1/14/2015
Preliminary Draft
Do not distribute.

SHADOW BANKS AS "CREAM SKIMMERS"

Diana Hancock and Wayne Passmore[1]

Board of Governors of the Federal Reserve System

Washington, DC 20551

ABSTRACT

We describe a model-based methodology to define shadow banking. Our "traditional banks" originate loans and provide a management input that creates wealth for the borrower. In contrast, a "shadow bank" engages in "cream skimming" from these traditional banks and only provides actuarially-based financing either to seasoned borrowers or to borrowers with easy-to-value collateral. In our framework, the presence of shadow banks means that fewer loans are originated and social welfare declines. We contrast our approach to shadow banking with those of others and we also discuss potential government policies that would enhance social welfare by increasing loan originations.

[1] Diana Hancock is an Associate Director and Wayne Passmore is a Senior Advisor in the Division of Research and Statistics at the Board of Governors of the Federal Reserve System. The views expressed are the authors' and should not be interpreted as representing the views of the FOMC, its principals, the Board of Governors of the Federal Reserve System, or any other person associated with the Federal Reserve System. We thank Anjan Thakor, Matthew Eichner and participants at an American Economic Association session in San Diego for their useful comments. We also thank Paul Fornia, Frederick Schneider and Jay Tian for their research assistance. Diana Hancock's contact information is: Mail Stop 153, Federal Reserve Board, Washington, DC 20551; phone: (202) 452-3019, e-mail: Diana.Hancock@frb.gov. Wayne Passmore's contact information is: Mail Stop 66, Federal Reserve Board, Washington, DC 20551; phone: (202) 452-6432, e-mail: Wayne.Passmore@frb.gov.

INTRODUCTION

Shadow banking has been much in the news since the financial crisis; however, clearly defining shadow banking has proven to be a difficult task. The Financial Stability Board, which is the international entity charged by the leaders of G20 countries to study shadow banking, is the main source of regulatory guidance on shadow banking for many countries (see www.finanicalstability.org). In August 2013, the Financial Stability Board recommended a variety of actions that G20 countries should consider with regard to repurchase agreements (repos), money market funds, and securitization; all these activities are considered by many observers as important components of the shadow banking system (see, for example, Financial Stability Board, 2013a).

The Financial Stability Board describes shadow banking as "credit intermediation involving entities and activities outside of the regular banking system" (Financial Stability Board, 2013b, p.1). On the one hand, this description encompasses a wide range of entities that engage in credit intermediation (e.g., finance companies, insurance companies, and asset managers) and activities (e.g., repos and securitization). On the other hand, this description seems to preclude banking conglomerates from engaging in shadow banking even though such entities sometimes set up new entities or activities to reduce regulatory burdens or possible intrusions by bank examiners.

The Financial Stability Board has found it difficult to provide more clarity in delineating what shadow banking is and what it is not. Instead, it argues that "[a]uthorities should have the ability to define the regulatory perimeter" (Financial Stability Board, 2012, p.9; Financial Stability Board, 2013c, p.13). Through defining this perimeter, the Financial Stability Board encourages authorities to monitor shadow banking and focus their attention on mitigating the spill-over effect

between the regulated banking system and the shadow banking system, particularly by examining large exposures of the banking system to activities outside of banking (Financial Stability Board, 2013d). In essence, this is the "we know it when we see it" approach to defining shadow banking, excluding only credit intermediation performed by the banking system.

Elsewhere, shadow banking is often defined as short-term market-based financing of longer-term loans, usually through collateral-based lending or securitization (see, for example, Pozsar, Adrian, Ashcraft, and Boesky, 2012). The scope of shadow banking in such studies is sometimes limited to "financial intermediaries that conduct maturity, credit, and liquidity transformation without access to central bank liquidity, or public sector guarantees" (see, for example, Pozsar, Adrian, Ashcraft, and Boesky, p. i). But this approach for defining and limiting the scope of shadow banking ignores the possibility that financial institutions may engage in the same transformations with *implicit* access to central bank liquidity and/or *implicit* government-backing. Moreover, some nonbank financial institutions (e.g., insurance companies) may have access to other government-backed liquidity programs (e.g., Federal Home Loan Bank advances).

Regardless of definition, shadow banking is estimated to be large. In November 2013, the Financial Stability Board estimated that that the assets of the shadow banking system worldwide had reached $71 trillion, although the uncertainty in these estimates of credit intermediation outside the banking system is large (Financial Stability Board, 2013b, p.2). Claessens, Pozsar, Ratnovski and Sigh (2012) provide more detailed information about the shadow banking system and how it finances lending; these authors estimate that the shadow banking system totaled about $64 trillion in 2011, much larger that their estimate of the shadow banking system in 2002, which was just $26 trillion. Together, these estimates suggest that the global shadow banking system is growing rapidly and is currently of comparable size to the global banking system.

The visualization of the distinctions between banking and shadow banking as a battle line that requires regulatory monitoring to protect the financial system is a common description of shadow banking. But neither this description nor the description where shadow banking is defined as long-term loans financed by short-term funding are based on more fundamental descriptions of the preferences of economic agents and of the technologies used by such agents when optimizing their utility. We fill this gap, by providing a model-based approach for defining shadow banking that focuses on these fundamental economic considerations. Moreover, we argue that both of the foregoing definitions of shadow banking can be derived using the model-based approach.

In particular, we posit there are two fundamental lending technologies: (1) relationship-based lending and (2) actuarially-based lending. A relationship loan is defined as a loan that is bundled with management assistance, which allows the borrower to finance a wealth-enhancing project. In contrast, actuarially-based funding is where the interest rate offered on a new loan is equal to the risk-free rate plus a mark-up that covers the probability of default multiplied by the (expected) losses given default. Our model considers the competition between these two alternative lending technologies, and demonstrates that shadow banking systems, which are based on actuarially-based lending technologies, can effectively "cream skim" particular types of loans from the banking system, which employs relationship-based technologies.

Our model suggests that (1) the regulatory perimeter will likely remain ill-defined because traditional banks may embed elements of shadow banks within them, (2) economic function and technology should be considered when discussing whether a financial entity is a "traditional bank" or "shadow bank," and (3) the most important distinction between traditional banking and shadow banking for financial stability purposes is the distinction between relationship-based lending versus actuarially-based lending. We will argue that this distinction also has important

consequences for loan origination, loan maturity, and social welfare. Finally, because of the social welfare consequences, there are also important implications for the design of subsidies provided by governments to their banking industries.

Although we argue that there is a strong distinction between the social welfare consequences of relationship-based lending and actuarially-based lending, this distinction, by itself, does not determine what entities, activities or products should be within, or outside of, the government safety net. As Darrell Duffie (2012) has written, "Nothing about the boundaries of the regulated banking system should be taken on principle. Which activities are allowed within this specially protected regulatory environment is a cost-benefit decision that should be based on how dangerous it would be for these activities to be interrupted, what sorts of collateral damage might be caused by their failure, and what risks these activities would pose to financial stability if conducted outside the regulated banking system."

This paper is structured as follows: Sections 1 and 2 provide our modeling framework considering financial systems without and with shadow banks, respectively; Section 3 considers the social costs of shadow banking; Section 4 provides context by discussing how our approach fits into and contributes to the existing literature; Section 5 considers what types of government programs can potentially reduce the social costs of shadow banking; Section 6 discusses the financial stability implications of shadow banking as defined using a model-based approach; and, Section 7 concludes.

