exercise discipline over intermediaries, be fully responsible for their investments, and live with the consequences of their mistakes.

Consistent with this AI rationale, current prudential regulation and supervision fall mainly on deposit-taking intermediaries. In exchange, and reflecting their systemic importance, these intermediaries benefit from the safety net. Other financial intermediaries (and all other capital market players) neither enjoy the safety net nor are burdened by full-blown prudential norms. Instead, they are subject mostly (if not only) to market discipline, enhanced by securities market regulations focused on transparency, governance, investor protection, market integrity, and the like.

As a matter of historical fact, however, the line in the sand became porous and was widely breached during the build-up to the subprime crisis, as highly leveraged intermediation spilled into shadow banking outside the confines of traditional banking. The safety net eventually had to be sharply expanded to include unregulated institutions. By exacerbating dynamic regulatory arbitrage, the intent of the Glass-Steagall Act—namely, to shift risk away from regulated intermediaries to capital markets and unregulated intermediaries—fundamentally misfired. Well-informed investors can screen and monitor the intermediaries and require them to have sufficient skin in the game, so as to align the intermediaries' incentives with their own, but they have no incentive to internalize systemic liquidity risk and other CA frictions. Thus, the coexistence of a regulated sector, where systemic concerns are partially factored in, and an unregulated sector, where there is no policy inducement to internalize externalities, created a major wedge in returns, giving rise to a fundamentally unstable construct.<sup>28</sup>

In this context, the path of regulatory reform that has recently been proposed for the United States can be viewed as a return to the failings of the past. It seeks to expand the perimeter of hard prudential regulation to the bounded set of intermediaries that are considered systemically important. The criterion proposed for inclusion in this set is typically based on the size or interconnectedness of all intermediaries, not just commercial banks. While this proposal

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<sup>28</sup> Oddly enough, the Glass-Steagall Act resulted in a one-two punch on the soundness of financial intermediaries: its introduction boosted systemic risk outside commercial banking, and its repeal under the pressures of competition then boosted systemic risk within the commercial banking system itself. To compete with the blown-up investment banks under much stricter regulations, commercial banks had to find creative ways to shed their regulatory burden outside their balance sheet.

makes a commendable effort to adjust the boundary of regulation in accordance with the concerns of the CA supervisor, the effort falls short. CA frictions would be internalized only by the set of systemically important institutions, while the intermediaries outside that set would mostly be left alone, much like noncommercial bank intermediaries were under the Glass-Steagall Act.

The basic problem with this approach is the discontinuity created by the boundary—that is, the side-by-side coexistence of different regulatory regimes. This creates the opportunity for dynamic regulatory arbitrage, once again setting in motion forces of structural instability as financial activity increasingly migrates outside the perimeter. Moreover, any sharply defined regulatory perimeter is bound to create bunching effects, wherein intermediaries crowd in on the more favorable side of the boundary. In the process, unregulated systemic risk is likely to build up just outside the boundary. The appeal for circumventing the prudential regulation will be even stronger once this regulation is strengthened so as to better protect the intermediaries living within the perimeter from undue exposure to risks generated outside the perimeter (see below).

It may be argued that a more stringent regulatory treatment of systemically important intermediaries can compensate for the competitive advantages they derive from their too-big-to-fail or too-interconnected-to-fail status. Getting the balance right is likely to be an impossible task, however, especially if the differential regulation under current proposals is not institution-specific, but applies equally across the whole class of systemically relevant intermediaries. What may be right for the median institution within that class will not be right for the institutions at the tails.

To account for changes in the fabric of intermediation over time, such as those deriving from dynamic regulatory arbitrage, the approach would need to rely on continuous regulatory adjustments, including the regular listing and delisting of systemically important institutions. The experience of the Glass-Steagall Act, however, strongly suggests that such an adaptive approach is fraught with danger. Regulators can fall prey to regulatory capture (an AI problem) or remain unaware of the risks growing in the shadows until it is too late for action (a CC problem). In this case, regulatory inertia is likely to be compounded by the very stark signaling implications of a change in regulatory status. Reclassifying an institution as systemically important or systemically unimportant will unavoidably induce changes in the market's perception of that institution.

