Contract Law with Multi-Unit Sales

Preliminary and Incomplete

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Abstract

Private contract enforcement often depends on the collective actions of individual agents. For instance high rates of credit default obstruct enforcement of duties to perform, and individuals indifference to infringing on the property rights of owners can render private contracts ineffective. We develop a theory of contracting enabling private parties to internalize the effects of their behavior on others and of enforcing private provisions that yield positive spillovers

K22: Business and Securities Law

1 Introduction

For students of the law and contract theory the 2007-2008 collapse of the residential mortgage-backed securities (RMBS) market was notable for the failure of presumably well designed securities contracts. Securitization has had and continues to have an important role in the U.S Economy with over 11 trillion of outstanding securitized assets, which substantially exceeds the size of all outstanding marketable US treasury securities and related assets.[1]. But to avoid or at least reduce the likelihood of a future financial crisis, one needs to know why, where and how the securitization process went awry.

[1]See Gorton and Metrick (2011)

The conventional wisdom of leading financial economists is that the crisis revealed a number of serious problems with our financial system in general and securitization of assets in particular. A generic cause of the crisis were rampant conflicts of interest, better known to lawyers and economists and as agency problems. Agency problems arise in securitization contracts when a principal, i.e. an intermediary requests an agent, i.e. a bank, to supply prime grade assets backed by residential mortgages. Potential gains from trade between the principal and the agent exist. The parties rely on contract provisions to realize these gains and on the courts to enforce the provisions when one party fails to perform. In this paper we demonstrate why and how securitization agreements failed despite efforts to enforce them. The creation of mortgage backed securities withered under the weight of agency problems, including moral hazard, hidden information and financial regulations that overlooked the social costs of failed loans.

Section 2 argues that the root cause of the financial crisis, was a phenomena we refer to as "the large numbers problem". This problem arises when individual contracts, tailored for the sale of one unit of a homogenous set of units are beset by the simultaneous sale of a block of homogenous units, subject to systemic risk, where the failure of a single contract can lead to the failure of many or all of the contracts.

In section 3 we present a simple model to capture the salient features of systemic contract failures and employ it to review the string of events that led to the failure of individuated security contracts for intermediation. Like most financial transactions we argue that future payoffs were difficult to predict and the parties in this case, the borrowers, banks and intermediaries had disparate information and expectations about their relative payoffs. The large variations in payoffs of the operators made it difficult to attribute unexpected payoff gains or losses to one party's action or to market swings beyond the agents' control. Despite this, had there been vigilant regulators, parties would have regarded this as a risk of "doing business" and insured themselves against payoff variations with capital and diversified portfolios.

However, because this indeterminacy in payoffs went unchecked the operators had incentives to shirk their duty to invest to avoid harming each other. Under normal conditions, the courts overseeing a bilateral contract between a single bank and an investor have a decent chance of determining which of the parties has breached her duty to perform, and to fix that

breach with remedies of specific performance or expectation damages. However in the midst of the financial crisis that followed, there were widespread failures of residential loans and a dire need for repair and replacement of large numbers of loan agreements. It was impossible for the courts to identify and rectify every loan failure in real time.

To understand why contract individuation failed in this financial crisis, is to appreciate that each contract dispute generates negative externalities for the regulation of financial markets, just as each ton of emission generates negative externalities for environmental regulation. As is well known it is normally impossible to write a complete financial contract for the initiation and sale of a single loan that addresses contingencies in each possible state. Matters worsen in a financial crisis. One failed loan precipitates the failure of other loans. Wide spread loan defaults delay repair of individual mortgages allowing delinquent borrowers to evade eviction from their homes, and so on. Each failed loan imposes social costs on the RMBS market; creditors wait longer to be repaid; investors' returns from asset backed securities decline, forcing housing prices to fall and confidence in financial markets to wane.

Section 4 provides a simple formal model of the intermediation process. The individuation of bilateral contracts for the origination and sale of mortgage backed bank loans to intermediaries is compared with two intermediation alternatives. The first alternative is a return to old style intermediation where small local banks retained sufficient capital to fix any loan defaults. We show this alternative trumps the others if the social costs of systemic failures are sufficiently high and the cost of private capital is relatively low. The second alternative relies on government regulation of mortgage backed securities in place of open market securitization. We show this alternative is preferable to securitization of contracts in preventing financial collapse and reducing the social costs loan defaults when regulation is depoliticized.