1. Description of Model-based Approach to Defining Shadow Banking

In our model, loans are needed by borrowers for two periods. A bank operates in a competitive banking system and provides a relationship loan to a new borrower in the first period.

Both the loan and the management assistance associated with this loan are necessary inputs to originating the borrower's project in the first period.

We posit that traditional banks are in the business of originating loans and working with borrowers over time to manage their projects. In our model, a banking relationship is about finding credible borrowers and providing a management input that creates wealth for the borrower.[2] This process may involve building local bank branches, networking in local communities, meeting repeatedly with borrowers, and creating other modes of borrower interaction for the purpose of handling financial transactions. Because of these opportunities for wealth creation, loan borrowers at traditional banks value the relationship established with their banker.

From the perspective of a formal model, the important aspect of relationship lending is that the bank makes an upfront investment in establishing the relationship during the first period. The bank must determine the level of the upfront relationship investment for each borrower at loan origination before knowing the borrower's default probability and the level of the relationship that will be needed by the borrower in the second period. If the borrower no longer needs a bank relationship in the second period, he or she can choose to have the project actuarially-financed. For these borrowers, the bank can no longer price the second period of the loan contract using a loan payment that averages over possible default risks. Instead, the bank must account for the possible cream skimming of low risk borrowers in the second period and thus reduces its second period loan payment accordingly. In other words, the bank must now bear the upfront investment

[2] In their textbook, Freixas and Rochet (2008) define relationship banking as "the investment in providing financial services that will allow dealing repeatedly with the same customer in a more efficient way." This definition of relationship banking differs from our definition because we argue that the relationship itself may provide a key input into the customer's own production technology, increasing his or her wealth. In addition, our model is distinct from other relationship models, such as Sharpe (1990) and Rajan (1992), where the relationship is viewed as creating better information for the lending bank in a multi-period bargaining game with outside competitors. Thus, in this paper we use the term "traditional banks," rather than "relationship banks."

cost of the relationship without receiving any benefit in the second period. As a result of the banking system invests less in loan origination in the first period (because expected profits over the two periods have fallen), borrowers have less wealth and national wealth is concomitantly smaller.

We focus on the case where the borrower will not need the bank's relationship investment in the second period. Clearly, if it were possible for the borrower to contract with a bank for a relationship investment in the second period and then not use the investment (and thereby not pay for it), the bank would bear an additional cost and thus the bank would invest even less in the borrower's project in the first period. But here, both the borrower and the bank know that the bank only needs a relationship investment in the first period to originate the loan.

The borrower's utility function in the first period is given by:

$$p_1 v(P_1 - L_1 + I) + (1 - p_1)[u(y_1 - m_1) + v(P_1 - L_1 + I)] \quad (1)$$

where *v* is the utility of wealth for the future, *u* is the utility of today's income, *P* is the value of the project, *L* is the outstanding loan, *I* is the investment by the bank in the borrower relationship, *y* is the project revenue, *m* is the payment for the loan and the subscript 1 denotes the first time period. The functions *v* and *u* are assumed to be strictly concave and twice differentiable.

The probability *p* is the probability of loan termination, which is an independent event (e.g. lower demand for a firm's products during a recession). We assume that the bank monitors the loan, that the borrower makes a down payment on the project to obtain the loan, and that there are other contract features which are employed so that the borrower will not strategically default. These features are determined outside of our model. Moreover, the loan size is fixed by the borrower's project.

Thus, the loan extended by the traditional bank both requires borrower equity (a down payment determined outside our model) and *creates* borrower equity because the bank spends time and resources with the borrower to originate the loan. If the loan defaults, the borrowers keeps his wealth and the bank gets its loan back, but the bank losses its relationship investment in the borrower. Clearly, other divisions of the value of the project in default are possible, but we keep it simple here.

The borrower's project lasts two periods, and requires a fixed amount of financing in each period relative to the size of the project. The bank's investment in the borrower lasts one period, but the interest payments by the borrower can be different across the two periods. In the beginning of the second period, the uncertainty about the borrower's probabilities of loan termination is resolved. Let π^i denote the uncertainty associated with the borrower's termination probabilities, p_2^i prior to the second period. The borrower maximizes expected utility across the two periods at the beginning of period one, that is:

$$\max_{m_1,m_2,I} U = p_1 v(P_1 - L_1 + I) + (1-p_1)[u(y_1 - m_1) + v(P_1 - L_1 + I)] + (1-p_1)\sum_1^n \pi^i \left(p_2^i v(P_2 - L_2) + \left(1-p_2^i\right)[u(y_2 - m_2) + v(P_2 - L_2)]\right) \quad (2)$$

where π^i is ordered from the lowest to highest default rate, (1…n).

Let $\sum_i^n \pi^i p_2^i \equiv$ A. Then,

$$U = (1-p_1)u(y_1 - m_1) + v(P_1 - L_1 + I) + (1-p_1)[(1-A)u(y_2 - m_2) + v(P_2 - L_2)] \quad (3)$$

We assume that there is perfect competition among the group of traditional banks. The zero expected profit condition for traditional banks can be written as follows. Let

$$\Psi_1 = -p_1 I + (1-p_1)(m_1 - I) - d_1$$

$$\Psi_2^i = \left(1-p_2^i\right)(m_2) - d_2$$

$$\Psi_1 + (1-p_1)\sum_1^n \pi^i \Psi_2^i = 0$$

$$\Longrightarrow p_1(-I) + (1-p_1)(m_1 - I) - d_1 + (1-p_1)\sum_1^n \pi^i\left[\left(1-p_2^i\right)(m_2) - d_2\right] = 0,$$

Moreover, the foregoing expression can be rewritten as:

$$(1-p_1)m_1 - I - d_1 + (1-p_1)[(1-A)m_2 - d_2] = 0 \tag{4}$$

where *d* represents the cost of deposits for a traditional bank.

Thus, the borrower solves at the beginning of the two periods the following Lagrangian problem:

$$L = (1-p_1)u(y_1 - m_1) + v(P_1 - L_1 + I) + (1-p_1)[(1-A)u(y_2 - m_2) + v(P_2 - L_2)]$$
$$+\lambda\{(1-p_1)m_1 - I - d_1 + (1-p_1)[(1-A)m_2 - d_2]\} \tag{5}$$

The three first-order conditions for this optimization problem are:

$$\frac{dL}{dm_1} = (1-p_1)u'(y_1 - m_1) + \lambda(1-p_1) = 0$$
$$\Longrightarrow -u'(y_1 - m_1) = \lambda$$

$$\frac{dL}{dm_2} = (1-p_1)(1-A)u'(y_2 - m_2) + \lambda(1-p_1)(1-A) = 0$$
$$\Longrightarrow -u'(y_2 - m_2) = \lambda$$

$$\frac{dL}{dI} = v'(P_1 - L_1 + I) - \lambda = 0$$
$$\Longrightarrow v'(P_1 - L_1 + I) = \lambda$$

Combining the first two first-order conditions yields:

$$y_1 - m_1 = y_2 - m_2.$$

That is, the change in the loan payments across the two periods simply reflects the change in income.

