Endogenous Transactions Costs and Institutions and the 2007/08 Financial Crisis

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Abstract

This paper examines the manner by which transactions costs in financial markets, broadly defined, not only derive from the regulatory-institutional framework, but in turn affect the development of this framework. We document the increasing presence of such costs in the U.S. financial sector since 1980, along with how changes in transactions costs coevolved with regulatory and institutional innovations over the past 30 years. Such transactions costs amplified an ever-greater disconnect between market prices and their economic fundamentals, and increased financial fragility to the point that the system became vulnerable to the 2007/08 financial crisis.

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Nature's first green is gold,
Her hardest hue to hold.
Her early leafs a flower;
But only so an hour.
Then leaf subsides to leaf.
So Eden sank to grief,
So dawn goes down to day.
Nothing gold can stay.

Nothing Gold Can Stay 1–37 (Robert Frost)

1 Introduction

Financial crises are hardly new. Reinhart & Rogoff (2009) document no less than 122 separate incidences of crises since 1800. While such crises are not uncommon, their epicenter has typically centered on developing countries: Of the 50 crises that have occurred in the high-capital mobility period since the 1980s, only a fifth have originated in high-income economies, and—with the exception of the 1992 ERM crisis—their impact has generally been limited to a few countries. Furthermore, the vast majority of financial crises involve relatively simple financial instruments—such as currencies, plain-vanilla bonds or stocks, or basic mortgage assets—operating in a straightforward, if sometimes politically-distorted, institutional environment. What distinguishes the 2007 subprime crisis, and makes it interesting—if not altogether unique—is the concurrent incidence of three elements seldom seen together: Its origin in a high-income country, in possession of a deep and sophisticated financial and regulatory system, and leading to spillover effects that included nominal and real dislocations spread over a global scale.[1]

How did a two-year-long financial crisis arise with this unusual, and certainly unexpected, set of features? We argue in this paper that understanding the institutional environment is central to a complete explanation. More specifically, our thesis is that transactions costs, which are endogenous to the system, rose due to changes in the institutional structure of financial markets. As an important corollary, we argue that the cycle of feedback between deregulation and financial innovation ultimately increased financial fragility, and ultimately this fragility culminated in a financial crisis.

The recognition that the introduction of transactions costs can modify portfolio demand and optimal asset allocation is not new. However, such studies have have typically adopted one of two approaches. One approach begins by embedding transactions costs as a parameter faced by agents within the existing institutional structure, and then examining how the presence of such costs alter resultant equilibrium prices (taking the institutional structure as given)

[1] This is not to deny that many *other* elements surrounding the 2007 subprime crisis—such as the run-up of asset prices, accumulation and debt, and pattern of GDP contraction—are archetypal for crisis episodes (Reinhart & Rogoff 2008).

(Constantinides 1986; Merton 1989). The second approach takes this one step further and allows the realized institutional structure to be the consequence of a given distribution of transactions costs (Merton 1987).[2] What is missing, however, is that these transactions costs are not understood to exist as a function of the institutional setting. While they may change the institutional framework whereby agents operate, they are not allowed to be endogenously determined by the institutions that are currently in operation.

The subprime crisis of 2007 is one such case in point. We argue that the proximate causes of the crisis currently entertained in the literature—such as regulatory failure, incentive problems, and complex financial instruments—belie a deeper, more fundamental cause. In particular, we show that institutional changes—led by the regulatory reforms of the 1990s—brought about changes in the structure of financial markets, which in turn altered the transactions costs faced by market participants. This interaction between institutional and market governance set the stage for a financial crisis that would otherwise not have occurred in the deepest, most mature financial market in the world.

We conceptualize *transactions costs* in a fairly broad manner, including not just practical costs such as financial contract origination and sale, but, importantly, the cost of informational imperfections and agency problems—analogous to those identified by Grossman & Stiglitz (1980)—that are introduced along with the marginal financial contract as well. Although this limits the extent to which our definition can be operationalized empirically, the latitude that it offers affords us significant theoretical mileage.

There is emerging empirical evidence that such costs—and informational costs in particular—were rife in subprime markets, which in turn lead to inefficiencies. Adams *et al.* (2009) document problems of imperfect information in subprime lending for auto loans. Similarly, Keys *et al.* (2010) observe that subprime mortgages that were subject to securitization faced a significantly higher probability of default relative to a non-securitized portfolio with a comparable risk profile; they argue that their analyses point to reduced screening incentives on the part of lenders. Mian & Sufi (2009) show, convincingly, that securitization was accompanied by an erosion in subprime lending standards.

An important precedent to our theoretical work here is the paper by Akerlof & Romer (1993) who—as far back as 1993—were prescient in their concern that the relaxation of regulations in an environment of widespread informational asymmetries may lead to financial "looting." Their paper, however, is concerned with problems surrounding failures of informational flows, while our paper links such failures explicitly to the design of the institutional framework and its associated feedback effects. Another piece that relates indirectly to the argument we make here is the influential paper by Shleifer & Vishny (1997). In that paper, agency frictions between arbitrageurs and investors lead to circumstances where arbitrage does not occur. In a similar vein, our paper envisions such frictions as transactions costs, and these costs likewise prevent convergence

[2] Merton (1987) concentrates on informational costs as the primary cost that transactions endure. We allow for informational transactions costs (and indeed regard such costs as primal), but our definition is somewhat more expansive.

toward true fundamental values. Probably the closest paper in spirit to the arguments made here is that of Biais *et al.* (2009), who construct an agency model with learning of the sort that characterizes innovative industries (such as the financial sector). The authors demonstrate that, with uncertainty about profits and informational asymmetry over innovative sector effort, managers extract agency rents due to moral hazard-induced risk taking, and uncertainty can give rise to booms and crashes. However, while the paper employs a sophisticated representation of agent action in the presence of uncertainty and learning, they do not discuss the influence of the institutional environment, as we do. Finally, a recent paper by Eden (2012) demonstrates how welfare may be reduced in an unregulated financial system. Her paper—which envisions transactions costs associated with financial intermediation as a costly monitoring technology—serves as a nice complement to the arguments that we forward here, although its main focus is on the implications of such costly intermediation for liquidity value in a general equilibrium setting.

The recent slew of books and papers dealing with the crisis is too voluminous to address in detail here. In this crowded space, several authors have made arguments along the lines of what we describe here: these include challenges introduced by complex financial innovations and the securitization process (Brender & Pisani 2010; Jaffee *et al.* 2009; Rajan 2005), changes in the institutional and regulatory environment (Calomiris 2009; Gerding 2010; Tymoigne 2009), and incentive issues due to informational asymmetries (Achrya & Richardson 2009; Faber 2009; Richardson & White 2009; Ritholtz 2009; Sorkin 2009). However, while some among these have certainly made understanding institutional changes or financial market innovations central to their analysis, they generally do not go on and draw explicit connections between the two.[3] Moreover, while many authors that have highlighted potential incentive problems associated with moral hazard and principal agent problems, they do not embed these concerns into the broader rubric of transactions costs.

We focus in this essay on the financial markets, and specifically financial markets operating in the United States in the three decades prior to the 2007/08 crisis. We limit our discussion of the financial market primarily to the securitized paper market, especially the estimated $2 trillion Collateralized Debt Obligations (CDO) component (which in turn are mainly comprised of subprime and Alt-A related issues), and the $62 trillion credit (CDS) and equity (EDS) default swap market. While no part of the financial sector was untouched by the crisis—most notably the $32 trillion (and counting) stock market decline and widespread failures of hedge funds—and the crisis is far from limited to the United States—Iceland, Ireland, the United Kingdom, Spain, and much of Easter Europe experienced first-round crisis impacts—there is reason to believe that problems in these two parts of the financial sector both preceded the others, and that the operational heart of these markets was in the United States. One could plausibly argue that if the problems in the two were contained (or

[3] Calomiris (2009) and Tymoigne (2009) are two exceptions, although their focus is on how regulations affected financial innovation, without positing the link via transactions costs.

prevented), the other parts of the financial sector, as well as other parts of the world, may not have experienced the sorts of violent contractions that they have had.

Finally, our discussion of the CDS and EDS market is primarily of interest only to the extent that this market amplified the shocks of the subprime mortgage market (by its enabling role in synthetic CDO creation), not in the many other markets that default swaps have been used as a hedging instrument. Hence, our references to the CDS/EDS market are focused mainly on the subset of the market dealing with CDOs. To the extent that they overlap and are relevant, we also highlight the special purpose vehicles (SPVs) that issue the asset- and mortgage-backed securities (ABS and MBS's), which in turn form the basis for CDOs, along with related derivatives of CDOs, such as synthetic CDOs constructed from EDS's.[4] This does not, however, preclude a discussion of other important elements that were instrumental in a crisis of this magnitude, such as global capital flows, monetary policy, and the exchange rate, insofar as they were contributing factors. But as will become clear, our concern is the financial markets—and more specifically transactions costs inherent in these markets—since we believe that normal market forces would have corrected for these factors, *had the financial markets operated efficiently.*

The rest of the paper is organized as follows. In the following section, we provide a brief sketch of our notion of transactions costs and institutions, within the context of the financial markets examined in this paper. The section goes on to introduce a simple model that demonstrates how transactions costs and institutions are endogenously codetermined. Section 3 then dives deeper into how financial innovation via complex instruments can raise the transactions costs in the financial sector. The next section (Section 4) then examines the historical evolution of institutions in the financial sector, and systematically relates the evolution of these institutions to increased transactions costs. A final section concludes.

