WHY DOES BANK SCREENING MATTER? PRIVATE INFORMATION AND PUBLICLY TRADED SECURITIES*

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Abstract

This paper develops a general equilibrium model of information processing in order to trace the effects of bank screening from original loans to securitization instruments. We show both that bank screening capabilities are a sufficient condition for banks and market agents to coexist simultaneously in an essentially neoclassical equilibrium, and that tracing the impacts of private screening to public securities valuation involves the interaction of several crucial variables. Then by showing why changes in screening quality can be difficult and costly to detect as they occur, the model offers a new explanation for how some US mortgage loans’ default risk could increase from about 2003 onward, even while risk premia on the related securitization instruments did not increase.

The model also suggests alternative ways to reduce the moral hazard inherent in the securitization process. While the Dodd-Frank Act relies on skin-in-the-game provisions, the model of this paper suggests that at least in their current form, skin-in-the-game requirements provide relatively weak incentives to conduct rigorous screening. Such alternative arrangements as a bank-issued put accompanying a securitization issue, or selling the loans on a recourse basis, could provide stronger incentives.

Keywords: securitization, bank screening, information production.
1. INTRODUCTION

After screening individual loan applications, banks assemble portfolios of the loans they grant, then use either deposits or the proceeds of securitizations to fund the lending. In originate-to-hold activity, deposits are used and banks face strong incentives to screen and monitor loan quality, because the quality of loans on a bank’s books can affect both its profitability and its solvency.

In originate-to-distribute activity new loans are funded externally through securitization, raising the question of whether the increase in distance between original borrowers and ultimate fund suppliers might affect instrument risks. Our general equilibrium model shows both that the quality of original screening affects the securitization instruments’ default risk and that tracing the impacts involves assessing several interacting factors. We infer that evaluating these factors in practice may be difficult, costly, and time-consuming for investors.

Although changes in the default risk of securitization instruments have recently been detected empirically, and sometimes attributed to changing incentives, with the exception of Gennaioli, Shleifer, and Vishny (2012, 2013, henceforth GSV) there has been little theoretical investigation of how default risks might be perceived, or of how those perceptions might change over time. And indeed, the particular risks we discuss may not have been prominent when securitization was first introduced in the 1970s. At that time lenders assumed responsibility for default risks on the loans they sold, structuring the securitizations conservatively to meet institutional investors’ quality concerns.

During the 1990s and early 2000’s investor demand for securitized issues grew rapidly, and securitization instruments became much easier to sell. At the same time, a belief arose that by selling their loans to special purpose vehicles, banks could transfer default and other liability risks to investors in the securitized portfolio. Indeed, special purpose vehicles were designed as separate legal entities with that risk transfer purpose in mind. At that time the special purpose vehicles faced less stringent capital requirements than their originating banks, providing a second incentive to securitize. However, experience - particularly since 2008 – 2009 - indicates that banks continue to be regarded as responsible for at least some of the risks they originated, and recent legal actions reinforce that view. Moreover, in an attempt to clarify the original lenders’

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1 As detailed further below, GSV both examine how certain kinds of risks might be overlooked, and assign overlooked risks an important role in explaining how shadow banking contributed to the crisis.
2 “In December 2011, the Justice Department announced that Bank of America had agreed to pay $335 million to settle allegations that Countrywide discriminated against black and Hispanic borrowers during the housing boom. This was the largest residential fair-lending settlement in history. A department investigation concluded that Countrywide had charged higher fees and rates to more than 200,000 minority borrowers across the country than to white borrowers who posed the same credit risk. It also steered more than 10,000 minority borrowers into costly subprime mortgages when white borrowers with similar credit profiles received prime loans, the department said.” New York Times, Dec. 21, 2011. In August 2013 the department of justice initiated a lawsuit against Bank of
responsibilities, the 2010 Dodd-Frank “skin-in-the-game” provisions required securitizing lenders to retain some of their default risks.³

In practice, banks (or other lenders) might face varying incentives to screen the original loans, especially during times of growing demand for securitization instruments. If banks change to less rigorous screening procedures, loan default risks can increase. According to our model, it could be difficult for investors to discern the impacts of any such changes, especially in the short term. Hence while changes of internal bank practices can increase lending risks, they do not necessarily lead immediately to price decreases on securitized instruments. We contend this chain of events occurred in parts of the US subprime mortgage market in the years immediately preceding the 2008 crash, and in the sequel we cite both theoretical (GSV [2013]) and empirical support (Keys et. al. [2010], Demyanyk and Van Hemert [2011]) for this position.