A preferable approach would be to apply a risk metric that incorporates systemic effects uniformly across all intermediaries within an expanded perimeter of prudential regulation. The latter would be expanded to cover all leveraged intermediaries that borrow (whether directly, indirectly, or via contingent contracts) from the public or in the wholesale funding markets—that is, in the markets for large deposits or in the professional money and capital markets. Engaging in financial intermediation thus defined without a license would be illegal. Provided that the potential grey zones between financial and nonfinancial firms are strengthened to prevent nonfinancial corporations (such as department stores) from engaging in de facto financial intermediation without a license, this approach would eliminate the undesirable discontinuity effect of the boundary. The universe of financial intermediaries would thus be subject to a level playing field of risk-based prudential rules.



This approach to setting the regulatory perimeter would be more effective if accompanied by a universal intermediation license, thereby eliminating regulatory silos. If a universal intermediation license is unfeasible, however, a close substitute would be a functional approach to regulation—that is, one in which similar activities and financial products are similarly regulated, independently of the license under which they are produced.

Under this proposal, regulated financial intermediaries would face the same regulation for risk taking at the margin. They would thus be free to specialize in different business models and financial activities, generating distinct asset and liability portfolios. Such diversification would be the result of exploiting natural business advantages and risk niches under uniform regulatory rules, rather than the expression of regulatory arbitrage under uneven rules.<sup>29</sup>

Implementing a healthy interplay between a level playing field of regulation and a comparative-advantage-driven evolution of financial structure would undoubtedly involve substantial changes in regulatory philosophy and practice at the outset. In particular, a consistent risk-based regulatory approach that has a uniform marginal effect on risk taking would need to be developed. This is a daunting task, and in some respects it seems to have lost favor following the subprime debacle. In effect, important proposals under discussion advocate putting less emphasis on a Basel II risk-based approach to regulation and more emphasis on rough-and-ready quantitative limits such as a ceiling on the leverage ratio. However, as was the case with Basel I, such rough instruments are prone to affecting institutions with different business models differently, thereby promoting regulatory arbitrage. While the uniform risk-based approach we envisage would initially be harder to implement and might even increase risks in the short term, it would have a better chance of sustainable success over the longer run.

We would also recommend that all prudentially regulated financial intermediaries have equal access to the lender-of-last-resort facilities and deposit insurance if they are deposit takers. To limit moral hazard and properly align incentives, the benefits of such access should be priced in ex ante through Pigouvian taxation and a systemically adjusted premium on liquidity insurance (more on this in the next section).

The definition of the regulatory perimeter proposed above would not necessarily eliminate the space for the existence of unregulated financial intermediaries. In effect, our proposal strongly argues for allowing prudentially unregulated (but licensed) financial intermediaries to operate freely, as long as they only borrow from regulated institutions. Because the unregulated intermediaries would not need to meet cumbersome entry requirements, this scheme would favor innovation and competition. For this scheme to work properly, all relevant credit risk exposures (on- and off-balance-sheet) acquired by regulated intermediaries, including with unregulated intermediaries, would have to be covered by adequate capital and other prudential regulations. This would ensure sufficient skin in the game, so that the activities of the unregulated intermediaries would be indirectly regulated and monitored through their contractual

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<sup>29</sup> This approach contrasts starkly with the views expressed in some recent reports, which specifically praise the benefits of unlevel playing fields and identify the role of regulators as that of actively favoring the transfer of particular risks to those institutions that are better able to manage those risks on account of their current business models and portfolios. See, for example the Warwick Commission on International Financial Reform, (2009).

relationships with the regulated institutions that lend to them.<sup>30</sup> This delegated approach to oversight would limit its cost.

This kind of regulatory discontinuity thus should not introduce any distortion or cause any significant opportunity for arbitrage. Because the unregulated intermediaries would fund themselves only through regulated institutions, a dollar lent to a final borrower through an unregulated intermediary would end up paying the same Pigouvian tax as a dollar lent through a regulated intermediary. Systemic risk would thus be evenly internalized across all possible paths of financial intermediation. Nor should this scheme promote systemic instability. While the unregulated intermediaries should be allowed to fail under efficient resolution mechanisms, the potential systemic ripple effects of such failures would be contained through the regulated intermediaries' access to the safety net.