Section 5 concludes with observations on the role of individuated contracts and court enforcement of private investor performance in markets subject to agency costs and collective action issues.

2 The failure of individuated security contracts for intermediation

Contract law remedies implicitly suppose that parties agree to trade one unit of a homogeneous set of units. For example, under UCC §2-713, a disappointed buyer is entitled to recover "the difference between the market price at the time when the buyer learned of the breach and the contract price."[2] If the contract price of one unit is k, the market price of one unit is p and the parties agreed to trade $N \geq 1$ units, the buyer can recover $N(p - k)$: there is one price, k or p, that applies to each of the N units, and this could occur only if the units are identical. Similarly, the buyer can get specific performance under §2-716 "where the goods are unique", which implies that all of them must be unique in the same way. And under §2-714, the buyer's damages for a breach of warranty are the difference "between the value of the goods accepted and the value they would have had if they had been as warranted". This implies that a single warranty applied to all units, if more than one, an interpretation that is confirmed by the accompanying comment's reference to "the non-conformity".[3]

Conventional contract theory is similar. Theoretical analyses implicitly suppose that the parties agree to trade one unit or a set of homogenous units.[4] There is a contrast with auction theory. Sellers sometimes auction one unit, but other times auction several units that are not identical. The theoretical analysis of auctions treats these cases differently.[5]

We focus on sales of several goods under one contract, where the goods are sufficiently similar for parties to bundle them together but sufficiently dissimilar as possibly to be differently affected by breach. An example is a sale, or license, of several patents relating

[2]This paper uses buyer remedies as an example; seller remedies are symmetric.

[3]Installment sales are regulated under §2-612, which provides, in subsection 3, that when there is "default with respect to one or more installments [that] substantially impairs the value of the whole contract there is a breach of the whole". The comment explicitly rejects the interpretation that there is breach if the buyer can infer from an installment default that the seller is generally unreliable. Hence, a default with respect to an installment could "substantially impair the value of the whole contract" only if there was one product parts of which were to be delivered in installments, or all of the goods were identical.

[4]See Patrick Bolton and Mathias Dewatripont, Contract Theory (2005).

[5]See Paul Milgrom, Putting Auction theory to Work 251-295 (2004); Vijay Krishna, Auction Theory 163-77 (2002).

to different aspects of a product or process. The goods are patents that all relate to the same output, but the patents are differentially valuable so that, under current law, if there is breach a court cannot award damages or an injunction without disaggregating the set.[6] Another example, the subject of this paper, is mortgage securitization, an extensive treatment of which below illustrates the problems we analyze. In the years 2004-2008, parties bundled home mortgages for sale in large sets. The units were similar; they were all home mortgages. Individual mortgages within a group could differ materially, however, by loan size; the reliability of the ultimate obligor; the interest rate; the amount paid on a mortgage before default; the expected value realized on foreclosure; and so on. Hence, a systematic lender failure to investigate borrowers sufficiently could cause different declines in mortgage value. Movies and other goods also are bundled and sold together.

Generalizing from these examples, we define a "single unit sale" as the sale of one item or the sale of several homogeneous items. A "multi-unit sale" is the sale of more than one item when the items are sufficiently similar to make it efficient to sell them together, but sufficiently dissimilar as possibly to be differentially affected by breach. Similarity among traded units implies the possibility that breaches are positively correlated across the different units. For example, if a patentor did insufficient research on the state of the prior art, some patents in a sales set may be adversely affected, though to different degrees, and probably not all patents would be affected. That correlations are positive but not perfect and that more than one unit is traded under the same contract may create what we call "the large number problem": imperfect correlation raises the possibility of differential breach effects while a large number of units raises the possibility that it may not be cost justified for the buyer to establish when, and to the extent that, breach affects particular items within the traded set. This paper asks what remedies are efficient when the large number problem may present.