To trace information transmission effects theoretically, the paper develops a general equilibrium model showing how screening original loans affects securitization instruments’ default risk.⁴ Even in our starkly simplified equilibrium model, the risk premia on securitizing instruments depend on several factors: the effectiveness of the original screening process, the relative importance of competition for financing the original loans, the markets in which bank funds are raised, and investor preferences in those markets. Theoretically, if bank screening practices change, the values of securitizing instruments should be affected immediately. But in practice the effects are likely to be lagged: changes in screening quality, and consequently changes in the market value of securitization instruments, may take time to identify. (Although they identify other forms of risks, GSV [2013] contend that purchasers of securitizing instruments may overestimate expected collateral payoffs in worst case scenarios.)

This paper focuses on mortgage securitizations, but similar effects have been recognized in other markets. As mentioned, GSV (2013) focus on relations between shadow banking and financial system performance. As a second example, the practice of funding long-term asset portfolios with short-term instruments has sometimes been affected by trading freezes (cf. Acharya, Gale, and Yorulmazer [2011]). To date, the freezes have been attributed principally to system-wide factors, although some observers have noted difficulties in assessing details of portfolio quality.

The rest of the paper is as follows. After reviewing the literature, we model the essentials of bank screening activity and display its implications for the risks and returns of bank-issued securitizing instruments. We then further argue that pre-crash confidence in the safety of the originate-to-distribute function may have reflected a mistaken belief that the practices characteristic of the 1970s continued with little change. But the originally safe process changed substantially as increasing demand for securitization instruments, and the growth of originate-to-distribute lending, led to decreased rigor in bank screening. Since these changes were difficult for market agents to detect, it took time for their impacts to be recognized, as the evidence also

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⁴ For simplicity we only model bank originate-to-distribute activity.
indicates. As a result, the quality of at least some subprime mortgages deteriorated even as risk premia on the instruments securitizing them did not increase.

2. REVIEW OF LITERATURE

Bank and market financings have long been distinguished on the basis of differential information production. Informational asymmetries have been invoked to explain both moral hazard and adverse selection, and contract incentives have been designed to mitigate their effects; cf. DeLong (1991) and Ramirez (1995). Both DeLong and Ramirez suggest that banks traditionally screened borrowers more rigorously than did the market agents who arranged public financings. Gorton and Kahn (2000) show how banks’ loan governance can affect borrowers’ project choices and, consequently, loan default distributions. Holmstrom and Tirole (1997) show how either borrower-provided capital or collateral can reduce default risk attributable to moral hazard.

Peterson and Rajan (2002) argue that by creating distance between a loan’s originator and the bearer of the loan’s default risk, securitization may have reduced lenders’ incentives to screen and monitor borrowers. As noted by Keys et. al. (2009, 2010), both Blinder (2007) and Stiglitz (2007) observe that in an environment with limited disclosure on who holds what in the originate-to-distribute chain, there may have been insufficient “skin in the game” for some lenders to disclose their positions fully. On the other hand, securitization’s proponents contend that reputation concerns, balance sheet risk, and regulatory oversight could work to offset moral hazard effects. These same proponents usually assume there is little or no information loss as the distance between borrowers and investors increases. In contrast, this paper’s model suggests that increased distance could make the transmission of current information more difficult and more costly, not least because interpreting the information requires assessing several interacting factors, even in a simplified model. The model thus suggests the possibility of at least temporary information transmission difficulties, regardless of whether investors can eventually obtain full information.

Keys et. al. (2009, 2010) conclude that if a mortgage loan portfolio is likely to be securitized, it defaults by around 10-25% more than if (a similarly risky) loan portfolio is unlikely to be securitized. The authors’ findings are based on loans for which screening efforts can reduce default risk and for which soft information determines borrower creditworthiness. Keys et. al. conclude that a causal link between ease of securitization and screening quality exists, and report that “in a market as competitive as the market for mortgage backed securities, our results on interest rates are puzzling.” Theoretically, lenders’ compensation should reflect differences in default rates, but the authors do not find such an effect.

Demyanyk and Van Hemert (2011) also analyze subprime mortgage loans. After allowing for differences in borrower characteristics, loan characteristics, and macroeconomic conditions, these authors find that the quality of loans deteriorated for six consecutive years before the crisis. They argue further that while the increased riskiness of subprime loans should have been accompanied by an increase in the subprime risk premium, that mark-up actually

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5 Berndt and Gupta [2008] report similar findings, as does Purnanandam [2011].

6 On the other hand, the authors also point out that with enough hard information, as in the full-documentation market, moral hazard effects may be less likely.
declined over the period of their study. The authors attribute the effect to house price appreciation between 2003 and 2005, noting that risk premia increased when housing prices stopped climbing. While changing house prices might well have affected risk premia, this does not rule out the possibility of information transmission difficulties as well.