This proposal on the regulatory perimeter does not, in itself, address the too-big-to-fail or too-interconnected-to-fail problem. This is not as severe a shortcoming as it may seem, however, for several reasons. First, it is simply wrong to equate systemic risk with too big to fail. Systemic risk can be present even without the presence of institutions that are too big to fail. Second, systemic risk is addressed primarily by removing (or at least lessening) the root causes of systemic events. A uniformly applied systemic liquidity tax, as discussed in the next section, would be an important step toward this goal. Third, stricter regulation would be of little or no help if a too-big-to-fail institution becomes troubled or unviable. That scenario, which is the main concern of proponents of tougher regulations for such institutions, calls for different instruments, chiefly a suitable framework for the resolution of failed institutions—with powers to undertake actions such as closing, intervening in, and restructuring institutions; unwinding positions; and separating the good and bad parts of the balance sheet.<sup>31</sup>

#### **4. Internalizing Systemic Liquidity Risk**

The quest for liquidity is a universal feature of all four paradigms, yet its systemic impact and, hence, its policy implications are seen very differently by each. In the CE paradigm, liquid investments are the closest substitute to the unavailable rainy-day insurance that risk-averse investors desire. While a flight to liquidity following bad news can strain the financial system by forcing risk lovers to liquidate their positions and exit the market, this is simply a fact of life in which some win while others lose. Instead, in the CA paradigm, massive flights to liquidity are socially costly, and market-determined holdings and provision of systemic liquidity to fend off such extreme circumstances are socially insufficient.<sup>32</sup>

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<sup>30</sup> Thus, the risk weights attached to the loans of the regulated to the unregulated intermediaries would need to reflect the risks taken by the unregulated intermediaries.

<sup>31</sup> Current proposals to require that all large financial institutions prepare a living will facilitating their resolution should trouble arise seem to be a step in the right direction. Draft bills seeking new failure resolution authority are in different stages of preparation and discussion in the United States, United Kingdom, and the European Union.

<sup>32</sup> Diamond and Dybvig (1983) find that depositors' inability to coordinate results in self-fulfilling bank runs that justify the existence of deposit insurance. Instead, for Holmstrom and Tirole (1998), financial firms' inability to internalize the public good feature of liquidity results in insufficient liquidity being held against systemic shocks, justifying the need for public securities and lender-of-last-resort arrangements. Kahn and Santos (2008) consider that banks' inadequate account of the adverse implications of their failure to provide aggregate liquidity results in

The CC paradigm puts a similar social premium on liquidity, but in this case the flight to liquidity reflects a defense against volatility and uncertainty.<sup>33</sup> In this paradigm, the benefits of public intervention arise from the state's capacity to effectively distribute risk over a much wider population (both current and future generations), which enhances its ability to handle systemic uncertainty. In other words, the state remains risk neutral at all times, thereby allowing the cost of public capital to fall much below that of private capital under systemic events. One key role of the state under the CC paradigm is therefore that of an ex post risk absorber of last resort.<sup>34</sup>

Finally, the AI paradigm finds virtue where the others find flaws. In the AI paradigm, the preference for liquid investments and the occasional flights to liquidity and resulting banking crises are manifestations of market discipline at work. Everybody is better off under this paradigm when investors (the principals) use short-term lending to mitigate moral hazard (by keeping agents on a tight leash) and withdraw as soon as the agents' incentives become misaligned with their interests.<sup>35</sup> As already noted, however, free-rider incentives (that is, CA dynamics) can easily interfere with monitoring incentives (a basic AI staple), turning the bright side of wholesale funding over to the dark side.<sup>36</sup>

To address the lessons from the subprime crisis, the concerns of the CA and CC paradigms need to be explicitly taken into account when designing systemic liquidity regulation. This would help rebalance the regulatory architecture that has hitherto been unduly dominated by an AI worldview. We therefore support the now widely recognized need for regulatory reform to tackle the systemic vulnerabilities resulting from excessive reliance on short-term wholesale funding. However, the proposals based on controlling the asset-liability maturity mismatch are problematic.<sup>37</sup> Matching short liabilities with short assets can protect the liquidity of an individual intermediary (that is, it can limit idiosyncratic risk), but exacerbates systemic vulnerability. In systemic events, short loans become as illiquid as long loans unless intermediaries press borrowers to repay the loans. This simply shifts the liquidity pressure onto somebody else, either the final borrower or another intermediary, thereby increasing default risk across the system, raising overall volatility, and contributing to downward asset spirals.<sup>38</sup>

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excessive financial fragility, justifying the introduction of ex ante prudential policies and ex post public liquidity support arrangements.

<sup>33</sup> For example, Brunnermeier and Pedersen (2009) argue that self-fulfilling margin spirals caused by expectations of excess volatility result in abrupt decreases in funding and market liquidity. As financial intermediaries hit their capital constraints, they are compelled to engage in socially costly asset fire sales and market withdrawals. Similar endogenous fluctuations in volatility, risk aversion, and risk appetite can be found in several other recent papers, such as Danielsson and Shin (2009).