Using the zero profit constraint, we can implicitly solve for λ:

$$\begin{aligned}(1-p_1)\left(y_1 - u'^{-1}(-\lambda)\right) - \left(v'^{-1}(\lambda) - P_1 + L_1\right) - d_1 \\ + (1-p_1)[(1-A)\left(y_2 - u'^{-1}(-\lambda)\right) - d_2] = 0\end{aligned} \tag{6}$$

If $u(\cdot) = \alpha \ln(\cdot)$ and $v(\cdot) = \beta \ln(\cdot)$, then:

$$\begin{aligned} m_1 &= y_1 - \frac{\alpha}{\lambda^*} \\ m_2 &= y_2 - \frac{\alpha}{\lambda^*} \\ I &= \frac{\beta}{\lambda^*} - P_1 + L_1 \\ \lambda^* &= \frac{(2-A)\alpha + \frac{\beta}{1-p_1}}{y_1 - d_2 + (1-A)y_2 + \frac{P_1 - L_1 - d_1}{1-p_1}} \end{aligned} \tag{7}$$

In a competitive banking system with no loan refinancing, the bank provides the borrower with an optimal two-period loan contract and relationship investment that is based on the borrower's actual income and project wealth, on the bank's cost-of-funds, and on A, which is the weighted-average default probability of loans in the second period. The first two conditions set the marginal utility of income to λ^*. The third condition set the marginal utility of wealth to λ^*. The last condition defines λ^*, which is the change in borrower utility in response to a change in an additional dollar of bank profit.

2. INCLUSION OF SHADOW BANKS

Shadow banks can "cream skim" the banks' borrowers in the second period. A shadow bank cannot provide the borrower with an investment, but can provide financing for the loan in the second period once the default probability type for the project is known. For the borrower who needs no banking relationship in the second period, the shadow banks offer to refinance the loan in the second period as follows:

$$\begin{gathered} m_2^i = \frac{d_2^s}{1 - p_2^i} \\ d_2^s \leq d_2 \end{gathered} \tag{8}$$

If the borrower defaults, the shadow bank does not get a payment, but it does get the return of its loan. Shadow banking is also a competitive industry. So, loans are financed at the cost of funds marked-up for the risk of default. Shadow banks establish a minimum level of utility for the borrower in the second period. The wealth to the borrower equals $P_2 - L_2$, and the loan payment is determined by the shadow bank's marginal cost of funds and by the "haircut" to the loan based on the default rate.

The borrower will switch the source of financing if the utility from staying with the bank is less than the utility from switching to a shadow bank. Since the borrower has a concave utility function $u(\cdot)$:

$$\begin{gathered} \left[\left(1 - p_2^i\right)u(y_2 - m_2) + v(P_2 - L_2)\right] < \left[\left(1 - p_2^i\right)u(y_2 - m_2^s) + v(P_2 - L_2)\right] \\ \Leftrightarrow u(y_2 - m_2) < u(y_2 - m_2^s) \\ \Leftrightarrow m_2^s < m_2 \end{gathered} \tag{9}$$

The loan will be refinanced by a shadow bank when the loan payment offered by the shadows banks is less than the loan payment offered by the traditional banks.

However, the bank does not know the borrower's actual default risk at the beginning of period one. Suppose the bank picks a loan payment for the second period using the rule:

$$m_2 = \frac{d_2^s}{1 - p_2^k}$$

where $d_2 \geq d_2^s$. With this loan payment, the bank will get income from $B_k = \sum_{i=k}^{n} \pi^i$ fraction of the population who will stay in the contract through period 2 where k indexes the borrower with a project such that $p_2^1 \leq \cdots \leq p_2^{k-1} \leq p_2^k \leq p_2^{k+1} \leq \cdots \leq p_2^n$.

The new zero-profit condition for banks now becomes:

$$E(\Pi) = (1 - p_1)m_1 - I - d_1 + (1 - p_1)\left[\left((B_k - A_k)m_2 - B_k d_2\right)\right] = 0, \quad (11)$$

where $\sum_k^n \pi^i p_2^i \equiv A_k$. The borrower now maximizes his or her utility subject to the following constraints: (10)

$$(1 - p_1)m_1 - I - d_1 + (1 - p_1)\left[\frac{(B_k - A_k)}{(1 - p_2^k)} d_2^s - B_k d_2\right] = 0$$

$$m_1 \geq 0$$

$$I \geq 0.$$

The new loan contract offered by banks is now:

$$m_1 = y_1 - \frac{\alpha}{\lambda_s^*}$$

$$m_2 = \frac{d_2^s}{1 - p_2^k}$$

$$I = \frac{\beta}{\lambda^*} - P_1 + L_1$$

$$\lambda_s^* = \frac{\alpha + \frac{\beta}{1 - p_1}}{y_1 + \left[\frac{(B_k - A_k)}{(1 - p_2^k)} d_2^s - B_k d_2\right] + \frac{P_1 - L_1 - d_1}{1 - p_1}}$$

The bank now chooses p_2^k. As k becomes smaller, the banking sector keeps a larger share of the loans originated and generates more income. $\left[\frac{(B_k - A_k)}{(1-p_2^k)} d_2^S - B_k d_2\right]$ is negative when $\frac{d_2^S}{(1-p_2^k)} < d_2$, which seems likely for the relatively safe bank loans that are being creamed-skimmed from the banking industry. The bank is pricing to compete with the shadow banks, but is losing money on each loan. But the banking system's loss is less negative as the banks' market share increases if $\pi_{k-1} > \pi_k$; that is, when safer projects are more prevalent than riskier projects Note that as $k \to 1$, the loss on second period lending goes to $\frac{(1-A)}{(1-p_2^1)}(d_2^S - d_2)$.) As a result, λ_S^* decreases and the bank provides more investment at a lower first-period loan payment to the borrower. (12)

Desiring to please borrowers, the bank chooses k to be as small as possible, so long as the bank maintains zero profits. Thus, the bank chooses:

$$m_2 = \frac{d_2^S}{1 - p_2^1}$$

and as a result B=1, $\{m_1, m_2\}$ are as low as possible in the face of shadow banking competition, and I is as large as possible given the zero profitability condition. This choice maximizes borrower utility.

The bank's zero profit condition becomes:

$$(1 - p_1)m_1 - I - d_1 + (1 - p_1)\left[\frac{(1 - A)}{(1 - p_2^1)} d_2^S - d_2\right] = 0$$

and

$$\lambda_s^* = \frac{\alpha + \frac{\beta}{1-p_1}}{y_1 + \left[\frac{(1-A)}{(1-p_2^1)} d_2^s - d_2\right] + \frac{P_1 - L_1 - d_1}{1-p_1}}$$

3. THE SOCIAL COSTS OF SHADOW BANKS

The shadow banks have a lower cost of finance for a second period contract, which the banks must meet to remain competitive. The bank meets the competition by setting its second period loan rate for its lowest default customer to that offered by the shadow bank. As a result, borrowers with low default rates and no need of the bank relationship in the second period stay with the banks, rather than refinance their loan contract and receive funding from the shadow banks.

The effects of shadow banking competition on banking contracts is illustrated in the following figures. In Figure 1, the effects of increasing the shadow banks' cost of financing relative to that of the traditional banks is illustrated.

Figure 1

As shown in the top panel of Figure 1, the loan payment made by the borrower is higher and, as shown in the middle panel, the investment chosen by the borrower is lower. The bank can only keep expected profits equal to zero by offering a menu of higher loan payments and lower relationship investments to entrepreneurs. As the lower financing costs offered by shadow banks approach the financing costs that the banks would normally offer, the loan

payments in the first period are lower and the investments in relationships are higher. Nevertheless, there remains a significant loss of first period investment when shadow banks can provide second period financing.