Longstaff and Rajan (2008, henceforth LR) comment on another aspect of securitization. They note that special purpose vehicles (SPVs) investing in collateralized debt obligations can be regarded as synthetic banks, differing from actual banks in that the SPVs do not typically screen or monitor individual components of their assembled asset portfolios. LR report that the cost of bank monitoring does not seem to be reflected in their estimates of returns on bank portfolios as compared to special purpose vehicles. Although LR do not suggest that banks and synthetic banks might be substitute institutions, neither do they view the two as complementary. In contrast, our model shows why bank- and market-assembled portfolios can be complementary, and further that investor return distributions can be affected in a number of ways by interactions between the banks and the markets. We disentangle these interactions theoretically, and note that tracing them empirically merits further investigation.

Coval, Jurek and Stafford (2009, henceforth CJS) examine default risks in structured finance portfolios. CJS note that small errors in assessing a portfolio’s default probabilities can lead to relatively large errors in estimating the loss distributions on securitizing instruments, and especially on certain tranches. CJS treat the structured portfolio as a primary object of analysis, and show how its parameters are related to those of different tranches. This paper contends that the default distributions of structured portfolios are primarily determined by the default probabilities of the original asset portfolio. Thus even though the default risks can be redistributed by tranching, they derive from the original asset portfolio and can be affected by the incentives facing the originating banks.

Acharya, Gale and Yorulmazer (2011) argue that market freezes can occur when frequent rollovers of financing are required and there is a sudden collapse in the value of the underlying collateral. This paper suggests that one reason for a collapse in the value of collateral can be investor disillusionment. If market belief in rigorous screening is suddenly challenged by previously unavailable information, a collapse in estimated portfolio value is not unlikely; cf. Gorton and Metrick (2012). Our model does not rule out the possibility that changes in screening effectiveness could take place more or less continuously, but that is not to say their detection is equally continuous. Indeed, since market freezes have been episodic, difficulty detecting changes in information production becomes a likely suspect.

GSV (2012, 2013) contend that previously neglected risks are an important explanatory factor in how shadow banking, and particularly securitization, contributed to the financial crisis. They argue that by enabling diversification of idiosyncratic risks, securitization can promote the expansion of bank balance sheets. In stressing that securitization reallocates risks between risk-

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7Of course, the default risk of a mortgage loan portfolio is not the same as the default risk of the individual instruments making up the portfolio. The original screening and information production processes are aimed, in part, at managing these diversification possibilities. But even after diversification possibilities have been taken into account, the portfolio default risk remains dependent on the nature of the original screening. A portfolio composed of second mortgage loans, for example, will usually have a greater default risk than a portfolio of primary mortgage loans with a relatively low loan-to-value ratio.
averse investors and risk-neutral intermediaries, GSV argue both that expectations play a role in shaping securitization’s impacts and that investors might neglect some forms of downside risks. They contend that investors ignore how the collateral payoffs in worst case scenarios might be affected by system risks, and note further that “the risks neglected by market participants tend to be subtle and constantly evolving.” They suggest that if banks can identify activities in which investors misperceive risks, those banks could use securitization to a greater extent than otherwise possible. This paper identifies such a risk: changes in screening practice could be missed if investors have difficulty monitoring the evolution of banks’ internal activities. We do not contend that this misperception will last indefinitely, but we do view it as a factor that can delay market adjustment.

3. MODEL DESCRIPTION

Our model assumes that banks have a different screening technology than do market agents, then shows how the banking technology affects the value of securitization issues. In essence, we assume that banks can reduce the risk of individual loan defaults by intensive screening of the individual loans, and by negotiating detailed borrower contracts. We assume there are $K$ identical borrowing clients, all of unit size, wishing to sell their primary securities to financiers. We suppose that financial system demands for these primary securities are competitive in that when the original client sells her unit loan contract, either to the market agent or to the bank, she receives the same price $S_C$. Each client thus presents a financier with a proposition to raise funds equal to $S_C$ in exchange for a security promising a payoff distribution $C$.

For simplicity, assume that the payoffs on the primary securities offered by clients are $C = X + \varepsilon$, the sum of two independent normally distributed random variables, each of whose realizations are determined by an underlying factor. The underlying factor assumptions mean that realizations of the clients’ repayment distributions are identical across clients, so that a portfolio of client-issued securities yields stochastically constant returns to scale, the individual loans’ payoffs are perfectly positively correlated, and diversification within a portfolio of these securities $C$ yields no benefit, either to financiers or to the investors who ultimately fund the financiers.

On the supply side there is a single market financier and a single bank. The market agent and the bank compete to purchase borrowing clients’ securities. Each type of financier then funds its activities through subsequent transactions with investors. As already noted, bank and market agent both buy securities from clients at the same price $S_C$. The market agent acts as a broker-dealer who resells to investors, at price $S_M$, the securities she has purchased from

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8 A model with the present financial technologies was first presented in Neave (2009), where it was used to establish that if banks have screening capabilities different from markets, the two can coexist in an otherwise perfect markets equilibrium.