2 A Simple Model of Endogenous Transactions Costs and Institutions

To understand the role that transactions costs play, we begin with a definition.

Definition 1 (Transactions costs)**.** The vector τ of transactions costs are the direct costs of financial design, origination, sale, trading, enforcement, and compliance, as well as indirect (and often hidden) costs of informational imperfections and agency problems that result from the introduction of the marginal financial contract.

[4] We are aware, of course, that securitization vehicles encompass instruments far broader than just CDOs; these vehicles include, for example, collateralized loan obligations (CLOs) as well as bank-affiliated structured investment vehicles (SIVs). Again, for expositional purposes we primarily concentrate on the CDO market, although we would note that some of our arguments would plausibly be adapted to accommodate other securitization vehicles, especially SIVs.

What is the source of such transactions costs? These include: (a) The cost of contract origination and sale. Of course, such costs in any tradable financial instrument are likely to be much smaller than the gains in risk diversification, since the instrument would otherwise not exist. (b) The cost of exchange. Most structured products are sold in the over-the-counter (OTC) market, as opposed to a centralized exchange or clearinghouse. This reduced market liquidity is a cost of exchange. Moreover, the OTC market is also a poorer aggregator of information. Induced price volatility from informational failures can lead to thin markets (Gorton 2009), which in turn act as a cost of exchange. (c) The cost of design, enforcement, and compliance. Although financial contracts are seldom abrogated, except in the case of a bankruptcy, the implicit costs of ensuring legal compliance and contract enforcement are often priced into the final product. Such legal transactions costs rise as contracts become more structured and, hence, idiosyncratic. Such costs would rise even further in the event that the complex structuring of the product either embeds computational intractability (Arora *et al.* 2009) or even outright fraud (Eisinger & Bernstein 2010). (d) The cost of parameter, model, and valuation uncertainty. Modest imprecisions in parameter estimates can be amplified by the capital structure (Coval *et al.* 2009), resulting in much more risk than may be initially perceived. Model uncertainty arises due to the absence of standard models for evaluating complex instruments, and the consequence of model uncertainty is a wide variation of valuation estimates. Such errors may be perpetrated by investors, counterparties, or ratings agencies (Benmelech & Dlugosz 2009). (e) The cost of principal-agent problems. This includes adverse selection due to mortgagees misrepresenting their income and assets (on the demand side), or moral hazard as downstream lenders neglect to adequately assess credit risks and instead outsource due diligence to ratings agencies (on the supply side).

It is also important to point out, for the purposes of discussion, what such transactions costs do *not* entail. Such costs are not merely informational failures between market agents. While informational asymmetries and principal-agent problems may arise in many economic contexts, including this one, the argument that we are making here is that these costs are the *direct* result of the market and institutional structures in which the financial sector in the United States operated in the recent past. Changes in these structures—and, by implication, changes in the implied transactions costs—distinguish the transactions costs from the primarily information-based explanations for the crisis.

Thus, while related, our notion of informational costs is distinct from the more standard moral hazard argument. The idea of institutions "too big to fail"—and hence justifying an *ex post* bailout—may indeed have precipitated excessive *ex ante* risk taking, overleveraging, and indiscriminate lending, especially when conditioned on the expectation of receiving a bailout. However, moral hazard is only one component of overall informational transactions costs that was experienced prior to the crisis. Transactions costs also manifest themselves through pressures for adverse selection; for example, more risk-loving individuals may be attracted to investment banking and portfolio management when the system becomes heavily decentralized, since their type is more likely

to become pooled with those with a relatively more neutral appetite for risk.

Also important as well in our transactions costs-based explanation is that these are not simply the result of complex financial instruments, and especially securitization, *per se*. As we will argue in Section 3, while securitization increases the transactions costs associated with the use of certain financial products, they also reduce transactions costs in important ways. Suggesting that securitization led to the crisis is to assume that securitization must unambiguously raise transactions costs. We reject this notion, because we believe that transactions costs depend on the institutional setting, and there are important circumstances where appropriate institutional frameworks (such as transparency regulation) that can minimize the informational costs associated from securitization.

What we are arguing, however, is that the institutional structure of financial markets changed substantively in the 1980s and especially the early part of the 21st century, and this change led to an increase in the associated costs of financial transactions. We believe that the primary driver of this increase is related to the indirect costs related to informational asymmetries and principal-agent problems costs. One conceptualization of these costs is that Grossman & Stiglitz (1980)-type informational costs increased as a consequence of changes in the institutional setting.

We adopt our definition of institutions (first) from the institutional economics literature, which are the set of common-knowledge rules that structure agent interactions in an economy (North 1990):

Definition 2 (Institutions)**.** Institutions, $\mathfrak{I}$, are the outcome of a vector of regulatory policy decisions $\mathbf{p} = (p_1, \ldots, p_m)$ set in place by government policymakers in the economy, resulting from the set of interactions between heterogeneous optimizing economic agents in the financial sector and the government policymaker.

We are aware that this definition is, *inter alia*, inconsistent with more traditional definitions in the finance literature, which implicitly define the institutional framework as the result of (informational) transactions costs (Merton 1989). As will become clear as we develop the model, however, policy changes—and the resulting institutions that accompany such changes—ultimately condition the transactions costs that agents face, in addition to being determined by transactions costs *per se*.

To link our two definitions above, we introduce our first assumption.

Assumption 1. Prevailing policies, resulting from the previous period $t-1$, affect current transactions costs, $\tau_t = \tau(\mathbf{p}_{t-1})$.

Given our definition of transactions costs, this assumption should be relatively uncontroversial. It essentially renders transactions costs a function of policy, which is entirely reasonable: regulatory policy for the financial sector affects the costs faced by actors in the sector as they make their economic decisions. For example, regulation on disclosure affects the manner by which

financial contracts are written, and rules on capital requirements may limit the ability of firms to increase their financial exposures.

To fix ideas, we consider a very general setting for policymaking introduced by Dixit *et al.* (1997), which in turn builds on the common agency model of Bernheim & Whinston (1986). The economy is comprised of two classes of agents, a government policymaker, and all other $i = 1, \ldots, M$ economic agents. The welfare of a given agent i (which could be a group) at time t is given by

$$W_t^i\left(\mathbf{p}_t, \mathbf{c}_t\right) = w^i\left(\mathbf{p}_t, c_t^i\right), \tag{1}$$

where $\mathbf{p}_t$ is the prevailing policy at time t, and c_t^i is a given level of political contributions undertaken by agent i in the same period. Since all variables correspond to the same time period, we will suppress the time subscript in what follows, and only reintroduce the notation when necessary. We will constrain contributions to a schedule that we assume to be globally truthful:[5]

Assumption 2 (Contribution schedule)**.** Contributions are represented by a schedule

$$C^i\left(\mathbf{p}; \underline{w}^i\right) = \min\left\{\bar{C}^i\left(\mathbf{p}\right), \max\left[0, W^i\left(\mathbf{p}\right) - \underline{w}^i\left(y^i\right)\right]\right\}, \tag{2}$$

where $\bar{C}_h^i\left(\mathbf{p}\right) \equiv \sup\left\{C^i\left(\mathbf{p}\right)\right\}$ is the upper limit of feasible contributions that group i is willing to undertake, subject to its net welfare remaining positive, and $\underline{w}^i\left(y^i\right)$ is its reservation utility, which is dependent on its income y^i.

The welfare of the government policymaker is given by

$$G\left(\mathbf{p}, \mathbf{c}\right) = g\left(\mathbf{w}, c\right), \tag{3}$$

where $\mathbf{w}$ is the vector of all agents' welfare, and $c = \sum_i^M c_i$ is the sum of all contributions received.

We further assume that $\partial G/\partial c_i \geq 0$ and $\partial W^i/\partial c_i \leq 0$ for every i, and $\partial \underline{u}^i/\partial y^i > 0$.[6]

Let there be a subset $J \subseteq I$ of agents that overcome typical Olson-type collective action problems and are able to organize and engage in positive contributions. We can now offer our definition of a political equilibrium.

Assumption 3 (Political equilibrium)**.** In a political equilibrium: (a) $\mathbf{p}^i$ belongs to the policymaker's best-response set to the list of contribution schedules $C\left(\mathbf{p}\right)$; (b) There does not exist a contribution amount $\hat{c}^i \geq 0$ and a policy vector $\hat{\mathbf{p}}^i$ with $W^i\left(\hat{\mathbf{p}}^i, \hat{c}^i\right) > W^i\left(\mathbf{p}^i, C^i\left(\mathbf{p}^i\right)\right)$ and $G\left[\mathbf{p}^i, C_1\left(\hat{\mathbf{p}}^i\right), \ldots, \hat{c}^i, \ldots C_N\left(\hat{\mathbf{p}}^i\right)\right] \geq$

[5] This assumption, which we make for simplicity, is actually more restrictive than necessary. Dixit *et al.* (1997) demonstrate that may, under certain conditions, a (Pareto efficient) equilibrium in truthful strategies exists and is unique.