Focusing on the bottom panel of Figure 1, the borrower has lower utility with the arrival of the shadow banks, even though when the shadow banks arrive in the second period, they offer lower cost financing. As the costs of funds provided by shadow banks approach those of the banking system, the utility of borrowers increase because first period investments and loan payments fall more relative to the increase in second period loan payments.

Why is it that the traditional bank cannot recover the costs from offering an *ex ante* relationship technology in the second period by using a financial contract? It easily could if any form of prepayment penalty were allowed.[3] However, in many cases, particularly with U.S. mortgages, prepayment penalties are discouraged or the application of such penalties would make it more difficult to sell the mortgage to someone else (say, for securitization). Moreover, borrowers may hesitate to accept contracts with large prepayment penalties, which may attempt to recapture large fixed-costs, especially if their perceived odds of needing a relationship with the bank in the future are low. Finally, if litigation costs are high, such contracts may be unenforceable. Without the ability to "lock-in" borrowers for two periods, the bank scales back its relationship investments and social welfare declines.

The social welfare loss of being unable to "lock-in" borrowers may be large. If we examine the optimal unconstrained *ex ante* contract without the possibility of borrower refinancing, it equates the marginal returns from bank financing and bank relationship

[3] The Consumer Financial Protection Bureau amended Regulation Z on September 13, 2013, which implements the Truth in Lending Act (TILA), to also implement section 1414 of the Dodd-Frank Act, which limits prepayment penalties.

investment across both periods and across both the service of financing and the service of providing management expertise. Without knowledge of its second period relationship type, the borrower chooses a "Rawlsian" contract; covered by the veil of ignorance, that is, the borrower desires a long-term, fixed-rate contract to hedge any downside risk from being a borrower with a high default risk and from having a need for a (large) bank relationship in the second period.

But once shadow banks provide actuarially-priced financing in the second period, the borrowers who do not need a bank relationship in the second period may opt-out of their lending contract and instead use an actuarially-priced contract. Shadow banks can provide this financing at a low-cost market-rate because, unlike banks, they do not invest in relationships; they only evaluate the value of collateral using publicly-available sources of information and consider the revealed quality of the borrower. Thus, shadow-banks effectively "cream skim" the low-cost borrowers with knowable default risks from the traditional banks in the second period, leaving the traditional banks with an investment overhang. Note that in this context, it does not matter whether shadow banking is either collateral-based (e.g. funded through repurchase agreements) or securitization-based (for a description of this distinction, see Claessens *et al.*, 2012).

With the presence of shadow banks, traditional banks will have to take into account the possible switching of borrowers to actuarially-based lending. In response, traditional banks limit their upfront investment in relationships. With smaller investments, smaller positive net-present-value projects are funded; thus, fewer loan originations may mean social welfare declines.

4. How Does Our Model-Based Approach For Defining Shadow Banking Fit Into the Literature?

We argue that the competition between traditional banks and shadow banks should be recast as a competition between two lending technologies—relationship-based lending and actuarially-based lending. We also argue that actuarially-based lending effectively "cream skims" the most profitable borrowers from traditional banks. We see our explanation for shadow banking as consistent with four other popular explanations of shadow banking contained in the literature.

One explanation is that shadow banking is the pooling and tranching of cash flows from loans to create safe assets for investors worldwide. Securitization of bank loans overcomes the adverse selection problems associated with banks issuing debt directly and allows banks to increase the liquidity of their balance sheet while earning profits to satisfy investor demand for safe assets (Gorton and Pennachi, 1990). These "safe assets" can not only perform the role of money for households and businesses, but also propagate small shocks into large financial crises if the small shock is viewed as creating a large change in what was known about the underlying collateral (Gorton and Ordonez, 2012).

A second explanation is that shadow banking is regulatory arbitrage. Securitization and off-balance sheet collateral-based lending are methods to effectively lower the capital needed to finance relatively safe loans (Acharya and Richardson, 2009; Acharya, Schnabl, and Suarez, 2010).

A third explanation is that shadow banking is maturity transformation. Longer-term loans that are financed by shorter-term market-based funds usually create additional returns because of

the slope of the yield curve. However, such a system is vulnerable to runs by short-term debt holders if they perceive that the loans might default (Gorton and Metric, 2012), or to liquidity or solvency problems at the most critical dealer banks (Krishnamurthy, Nagel and Orlov, 2012).

Finally, a fourth explanation is that shadow banking is the exploitation of short-sighted investors by the banking industry. Some capital market investors are unable to incorporate "tail risk" into their economic return calculations, and therefore, these investors persistently underprice credit risks. Through securitization, banks are able to effectively expand their balance sheets by selling loans to these short-sighted investors. Of course, once there is a crisis, the system is undercapitalized (Gennaioli, Shleifer and Vishny, 2013).

All these explanations for shadow banking could be true simultaneously. And each of these explanations depends on the actuarial nature of the loans that are provided through securitization or that are used as the ultimate collateral in repurchase agreements, or asset-backed commercial paper.

What is unique about our approach to defining shadow banking is the focus on the origination of loans by traditional banks, and the characterization of shadow banks as those entities that "cream skim" some of the loans that are originated by these traditional banks to provide the underlying product securitization and other forms of collateral-backed lending. Our focus is on the competition, and symbiotic nature, between two different technologies: (1) relationship lending and (2) actuarially-based loan financing.

Relationship lending has been the focus of many theoretical and empirical studies in economics over the last thirty-years. Traditional relationship banking is needed for at least three reasons. First, to provide insurance to some borrowers, who value consistent bank financing across both good and bad economic times. Second, to provide monitoring of borrowers who are opaque

to the market and thus cannot raise debt or equity directly. Third, relationship lending is needed to provide loans to borrowers utilizing "soft information." This "soft information" can only be learned by "getting to know" the borrower.

One of the most comprehensive theoretical studies of relationship banking is Boot and Thakor (2000), who compare relationship lending to transaction lending, and how the bank's choice between the two technologies is affected by both interbank and capital market competition. They find that greater capital market competition is associated with a reduction in relationship lending (although each relationship loan is more valuable to the bank) and that the highest quality borrowers benefit most from such competition. Both of these results are similar to the results derived from our model that focuses on the competition between traditional banks and shadow banks, even though the modeling framework of Boot and Thakor is different and even though financing through their capital markets—which often involves elements of relationship banking—is not the same as the actuarially-based shadow banking system we describe here.

In general, the relationship banking literature establishes that it is difficult for relationship banks to appropriate all the benefits from a borrower relationship (Cetorelli and Peretto, 2012; Thakor, 2011; Dong and Guo, 2011). Our model is consistent with this view, but for different reasons.

An associated empirical literature is focused on whether banks can "lock-in" borrowers using banking relationships. The results of these studies are mixed (Fernando *et. al*, 2012; Bharath *et. al*., 2011; Dass and Massa, 2009). Our model suggests that the "lock-in" effect may vary *ex post* with the quality of the borrower, which might make the lock-in effect difficult to estimate.

5. WHAT IS THE APPROPRIATE GOVERNMENT RESPONSE TO "CREAM SKIMMING" BY SHADOW BANKS?

Our model suggests the relationship investments overall are smaller, and long-term bank loans are more difficult to sustain when some borrowers can opt out of their bank relationships and shift to actuarially-based financing. Given this outcome, it is not surprising that government-backed loan financing programs often have the goal to increase loans to new borrowers and / or to extend the maturities of loan contracts.