9 Much current literature emphasizes macroeconomic factors such as the impact of an interest rate increase on the probability that a portfolio of adjustable rate mortgages will default, in part or in whole. But the whole of the story also involves microeconomic factors such as discussed here. For example, a higher-income homeowner is less likely to encounter mortgage repayment difficulties than an otherwise similar but lower-income homeowner. Numerous other factors, such as the location of a particular property, are also relevant to the risk assessment of individual mortgage loans. It is the combination of these factors, both tangible and intangible, that bank approval processes consider at the individual loan level.
borrowing clients. That is, as shown in Figure 1 (at the end of the text) the market agent sells exactly the same payoff distribution that she buys from issuing clients; $M = C = X + \varepsilon$. For ease of analysis the market agent is also assumed to operate at zero profit; $SC = SM$.

As indicated in Figure 1, the bank operates a lend-to-distribute activity, funding its lending by selling a newly issued security. For each security $C = X + \varepsilon$ acquired by a bank at price $Sc$, the bank sells a new security to investors, denoted by $B = X$, at price $SB$. Bank screening creates value by eliminating the risk term $\varepsilon$. As before, investors may buy one or more bank-issued securities, and as was the case with securities sold by market agents, there are no diversification benefits within the class of bank-issued securities. Figure 1 provides a schematic diagram of the transactions.

The bank is also assumed to operate subject to a zero profit condition; i.e. $SC = SB$, with (as shown next) screening expenses being deducted from the payoff distribution investors acquire when purchasing the bank-issued securities. The impact of the bank screening technology is reflected through individual loan repayment distributions, the aggregated portfolio composed of such loans, and eventually on the payoff distributions of securities sold by the bank. Bank-issued securities $B$ offer payoff $(X – a)$ to investors. The constant costs $a$, representing the costs incurred by the bank when screening an individual loan, are deducted directly from the investor payoff distribution; i.e. the bank recovers its screening costs from the loan payoff. Since the payoff to investors in bank-sold securities $(X – a)$ is not affected by the noise term $\varepsilon$, screening means that both the expected return and the risk on bank-issued securities are reduced.

An investor can costlessly invest in any of: a single riskless security, the securities sold by the market agent, and the securities sold by the bank. The model assumes that securities prices paid by investors, $SM$ and $SB$, are determined competitively by investors, with the result that both the market agent and the bank take $SM$ and $SB$ as given. Investors in market-traded securities acquire the payoff distribution $(X + \varepsilon)$ for price $SM$. Investors in bank-issued securities purchase the altered payoff $(X – a)$ for price $SB$. As a result, diversification between securities that investors purchase from the market agent and those they purchase from the bank can create investor benefits, even though by assumption diversification within the individual security classes (i.e. within a portfolio of only $M$ securities, or within a portfolio of only $B$ securities) creates no benefits. Nevertheless, the investor purchasing both $M$ and $B$ securities acquires a diversified portfolio, since the two types of securities have different risks and different returns.

There are $N$ investors, all with identical time 0 wealth positions, expectations and preferences. Hence all investors make identical decisions. Investor preferences are reflected by a negative exponential utility function, and investors maximize the expected utility of time 1 wealth $W$:

$$E\{ u(W) \} = E\{ -\exp-(\gamma W) \},$$

(1)

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10 We could model diversification effects within security classes as well, but to do so would complicate the presentation without generating additional insights.
where $W$ is assumed to be normally distributed. The coefficient $\gamma$ is the investor’s Arrow-Pratt index of (constant) absolute risk aversion. For a negative exponential utility and normally distributed wealth it is well-known that

$$E\{ u(W) \} = -\exp(-\gamma) \{ E(W) - (\frac{1}{2})\gamma \sigma^2(W) \};$$

(cf., e.g., Huang and Litzenberger (1988). The sequel refers to the wealth position

$$E(W) - (\frac{1}{2})\gamma \sigma^2(W)$$

as the certainty equivalent value of investor wealth.

Investor returns on the risky securities are described by the normal distributions $M$ and $B$ respectively, where $M$ is the distribution of returns on securities sold by market agents, and $B$ is the distribution of returns sold by the bank. At the end of the period, investor wealth is described by the normally distributed variate

$$W = \left[ w - \left( \theta_b S_B + \theta_m S_M \right) \right](1+r) + \theta_b B + \theta_m M$$

where $w$ is initial wealth and $\theta_b, \theta_m$ are the quantities of bank and market securities respectively, purchased by the investor at prices $S_B$ and $S_M$ respectively. The riskless interest rate is denoted by $r$. Thus the investor’s problem is to

$$\max \ \theta_b, \theta_m \ E\{u( \left[ w - \left( \theta_b S_B + \theta_m S_M \right) \right](1+r) + \theta_b B + \theta_m M )\}$$

where the prices $S_B$ and $S_M$ are taken as given by the individual investor. (Equilibrium prices will be found below.) Before analyzing the necessary optimality conditions satisfying (4), it is convenient to specify security payoffs in greater detail.