[6] This final assumption may be rationalized as follows: Defining reservation utility as the base utility that corresponds to income gross of borrowing and government taxes/transfers, a negative (positive) shock to output then reduces (increases) this base level. Intuitively, an increase (reduction) in income raises (lowers) the opportunity cost of pursuing outside options, which implies a positive relationship between income and reservation utility.

$G\left[\mathbf{p}^{-i}, \mathbf{C}^{-i}\left(\mathbf{p}^{-i}\right)\right]$, where N is the total number of organized groups, and the superscript $-i$ indicates the absence of element i. We denote the equilibrium policy and contribution vectors by $\mathbf{p}^{\circ}$ and $\mathbf{c}^{\circ}$.

We can now establish our first proposition.

Proposition 1 (Dixit *et al.* (1997))**.** *Let preferences* $\left(\left\{W^{i}{}_{i\in I}\right\}, G\right)$ *be represented by the quasilinear form* $W^{i}\left(\mathbf{p}, c^{i}\right) = \Omega^{i}\left(\mathbf{p}\right) - \omega^{i}c^{i}\ \forall\ i \in I$ *and* $G\left(\mathbf{p}, \mathbf{c}\right) = \Gamma\left(\mathbf{p}\right) + \gamma c$*. The equilibrium policy vector is then given by*

$$\mathbf{p}^{\circ} = \arg\max_{\mathbf{p}\in\mathbf{P}} \frac{\Gamma\left(\mathbf{p}\right)}{\gamma} + \sum_{i\in I} \frac{\Omega^{i}\left(\mathbf{p}\right)}{\omega^{i}}.$$

Proof. The details are analogous to Dixit *et al.* (1997). □

This result is a general expression of a host of applications in political economy, many of which are reviewed in Grossman & Helpman (2001) and Persson & Tabellini (2000). For our purposes, however, we establish an additional corollary.

Corollary 1 (Transactions costs from institutions)**.** *Transactions costs in the current period are a function of the institutions that exist as a result of equilibrium policy chosen in the previous period. That is,*

$$\tau_{t} = \mathfrak{I}\left(\mathbf{p}^{\circ}_{t-1}\right).$$

Proof. The corollary follows directly from Proposition 1, using the definition of institutions given in Definition 2 and Assumption 1. □

Now, consider how transactions costs at time t affects income (and hence welfare) of agent i. For simplicity, let income be constant such that $y^{i} = y\ \forall\ i$. Without loss of generality, let the change in transactions costs for agent i be negative, that is, $\tau_{t} < \tau_{t-1}$. This then implies that $\underline{u}^{i\prime} - \underline{u}^{i} = \Delta\underline{u}^{i} < 0$, which in turn implies that

$$C^{i}\left(\mathbf{p}; \underline{u}^{i\prime}\right) \geq C^{i}\left(\mathbf{p}; \underline{u}^{i}\right).$$

For a given constant level of welfare, therefore, there are now potentially groups for which the upper limit of feasible contributions—the term on the left of (2)—is now higher than the group's welfare net of its reservation utility (which is the group's welfare if it participates in the political game—the term on the right). This brings us to our second proposition.

Proposition 2. *With preferences in the same quasilinear form given by Proposition 1, the equilibrium policy vector due to a change in transactions costs is given by*

$$\mathbf{p}^{\circ\prime} = \arg\max_{\mathbf{p}\in\mathbf{P}} \frac{\Gamma\left(\mathbf{p}\right)}{\gamma} + \sum_{i'\in I, i'\neq i} \frac{\Omega^{i}\left(\mathbf{p}\right)}{\omega^{i}},$$

Proof. See appendix. □

Corollary 2 (Transactions costs to institutions)**.** *Changes in transactions costs lead to changes in the structure of institutions. That is,*

$$\mathfrak{I}\left(\mathbf{p}_t^{\circ}\right) = f\left(\tau_{t+1}\right).$$

Proof. The corollary follows directly from Proposition 2, using the definition of institutions given in Definition 2 and Assumption 1. □

Why might lobbyists choose to push for policy changes that could result in *increases* in transactions costs and, hence, effectively shoot themselves in the foot? The intuition behind this result is similar to the generic lobbying game of Dixit *et al.* (1997). In that setting, lobbying activity on the part of each lobbying group results in a Bertrand-type equilibrium where all the surplus from the political relationship is captured by the common agent (the policymaker). Thus, while the outcome may not be ideal for any given lobbying group—*ceteris paribus*, it would prefer to minimize its contributions while maximizing its surplus from the political relationship—competition between groups results in competitive bidding in contributions and a "race to the bottom" in terms of foregone surplus. In an analogous fashion, for any given change in transactions costs, each group pursues its preferred policy conditional on the configuration of transactions costs. The equilibrium that results may embody a smaller number of firms and higher transactions costs, but this outcome is stable in a game-theoretic sense. As long as there is more than one competing lobbying group, lobbying competition will always ensure that the policymaker captures the political surplus, with each group fully exhausting its surplus in equilibrium.

3 Financial Innovation and Transactions Costs

In this section, we examine the relationship between financial innovation and transactions costs in greater detail. We first establish that the contrivance of complex financial instruments did not, *ipso facto*, lead to the financial crisis. We then spell out the role that complex finance *did* play, in terms of increasing the type of transactions costs described in Section 2.

3.1 Was It All Because of Complex Finance?

One of the oft-cited causes of the crisis is the diversity and complexity of financial instruments, which arguably were so complex that the investment banks who sold these products scarcely understood their risk implications. We do not deny that complex instruments were an important contributor to the crisis. However, there are reasons to question whether such instruments were a fundamental, rather than proximate, cause.

First, such instruments are neither necessary nor sufficient to ensure a crisis. They are not necessary, because financial crises have occurred in economic environments far more primitive than the U.S. financial landscape just prior

to the crisis. Japan's bubble and crash in 1992 occurred, notably, in an economy where financing was conducted primarily through plain-vanilla loans, and the economies embroiled in Asia's crisis in 1997 had immature financial markets, relying mainly on long-term domestic-currency loans (albeit funded with short-term borrowings denominated in foreign currency). Nor are they sufficient, because complex derivatives were—and still are—present in many market segments, and these have been successfully deployed for long spans without incident. It is also notable that some of the most major employers of such instruments—the hedge funds—were more victims rather than villains of the crisis.

Although hedge funds and their routine use of derivatives did not precipitate the crisis, it is likely that they amplified the initial shock in a crisis environment. An idiosyncratic shock that leads one hedge fund to start unwinding its positions can send signals to other (highly leveraged) funds that, if operating on a similar quantitative trading strategy, be interpreted as a signal to sell as well, hence amplifying the original shock (Khandani & Lo 2011). These are further propagated and amplified by the leveraged capital structure (Coval *et al.* 2009), both from resecuritizations as well as payouts resulting from triggers on CDS's, naked CDS's, and (for synthetic CDOs) EDS's.

Nonetheless, even given their amplification role, quantitative hedge funds cannot be the entire story. The LTCM/Russian crisis of 1998 and the hedge-fund crisis of August 2007 came and went with relatively little fanfare. While it is undeniable that the events surrounding both episodes induced sharp panic in the financial markets, they were ultimately contained within the financial sector. Unlike the subprime crisis, these crises did not induce a long, drawn-out crisis with real spillovers that are more akin to those experienced by developing countries. The extent in which the financial shock has been accompanied by a real shock suggests that, compared to LTCM, the credit misallocations were more severe and expansive, and hence must have been attributable to a deeper cause.

Second, such instruments, in and of themselves, are theoretically designed to disperse, rather than concentrate, risk. As a consequence, the instruments cannot be held culpable for the poor *assignment* of risk, since this assignment is the result of decisions made outside of the instruments themselves.[7] Contingent on proper risk assignment, derivative securities can actually *reduce* the transactions costs associated with economic exchange, since risk would generally be transferred from those with lower appetite for bearing risk and poorer access to information to those with superior knowledge and/or greater risk appetite. Moreover, derivatives can promote market completeness and thickness; this in

[7]There is an additional wrinkle that comes from the subsequent transfer of the risk from the holders of these instruments to sellers of credit default swaps. In the subprime episode, unfortunately, the primary seller of such CDS's was AIG. There is therefore a potential counterargument that risk was subsequently re-concentrated as a result. We do not examine this possibility in detail here, but note that absent expectations that AIG was too-big-and-interconnected-to-fail, the main counterparty of these trades would not necessarily have consistently been AIG.

turn can ignite a financial innovation spiral that leads, in theory, to the limiting case of zero marginal transactions costs (Merton & Bodie 2005).[8]

However, such instruments will fail to diversify systemic risk when they are not sold to other willing bearers but are kept on banks' balance sheets (Acharya & Schnabl 2009; Acharya *et al.* 2013). While the banks had sliced, repackaged, and sold the low-risk, high-grade tranches to money market and hedge funds, they kept on their balance sheets the lower-grade tranches of securitized products. These were then subsequently traded between banks, so that the assets that ultimately appeared on a given bank's balance sheet would be those of a counterparty bank (rather than their own). Since these did not originate from the borrowing firm, credit default swaps could be purchased on them to further hedge risk. It was this creative use of the *combination* of CDOs and CDS/EDS's, abetted by high transactions costs, that allowed—and further perpetuated—informational asymmetries in the form of misleading bank balance sheets, rather than the derivative nature of the instruments involved. If such informational asymmetries were absent, banks would not have been able to relinquish risk to off-balance sheet vehicles, rendering the use of derivatives irrelevant.