<sup>34</sup> The basic rationale for the role of the state in handling uncertainty goes back to Arrow and Lind (1970). See also Caballero (2009) for a more recent reinterpretation of the insurance role of the state in systemic crisis conditions.

<sup>35</sup> See Diamond and Rajan (2000); Allen and Gale (2005).

<sup>36</sup> Calomiris and Khan (1991); Huang and Ratnovski (2010).

<sup>37</sup> See, for example, Brunnermeier and others (2009).

<sup>38</sup> By lending as short as they borrow, financial intermediaries could fully avoid a tax on maturity mismatches. The resulting equilibrium would clearly be sub-optimal from a systemic perspective since it would shift the liquidity risk downstream (to final borrowers), where liquidity failures are bound to have systemic impacts, instead of upstream (to investors), where risk can be most effectively bottled up and contained.

A properly designed systemic liquidity regulation should encourage the provision of liquidity by a financial intermediary, including lending long or offering liquidity lines, provided it does not put the intermediary itself at risk. This approach turns the conventional maturity mismatch principle—namely, that it is okay to borrow short if you also lend short—partially on its head. In effect, a suitable Pigouvian tax would penalize both the short funding from uninsured wholesale investors and the short lending by intermediaries to final borrowers or unregulated intermediaries.<sup>39</sup> This would induce investors and leveraged intermediaries to at least partially internalize the adverse externalities of their individual actions. Such a Pigouvian tax would also contribute to the appropriate pricing of the option to “lend short and run” that the deposit insurance and lender of last resort implicitly provide. This tax would not apply to unleveraged intermediaries, such as pure asset managers that do not incur debt and only operate with their own capital or with equity-type participations from investors.<sup>40</sup>

Operationalizing a systemic liquidity regulation would be a major challenge. One alternative is to introduce a regulation focused only on discouraging short-term (wholesale) funding and lending, as part of a broader set of regulations aimed at inducing the internalization of externalities. Another, arguably superior, alternative is to adopt an approach such as the CoVaR proposed by Adrian and Brunnermeier, which would set the Pigouvian tax on the basis of an objective measure of an institution's marginal contribution to overall systemic risk.<sup>41</sup>

The Pigouvian tax itself could take the form of a capital surcharge, a risk-adjusted premium on deposit insurance, or a risk-adjusted premium on newly created systemic liquidity insurance linked to the lender-of-last-resort facility.<sup>42</sup> Given the systemic nature of this regulation, a good case can be made for using the proceeds of the Pigouvian tax to feed a systemic protection fund (as would naturally be the case if the tax took the form of a risk-adjusted deposit insurance premium) that the appropriate authorities could use to deal with a systemic crisis should one materialize.<sup>43</sup> In view of the complications involved, much more work is clearly needed in this area before a meaningful regulatory reform can be implemented.

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<sup>39</sup> To avoid double taxation, short-lending from a regulated intermediary to another should not be taxed (the borrowing institution would already be subjected to the tax on the receiving end of the transaction).

<sup>40</sup> Note that, per our previous proposal, unleveraged intermediaries would lie outside of the perimeter of prudential regulation.

<sup>41</sup> That measure would take into account not just overreliance on short-term wholesale funding, but all the relevant characteristics of an intermediary that pose systemic risk, including size, interconnectedness, leverage, and so on. Adrian and Brunnermeier (2009) measure the systemic risk posed by institution  $i$  (CoVaR <sub>$i$</sub> ), defined as the value at risk of the system as a whole (VaR) conditional on institution  $i$  being in distress. The difference between CoVaR <sub>$i$</sub>  and VaR is the marginal contribution of institution  $i$  to systemic risk. The authors apply quintile regressions to panel data so as to identify past factors that predict CoVaR today. The regression coefficients indicate the weight that each contributing factor should be given in determining the Pigouvian tax.

<sup>42</sup> Calibrating this tax properly will not be trivial, however, not only because of inherent problems in measuring liquidity risk (how does one compare, for example, the rollover risk associated with an overnight loan and that of a one-month loan?), but also because of the inherent conflict across paradigms. Some intermediate funding maturity range might be optimal, if it is long enough to limit the risk of sharply destabilizing runs yet short enough to enable market discipline to function.

<sup>43</sup> A formal justification for this approach can be found in Jeanne and Korinek (2010).