As already noted, the investor’s payoff distribution for securities sold by the market agent is $M \equiv X + \varepsilon$, and the payoff distribution for securities sold by the bank is $B \equiv X - a$, where $a$ is a constant. The expected payoffs on the securities are thus

$$E(M) = E(X)$$

$$E(B) = E(X) - a;$$

while the payoff variances are

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11 Note that $a > 0$ is necessary to rule out second degree stochastic dominance of $M$ by $B$. 

\[ \sigma^2(M) = \sigma^2(X) + \sigma^2(\epsilon); \]
\[ \sigma^2(B) = \sigma^2(X). \]

Finally, the covariance between payoffs is easily shown to be

\[ COV(M, B) = \sigma^2(X). \]

Note further that the mean-variance ratio of the market-traded securities payoffs may be either larger or smaller than that of the bank-issued securities, depending on the screening cost \( a \) and the risk parameters \( \sigma^2(X), \sigma^2(\epsilon). \)

Respectively, the ratios are

\[ \frac{E(M)}{\sigma^2(M)} = \frac{E(X)}{(\sigma^2(X) + \sigma^2(\epsilon))} \]

and

\[ \frac{E(B)}{\sigma^2(B)} = \frac{(E(X) - a)}{\sigma^2(X)} \]

Since both the numerator and the denominator of the second ratio are smaller than those of the first, the second ratio can be either smaller or larger than the first.

Substituting (5), (6) and (7) into (4), we obtain the normally distributed variate for end of period investor wealth

\[ W = [w - (\theta_B S_B + \theta_M S_M)](1+r) + \theta_B B + \theta_M M = w (1+r) + \theta_B [X - a - S_B (1+r)] + \theta_M [X + \epsilon - S_M (1+r)]. \]

The first two moments of \( W \) are

\[ E(W) = w(1+r) + \theta_B [E(X) - a - S_B (1+r)] + \theta_M [E(X) - S_M(1+r)] \]

and

\[ \sigma^2(W) = \theta_B^2 \sigma^2(B) + 2 \theta_B \theta_M COV(B, M) + \theta_M^2 \sigma^2(M) \]

\[ = \theta_B^2 \sigma^2(X) + 2 \theta_B \theta_M \sigma^2(X) + \theta_M^2 (\sigma^2(X) + \sigma^2(\epsilon)). \]

\[ ^{12} \text{Since we have not yet determined securities prices, we state risk and return in terms of payoffs rather than in terms of Sharpe ratios.} \]
Since expected utility is increasing in the certainty equivalent (3), it suffices to maximize (3) after substituting in expressions for $E(W)$ from (9) and $\sigma^2(W)$ from (10). The necessary optimality conditions given by taking the first partial derivatives with respect to $\theta_B$ and $\theta_M$ are:

$$E(X) - a - S_B(1 + r) - \gamma\{ \theta_B \sigma^2(X) + \theta_M \sigma^2(X) \} = 0$$

$$E(X) - S_M(1 + r) - \gamma\{ \theta_B \sigma^2(X) + \theta_M(\sigma^2(X) + \sigma^2(\varepsilon)) \} = 0$$

(11)

Thus the investor demand functions $\theta_B^*$, $\theta_M^*$ are given by the solution to:

$$\theta_B \sigma^2(X) + \theta_M \sigma^2(X) = \{ E(X) - a - S_B(1 + r) \} / \gamma$$

$$\theta_B \sigma^2(X) + \theta_M(\sigma^2(X) + \sigma^2(\varepsilon)) = \{ E(X) - S_M(1 + r) \} / \gamma$$

(12)

Since it is clear by inspection that the determinant of the left-hand side coefficients is non-zero, the system of equations (12) has a solution. We assume the problem parameters are such that the optimality conditions require both investor demands to be positive.

Then, further assuming a fixed supply $K$ of client-issued securities, and writing

$$N(\theta_B^* + \theta_M^*) = K, \text{ and } \theta_M^* = \delta(K/N)$$

where $N$ is the number of investors, and $\delta \in (0, 1)$ the proportion of securities sold by the market agent to each investor, we can combine the two supply equations with the two demand equations (11) to express the equilibrium prices as

$$S_B(1 + r) = E(X) - a - \gamma(K/N) \sigma^2(X)$$

$$S_M(1 + r) = E(X) - \gamma(K/N)\{ \sigma^2(X) + \delta \sigma^2(\varepsilon) \}.$$  

(13)

It will be noted from (13) that the prices $S_B$ and $S_M$ depend on a (so-far) unspecified parameter $\delta$. We next determine a value for $\delta$ by recalling the zero profit conditions specified earlier.