Consider these questions. When some units are defective (i.e., they result from breaches), but the full set traded is large, third parties cannot easily identify particular defective items. If these parties nevertheless believe that breaches have occurred, the market value of the entire set will fall: prospective ultimate buyers (from an intermediate seller) or lenders will

[6] See Lewis and Schwartz (2017)

offer less or lend less against the set (referred to herein as "the portfolio"). Under current law, a buyer of the portfolio must establish breach item by item (patent or mortgage). This can be very costly. Should contract law expand to permit "group defaults"? That is, if the value of the portfolio falls materially in consequence of breaches, should the buyer be permitted to use standard remedies – to cancel the sale of the entire portfolio, to recover the difference between portfolio value as warranted and as delivered? If so, how should the law define "materially"?]

If the law should not create an entire "portfolio default", can parties contract for one? Thus, let a contract to sell a patent portfolio define a "default" as a decline in portfolio market value by x%. The contract remedy would require the seller to buy the entire portfolio back. Suppose that the actual number of breached items would, if known, reduce the value of the portfolio by y% where $y < x$. The value of the portfolio if there were no breaches would have been V. Under the contract remedy, the buyer's "true loss" is $(1 - y)V$, and his market loss is the greater $(1 - x)V$, but the contract authorizes the buyer to recover all of V. Suppose that the parties' reasonable expectation, when they contracted, was that breaches could materially reduce the value of the portfolio, but not to zero.[7] Then the buyback remedy necessarily over-compensates the buyer. Should it be void as a penalty?[8] If so, again the buyer will have to establish breach as regards individual units.

Buyers bear the burden of establishing breach for accepted goods but a modified individuated contract law could supply an alternative to the portfolio default term just analyzed by shifting the burden of proof to the seller. Consider three sample rules: (a) If the market value of the portfolio fell by a material amount, the seller would have to buy back (or pay damages for) every unit as to which the seller could not establish compliance; (b) If the buyer establishes actual breaches for a material number of units, the seller has to buy back (or pay damages for) those units and every other unit for which it could not establish

[7] Both x and y, the parties would believe, are bounded away from zero. The market fall usually will exceed the actual fall because prospective buyers or lenders will discount for risk.

[8] Contract law will not enforce a damages term that, the parties can anticipate, will necessarily award the promisee more than her expectation interest. Here, the buyer expects to purchase V, but $(1 - y)V$ will necessarily be less than V when y is expected to be positive. Hence, a term awarding the buyer V may be challenged as a penalty

compliance;[9] (c) If the buyer shows that y percent of items in a "representative portfolio sample" is defective, the law should assume that y percent of the entire portfolio is defective, so that again the seller would have to buy back (or pay damages for) y percent of items in the portfolio. Would any of these rules be optimal? If parties contracted for any of the solutions these rules embody, should their contracts be enforced?

Portfolio defaults could be positively correlated for two reasons. First, the seller's breach entailed pursuing a practice that likely would produce numerous noncompliant items. As examples, the patent portfolio seller's practice was to slight research into the prior art, or the mortgage portfolio seller's practice was to slight good underwriting standards. Second, exogenous events could affect the portfolio. Thus, an industry recession could reduce the value of a patent portfolio and a general fall in real estate prices could reduce the value of a mortgage portfolio.

It is a general contract law premise that sellers bear defect risk and both parties bear market risk. How should this premise apply to multi-unit sales? For example, suppose that the law, or a contract, requires the seller to buy back a portfolio that has fallen in market value by x percent. Should the seller be permitted to show that only a fraction of the fall could be attributed to its breaches? Should the buyer bear the burden of disaggregating exogenous from endogenous risk? Or should the law ignore the issue, leaving it to the parties to specify those risks that each of them is to bear?]

All of the questions this introduction asks are open and they are significant. Ex post, contract remedies shift wealth between the parties; ex ante, they affect entry and the parties' incentives to comply with the contract's substantive obligations. Regarding the latter, contract remedies compensate for but also attempt to deter a particular form of moral hazard: the promisor exploiting asymmetric information and high enforcement costs to reduce its compliance level. Multi-unit sales make this form of moral hazard more likely. In this context, breach can affect particular units differently and not affect every unit. Then the large number of units creates asymmetric information: while a drop in value of the whole

[9] There is some contract law authority that when a party establishes a breach in a single unit sale but damages are difficult to prove, the burden of proof shifts to the other party to reduce the first party's damage claim. How this authority should apply to the multi-unit case is not known.

may be readily observable, just which units in the portfolio caused the problem is not readily observable. Picking out only the defective units and then suing only with respect to those can be quite costly. The moral hazard concern is heightened when portfolios are traded because later buyers likely have less information about the originating context and how breach can occur, and therefore higher costs of establishing violations. So to summarize, contract law remedies' individuating character can much reduce the law's efficacy in compensating for and in deterring the moral hazard of reduced contractual compliance in connection with multi-unit sales. And this raises the related questions how the law should change regarding these sales and what optimal contracts for such sales would look like.