## 5. Expanding the Role of the Supervisor

The relative importance and roles of markets and supervisors in preserving the soundness of financial systems varies sharply across paradigms. In the CE paradigm, markets should be allowed to operate unimpeded. Since they are incomplete, markets will generally fail to deliver fully efficient and resilient financial systems. While public policy (focused, for instance, on improving contract rights) can help complete markets, prudential oversight policy cannot of itself improve the situation. In the AI paradigm, markets themselves will do the work provided they get some help from the supervisors in the form of transparency promotion and representation of the uninformed. In the CA paradigm, supervisors need to drastically review and adjust the rules of market engagement to ensure that private incentives are properly aligned with social interests. Once this is done, they can stand back and only take a more active role to help limit damages when occasional disasters hit.

By contrast, in the CC paradigm, supervisors' work is never done. They need to be constantly on the watch for icebergs ahead, ready to warn the markets of perils, and, if necessary, slow down the boat or alter its course. While in principle supervisors are subject to the same cognition failures as the private players in financial markets, in practice they can rely on their public policy mandate (and the risk neutrality of the state) to develop systemic risk monitoring and countercyclical roles, provided that they avoid being captured by the industry in the process. These roles clearly call for a very different style of supervision, one that is at odds with the prevailing AI mantra that supervisors can do little to help improve financial intermediaries' risk management ("intermediaries know best"). A CC-driven reform agenda consistent with these supervisory roles requires a major change in supervisory philosophy, capacity, and organization. Making this change would not be easy, yet the virtual absence of reform proposals in this key area is remarkable. While some reports do recognize that markets can be caught in cognitive failures (mood swings), there are few specific recommendations on how to address the associated market inefficiencies.<sup>44</sup> This is an important gap that needs to be filled.

In the rational expectations version of the CC paradigm—in which mood swings reflect a rational updating of imperfect information—the new function of the supervisor can be restricted to that of scouting. Once warned by the supervisor of the potential icebergs ahead, rational markets should change course on their own. As noted, however, scouting is a difficult function that would require additional public resources. It also raises a number of delicate technical questions concerning the most effective way to look ahead and assess possible systemic vulnerabilities.

A first question in this regard is how to find a proper balance between quantifying the risks and simply connecting the dots. While many efforts are under way to redesign stress testing

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<sup>44</sup> The Financial Services Authority (2009) notes, for example, that "the acceptance that financial markets are inherently susceptible to irrational momentum effects does imply that regulatory approaches should be based on striking a balance between the benefits of market completion and market liquidity and the potential disadvantages which may arise from inherent instabilities in liquid markets." However, while the report stresses the need for expanding resources to match the supervisor's enhanced responsibilities, it leaves open for further analysis the most complex and potentially polemical issues associated with broadening the supervisor's role, such as controlling innovation, taking discretionary countercyclical action, and more broadly opposing irrational momentum effects.

within a more systemic context that takes into account tail risk and changes in correlations, the question arises as to whether the task of finding the cracks in the system is more qualitative than quantitative.<sup>45</sup>

A second, somewhat related question is how to combine on-site and off-site work most effectively. Many experienced supervisors seem to favor bringing tomorrow's supervision closer to the ground, through a heavier on-site presence. Such an approach makes perfect sense in the AI paradigm, but the CC paradigm might emphasize understanding the systemic vulnerabilities rather than verifying individual risk assessments. From this perspective, it is no longer clear whether the best response is more on-site presence or better off-site supervision. The two approaches would certainly need to be better combined, which leads to a third, more encompassing question, namely, of how best to marry an on-site idiosyncratic view (bottom-up) with an off-site macro systemic perspective (top-down). Effective feedback between the two approaches involves a meeting of the minds of staff with very different backgrounds and training. Ideally, such an exercise should involve field supervisors, market specialists, and research staff able to bring together issues of monetary policy, industrial organization, finance, and prudential regulation.

These challenges are compounded when one needs not only to assess, but also to act. In the alternative interpretation of the CC paradigm—a world of bounded rationality and sentiment-driven traders—information and analysis do not suffice. Instead, market guidance requires adding deeds to words. To this end, supervisors will need more powers to slow down credit cycles and expand prudential buffers when systemic uncertainty increases. They may also need more powers to regulate and standardize financial innovation. Both will require boosting supervisors' capacity and skills, and this is likely to require even deeper institutional and administrative reforms.