Recall that the market agent pays $S_C$ for securities tendered by clients, and sells those securities to investors for price $S_M$. Hence zero profits for the market agent means $S_C = S_M$. The assumption that the bank pays an equal amount for primary securities means that the unit cost to the bank of a security is the same $S_C = S_M$, for which the bank receives $S_B$. Hence, the bank’s zero profit condition means that the funds it receives from securities sales, less the value it pays out, must be $S_B - S_C = S_B - S_M = 0$. Recall the bank recovers its loan screening costs from the purchasers of bank-issued securities.
Taking the difference of the price equations (13) gives

$$[S_M - S_B] (1+r) = a - \gamma \delta (K/N) \sigma^2(\epsilon)$$

from which the zero profit conditions imply

$$0 = a - \gamma \delta (K/N) \sigma^2(\epsilon)$$

and consequently

$$\delta = aN/\gamma K \sigma^2(\epsilon)$$

(15)

We assume without further specification that the parameters of (15) are consistent with our earlier assumption $\delta \in (0, 1)$.

The proportion of securities purchased by the market agent is therefore an increasing function of the bank’s marginal screening costs $a$ and the number of individual investors $N$. It is a decreasing function of the index of risk aversion $\gamma$, the fixed quantity of securities supply $K$ and of the extra risk presented by market-traded securities, $\sigma^2(\epsilon)$. The proportion of securities purchased by the bank is

$$1 - \delta = 1 - (aN/\gamma K \sigma^2(\epsilon)).$$

While positive screening costs imply that bank operations are more costly than those of market agents, screening also creates value through risk reduction. Accordingly, it does not necessarily follow that the prices paid by investors would, even if the zero profit conditions of this paper were relaxed, be greater for bank-issued securities than for their market-traded counterparts. Any difference in investor prices depends on the proportion $\delta$ of financing through market agents, as well as on the other parameters specified in (13).

In addition, the equilibrium expected returns on market-traded and bank-issued securities are $E(r_M)$ and $E(r_B)$ respectively, where

$$E(r_M) \equiv (E(X) - S_M) / S_M$$

and

$$E(r_B) \equiv (E(X) - a - S_B) / S_B.$$  

The securities returns satisfy $E(r_M) > E(r_B)$ even though we assume $\delta$ is such that the equilibrium prices are $S_M = S_B$. The conclusion follows immediately, both from the foregoing and from

$$\sigma^2(M) > \sigma^2(B) \text{ and } S_M = S_B.$$
which together imply

\[ \sigma^2(r_M) > \sigma^2(r_B) . \]

Finally, the model indicates the direction of change if the bank were to alter its screening practices. Suppose the bank makes the following, unannounced change in its internal practices. It screens less intensively, saving on its screening cost outlays even while it continues to collect the same charge \( a \) per loan as before. Moreover, less effective screening means riskier securitized instruments. (Instead of the risk being reduced by the former \( \sigma^2(\epsilon) \) it is now lowered by, say \( \beta \sigma^2(\epsilon), 0 < \beta < 1 \).) Since the change in practice is unannounced, there is no reason to suppose equilibrium prices are affected. Investors will then be worse off because they will continue to pay a previously established price for what are now riskier instruments. Moreover, there is no reason to suppose investors could immediately detect the difference: they might have to wait until new market data about the increased risk eventually become available.

4. MODEL IMPLICATIONS

Other than its postulate regarding screening, the model assumes no market imperfections. Yet in contrast to early textbook observations, the bank and the market agent can coexist at equilibrium in this essentially neoclassical model. Screening reduces the risks of bank-sold securities relative to those sold by the market agent, and investors can benefit from diversification between the types.

4.1 Effects of tranching

Tranching can redistribute, but not eliminate, the impacts of bank information processing. That is, like a macroeconomic effect, the effects of screening pervade the entire securitized portfolio rather than just the riskier tranches. And, of course, changes in the rigor of the screening technology can also affect the default probabilities of all tranches, albeit to a lesser extent for tranches taking precedence in default.

Consider a single bank-issued security funded by selling three tranches to investors. The tranches are assumed to have payoffs divided into proportions \( \alpha_1, \alpha_2, \alpha_3 \), with \( \sum \alpha_i = 1 \) and \( \alpha_i \geq 0, i = 1, 2, 3 \). Following Hull (2003), we assume any default losses are borne in the same proportions \( \alpha_i \); i.e., the first \( \alpha_1 \) of any losses are charged against holders of the first tranche, the next \( \alpha_2 \) proportion of losses is charged against the second tranche, and so on.