3 A Simple Setting: Individuation Contracts

We begin with a simple formal model highlighting the central effects of intermediation on loan quality in the context of individuated contracts. We focus on the benchmark case of one time origination with eventual sale of mortgage backed securities to intermediaries. B is a representative local bank who initiates a continuum of collateral backed loans $l_B \in [0,1]$ of mass 1 (measured in $\$1$ *m.*) Loans are of *type* g (good) or b (bad) and g loans are repaid while b loans are defaulted. The quality of the portfolio $q_B\left(e_{B)}\right) \in (0,1)$ is the probability l_B is good and q_B is an increasing and concave function of the bank's effort e_B to find credit worthy borrowers and underwrite best practices loan agreements. Importantly, financial regulators and agencies may monitor loan quality, but the actual quality of the bank's portfolio is assumed to be unverifiable. [10]

Once B initiates a portfolio of loans an intermediary I (the originator) contracts to purchase claims for the loan repayments [11] The contract stipulates a price p_B, roughly equal

[10] This model assumes borrowers are non strategic actors who obey the loan provisions when possible. Note the loan types g used in the model differ from the legal classification of *good* loans as being underwritten following best practice. The model assumes it is not possible to determine the cause of a failed loan. Hence banks that are liable for fixing bad loans are guaranteeing the loan performs.

[11] More precisely, current day practice is for the bank to sell its higher quality loans to an originator (also referred to as an intermediator). The effect of the sale is to remove the loan from the bank's balance sheet, thus providing the bank with more capital to initiate more loans but also to reduce the bank's liability for failed loans. See Gorton and Metrick(2011)

to the expected rate of return on the portfolio, which B stipulates is underwritten following best practice. Should the loan fail and the court determines B breached her promise to perform the court enforces a *specific performance* or *expectation damages* remedy to repair or replace the loan at expected cost $c_R\left(1-q_B\left(e_B\right)\right)$.In the forthcoming formal analysis these arrangements are referred to as *individuated contracts*. Individuated contracts work well under the condition they are intended for. In particular because B originates the loan, she is uniquely qualified to guarantee its performance by exerting efficient effort, $e_B := \max_e 1-c_R\left(1-q_B\left(e\right)\right)-C_B\left(e\right)$ to obtain portfolio quality $q_B\left(e\right)$[12]. B is the residual claimant to net surplus she creates and therefore is incented to invest efficiently.

Important changes in individuated contracts arise however, when there is an additional stage of intermediation following loan origination. This is a common practice in financial markets to increase capital deepening and the supply of asset backed securities to the economy. To illustrate, I contracts separately with N representative banks B to supply independently distributed loan portfolios of quality $q_B\left(e_B\right)$. I combines the portfolios to form a continuum of *synthetic assets*, $l_I \in [0,1]$ consisting of equal parts of loans originated by the N banks[13]. I sells the synthetic assets to a Trust to market as low-risk asset backed securities to investors. This intermediation improves the quality of the assets by mixing securities with independent returns. However, when I sells the claims of proceeds from the representative bank loans to a Trust, individuated contracts becomes difficult, if not impossible to enforce. This was the case during the recent financial crisis. With the sale of their loans to an intermediary, the bank is no longer aware of the mortgage holder's behavior, if she is making regular payments, if she has defaulted or if the loan is still performing. Ironically, the bank may be the last to learn her loan is not performing. Upon learning that investor returns are lower than expected, I 's only recourse is to seek compensation from the banks who initiated the loans. This requires the courts, with the begrudging assistance of the banks and intermediary, to determine which loans from the myriad of participating banks are underpaying. Even if this

[12]That is effort is efficient if it minimizes the sum of expected cost of repairing failed loans and the cost of effort, $-c_R\left(1-q_B\left(e\right)\right)-C_B\left(e\right)$.