Indeed, the institutional framework of modern financial markets probably facilitated the operation of the originate-to-distribute model. Although in principle the repeal of Sections 20 and 32 of the Glass-Steagall Act should have vested financial market participants with greater incentives to diversify their business lines, in practice it led to consolidations only among banks, while (paradoxically) encouraging *even greater specialization* in terms of other niche financial market players. Free from concerns over violating Section 32 provisions, consolidated banks engaged in more active proprietary trading of complex financial instruments, which in turn provided even greater incentives for smaller firms to specialize in the design of ever-more esoteric instruments.

A related point is that risk models can be accurate, so long as their underlying parameters are calibrated in a manner that is not just consistent with historical post-war data, but also with instabilities more inherent to the global system prior to the Great Depression. The choice of such parameters and instruments, however, reflect the choices of modelers and risk managers (although these were generally guided by historical correlations). Such models fail when they either do not fully account for, or poorly capture, the likelihood that the (exogenous) distribution of risk factors may have been themselves affected by the use of the models.[9]

[8] Recent work has come to question this premise that financial innovations actually result in greater financial stability. This is the case especially when disagreements over traders' beliefs concerning asset valuations is large (Simsek 2013). Even in this case, financial innovations can be regarded as merely amplification mechanisms over the more fundamental problem of uncertainty over asset values (which, by our definition, is a type of transactions cost).

[9] Although, admittedly, it will be difficult for any given model to fully endogenize such a possibility, since there is imperfect information about the extent to which such models are used by other agents, and the degree of customization made to the proprietary models used by other agents. For example, to the extent that Value-at-Risk calculations are successfully able to measure intra-firm risk exposure—even across multiple portfolios and asset classes—

Third, it is unclear whether the possible risks in the widespread use of such instruments could actually be mitigated to any useful extent, or whether such risks could have been actually recognized, *ex ante*. Supernormal returns that result from high levels of risk taking are observationally equivalent to high returns resulting from superior deployment of such instruments in models. Moreover, even if it were possible to recognize such risks as being potentially dangerous, there are limited avenues available to a given fund manager or investment banker. If he (or she) were to opt for a relatively safer allocation of assets—to, say, a stock index rather than credit default swaps—the performance of his (or her) portfolio may nonetheless suffer from severe market declines that result from generalized financial market turbulence that originated elsewhere.

Alternatively, financial institutions could well have been fully aware of systemic risk, but chose to neglect the effects of their actions on such risk (Danielsson & Zigrand 2008). A variation of the Lucas (1976) critique is applicable here: Financial models were heavily reliant on the stability of the models' underlying parameters and probability distributions, but unfortunately these were not the deep structural parameters required for true predictive power. Ultimately, models fail when there is an endogenous change in the structure of the market, and this change is in turn affected by changes in the institutional setting in which such markets operate. In either case, the problem appears to lie in the strong incentives for agents to concentrate systemic risk, and this concentration of risk was kept opaque by the strong informational asymmetries and other transactions costs that were pervasive in the securitized product markets.

3.2 Transactions Costs Introduced by the Securitization Process

It should by now be apparent that, while complex financial instruments were only a proximate factor contributing to the crisis, the development of these instruments meant that the market had in play novel and untested mechanisms for informational failures. One major difference between this class of financial innovation and earlier ones—such as the Black-Scholes model—is that instead of lowering the transactions costs required for completion of mutually-beneficial trade, it raised these costs as additional informational burdens were introduced between the agent and principal. Of course, instruments that increase overall transactions costs need not be highly sophisticated. The S&L crisis in the 1980s and 90s was relatively low-tech, centering on imprudent loans and high-yield speculative debt. However, containment of the crisis was easier, since agency problems were much more easily addressed *ex post*. Consequently, the American economy recovered rapidly from the financial shock.[10]

capturing system-wide VaR is, for all practical purposes, impossible.

[10]The counterexample to this, of course, is Japan's "lost decade" of the 1990s. It can be argued that the problem there was that agency issues continued to abound even after the crisis began, because the unwillingness of banks to realize losses was tacitly supported by the government. In other crises, such as Sweden in 1992 and East Asia in 1997, recapitalization was swift and definite, losses were quickly written down, and as a result the real contraction

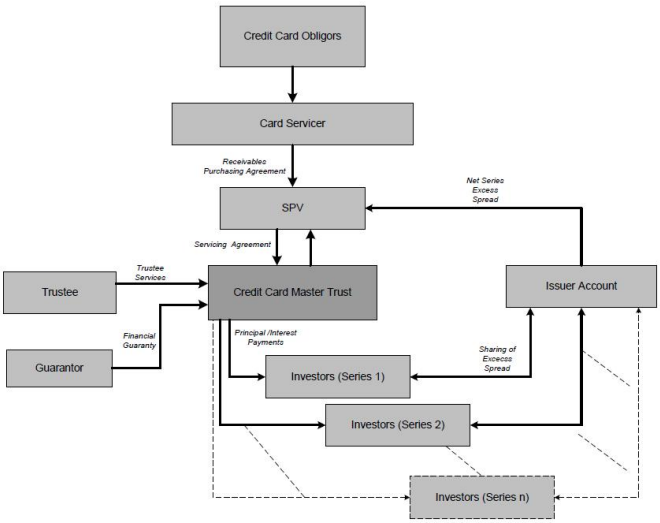


Figure 1: A typical asset-backed security, with multiple layers between the ultimate investors and the original obligors. Notice the initial contract between the borrower and the lender is subsequently spun off into an SPV, which in turn securitizes the debt into an ABS, before being sold off to investors, often in several tranches.

In the subprime crisis, the extensive securitization of subprime and Alt-A loans meant that even if moral hazard problems were now recognized, they remain embedded in the structure of the toxic assets due to the extensive disconnect between principal and agent. Although some banks have taken extensive writedowns due to mark-to-market accounting, the true extent of losses remains unknown due to the multiple layers of intermediation in this episode. The result was real spillovers that were not easily contained to the financial sector. These layers are, by now, well known, and illustrated in Figure 1 for a typical securitized product (in this case, a credit ABS). Additional layers were added by tranching and repackaging ABS's and MBS's into CDOs and CDO-squareds, as shown in Figure 2 for a (subprime) MBS.

It is important to recognize here the paradox of how the securitization process, which could only have been as widely successful as it was in a mature and sophisticated financial system, was also the source of systemic risk in an otherwise well-functioning and stable sector. The main benefit of securitization through SPVs, ABS's, MBS's, and CDOs—to isolate legal and financial risk from the originator—also introduced important transactions costs to the exchange; there is convincing evidence that securitization is strongly correlated with declining credit standards in subprime lending (Mian & Sufi 2009). In practice, such costs were not limited to problems of informational asymmetry,

and recovery were correspondingly expedited.

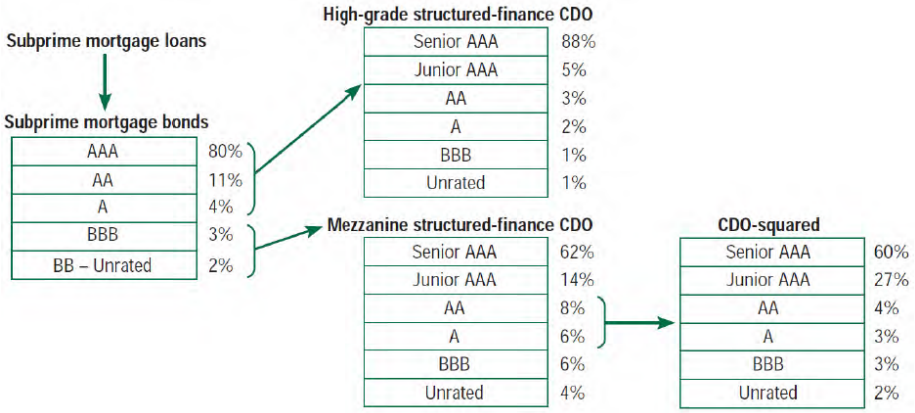


Figure 2: Tranching and repackaging a subprime MBS into two grades of CDOs (high and mezzanine). The latter is then subsequently re-tranched and repackaged into a CDO squared. The process allows for the conversion of the lowest tranches of the MBS (5%) into additional high-grade CDO paper, and the middle tranches of the CDS (14%) to more high-grade CDO-squareds, and introduces tremendous distance between obligor, originator, and investor.

but included legal and structural constraints on the manner in which agents could perform exchanges, as well as corrupted incentives skewed toward excess risk taking with overleveraging (Tymoigne 2009). These ultimately led to severe liquidity problems when confidence in the market collapsed, coupled with significant difficulties in any post-bankruptcy resolution attempts.