One example of this phenomenon in the United States is Fannie Mae and Freddie Mac. The justifications for these government-sponsored enterprises (GSEs) are often stated in terms of helping new borrowers. Moreover, the thirty-year fixed-rate mortgage is often argued to exist only because Fannie Mae and Freddie Mac intervene in the secondary mortgage market.

In the context of our model, Fannie Mae and Freddie Mac lower the costs to the banking system by refinancing those borrowers who might otherwise opt-out and be refinanced though private sector securitizations. The mortgage borrowers who might opt-out are the ones who can be actuarially-financed because their default characteristics are well-understood by the market. Fannie Mae and Freddie Mac allow banks to have access to a lower cost actuarially-based technology, and thus they can potentially compete with (and perhaps even out-compete) private-sector securitizers. By using the Fannie Mae and Freddie Mac, the bank is able to access a market-based cost-of-funds and capture some of the interest income that is associated with the mortgage in the second period.

However, government actions that allow the bank to capture some of the marginal costs associated with lending to the borrowers who can switch to actuarially-based financing in the second period do not resolve the problem that the banking system must carry the costs associated

with relationship banking (including the costs of loan originations to new borrowers) across two periods. Loan originations still contract in the presence of actuarially-based financing because the fixed costs of origination are borne by fewer borrowers over the two periods. As described in Figure 2, first period loan payments are lower and investments in loan origination are higher as the cost of funds to the banking industry falls (top and middle charts). Borrower utility also rises, but not to a point where is matches the utility of borrowers under a regime with no shadow banking.

More generally, our model suggests that government actions that either (1) lower the costs of funds to banks, (2) subsidize the bank's up-front investments in new loans, or (3) insure banks against the risk of borrower default in second period, are more likely to expand credit to new creditworthy borrowers. As shown in Figures 3 and 4, up-front subsidies and insurance lower first-period loan payments, raise initial investments by the bank, and raise borrower utility.

Which policy seems to best offset the presence of shadow banks? As shown in Figure 5, only subsidizing up-front investments has the potential for policymakers to create an environment that recovers the utility level of the original equilibrium (before there were shadow banks). As shown by the green line, and its intersection with the black line, offsetting these up-front costs (with, for example, a tax credit) can mitigate the negative effects of shadow banks on social welfare.

6. SHADOW BANKING AND FINANCIAL STABILITY

In practice there are three types of entities: (1) traditional banks, (2) shadow banks, which only provide actuarially-based loan financing, and (3) "mixed-strategy banks," which combine traditional banking and shadow banking. Traditional banks promote loan originations,

provide business assistance or improve financial literacy, and generate wealth through relationship lending. Thus, some traditional banks, as defined by the extent of their borrower relationships, may not be found in the regulated banking industry. Business loan originations to new borrowers might be in the form of private equity or venture capital. Household loan originations to new borrowers might be in the form of financing from non-profit organizations, or finance companies. The key distinction is whether the entity invests in the infrastructure and technologies that are needed to originate loans and forge relationships with new borrowers.

Turning to "shadow banks," actuarially-based financing appears to be more financially fragile than traditional banking for at least two reasons. First, actuarially-based lending lacks uniqueness. This type of lending is based on expectations of credit loss for large classes of similar loans. As pointed out by Stein (2011), when such calculations do not account for the externality that occurs when a bank (or a shadow bank) sells the assets it holds in common with other banks, collateral values can be degraded. In a crisis, the fire sales of such common assets may sharply lower the valuations of all such assets. In contrast, relationship loans that are held by traditional banks are less correlated with each other and may also have longer-term forms of financing.

Second, there is little competitive advantage to be found in large actuarially-based financing. As discussed in Hanson, Kashyap and Stein (2011), narrow margins in actuarially-based lending means that slight increases in funding costs yield large decreases in profits. As a result, shadow banks may strongly resist any decline in leverage, even if equity is only slightly more expensive than debt.

Consequently, as discussed above, government policymakers might consider whether government programs are supporting the relationship building aspect of traditional banking, or

only lowering the marginal costs of banks that are associated with actuarially-based financing (such as the GSEs described earlier). The activities of traditional banks and shadow banks might be distinguished by examining a lending institution for (1) longer maturity liabilities, (2) longer maturity assets, (3) relationship-based assets, and (4) investments in relationship-building technologies (e.g., management consulting or financial education programs) and credit analyses of new borrowers. To the extent an institution—or a "channel" of non-bank lending—has these characteristics, government-backing might enhance both social welfare and financial stability.

7. CONCLUSION

We provide a model-based methodology to define shadow banking. Our "traditional banks" originate loans and provide a management input that creates wealth for the borrower, whereas "shadow banks" provide actuarially-based funding to either seasoned borrowers, or to borrowers with easy-to-value collateral. Competition between these two lending technologies results in shadow banks "cream skimming" particular types of loans from the banking system, which employs relationship-based technologies. As a result of this cream skimming, we demonstrate that banks invest fewer upfront resources into originating new loans, borrowers pay more for their loans and reduce their investments, and social welfare declines compared to a financial system composed only of traditional banks. Simply put, because some borrowers can opt out of the banking system *ex post*, all borrowers are worse off.

Our explanation for shadow banking is consistent with other popular explanations of shadow banking contained in the literature. Moreover, it is consistent with empirical evidence derived from studies that have considered relationship lending by banks, particularly studies that have shown that it is difficult for banks to appropriate all the benefits from a borrower

relationship. That said, this study is unique because we focus on the competition, and symbiotic nature, between two different technologies—relationship lending and actuarially-based loan financing.

We also consider various government policies that subsidizes banks and offset some of the social losses imposed by the presence of shadow banks. We suggest that government programs that encourage relationship lending to new borrowers might be the best public investment.

Finally, we consider the financial stability risks associated with shadow banking. Shadow banks are more fragile than traditional banks because they are more susceptible to asset fire-sales and because the small margins associated with actuarially-based financing means that shocks in funding costs can result in large decreases in profits. In contrast, traditional banks, which rely on relationship loans, tend to be financed using longer-term forms of financing and tend to have loan defaults that are less correlated with each other.

Our model raises many questions about shadow banking and the social welfare of actuarially-based financing. Is there any underlying economic value associated with such financing, or is it simply redistributing financial claims on assets? Would more relationship-based lending enhance financial stability, and would less "financial engineering" of cash flows associated with actuarially-based lending also enhance financial stability? Should government benefits be more targeted toward traditional relationship oriented banking? And finally, are some types of capital markets activities more like relationship banking, and should these capital markets activities, therefore, be encouraged by public policies? Clearly, more research is needed to consider these fundamental questions that are germane to policymakers in the United States and abroad.

References

Acharya, Viral, V. and Matthew Richardson, 2009, "How securitization concentrated risk in the financial sector," *Critical Review*, Vol. 21, No. 2, pp.195-210.

Acharya, Viral V., Philipp Schnabl, and Gustavo Suarez, 2010, "Securitization without risk transfer," National Bureau of Economic Research (NBER) Working Paper No. 15730, February.

Bharath, Sreedhar, Sandeep Dahlya, Anthony Saunders, and Anand Srinivassan, 2011, "Lending relationships and loan contract terms," *Review of Financial Studies*, Vol. 24, No. 4, pp. 1141-1203.

Boot, Arnoud and Anjan Thakor, 2000, "Can relationship banking survive competition?" *Journal of Finance*, Vol. 55, No. 2, pp. 679-713.

Cetorelli, Nicola and Pietro F. Peretto, 2012, "Credit quantity and credit quality: Bank competition and capital accumulation," *Journal of Economic Theory*, Vol. 147, No. 3, pp. 967-998.