[13]A mixture of assets that, when combined, have the same effect and value as another asset is called a synthetic asset. Asset backed securities are often combined to form synthetic assets which are backed by collateral and yield low variance returns.

is possible in finite time and cost, the problem of finding (or negotiating) which bank(s) have breached and calculating cost effective breach remedies, still remains. Finally, this process hopefully converges in sufficient time to avoid a repeat of the 2008-2009 financial crisis.

Suppose instead I and the banks B have shared knowledge of the composition of the synthetic asset, whether the banks' loans are being repaid. Then I ensures her ideal outcome by delegating repairs of delinquent mortgages to initiators who would know if the loan was performing, assuming it was on the bank's books and still part of its capital structure. This delegation may be implemented by separate or collective individuated contracts for initiation and origination, as described above. In this case contracts for intermediation are amended by the banks B selling their loan portfolios to I providing provisional guarantees *of repayment.* to ensure performance. That is B agrees to repair or replace delinquent mortgages provided the intermediary has otherwise maintained the loans in working order.

Provided the Trust serving investors regularly monitors her returns, the late payments of loans will be publicly observed, requiring the banks responsible, to repair or replacing the loan, thus compelling each bank to invest efficiently in loan quality. Assuming there are competitive markets for origination and intermediation, it is readily shown (in section 3) that enforceable contracts exist inducing the representative banks to exert efficient effort $\langle e_B \rangle := \max_{\langle e \rangle} 1 - c_R(1 - q(e)) - C_B(e)$ that minimize the cost of risk free loans. Courts that enforce conditional guarantees allow the originator to signal the intermediary that she also is complicit in loan failures. The costs of maintaining loan quality is borne by all of the parties.

This is precisely the strategy for the courts to use in general. When intermediation involves combining loans from several suppliers it affords intermediaries a choice of originators to pair with. For example I creates a synthetic security combining the loan portfolios of N banks. It is common knowledge the quality of the loans that B initiate and sell to I is an increasing and concave function $q(e_B)$ of the private effort e_B the bank expends The resulting synthetic security that I creates has quality $q(Ne_B)$. Should a synthetic security under perform the parties contribute a predetermined amount to its repair. It is not necessary to determine which individual bank loan(s) are delinquent, because the parties commit to compensate public sector investors for their out-of -pocket losses. This arrangement might

be implemented by N pairs of two-way contracts between I and each B, however one $N+1$ way contract between I and the N banks would be less costly to write and enforce.

These findings may help explain why intermediation of asset-backed securities is at once appealing but sometimes susceptible to failure. When there is imperfect but reliable information about the quality of loans and the composition of mortgage backed securities is transparent, conditional guarantees are possible to enforce, provided the parties are jointly liable. Intermediation affords the initiators a choice of retaining their low quality loans or selling their high quality loans to the market. At the same time, intermediaries can increase the volume of minimum risk investor grade securities by combining high and moderate quality mortgages given the investments in loan quality of the initiators and intermediaries are incentive compatible. However intermediation may fail, sometimes on a grand scale, when loan quality and investment are not transparent or monitored, which is often the case when the parties are not liable.

4 Intermediation of Multiple Banks and Private Investment

We now demonstrate these qualitative conclusions persist more generally, albeit with some qualification regarding the access to capital banks are assumed to have. We will also show individuated contracting may work when combined with greater enforcement capacity, in contrast to the failure of individuation during the recent financial crisis. For concreteness we continue to focus on the private investment with moral hazard interpretation of our model.

As before we assume an intermediary I contracts with $N \geq 2$ identical banks to buy a mass of loans worth $\$1m$ I views each bank's loan portfolio as an independent distribution of assets of quality $q(e_B)$. At zero cost I apportions the loans into uniform quality pools (or traunches) that form a continuum of synthetic assets, $l_I \in [0,1]$. A synthetic asset l_I fails only if all of the component parts of the asset fail. Given $\tilde{q}(e_B)$ is the failure rate of an individual loan, this implies $1-\tilde{q}(e_B)^N$ is the success rate for an asset comprised of N independently distributed loans. In the event of a synthetic asset failure, I reduced the cost of repair with a fixed investment $\bar{e}_I$ to monitor the component loans qualities to determine

which loans require replacement or repair. Without that investment the average repair cost is $c_R(N)$ instead of $c_R(1)$ with the investment.