At the same time, much has been said about the perils of giving supervisors excessive discretion. A major lesson from the crisis is precisely that official oversight can often lag behind the problems, reflecting the fact that supervisors, like institutions and markets, are also exposed to the basic failures of each of the paradigms. This includes a host of agency problems (including regulatory capture), coordination failures (both cross-agency and cross-border), and cognition problems and mood swings (to which supervisors are certainly not immune).<sup>46</sup>

Fortunately, monetary policy provides a useful model of analysis and decision-making that macroprudential policy may wish to emulate. The parallels between monetary policy and the requirements of macroprudential policy in a world of collective action and cognition failures are significant. First, in both cases, public guidance is needed to respond to a basic coordination failure among market participants. Judgment is called for, based on a complex fact-finding and decision-making process. Policymakers need to make unpopular decisions, but they also need to be accountable and explain their decisions as well and as transparently as possible. Granted, macroprudential policy decisions are likely to generate more focused opposition than monetary

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<sup>45</sup> Haldane (2009) makes a broadly similar point.

<sup>46</sup> See Demirgüç-Kunt and Servén (2010) and Levine (2011) for recent discussions of the need to better oversee the role and performance of official oversight.

policy decisions, because they more directly affect a specific economic sector. This need not be an insurmountable problem, however, given a properly strengthened institutional setting. At the same time, these considerations in favor of a more active supervisor clearly strengthen the argument for expanding the perimeter of regulation so that all financial intermediaries are equally affected by policy decisions, whether directly or indirectly, as suggested above.

An appropriate mix of rules and discretion might combine preset, cyclically adjusted prudential norms that target expected risks (that is, dynamic provisioning requirements to offset predictable swings in default risk over the cycle) with countercyclical, discretionally adjusted prudential norms that target unexpected risks (such as capital adjustments in response to increases in systemic uncertainty that make tail risks grow). When supervision is conducted outside the central bank, the cyclically adjusted prudential norms should remain under the direct responsibility of the supervisory agency, whereas the countercyclical, discretionally adjusted macroprudential norms should naturally become part of the central bank's toolkit. Macroprudential policy decisions should thus be taken simultaneously with monetary policy decisions, as part of a single analytical decision-making process. Appropriate arrangements will be needed to ensure proper coordination between the supervisory agency and the central bank.

## **6. Conclusions**

This paper has expanded on the financial paradigms framework presented in some of our earlier work.<sup>47</sup> It recognized the existence of the costly enforcement (CE) paradigm as a logically separate fourth paradigm in which financial crises may result from segmented incomplete markets without any collective action failures. While this paradigm does not have direct implications for prudential reform, recognizing its existence is nonetheless important for a full analysis.

The paper focused on three basic regulatory reform issues that are key to finding a more harmonious balance between the financial paradigms. The first two issues, namely, the redrawing of the regulatory perimeter and the introduction of a truly systemic liquidity regulation, are closely interconnected and are meant to address the main failures of regulation from a CA perspective.

With regard to the regulatory perimeter, we share the view that the perimeter needs to be expanded to better reflect the systemic impact of all financial institutions and activities. However, we depart from most positions on the need to directly address the dangers of dynamic regulatory arbitrage. The subprime crisis was largely caused by regulatory arbitrage driven by uninternalized externalities, which went wild under an uneven, silo-based regulatory framework that regulated the systemically more important commercial banks differently from other institutions. Thus, introducing similar regulatory distinctions between systemically important institutions and smaller intermediaries looks to us like a perilous return to the past. The two-tier differentiation we propose would uniformly regulate all institutions that borrow from the markets (or from large depositors), while allowing prudentially unregulated institutions to coexist as long as they only borrow from regulated entities. This approach has the best chances of taming the

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<sup>47</sup> De la Torre and Ize (2010).

forces of regulatory arbitrage, limiting supervisory costs, and promoting innovation and competition.

We also agree with other analysts that internalizing the systemic risks of short-term wholesale funding will be essential to limiting financial fragility and the potentially adverse moral hazard implications of an expanded safety net. However, the proposals to regulate maturity mismatches are a remnant of purely idiosyncratic thinking that needs to be reconsidered. Lending short may limit idiosyncratic risk, but it will generally exacerbate systemic vulnerabilities.

The third issue covered in this paper—specifically, building up supervisory capacity—reflects the need to pay much more attention to the CC paradigm. Our reading of the subprime crisis suggests that the public sector will need to play a central role in overcoming cognition failures and the pernicious mood swings that go with them. This may seem an impossible task given the obvious failures of official oversight during the build-up phase of the crisis, yet it should be feasible to expand the role of the supervisor provided a proper institutional set-up is put in place, such as the one used for monetary policy.