Claessens Stijn, Zoltan Pozsar, Lev Ratnovski and Manmohan Singh (2012), "Shadow banking: Economics and policy," International Monetary Fund, staff discussion note SDN/12/12, December 4, available at: http://www.imf.org/external/pubs/ft/sdn/2012/sdn1212.pdf.

Dass, Nishant, and Massimo Massa, 2011, "The impact of strong bank-firm relationship on the borrowing firm," *Review of Financial Studies*, Vol. 24, No. 4, pp. 1204-126

Dong, Baomin and Guixia Guo, 2011, "The relationship banking paradox: no pain no gain versus raison d'être," *Economic Modelling*, Vol. 28, September, pp. 2263-2270.

Duffie, Darrell, 2012, "Drawing boundaries around and through the banking system," in *World Economic Forum: Financial Development Report*, Chapter 1.2, October 31.

Fernando, Chitru, Anthony D. May, and William L. Megginson, 2012, "The value of investment banking relationships: evidence from the collapse of Lehman Brothers," *Journal of Finance*, Vol. 67, No. 1, pp. 235-270.

Financial Stability Board, 2012, "Consultative document: Strengthening oversight and regulation of shadow banking: an integrated overview of policy recommendations," November 18, available at: http://www.financialstabilityboard.org/publications/r_121118.pdf

Financial Stability Board, 2013a, "Strengthening oversight and regulation of shadow banking: policy framework for addressing shadow banking risks in securities lending and repos," August 29, available at: http://www.financialstabilityboard.org/publications/r_130829b.htm.

Financial Stability Board, 2013b, "Global shadow banking monitoring report 2013," November 14, available at: http://www.financialstabilityboard.org/publications/r_131114.htm.

Financial Stability Board, 2013c, "Strengthening oversight and regulation of shadow banking: policy framework for strengthening oversight and regulation of shadow banking entities," August 29, available at: http://www.financialstabilityboard.org/publications/r_130829c.pdf.

Financial Stability Board, 2013d, "Strengthening oversight and regulation of shadow banking: an overview of policy recommendations," August 29, available at: http://www.financialstabilityboard.org/publications/r_130829a.pdf

Freixas, Xavier and Jean-Charles Rochet, 2008, *Microeconomics of Banking*, second edition, Cambridge, Massachusetts: The MIT Press.

Gennaioli, Nicola, Andrei Shleifer, and Robert W. Vishny, 2013, "A model of shadow banking," *Journal of Finance*, Vol. 68, No.4, pp. 1331-1363.

Gorton, Gary and Andrew Metrick, 2012, "Securitized banking and the run on repo," *Journal of Financial Economics*, Vol. 104, No. 3, pp. 425-461.

Gorton, Gary and Guillermo Ordonez, 2012, "Collateral crises," Yale University Working Paper, March, available at: http://www.econ.yale.edu/~go49/pdfs/CC.pdf.

Gorton, Gary and George Pennacchi, 1990, "Financial intermediation and liquidity creation, *Journal of Finance*, Vol. 45, No. 1, pp. 49-72.

Hanson, Samuel G., Anil K. Kashyap, and Jeremy C. Stein, 2011, "A macroprudential approach to financial regulation," *Journal of Economic Perspectives*, Vol. 25, No. 1, pp. 3-28.

Krishnamurthy, Arvind, Stefan Nagel, and Dmitry Orlov, 2012, "Sizing up repo," National Bureau of Economic Research (NBER) Working Paper No. 17768, January.

Pozsar, Zoltan, Tobias Adrian, Adam Ashcraft, and Hayley Boesky, 2012, "Shadow banking," Federal Reserve Bank of New York Staff Report, No. 458, February.

Rajan, Raghuram, 1992, "Insiders and outsiders: the relationship between relationship and arms-length debt," *Journal of Finance*, Vol.47, No. 4, pp. 1367-1400.

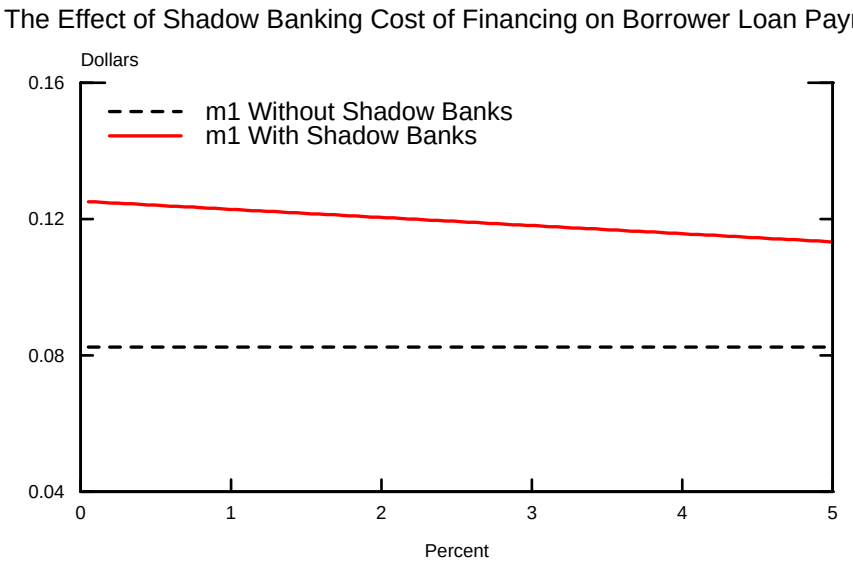
Sharpe, Steven A., 1990, "Asymmetric Information, bank lending, and implicit contracts: A stylized model of customer relationships," *Journal of Finance*, Vol. 45, No. 4, pp. 1069-1087.

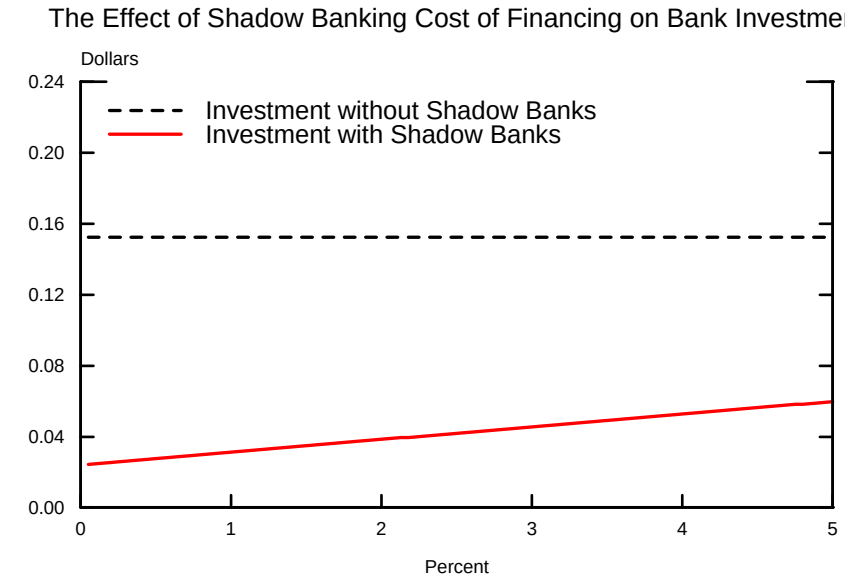
Stein, Jeremy C., 2011, "Monetary policy as financial-stability regulation," National Bureau of Economic Research (NBER) Working Paper, No. 16883, March.