The contract terms are tailored to induce the representative bank to invest the efficient amount in equilibrium, where

$$e_B := \max_e 1 - c_R(1)(1 - \tilde{q}(e)^N) - C_B(e),$$

is the investment minimizing the total cost of supplying risk-free assets, $c_R(1)(1-\tilde{q}(e_B)^N)$ is the unit cost of repair multiplied by the fraction of failed assets and $C_B(e)$ is the cost of investment that is increasing at an increasing rate in e.

This section compares intermediation agreements for different types of contract individuation. It's clear individuation would not be the contract of choice were it not for the possibility that banks are sometimes capital constrained and unable to assume complete liability for their loans. To analyze the effect of capital constraints on contracting for bank loans we begin by analyzing optimal intermediation for the case where bank capital is unconstrained.

A. OPTIMAL CONTRACTS WHEN BANKS AND ORIGINATORS ARE LIABLE

In this setting I maximizes the net social surplus of the representative risk free security by inducing banks to invest efficiently to solve problem [P$_{\text{U}}$],

$$(1) \quad S(U) \equiv \underset{e_B,,\lambda_B,\lambda_I,\tau_B,\tau_I}{\text{maximize}} \left[1 - c_R(1)(1 - \tilde{q}(e_B)^N) - C(e_B) - \bar{e}_I\right]$$

subject to

$$(2) \quad \pi_B, \pi_I \geq 0$$

$$(3) \quad \pi_B = \tau_B - \lambda_B c_R(1)(1 - \tilde{q}(e_B)^N) - C(e_B) + p_B$$

$$(4) \quad \pi_I = \tau_I + 1 - \bar{e}_I - p_B$$

$$(5) \quad N\tau_B + \tau_I = 0$$

Expression (1) implies the social surplus is the difference between the expected return on the synthetic assets 1, and the failed security replacement and investment costs, $-c_R(1)(1-\tilde{q}(e_B)^N) - C(e_B) - \bar{e}_I$. Expression (2) ensures the parties participate because each expects to receive non negative profits, (π_B for B, and π_I for I). Expression (3) implies bank profits

equal to the party's transfer payment including price p_B minus her share of the synthetic assets repairs and investment costs[14]. This expression incorporates the assumption the parties have sufficient capital to pay their share of the shortfall in synthetic asset returns, and it is efficient for I to invest e_I to reduce the cost of repair for banks. Required modifications in the contract when initiators are capital constrained are discussed in Section 4.B. Expression (5) requires the parties' transfers sum to zero. This ensures creation and insurance of the synthetic asset is self supporting. [15].

Lemma 1 characterizes efficient investment in the synthetic asset when the parties' investment in quality is not observed, but parties have sufficient capital to cover any loan failures.

LEMMA 1 *Suppose the banks are liable for failed loans, bank investments e_B are unverifiable and any shortfalls in assets returns are publicly observed. Then a sufficient condition for efficient initiation and intermediation is the marginal share of repair costs* is $\lambda_B = 1$ *for all banks B.*

Proposition 1 reports that I contracting simultaneously with all initiators to provide high quality loans is cost minimizing under the conditions of Lemma 1. The Proposition refers to $S(U)$ and $e_B(u)$, which are the expected surplus and investments at the solution $[\mathrm{P_U}]$

PROPOSITION 1 *Suppose the initiators guarantee loan repayment, initiator investment is private and the failure and repair of the risk free asset is observed. Then the solution $[P_{\mathrm{U}}]$ is efficiently implemented by a contract with these properties:*

(i) The N initiators are jointly liable for any shortfall in the synthetic asset payoff. It is only necessary to determine which loans are not operating to prevent further loan failures.

[14] We assume without loss of generality that the intermediary receives the proceeds from the sale of the synthetic asset and bears non of the cost of replacing the assets.

[15] In practice the Federal government is the insurer of last resort for synthetic assets and securities, but it cannot guarantee to make all investors whole when there is large scale default.

(*ii*) *Dispersed control, i.e. the construction and maintenance of the risk-free asset is collectively borne by the initiators who invest*

$$e_B(1) \ := \max_{e_B} -c_R(1)\left(1-\tilde{q}\left(e_B\right)^N\right) - C_B\left(e_B\right),$$

(iii) Each initiator is the residual claimant to her investment surplus[16]*. Individual banks are therefore incented to account for the beneficial effects of their investment on the other loans that there loan is combined with*

(iv) Total surplus is increasing in the number of independent originators.