Pervasive securitization also facilitated the sale of securitized assets to international investors. This development brought risk diversification to the global level. However, such international diversification also meant that yet another layer of agency problems would have been added to the mix, since it became even harder to monitor agent behavior. An investor in a AAA-rated ABS or MBS, based in Dubai or Hong Kong, can hardly be expected to be either aware of, or familiar with, the myriad legal, institutional, and cultural elements that shape the consumer loan practices embedded in credit card, auto loan, and home equity loans embedded in the ABSs and MBSs, especially if the securities originate in New York or London. This distance often led lenders to favor hard information, such as borrower credit scores, over softer information obtained about borrowers (which is extremely difficult to verify). Such a bias can lead to a fundamental changes across securitization regimes, and there is evidence that this is precisely what happened in securitized subprime between 1997 and 2006 (Rajan *et al.* 2008). Thus the global diversification of risk, designed to spread risk across uncorrelated world markets, introduced informational transactions costs that increase risks instead. Finally, the international nature of asset diversification also helped promulgate the crisis globally.

Another side effect of widespread securitization was that a given spread

on the initial financial contract was now apportioned into smaller and smaller pieces. Smaller spreads on each leg of the transaction meant greater competition for each piece of the pie. While increased competition can, in principle, lead to improved market efficiency, such competition in the context of an outsized financial sector and costly exit (in the form of labor retraining) meant that financial agents and firms often had an incentive to take shortcuts and focus on short-run profitability, rather than longer-run viability. This was then further exacerbated by informational asymmetries, which allowed such inefficiency to persist for longer than in their absence. Such frictions meant that the actual transactions costs inherent between each leg was far greater than the observed charges.

Finally, many models of financial instruments as well as risk management require inputs of information that are often neither available nor plausibly attainable. Of course, models are by definition simplifications of reality that cannot, and are not expected to, fully capture reality. However, the power afforded by fast computing allowed financial models to incorporate increased numbers of parameters and variables that were perhaps only available for a subset or subclass of all instruments. The parameterization of these unknown quantities were then reduced to educated guesses, often reliant on data generated by similar (but distinct) products. The (now) infamous Gaussian copula formula and its variants (Li 2000; Schönbucher 2003), for example, relied on market prices of credit default swaps to determine correlations for default probabilities; however—unlike default rates extracted from historical data or Black-Scholes-type option pricing—implicit rates obtained from market information are more likely to be either susceptible to mispricing or, more likely, to be endogenous to the system itself. Such practices can lead to an overconfidence in the final quantifiable result, given that the initial inputs are not necessarily reliable or accurate.

In markets where informational frictions are low, financial models based on implausible assumptions are likely to fall out of favor, as market participants utilizing these models have strong incentives to switch to better-performing models. However, if informational frictions are high, this discovery process may be postponed and, more importantly, agents may not fully bear the cost of non-discovery. In the recent crisis, the former problem arose due to the black-box nature of many financial models, and the latter problem was commonplace, as MBA-trained managers—not quantitative finance specialists—were often the ultimate decisionmakers regarding trades and asset allocations. As a consequence, poor financial models may continue to be employed indefinitely, while allowing mispricing to continue indefinitely.

Given the reasons outlined in the previous subsection, it would appear that it was not so much complex financial instruments that were responsible for misallocations of risk and the subsequent bubble-generating behavior, but informational transactions costs that were at the heart of the mispricing. Principal-agent problems abounded between the originator of the risk and the ultimate bearer of any potential losses. The increased distance between the principal and agent afforded by securitization produced additional layers of removal that

called for due diligence, but that due diligence was not well performed by agents along the chain, because the benefits of doing so were diffuse, which costs were concentrated. Moreover, these responsibilities were often abrogated by a pure reliance on external credit rating agencies. As a result, irreconcilable informational asymmetries became pervasive in financial models, and the informational input required for these models to function correctly became increasingly difficult to attain.

4 The Political Economy of Financial Markets and Institutional Change

In this section, we establish the relationship between institutional change and financial innovation (and hence transactions costs). We first argue that institutional changes supporting greater deregulation in financial markets were insufficient to explain the depth and breadth of the crisis. Second, we build our case of how deregulation and financial innovation coevolved endogenously, consistent with the mechanism in Section 2.

4.1 Beyond Regulatory and Government Failures

While we recognize that the trend of deregulation of the financial sector in recent decades was one precipitating factor behind the crisis, there are three problems with any argument that the decades-old deregulation initiative is, *ipso facto*, a sufficient explanation.

First, the deregulatory blueprint laid out by the Reagan administration went as far back as 1981, following the Depository Institutions Deregulation and Control Act of 1980. It is possible to argue that the Saving and Loans crisis was a direct consequence of this deregulation, or that the dot-com bubble likewise a consequence of the deregulatory moves of the late 1990s. But such occurrences are insufficient to link the recent subprime crisis to specific acts of deregulation, since these earlier crises were remarkably well-contained, and despite the fact that the former was also centered on mortgage loans.

Second, deregulated financial markets have not been uniformly problematic. The Commodities Futures Trading Commission (CFTC), operating since 1975, has exercised regulatory oversight with little fanfare. While it is certainly true that occasional crashes have erupted as a result of certain classes of derivatives, many derivatives have been successfully traded in loosely regulated environments for long periods without inducing systemic crises, and have in fact led to improvements in risk management and transfer.[11] Blaming derivatives regulation (or the lack of it) thirty years or so after the fact seems, to us, a *post hoc*

[11] More primitive versions of derivatives, such as futures, have been traded since the 18th century, and the Chicago Board of Trade was established in 1848. Yet the history of U.S. financial crises predates the creation of derivatives, and of these crises, only a handful have been due to financial innovations of the time.

demonizing of financial sector regulatory ability which has hitherto functioned in a reasonably acceptable fashion.

Third, regulatory attention does not necessarily prevent the formation of bubbles and consequent crises. The tech market bubble of the late 1990s was not accompanied by significant relaxations in the authority and oversight of the SEC, nor have bubbles been routinely contained in highly-regulated markets elsewhere (witness property bubbles in many parts of the world). Indeed, experimental evidence indicates that spot asset markets can form bubbles even in the absence of any clear institutional stimuli, relying only on heterogeneous expectations among experimental subjects regarding capital gains (Smith *et al.* 1988). For the 2007/08 crisis, there is evidence that outlays for banking and financial regulation actually *increased* in the run-up: from only $190 million in 1960, to $1.9 billion in 2000 and more than $2.3 billion by 2008 (in constant 2000 dollars) (Calabria 2009). Clearly, the substantial increase in regulatory expenditures since the middle of the 20th century were insufficient to circumvent the crisis.

We would hesitate, however, to attribute the crisis to regulatory changes alone. The effect of regulatory changes with direct relevance to the crisis—such as the repeal of the 1930s financial regulations, and the relaxation of regulations governing credit default swaps and mortgage markets—have been analyzed in greater detail elsewhere (Calabria 2009; Mian *et al.* 2010; Moran 2009), and will not be revisited here. We instead restrict our focus to a number of salient arguments as we set the stage for our transactions costs argument that follows.

The standard political economy argument for the crisis claims that a lax regulatory environment permitted and promoted rampant risk-taking activity among market participants (the "deregulation" argument), and this excessive risk taking ultimately led to the fall. Proponents of this view apportion the lion's share of the blame on the Gramm-Leach Bliley Act (GLBA, or the Financial Services Modernization Act of 1999). The attractiveness of this argument is immediately obvious, since the GLBA in essence removed obstacles between investment banks, commercial banks, and insurance companies, the three key players that arguably underpinned the crisis.

But the blame on the GLBA has unfortunately been levied with little by way of specifics. Scratching below the surface, the anti-GLBA argument can be attacked at two levels. First, one may question the link between the failure of the institutions precipitating the crisis—Bear Sterns and Lehman had no commercial banking arms—and the intended objectives of the GLBA. On the contrary, if either Bear Sterns or Lehman possessed a large source of insured deposits, they may have well survived their short-term liquidity crisis (Calabria 2009).

Second, placing the blame solely on the GLBA loses sight of the larger global forces at work in the decade preceding the crisis. The U.S. had been a major recipient of foreign saving generated in emerging market economies. This was especially so for the developing economies of Asia—where rising incomes had outstripped consumption—as well as for the Middle East, where many oil-exporting economies sought investment avenues that were deemed "safe." This

influx of funding exacerbated the downward pressure on interest rates which had been on a downward trend following both the dot-com bust and events surrounding September 11 at the turn of the century. This resulted in rapid expansion of mortgage lending, which in turn drove the housing boom. Seen in this context, the role of the GLBA in the crisis—and in particular any effect it may have had in the alleged deregulating of financial institutions—is at best only a contributing factor.