## References

- Abreu, Dilip, and Markus K. Brunnermeier. 2003. "Bubbles and Crashes." *Econometrica* 71(1): 173–204.
- Acharya, Viral, and Matthew Richardson. 2009. *Restoring Financial Stability*. Hoboken, N.J.: John Wiley and Sons.
- Adrian, Tobias, and Markus K. Brunnermeier. 2009. "CoVar." Federal Reserve Bank of New York and Princeton University.
- Allen, Franklin, and Douglas Gale. 1998. "Bubbles and Crises." Working Paper 98-01. University of Pennsylvania, Wharton School Center for Financial Institutions.
- . 2005. "Systemic Risk and Regulation." Working Paper 95-24. University of Pennsylvania, Wharton School Center for Financial Institutions.
- Arrow, Kenneth J., and Robert C. Lind. 1970. "Uncertainty and the Evaluation of Public Investment Decisions." *American Economic Review* 60(3): 364–78.
- Barberis, Nicholas, and Richard Thaler. 2003. "A Survey of Behavioral Finance." In *Handbook of the Economics of Finance*, edited by George Constantinides, Milton Harris, and Rene Stulz. Amsterdam: Elsevier.
- Berger, Allen, Richard Herring, and Giorgio Szego. 1995. "The Role of Capital in Financial Institutions." School Working Paper 95-01. University of Pennsylvania, Wharton School Center for Financial Institutions.
- Brunnermeier, Markus K. 2008. "Deciphering the Liquidity and Credit Crunch, 2007–2008." *Journal of Economic Perspectives* 23(1): 77–100.
- Brunnermeier, Markus K., and Lasse Pedersen. 2009. "Market Liquidity and Funding Liquidity." *The Review of Financial Studies* 22(6): 2201–2238.
- Brunnermeier, Markus K., and others. 2009. *The Fundamental Principles of Financial Regulation*. Geneva Reports on the World Economy 11. London: Centre for Economic Policy Research.
- Caballero, Ricardo J.. 2009. "A Global Perspective on the Great Financial Insurance Run: Causes, Consequences, and Solutions." Notes prepared for the MIT Economics Alumni dinner. New York, 20 January.
- Caballero, Ricardo J., and Arvind Krishnamurthy. 2008. "Collective Risk Management in a Flight to Quality Episode." *Journal of Finance* 63(5): 2195–230.

- Caballero, Ricardo J., and Alp Simsek. 2009. "Complexity and Financial Panics." Working Paper 14997. Cambridge, Mass.: National Bureau of Economic Research.
- Calomiris, Charles W., and Charles M. Khan. 1991. "The Role of Demandable Debt in Structuring Optimal Banking Arrangements." *American Economic Review* 81(3): 497–513.
- Coval, Joshua D., and Anjan V. Thakor. 2005. "Financial Intermediation as a Beliefs-Bridge between Optimists and Pessimists." *Journal of Financial Economics* 75(3): 535–69.
- Danielsson, Jon, and Hyun Song Shin. 2003. "Endogenous Risk" In *Modern Risk Management: A History*, Risk Books
- De Grauwe, Paul. 2008. "Animal Spirits and Monetary Policy." Working Paper 2418. Munich: CESifo.
- De la Torre, Augusto, and Alain Ize. 2010. "Regulatory Reform: Integrating Paradigms." *International Finance* 13(1): 109–39.
- Demirgüç-Kunt, Asli, and Luis Servén. 2010. "Are All the Sacred Cows Dead? Implications of the Financial Crisis for Macro- and Financial Policies." *World Bank Research Observer* 25(1): 91–124.
- Dewatripont, Mathias, and Jean Tirole. 1994. *The Prudential Regulation of Banks*. MIT Press.
- Diamond, Douglas W., and Phillip H. Dybvig. 1983. "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91(3): 401–19.
- Diamond, Douglas W., and Raghuram G. Rajan. 2000. "A Theory of Bank Capital." *Journal of Finance* 55(6): 2431–65.
- Epstein, Larry, and Tan Wang. 1994. "Intertemporal Asset Pricing under Knightian Uncertainty." *Econometrica*, 62(2): 283–322.
- Farhi, Emmanuel, and Jean Tirole. 2009. "Bubbly Liquidity." Working Paper 09-101. Toulouse School of Economics.
- Financial Services Authority. 2009. "The Turner Review: A Regulatory Response to the Global Banking Crisis." London.
- Fisher, Irving. 1933. "The Debt Deflation Theory of Great Depressions." *Econometrica* 1: 337–57.
- Fostel, Ana, and John Geneakoplos. 2008. "Leverage Cycles and the Anxious Economy." *American Economic Review* 98(4): 1211–44.