The conclusions of Proposition 1 stem from the following considerations: The parties induce each other to undertake the efficient investments at no costs of monitoring. Assuming the parties are liable for paying the marginal costs of repairing a failed loan, it is unnecessary to identify the initiator(s) at fault under the contract conditions. Baring an unforeseen change in conditions, the contract stipulates each initiator is individually liable for loan failures, implying each has incentives to invest efficiently when each is the residual claimant of the rewards from her investment. These terms induce efficient investment without unnecessary expenditures to check for specific initiator liability. Finally Proposition 1 reports there are (weakly) increasing returns to scale in the number of independent originators employed to construct the synthetic asset. The import of this finding is to illustrate that when banks are well capitalized, it is efficient to delegate the origination of loans to numerous banks from diverse sectors of the economy to form and insure minimal risk securities at least cost.

These findings have important implications for the selection of terms and remedies in individuated contracts. Proposition 1 implies it may be less costly to compensate the harmed parties for payment shortfalls rather than repair or replace the failed mortgage that is, if banks initially guaranteed loan performance rather than warranted an input to ensure the loan was properly underwritten. Put another way, would the logic of the proof of Proposition 1 go through if the initiating banks only warranted their loans?

COROLLARY 1 *It is not sufficient for banks to warranty the underwriting of their loans to ensure efficient origination of loans. Without assuming full liability for loan performance,*

[16] The appendix provides a proof of Lemma 1, and all other formal results.

there is too little investment in loan quality by each bank and the cost of repairing a failed loan is generally higher.

The proof of Corollary 1 in the appendix, reveals the investment in quality is distorted in several ways when banks are liable only for their mis-written loans. First as noted above, is it is less costly to simply fix a broken loan without identifying the party responsible for miswriting the loan. Less obvious but more important, is banks under-invest in quality from a social viewpoint when they ignore the benefits their investment has for the other loans their loan is combined with. Banks internalize this investment externality when they are jointly liable for the entire set of loans comprising the synthetic asset.

In concluding this section, we ask why the agreement portrayed in Proposition 1 isn't used today. Gorton and Metrick (2011) remark: prior to the 1990's most banks who originated loans to finance residential mortgages held those loans on their balance sheets until maturity in order to retain sufficient capital to maintain their loans in good working order. However, in response to a call for greater liquidity in the US housing market, intermediaries purchased pools of bank financed mortgages which they packaged into low risk mortgage backed securities, marketed to the general public as investment grade securities. The sale proceeds of these securities was diverted back to the banks to fund another round of residential mortgages the intermediaries purchased and repackaged for sale, and so on.

B. CONTRACTS FOR BANKS SPECIALIZING IN INITIATION

We now extend the analysis to study contracts for large scale origination of bank loans to increase liquidity. Appropriately we begin with the origination contract employed in the 2008-9 financial crisis. By Gorton and Metrick's account, originators purchased the claims to bank loan repayments, secured by the banks warranty of underwriting. Originators' were to believe if a bank's loans did not perform she was protected by warranty. On this belief originators created competitive markets to purchase bank claims for eventual sale as low risk, mortgage backed securities. However, the banks' eagerness to churn new loans combined with originators' appetite for more liquidity conspired to drive investment quality loans from the market. Simply put, banks initiated loans without regard for the likelihood the loan would

perform. The result was a massive failure of the MBS market. This unraveling of low risk asset backed securities was in hind sight, very predictable. Unregulated markets for unknown quality asset were ill equipped to support investor-grade securities. Courts were not able to enforce contracts that held banks liable for non performing loans that were no longer on their books.

This episode teaches that contracts for the sale of specified quality assets can not incent banks to warranty their loans after the loans are sold and repackaged for use by another party. The parties don't perform because the contracts are not enforceable. By the time a loan is failing, for whatever reason, it is too expensive and difficult to determine liability and too late to repair damage done to investors.

We now explore a contractual remedy for this intractable situation. This requires rewriting contracts to require *pre- market* certification of loan quality in place of *post- market* enforcement of quality. As before assume that B sells loan repayments claims to I. She offers certifiable quality loans $q(e_B)$ at price $p_B = \mu C(e_B)$, which is $B's$ cost of initiating and verifying investment-quality loans[17]. This is in contrast to the prior setting where B guarantees loan performance. In this case the cost of repairing a failed or non performing loan shifts to I. Originators internalize the costs of loan certification in the origination price offered to competing banks.