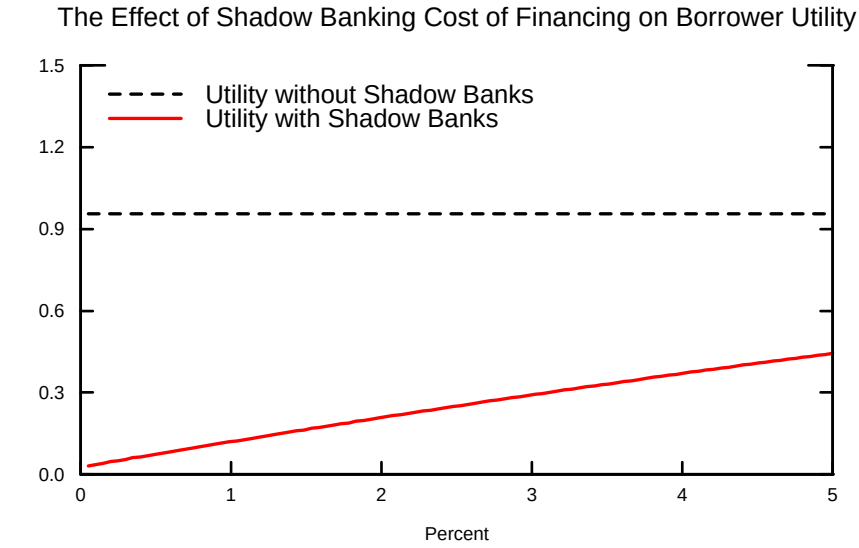
Thakor, Anjan, 2012, "Incentives to innovate and financial crises," *Journal of Financial Economics*, Vol. 103, No.1, pp. 130-148.

Figure 1

The Effect of Shadow Bank Financing on ex-ante Loan Outcome



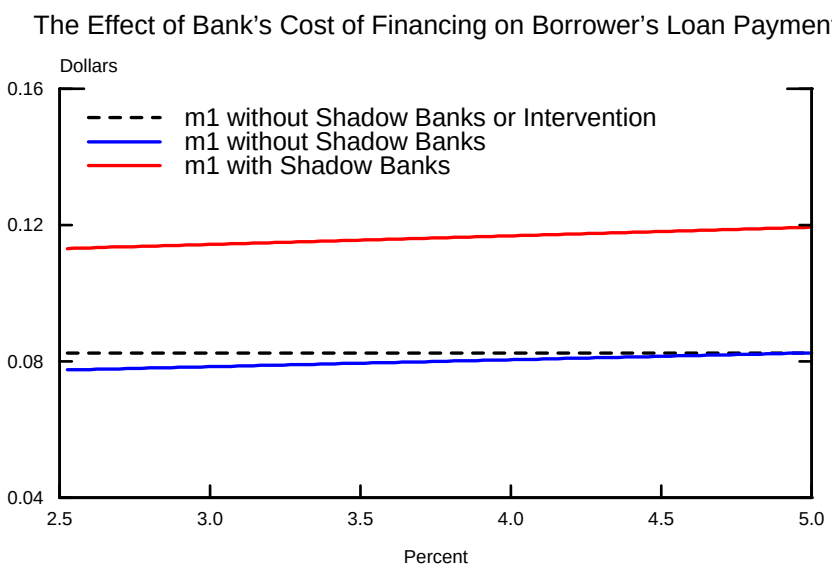


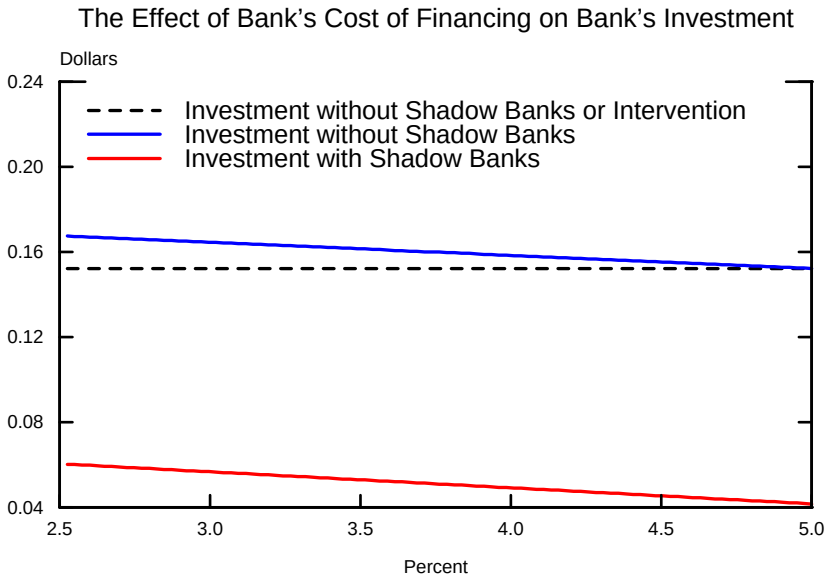


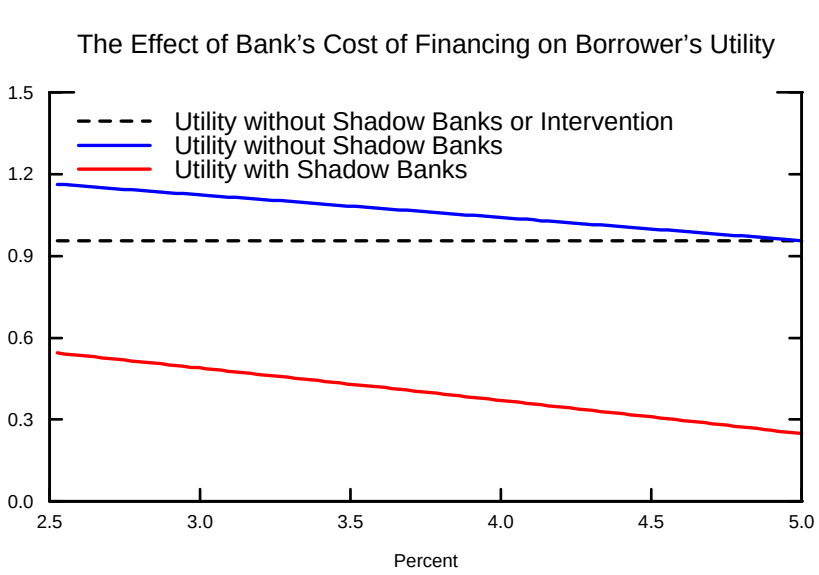
We assume that the borrower's project is $1, the loan is $0.8, the bank's cost of financing in both periods is 5%, and the shadow bank's cost of financing is between 0 and 5%. The probability of default in period 1 is 1%. Utility is scaled to become positive.