Geanakoplos, John. 2009. "The Leverage Cycle." Discussion Paper 1715. Yale University, Cowles Foundation for Research in Economics.

Geanakoplos, John, and Heracles Polemarchakis. 1986. "Existence, Regularity, and Constrained Sub-optimality of Competitive Allocations When the Asset Market Is Incomplete." In *Essays in Honour of K. J. Arrow*, vol. 3, edited by W. Heller, D. Starret, and R. Starr. Cambridge University Press.

Gorton, Gary. 2008. "The Subprime Panic." Working Paper 14398. Cambridge, Mass.: National Bureau of Economic Research.

Group of Twenty. 2009. "The Global Plan for Recovery and Reform." London Summit Declaration. April.

Haldane, Andrew G. 2009. "Why Banks Failed the Stress Test." Speech given at the Marcus-Evans Conference on Stress Testing. Bank of England, London, 9–10 February.

Holmstrom, Bengt, and Jean Tirole. 1998. "Private and Public Supply of Liquidity." Working Paper 5817. Cambridge, Mass.: National Bureau of Economic Research.

Huang, Rocco, and Lev Ratnovski. 2010. "The Dark Side of Bank Wholesale Funding." Working Paper 1223. Frankfurt: European Central Bank.

Jeanne, Olivier, and Anton Korinek, 2010. "Managing Credit Booms and Busts: A Pigouvian Taxation Approach", Mimeo, John Hopkins University and University of Maryland.

Keynes, John Maynard, 1936. *The General Theory of Employment, Interest and Money*. Palgrave-Macmillan

Khan, Charles M., and João A. C. Santos. 2008. "Liquidity, Payment, and Endogenous Financial Fragility." Paper prepared for the Conference on Liquidity: Concepts and Risks. CESifo, Munich, 17–18 October.

Kim, Deasik, and Anthony M. Santomero. 1988. "Risk in Banking and Capital Regulation." *Journal of Finance* 43(5): 1219–33.

Kindleberger, Charles P., and Robert Aliber. 1996. *Manias, Panics, and Crashes: A History of Financial Crises*. Hoboken, N.J.: Wiley Investment Classics.

Korinek, Anton. 2008. "Regulating Capital Flows to Emerging Markets." Paper prepared for the Conference on Risk Analysis and Management. World Bank and International Monetary Fund, Washington, October.

Leamer, Edgard. 2008. "Housing Is the Business Cycle." Working Paper 13428. Cambridge, Mass.: National Bureau of Economic Research.

- Levine, Ross. 2011. "The Sentinel: Improving the Governance of Financial Policies." In *The International Financial Crisis: Have the Rules of Finance Changed?* edited by Asli Demirgüç-Kunt, Douglas D. Evanoff, and George G. Kaufman. Hackensack, N.J.: World Scientific Publishing Co.
- Lorenzoni, Guido. 2007. "Inefficient Credit Booms." Working Paper 13639. Cambridge, Mass.: National Bureau of Economic Research.
- Majnoni, Giovanni. 2010. "Micro and Macro Prudential Oversight: Are Good Engagements Conducive to Good Marriages?" Mimeo, World Bank (August).
- Martin, Alberto, and Jaume Ventura. 2010. "Theoretical Notes on Bubbles and the Current Crisis." Working Paper 16399. Cambridge, Mass.: National Bureau of Economic Research.
- Minsky, Hyman. 1975. *John Maynard Keynes*. Columbia University Press.
- Routledge, Bryan, and Stanley Zin. 2009. "Model Uncertainty and Liquidity." *Review of Economic Dynamics* 12(4) : 543–66.
- Saint-Paul, Gilles. 2005. "Fiscal Policy and Economic Growth: The Role of Financial Intermediation." *Review of International Economics* 13(3): 612–29.
- Shiller, Robert. 2006. *Irrational Exuberance*. Princeton University Press.
- Shleifer, Andre, and Robert W. Vishny. 1997. "The Limits of Arbitrage." *Journal of Finance* 52(1): 35–55.
- Vives, Xavier. 2008. *Information and Learning in Markets: The Impact of Market Microstructure*. Princeton University Press.
- Warwick Commission on International Financial Reform. 2009. "In Praise of Unlevel Playing Fields: Report of the Second Warwick Commission." University of Warwick.