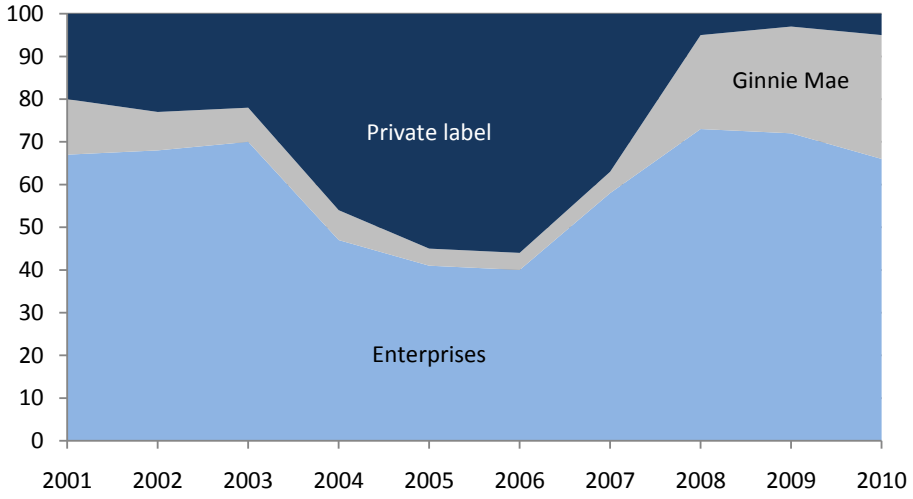
We turn next to the Commodity Futures Modernization Act (CFMA), signed into law in late 2000 by then-President Bill Clinton. The CFMA effectively took regulation of credit default swaps out of the hands of the states and clarified the law so that most over-the-counter (OTC) derivatives transactions, including CDSs, between "sophisticated parties" would not be regulated as "futures" under the Commodity Exchange Act of 1936 (CEA), or as "securities" under the federal securities laws. Unlike what the GLBA was to those financial institutions which failed, the link between CDS and the crisis seems rock solid. There appears to be little doubt that the CDS was to be the poster boy for any blame campaign for the crisis given the sheer enormity of the numbers: over $50 trillion underwritten as of 2007.

However, to credit the scope of the crisis to deregulation or lax regulation of such OTC derivatives, it is important to evaluate the perceived risks of CDSs *without* the benefit of hindsight. *Ex ante*, it would have been difficult to fairly label the insurance-like feature of covered CDSs as fraudulent (which some have done), given the origins of CDS contracts as legitimate financial insurance covering real business risks, which promote efficiency through risk transfer. Even *naked* CDS contracts—those written without direct ownership of the underlying asset—fulfill an important informational role, since the CDS spread provides a market estimate of the perceived riskiness of the original transaction. CDSs only increase risk when they allow counterparties to abrogate their necessary due diligence; in which case the issue was not so much CDSs *per se* but the (informational) transactions costs failures that allowed risk valuations to deviate from true inherent risk. What is also often lost in criticism is the fact that AIG was not crippled by the occurrence of a string of underwritten risks accruing to bad CDS bets, or even due to default of obligations, but rather by jittery counterparties—major investment banks—that demanded increased collateral as the crisis unfolded. What AIG faced was a problem of illiquidity, not necessarily insolvency due to underwritten CDSs.

Finally, we consider the institutional changes in the mortgage market. A typical government-failure argument states that implicit government guarantees to the Federal Home Loan Banking system—especially government mandates for Fannie Mae (FNMA) and Freddie Mac (FRMC) to lend to low-income households—perverted credit standards by these institutions, and indiscriminate lending by these agencies to the subprime sector ultimately led to their forced takeover in 2008.[12] While such guarantees undoubtedly played a part in

[12]The claim being that government paved the way for the creation of the subprime lending industry, due to the Depository Institutions Deregulation and Monetary Control Act of 1980

the overall failure of the system, it is unlikely that they were, in and of themselves, a major contributor. After all, beginning in 2005, FNMA and FRMC lost market share to private commercial banks and mortgage finance companies (Figure 3), and these latter institutions were responsible for originating just as many of the so-called NINJA (no income, no job or assets) loans. And while moral hazard may have played a role in FHLB mortgage loan activity, there was very little basis to believe that the federal government would have extended the same credit support to the private sector entities, had they run into serious liquidity and solvency problems. Even when Fannie and Freddie were purchasing a significant share of subprime mortgage securities in the secondary market, banks continued to hold many of these assets on and off their balance sheets (through SPVs). Thus, it appears that incentive problems at these Government Sponsored Enterprises (GSEs) are likely to have been marginal, at best, in bringing about a full-blown crisis that involved the entire banking system.



Source: Author's calculations, based on *Inside Mortgage Finance*

Figure 3: Total market share distribution in MBS market, by issuer, 2001–2010. The collapse of the private label MBS market following the financial crisis is evident, as is the rise in the market share captured by private label issuers prior to the crisis. Total issuance volume of MBS peaked in 2003, at close to $290 billion, but averaged levels of $200 billion between 2004–2007.

Finally, it is worth considering how the presence of the dual oversight system in the United States—where both public and private institutions are responsible for providing prudential oversight—necessitates that any true accounting of regulatory failure would have had meant simultaneous problems in both arms

and Alternative Mortgage Transaction Parity Act, passed in 1982.

of the system. While this may well have been the case for the 2007/08n crisis, it begs the explanation of why there was such a concurrent failure in regulatory function, and in particular why private sector competition and reputation effects did not perform their usual self-enforcement role when government regulation leaned toward greater laxity.

Part of the reason probably lay in the fact that, in the years leading up to the crisis, there was a significant increase in the tendency for both regulators to rely on market-based self-regulatory mechanisms on one hand, and private actors to regard regulatory permissiveness of specific business practices as tantamount to endorsement (rather than simply acquiescence or even ignorance) of them.[13] Indirect evidence of these interacting factors can be obtained via textual analysis. The atmosphere of increasing reliance on market-based regulation can be seen by the frequency of incidence of the terms "self regulation" and "market discipline" in the corpus of published English-language books. The expression "self-regulation," for instance, rose steadily through to the mid-1980s, plateaued for half a decade, before resuming its rise through until the crisis. The use of both of these terms peak a few years before the crisis, with a decline thereafter. By a similar token, pre-crisis regulatory documents exhibited little regard to the risks posed by informational transactions costs. For example, in the entirety of the comprehensive 347-page document documenting Basel II rules (Basel Committee on Banking Supervision 2006), the term "complex" only features 20 times, and even among those instances, only a quarter are specifically addressed to the informational risks associated with complex financial instruments.[14] This mutual codependency—between official and industry self-regulation—turned out to be not only self-reinforcing, but detrimental to financial stability.

Of course, this does not imply that regulatory bodies based in the private sector—or, more precisely, private ratings agencies that become invested with a *de facto* regulatory role—must necessarily outperform an equivalent government agency in carrying out their regulatory functions. The ratings agencies have often been vilified for being "in the pocket" of the firms they were tasked to regulate, since they typically collected fees from these firms in exchange for their rating services, and the potential conflict of interest problems are clear. However, to claim that a public regulator can necessarily do better implicitly does assume that government regulators are not subject to similar failures in the dispensation of their official duties. But just as a private regulator may be subject to financial compromise, a public regulator can likewise be subject to political capture (Dixit *et al.* 1997). Again, the underlying problem here seems to require a more encompassing explanation than simply one of government ineptitude.

In any case, even in the complete absence of formal regulation, it is possible that a combination of self-regulation, short-run concerns over excessive

[13] We thank an anonymous referee for prompting us to pursue this point.

[14] These occur on p. 116 with regard to valuation difficulties of a complex equity portfolio, on p. 194 on complex arbitrage strategies that could raise risks in a bond portfolio, and on pp. 196, 206, 217, and 230 on complex derivatives. Even in these cases, the call is simply for disclosure, rather than some limitation of their deployment due to informational costs.

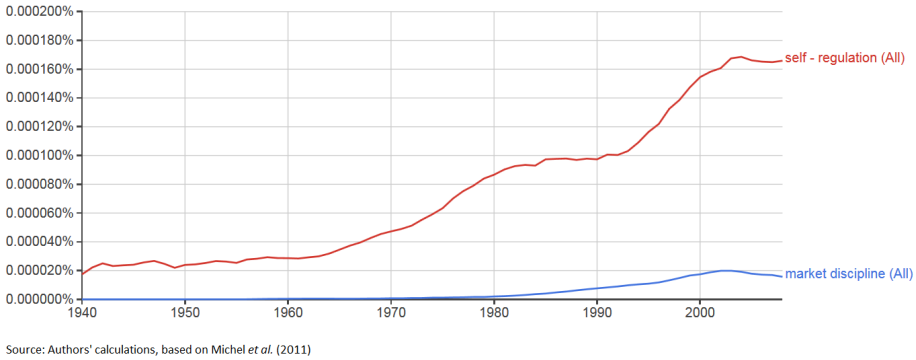


Figure 4: Frequency of incidence of terms "self-regulation" and "market discipline" in a 5.2 million-book bibliography, 1940–2008. N-gram data trajectories correspond to the English corpus, with a smoothing parameter of 3, relying on the methodology described in Michel *et al.* (2011). There is a steady increase in both terms since the 1940s, peaking around 2003, and a decline thereafter. There are points of inflection in these terms in the mid- to late-1990s, consistent with the deregulatory efforts of the period and the rise in ever-more complex financial instruments.

risk-taking, and longer-run reputational and profitability considerations may preclude imprudent action on the part of market participants. How probable such an outcome would be is, of course, an empirical question. Nonetheless, it would appear to us that a more fruitful question to pursue is not whether weak regulatory standards, along with their incomplete enforcement, were to blame—surely they were—but rather how the institutional environment supported excessive risk-taking. More precisely, we wish to pin down how changes in the regulatory environment may have expedited the development and perpetuation of high-transactions cost operations.