$I's$ problem $[\mathrm{P}_V]$ is to solve

$$(6) \quad S(v) \equiv \max_{e_B} 1 - c_R(1)\left(1 - \tilde{q}(e_B)^N\right) - e_I - p_B$$

subject to

$$(7) \qquad p_B = \mu C(e_B);\ \mu > 1$$

Expression (6) says that $I's$ profit is the difference between 1 the value of the risk-free synthetic asset and $I's$ cost of purchasing and repackaging bank loans, $p^B + e_I$ plus the expected cost of repairing the loans, $c_R(1)\left(1 - \tilde{q}(e_B)^N\right)$. In this case $I's$ profits corresponds to social surplus, so I is acting as a social planner. Expression (7) indicates the equilibrium price equals the cost of verification.

Proposition 2 reports the properties of the solution to $I's$ problem. The Proposition refers to $S(v)$ and $e_B(v)$), the expected surplus and investment at the solution to $[\mathrm{P}_V]$.

[17] Loan quality may be verified by a financial regulator or agency.

PROPOSITION 2: Suppose I contracts with N banks for delivery of certified loans of quality $q(e_B)$. At the solution to $[P_X]$

(i) I is liable for loan failures at mnimal cost $c_R(1)$, The expected failure rate, $(1-\tilde{q}(e_B)^N)$, is controlled by I.

(ii) I induces verifiable investment,

$$e_B(v) := \max_{e_B} \; -c_R(1)\left(1-\tilde{q}(e_B)^N\right) - \mu C(e_B)$$

by agreeing only to buy loans of specified quality (certified by an objective third party) at unit cost of $\mu > 1$.

(iii) *The investment is socially efficient given verification costs.*

The conclusions in Proposition 2 stem from the following considerations. Because the allocation of loans and construction of mortgage backed securities are governed by competitive markets, the originator's profit coincides with social surplus. Hence I replicates the actions of a hypothetical social planner. In particular Proposition 2(iii) confirms that the quality of the loans that I demands is socially optimal, given the added cost of verification. It is necessary to verify loan quality in this setting because banks cannot be held liable for loan failure and specialize in loan initiation in order to respond to the call for greater liquidity in the MBS market.

5 Conclusion

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6 Appendix

6.1 A. Sketch of the Proof of Proposition 1 and Lemma 1

Substituting conditions $(2)-(5)$ into expression (1) for the maximand we can rewrite $[\mathrm{P_U}]$ as,

$$\underset{e_B}{\text{maximize}}\ \pi_B = \left[1 - c_R(1)\left[1 - \tilde{q}(e_B)^N\right] - q(e_B)\right]$$

That is once we recognize that the transfer payments must balance it becomes apparent that each bank becomes the residual claimant to the net surplus created by it's investment in loan quality when $\lambda_B = 1$. The selection of the profit maximizing surplus is modeled as a Nash equilibrium. Given our assumption regarding C and q there exists a unique equilibrium

$$e_B(1) := \max_e -c_R(1)\left[1 - \tilde{q}(e)^N\right] - q(e)$$

corresponding to the efficient investment. This proves that the contract implements the cost minimizing investment in loan quality.

[18] Apparently the intended effect of this transition was to increase the supply of investment grade securities to the general public, by having the banks and intermediaries specialize in their comparative advantage. Banks who are good at initiating loans were relegating to finding qualified borrowers and underwriting good loan agreements. Intermediators who are good at loan origination, were relegated to buying, repackaging and marketing mortgaged backed securities for the general public to invest in. The courts were supposed to enforce the contracts that bound the banks and originators together. The legal process collapsed however under the weight of fast and complicated financial transactions that the banks and originators didn't plan for. The insights provided by Proposition 1 suggest that could govern the activities pools of bank loans were supposed to make markets for investment grade asset backed securities by repackaging pools of loans for the general public to invest in. g gat the cost of removing the banks as the first line defense against loan failures.

6.2 B. Sketch of Proof of Corollary 1

6.3 C. Sketch of Proof of Proposition 2

7 Bibliography