The payoff available to the holders of a tranche before redistribution of any losses is then \( \alpha_i(X - a) \). In the rest of this section, and notwithstanding our original assumption of \( X \) being normally distributed, we assume \( \alpha_i(X - a) \geq 0, i = 1, 2, 3 \) to avoid cumbersome qualifications. We define realized losses as

\[ L = \max(-X + a + S_b, 0) \geq 0. \]

Realized losses will then be redistributed across the tranches as follows.

\[ 13 \] In fact, given that the bank screening is internal, we could claim there are no market imperfections per se.

\[ 14 \] Given our assumption that bank-issued securities’ payoffs are perfectly positively correlated the analysis of a portfolio of several securities would be identical.

\[ 15 \] Note the losses are accounting losses in the sense that interest on the purchase price \( S_b \) is ignored.
Case i) If

\[ L \leq \alpha_1(X - a), \]

an event occurring with probability \(^{16}\) \( Pr \{ L \leq \alpha_1(X - a) \} \), the net payoffs to the tranche holders are respectively \( \alpha_1(X - a) - L \), \( \alpha_2(X - a) \), and \( \alpha_3(X - a) \). That is, if realized losses are sufficiently small, their entire impact is borne only by holders of the first tranche. In these circumstances, tranches 2 and 3 pay a share of the screening cost \( a \), but suffer no realized losses.

Case ii) If

\[ \alpha_1(X - a) \leq L \leq (\alpha_1 + \alpha_2)(X - a), \]

an event occurring with probability \( Pr \{ \alpha_1(X - a) \leq L \leq (\alpha_1 + \alpha_2)(X - a) \} \), the payoffs to the three tranche holders are respectively \( 0 \), \( \alpha_2(X - a) - (L - \alpha_1(X - a)) \), and \( \alpha_3(X - a) \). That is, if realized losses exceed the maximum amount that can be assigned to the first tranche, the holders of the first tranche receive zero payoff, and the payoff to holders of the second tranche is reduced by the remainder of the realized losses.

Case iii) If

\[ (\alpha_1 + \alpha_2)(X - a) \leq L \leq (X - a), \]

the right-hand inequality in the last line is redundant by definition of \( L \), and will henceforth be ignored. This event occurs with probability \( Pr \{ (\alpha_1 + \alpha_2)(X - a) \leq L \} \) and the payoffs to the three tranche holders are respectively \( 0 \), \( 0 \), and \( \alpha_3(X - a) - (L - (\alpha_1 + \alpha_2)(X - a)) \). That is, if losses are sufficiently large, their impact reduces the payment to holders of the first two tranches to zero, and the holders of the third tranche absorb any remaining realized losses.

Note that even though the third tranche can be regarded as safer than the others, a change in bank screening can have implications for all tranches – if bank screening becomes less rigorous so that the payoff \((X - a)\) becomes riskier, default probabilities and expected losses change. Moreover, that possibility might be difficult for market participants to discover. In addition, a given tranche holder, particularly the holder of tranche three, might be tempted to free ride if attempts to monitor possible changes in the payoff distribution were costly. GSV (2013) report that Adelino (2009) finds yields on different AAA-rated MBS were not predictive of subsequent performance, in contrast to the yields of lower-rated securities.

Coval, Jurek, and Stafford (2010) observe that it can be difficult to estimate default parameters for tranches directly, and our model suggests an additional difficulty can arise from changes in the rigor of the screening process. In theory, we can start with assessing the default probabilities on individual loans (probabilities that depend on the screening function) as a means of improving the estimated default probabilities on portfolios of those loans.\(^{17}\) We can then proceed from the aggregate risks of the loan portfolio to the risks of the individual tranching instruments. Even in our simplified model setting, estimating default probabilities for the

\(^{16}\) Calculating the probability is standard since we assume \( X \sim N(E(X), \sigma(X)) \).

\(^{17}\) But recall that these probabilities can change depending on whether the loans are to be securitized or not.
Securitized instruments involves assessing several interacting factors. Tracing the effects involves recognizing: market conditions for primary financings, the nature of competing providers of that financing, the technologies employed by those financiers, the costs and benefits of those technologies, the risk preferences of investors and the nature of the public securities markets in which they deal. The combined magnitude of these tasks, not to mention the costs of carrying them out, may prove beyond the capabilities of many investors.

While the model assists in understanding the factors determining the tranches’ default probability distributions, its essentially neoclassical structure provides no economic rationale for creating tranches. Indeed, given the absence of transactions costs or other market imperfections, and further given homogeneous investor expectations and preferences, Modigliani-Miller homemade leverage arguments show that in the present model any form of leverage created by tranching could be undone by recombining the securities. Tranching is a method of designing a capital structure, and just as in a Modigliani-Miller world, capital structure changes in an essentially neoclassical environment do not in themselves create economic value.

In contrast, using a model with heterogeneous investors Fostel and Geanakoplos (2012) establish important results regarding the equilibrium pricing effects of tranching and other forms of structured finance. In their model, investor heterogeneity provides an economic rationale for using structured finance - optimistic investors pay a premium for high-return securities. (The Fostel – Geanakoplos approach also shows how structured finance can create cyclical effects in securities prices.) On the other hand, a heterogeneous investors equilibrium is a more complex setting than this paper’s, and hence its greater complexities can exacerbate further the problems of information transmission studied above.