4.2 Interactions Between Deregulation and Financial Innovation

Although securitization—along with early regulatory efforts directed toward addressing the broadened financial market that was the consequence of such securitization—began in the 1970s, it was not until the mid-1980s that both innovations and regulatory changes began to occur more frequently (Table 1). The first MBS was issued by Ginnie Mae in 1970. The net capital rule, which was designed to limit leverage among broker-dealers to bring them closer to the operating leverage of banks, was only introduced five years later.

In the early part of the 1980s, two pieces of legislation were introduced that promoted the development of the mortgage market and mortgage-related securities. The Depository Institutions Deregulation and Monetary Control

Act abolished caps on chargeable interest on primary mortgages. This Act resulted in significant changes to the financial system, and in particular included a clause that effectively barred states from placing a ceiling on mortgage interest rates (Aaron 2009). This precipitated the birth of subprime lending over the decade and created an institutional environment that would enable the subprime lending industry to take off 20 years later, since lenders were free to charge rates of as much as 60 percent on mortgages deemed subprime.

The Garn-St. Germain Depository Institutions Act of 1982 ended New Deal restrictions on mortgage lending, and authorized banks to compete with money market mutual funds and reduce restrictions on issuing mortgages. Such loosening, arguably, supported the environment for the proliferation of subprime loans. These institutional developments set the stage for the introduction of second-level securitization, with First Boston and Salomon Brothers packaging a collateralized mortgage obligation (backed by MBS) for Freddie Mac.

Another key piece of legislation was the Alternative Mortgage Transaction Parity Act of 1982. The Act made it possible for lenders to offer exotic mortgages, rather than the plain-vanilla 30-year, fixed-rate loan that had been offered hitherto. This gave birth to a myriad of new mortgage products: time-varying adjustable-rate mortgages (ARMs), mortgages with balloon payments, interest-only mortgages, and so-called option-ARM loans (Aaron 2009). This legislation also paved the way for federal regulators to set guidelines for the lenders they regulate, thereby preempting state banking laws. By the late 1990s, lenders were using the law to circumvent state bans on mortgage prepayment penalties and other consumer protections.

Second-level securitization rapidly expanded through the second half of the 1980s to cover equipment leases, consumer credit (auto loans and credit card debt), corporate securities, and—by the end of the decade—non-investment-grade collateral (high yield loans and distressed bonds) (Kothari 2006). Along the way, Citigroup invented the SIV that allowed the formal transfer of ABS's off the balance sheets of banks, while maintaining exposure to potential risky profits (de Servigny & Jobst 2007).

Several institutional developments in the first half of the 1990s weakened the private-sector component of the regulatory apparatus. First, firm failures and mergers increased concentration among the Nationally Recognized Statistical Rating Organizations (NRSROs), leaving only three—S&P, Moody's, and Fitch—by the end of the decade. Second, both the Federal Housing Enterprises Financial Safety and Soundness Act as well as amendments to the Community Reinvestment Act sought to improve affordable housing by expanding the lending scope of mortgage lenders by offering greater recognition for mortgage-related securities.

In 1994, Congress passed the Home Ownership and Equity Protection Act (HOEPA). This Act created restrictions on loans in excess of 100 basis points above rates for comparable Treasury securities, as well as prohibiting negative amortization.[15] Financial engineers promptly got to work to circumvent the

[15] Also known as deferred interest mortgages, negative amortization loans allow for an ex-

Act's designed constraints with new mortgage practices that were not explicitly disallowed. For example, credit insurance or loan flipping—practices that raised the transactions costs associated with securing mortgages—were introduced (Aaron 2009). Moreover, while HOEPA was able to eliminate the most abusive lending practices among regional lenders, this simply resulted in similar practices imbued within national-level financial institutions.

Third-level securitization quickly followed, with the first CDO-squared issued in 1998;[16] other forms, such as those referenced to equity or debt, followed shortly (Watterson 2005). The repeal of the Glass-Steagall Act in 1999 (through the Gramm-Leach Bliley Act) further catalyzed the growth of third-level securitization, by allowing banks to pool resources to benefit from economies of scale. Resecuritization took off for the rest of the 2000s, with various cash and synthetic CDO-squareds, ABS's, CDS's, and EDS's becoming increasingly popular among investors. This pervasive securitization ultimately enabled loan originators to maintain lower equity capital on mortgage loans vis-à-vis commercial loans (Calomiris 2009).

Several steps were taken to strengthen the regulatory environment during this period. 2002 saw the introduction of the Sarbanes-Oxley Act, which enhanced accounting reporting standards for publicly-listed firms in the wake of the Enron scandal. The Basel II accords were also published in mid-2004, creating international banking standards which, among other things, institutionalized the acceptability of Value-at-Risk (VaR) modeling. That year also saw changes in the Net Capital Rule. Although the changes imposed new minimum capital requirements on broker-dealers, it also granted exemptions to the largest broker-dealers by allowing them to compute these requirements based on internal models and stress tests—the so-called "Bear Stearns exemption" (Ritholtz 2009).

As evident from Table 1, the pattern of financial innovation in the United States since the 1980s has hewed remarkably closely to changes in the institutional and regulatory environment. More specifically, financial innovation moved along with each significant move in the institutional environment. More precisely, institutional changes that involved a more deregulatory stance were often accompanied by a spurt of financial innovation, while institutional changes that were either neutral or tightened regulation were usually met with little by way of new financial instruments. Although this point is so seemingly self-evident to the point of tautology, it is important to note the asymmetry inherent in these developments, and to recognize that this meant that the overall trend in financial innovation was toward greater complexity.

Furthermore, it is impossible to rule out the possibility that a reduction in *observable* transactions costs due to advances in financial engineering—as argued in the Section 3.2—may have potentially encouraged further moves toward

tremely low minimum payment by continuously capitalizing accrued interest into the outstanding principal balance. Such high-risk loans allow borrowers to enter into housing markets with minimal equity outlay, but have been criticized for enabling house "flipping."

[16] This issuance was by New Jersey-based ZAIS Group via a $343 million investment-grade offering.

Table 1: Historical evolution of financial innovation and major institutional developments, 1970–2005†

Year	Innovation/Institutional Change	Detail
1980	Depository Institutions Deregulation and Monetary Control Act	Abolishes caps that limited interest rates banks could charge on primary mortgages
1982	Garn-St. Germain Depository Institutions Act	Deregulation of S&L industry and end of New Deal restrictions on mortgage lending
1983	Second-level securitization introduced	First Boston and Salomon Brothers issue first collateralized mortgage obligation (CMO)
1985/86	Expansion of ABS beyond mortgages to commercial credit	Sperry Lease Finance Corporation issues first ABS for equipment leases
	Expansion of ABS to consumer credit	Marine Midland Bank issues Certificate for Automobile Receivables (CAR) for auto loans
		Bank One creates Certificate for Amortizing Revolving Debts (CARD) for credit card receivables
1987	Expansion of ABS to corporate securities	Drexel Burnham Lambert issues first collateralized debt obligation (CDO) for commercial bonds (CBO)
1988	Special purpose vehicles introduced	Citigroup invents SIVs for risk transfer off-balance sheets
1989	Expansion of CDOs to risky securities	Issuance of CDOs on high-yield corporate loans (CLO) and distressed bonds
1990s	Increased concentration among NRSROs	Mergers reduce NRSROs to S&P, Moody's, and Fitch
1992	Federal Housing Enterprises Financial Safety and Soundness Act	Enables Fannie and Freddie to increase affordable housing with mortgage pooling and securitization
1993/94	Credit and equity default swaps introduced	Bankers Trust and JP Morgan independently invent CDS and EDS
1995	Community Reinvestment Act amendments	Allows mortgage lenders to receive credit toward affordable-housing lending obligations for buying subprime securities
1998	Third-level securitization introduced	ZAIS Group invents first CDO-squared
1999	Gramm-Leach-Bliley Financial Services Modernization Act	Partial repeal of Glass-Steagall provisions
2000	Commodity Futures Modernization Act	Relieves OTC derivatives from regulation as futures or securities
2000s	Resecuritization takes off	Broad issuance CDOs of CDO/ABS/CDS/EDS
2002	Sarbanes-Oxley Act	Enhances financial reporting standards for public firms
2004	SEC changes to net capital rule	Lifts leverage restrictions by allowing large broker-dealers to compute net capital based on models
	Basel II Accords	Institutionalization of Value-at-Risk (VaR)
2006	Credit Rating Agency Reform Act	Constrains NRSRO rating standards of ABS/MBS-issued securities

† Notes: Attribution of innovation generally assigned to originating corporation, not necessarily the financial institution that designed and/or brought to market the innovation, unless the innovation originated directly at a financial institution.

deregulation. Citing such advances, the regulatory authorities could have favored greater deregulation, which would have further reduced observable transactions costs. Unfortunately, these technological advances were not necessarily accompanied by reductions in informational asymmetries. Importantly, the true underlying transactions costs in financial markets may have actually increased over the period, and this would have altered the optimal institutional structure that should accompany these costs. Since such costs were not realized, however, market participants and regulatory institutions simply operated under the assumption of falling transactions costs, and adapted institutions to that effect. Ultimately, changes in transactions costs may have contributed to the evolution of the institutions which gave rise to them in the first place.

The institutional framework governing financial markets thus played a non-trivial role in conditioning the emergence of transactions costs. Institutional changes clearly affected the nature and costs of financial market transactions, lending support to Corollary 1. In addition, institutional changes were in turn being shaped by the prevailing transactions costs at any given time, as claimed in Corollary 2.

5 Conclusion

In this paper, we have offered a transactions-cost based view of financial markets and the recent financial crisis. More specifically, we have argued that transactions costs, broadly defined, are not only a function of the institutional framework, but affect the development of institutions as well. Such transactions costs have been rising over time in financial markets, and amplify an ever-greater disconnect between market prices and their economic fundamentals. In the limit, transactions costs increase financial fragility to the extent that the system becomes vulnerable to a financial crisis, such as the one recently experienced.

We have also elaborated on two of the primary elements in our framework. We first argue that financial innovation through complex instruments raise the transactions costs related to economic exchange in the financial markets, which result primarily—although not exclusively—from agency and moral hazard costs associated with informational asymmetries. Second, we demonstrate, for the United States, that a relaxation of regulation in the financial sector is often followed by the introduction of new financial instruments, which regulatory tightening has not, in general, led to rollbacks of such instruments. We contend that this asymmetry has meant a trend increase in transactions costs in financial markets over time.

Finally, we have considered alternative explanations for the financial crisis, by placing the fundamental determinants associated with these alternatives within the context of observed global imbalances. We have shown that, while plausible, many of these explanations are either insufficient as a broad-based account of the crisis, or were more a result rather than than causal in their nature. To the extent that these explanations have offered a convincing explanation, we have shown that these arguments often bring us back to a transactions costs-

related argument.

The main policy lesson to take away from this paper is the need for a more explicit recognition of the limits that transactions costs can impose on financial markets, as well as the limits faced by regulation seeking to offset these costs. Undoubtedly, an omniscient and omnipotent regulatory authority, exercising total enforcement of each and every known transaction, could, by definition, ensure that no imprudent loans were made. But such perfect regulatory systems do not exist, not least because the costs of doing so would be infinitely large. And even if such costs could be managed, unless the regulator possessed superior information to actual market participants, the regulator may actually stifle economic activity with overzealous regulation. Ultimately, the choice inevitably involves a compromise between sufficient regulation that would prevent the worst of credit market excesses, and a realistic level of costs accrued in the process of doing so.

Even though the crisis was not due to the machinations of complex financial instruments, *per se*, complex instruments that pose a systemic risk due to their unlimited downside potential in an extreme standard deviation event—however rare such events may be actually realized—do deserve closer regulatory scrutiny. However, such scrutiny should not involve attempts to game market participants or *ex post*, *ad hoc* tweaks to the regulatory mechanism that governs such instruments. Rather, the introduction of any new, untested financial innovation should be accompanied by a transparent set of disclosure, reporting, and monitoring mechanisms designed to to bring principals' incentives more in line with agents'.

While this may be a fairly complex task, advances in the study of mechanism design could make this difficult task at least plausible. Ideally, this would be coupled with appropriately-directed financial resources, perhaps co-funded by financial innovators who wish to market such products to the investment community. The empirical evidence suggests that ensuring that market discipline—through skin-in-the-game—is likely to be more successful than blanket regulation *per se* (Keys *et al.* 2009). This is the form of microprudential regulation that, in our view, appears most likely to succeed. Even so, there is the risk that such regulation ends up playing a catch-up game.

Successful macroprudential regulation, on the other hand, is likely to be more elusive. In principle, a financial supervisory authority is better able to internalize the systemic risk that individual banks would take as given. However, this requires an extraordinary access to firm- and system-specific information by the supervisory authority that we do not consider to be realistic. The danger, then, is that the financial supervisor may commit errors in its evaluation of the extent to which a given bank constitutes a systemic risk. As a consequence, this would stifle beneficial financial innovation at the bank level. Moreover, even if the supervisor were able to correctly identify the systemic risk a firm posed, how would the supervisor make the case to the firm? After all, since the risk would by definition be at the systemic and not the firm level, the firm would be entirely justified in pointing out that, given existing conditions, it was well within acceptable risk limits. Macroprodential regulation of this form thus

requires a strong, implicit belief that the model employed by the supervisory agency is trustworthy and accurate—an assumption that may well be challenged.

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Appendix

A.1 Proofs

Proof of Proposition 2. To grasp the details of the proof, it is useful to first understand the initial equilibrium in a standard common agency problem. We illustrate this with the help of Figure A.1, which is adapted from Figure 1 in Dixit *et al.* (1997). As proven in detail in Proposition 1 of Dixit *et al.* (1997), an agent j faced with an indifference curve of the government policymaker GG will choose a policy associated with zero contributions $\mathbf{p}^{-i}$, which coincides with the agent's reservation utility captured by the flat portion of the indifference curve W^jW^j, unless the agent's welfare is increasing in the chosen policy, in which case equilibrium contributions are nonzero at $c^{j\circ}$ with corresponding policy p_j°. Policymakers can easily construct a payment schedule that induces the agent to choose the nonzero level of contributions. The problem is symmetric for all other organized agents $j \in J$, and an equilibrium exists where the policymaker effects policy in a manner that rewards all agents according to exactly the change in the policymaker's welfare, conditional on positive contributions (an equilibrium Bernheim & Whinston (1986) term *truthful*).

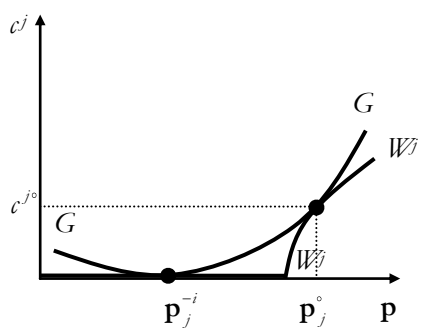

Figure A.1: Equilibrium contribution schedules.

Now consider the effect of the previous period's policy on the current configuration of transactions costs. Since transactions costs (by definition) affect the income of agent i, there are now agents for which the upper limit of feasible contributions originally dominated the welfare gain from being able to influence policy, but, as a result of the (assumed) reduction in transactions costs, will now participate in the political contribution game. The indifference curves that correspond to these are the dashed line $W^{j\prime}W^{j\prime}$ and the solid $W^{j\prime\prime}W^{j\prime\prime}$ (with the corresponding critical values of positive welfare-inducing policy being $\mathbf{p}_j$ and $\mathbf{p}_j'$, respectively), illustrated in Figure A.2.[17] Therefore, as a result of transactions costs, groups that formerly did not participate in the lobbying process now have an incentive to do so. This implies that $I \supseteq J' \supseteq J$. As illustrated for one such group j, this leads to contributions that are equivalent to the equilibrium level $c^{j\circ\prime}$, thus yielding the equilibrium policy $g_j^{\circ\prime}$.

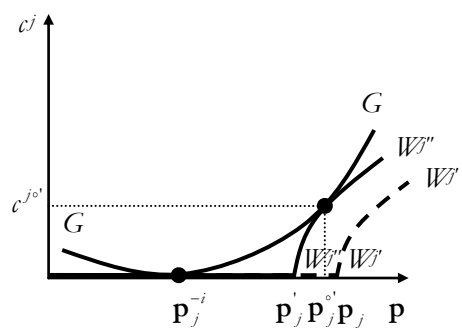

Figure A.2: Changes in compensating contribution schedules.

Note that, since the basic structure of the game remains unchanged (save for a different number of politically-organized groups), all the key findings that have been established for the original Bernheim & Whinston (1986) and Dixit *et al.* (1997) models continue to hold. In particular, the truthful political equilibria will continue to have both joint efficiency and coalition proofness properties. Finally, note that while the proof has relied on the case of how a reduction in transactions costs induces entry into the lobbying game (which is easier to grasp intuitively), the converse holds for increases in transactions costs (which is the empirically-relevant case for the developments in the U.S. financial sector). Either way, the central idea of changes to transactions costs affecting the structure of institutions continues to hold. □

[17] Note that we have chosen to illustrate the function $\bar{L}^i(\mathbf{g})$ as a curve, although this could well be linear.