**4.2 Policy implications**

If in practice it is difficult for investors quickly to track changes in bank screening processes, our analysis raises the question of whether the Dodd-Frank ‘skin-in-the-game provisions’ provide strong enough incentives to for banks to maintain the rigor of their screening processes. The source of the problem is that banks produce a combination of hard and soft information, at least some of whose features can be both difficult and costly to produce and to transmit. It remains to be seen whether a 5% provision generates a sufficient incentive to keep screening rigorously. Hull and White (2003) note that if securities are tranched, it can be difficult for banks to sell the lowest 5% tranche, a tranche sometimes referred to as “toxic waste.” Thus it seems possible that the current Dodd-Frank 5% provision is only reinforcing a practice that has already been shown to be ineffective. Moreover, if banks are originating loans of different quality, the Act’s provisions may not prevent banks from selectively retaining the higher quality loans for themselves, thereby satisfying “skin-in-the-game” provisions even as they securitize the lower-quality loans.

An alternative policy could require banks to sell a put (or a series of puts) to accompany securities sold by their special purpose entities. To be workable, such puts would likely have

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18 Recall that our principal purpose is not to provide an economic rationale for tranching. Rather, it is to trace the effects of screening original loans to their impacts on bank-issued securities, tranched or otherwise.
flexible strike prices and perhaps limitations on their exercise dates. They would have to be backed by the bank and not by the special purpose vehicle, and of course the bank would have to demonstrate its financial capability to honour the puts. The principal advantages of issuing puts rest first on their ability to limit the moral hazard inherent in bank-promoted security sales, and secondly give buyers the ability to negotiate with the bank – the party best informed about the original loans’ quality. Third, issuing puts would provide disincentives for banks clandestinely or inadvertently to reduce the rigor of the original screening process.

If private information is difficult or costly to transmit, it would not be as economic for the puts to be offered by a third party. With a third party issuer, the moral hazard inherent in the screening process would have to be incorporated in the price paid for the puts. By the same token, our analysis suggests that it is more difficult for rating agents than for banks to rate the securities, since the former are not privy to the details of the information production process used by the latter. Recall Adelino (2009) finds that ratings may be vulnerable to the neglect of risks, raising the question of whether the risks from changes in screening practice might be one such source of vulnerability.

A second alternative corrective policy could utilize selling securitization instruments on a recourse basis, with recourse requiring the originating banks to buy back loans whose defaults exceed some prespecified norm. If in the future banks face difficulties in selling securitization instruments, the above proposals might help to increase investor confidence.19

5. CONCLUSION

This paper models the impacts of bank screening in an economy with no market imperfections other than the effects of screening. Screening creates a benefit through reducing the risk of bank-issued securities (as assessed relative to the risk of securities traded by a market agent who does not screen). In the present model, the cost of this information production is reflected through a reduction in the expected return to the bank-issued securities, which then further affects the market value of the securitization instruments.

The assumption of private information processing’s impacts is sufficient to explain the equilibrium coexistence of banks and market agents in an otherwise neoclassical setting. In the equilibrium modelled here, privately screened securities have both a lower expected return and a lower variance of return than securities backed by unscreened loans. But the prices of the two securities depend further on such other factors as the proportion of financings provided by the two types of financiers, details of the information processing activity, the nature of the original demands for finance, the market conditions in which the original demands are satisfied, and the market conditions in which the original loans are ultimately funded.

In practice, changes in the rigor of private screening activity can affect the risk of securities purchased by investors; less intensive screening can lead to less risk reduction, and it may go undetected. In practice changes in screening may only be discernible with a lag,

19 SIFMA data show that non-agency mortgage securitizations outstanding have declined steadily from 2110.3 million in 2008 to 1279.0 in 2012. SIFMA, Structured Finance, US mortgage related issuances and outstandings, table 2.1. http://www.sifma.org
implying that securities prices may only adjust with a lag. If a change in bank behaviour is difficult to detect, securities prices may remain incorrect for some time, and market freezes or sudden adjustments of prices do not seem unlikely as and when such pricing errors are uncovered. Recent empirical observations support both these observations.

Finally, tranching can change the distribution of default losses among different investor classes, but in this paper’s neoclassical setting tranching cannot in itself create economic value. However with heterogeneous expectations tranching can become a value creation activity, as Fostel and Geanakoplos (2012) show. And in either our model or the FG model, determining the equilibrium impacts of information production involves analyzing the interaction of several variables. Indeed, in the heterogeneous expectations context the arguments of the present paper are strengthened, since tracing the information production process involves the interaction of additional variables.

REFERENCES


Figure 1. Financing and Securitizing Transactions