Figure 2

The Effect of Bank's Financing on ex-ante Loan Outcome



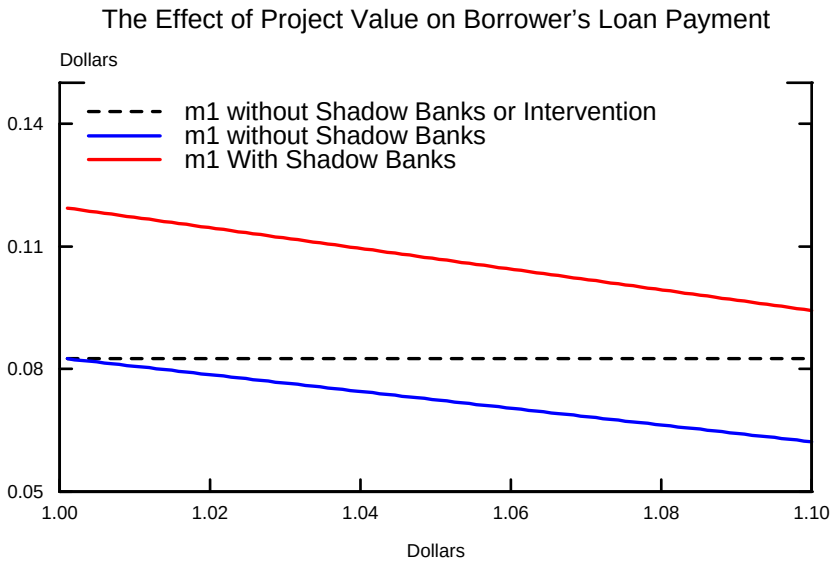


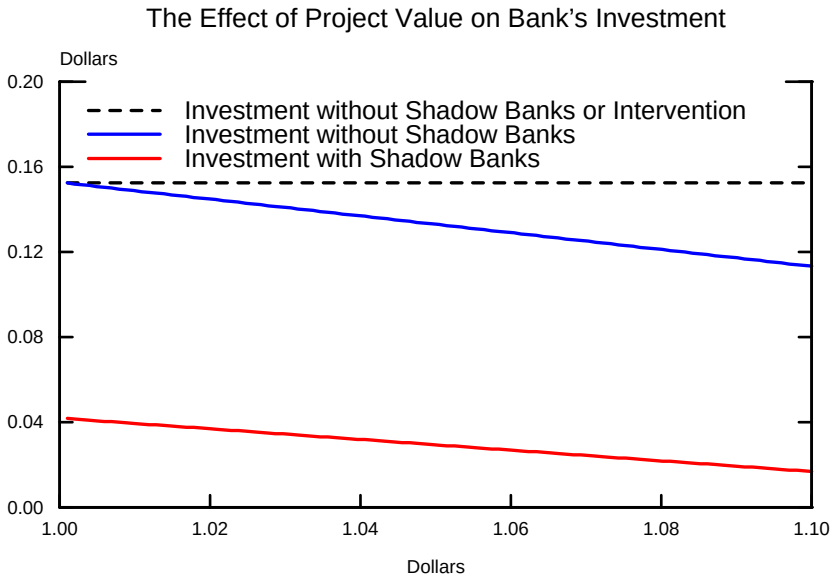


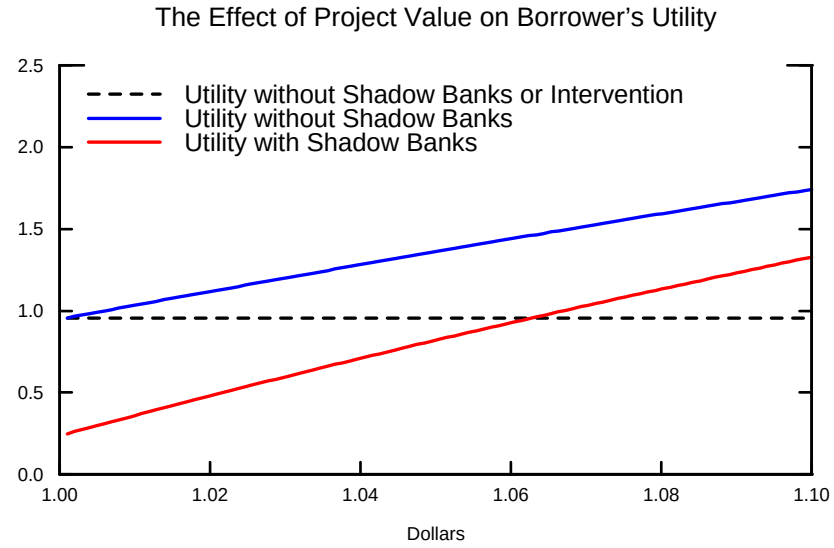
We assume that the borrower's project is $1, the loan is $0.8, the shadow bank's cost of financing in both periods is 2.5%, and the bank's cost of financing is between 2.5% and 5%. The probability of default in period 1 is 1%. Utility is scaled to become positive.

Figure 3

The Effect of Project Value on ex-ante Loan Outcome



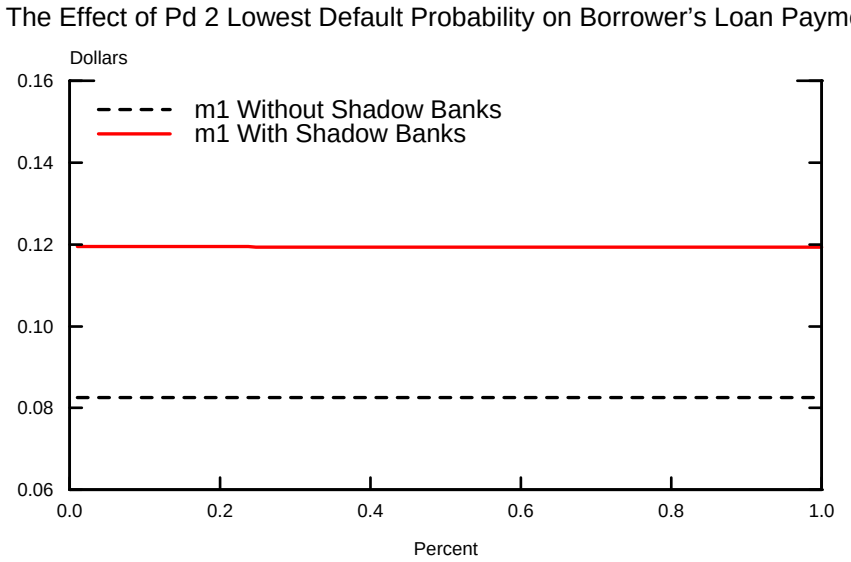


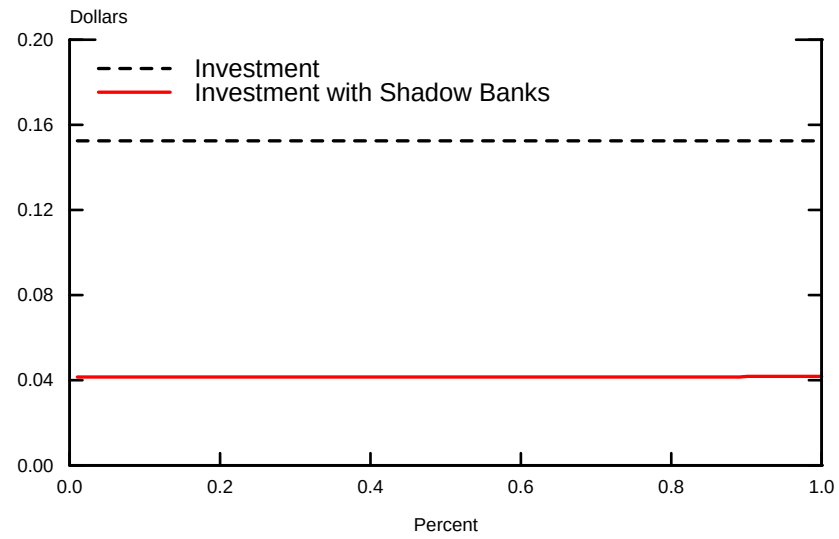


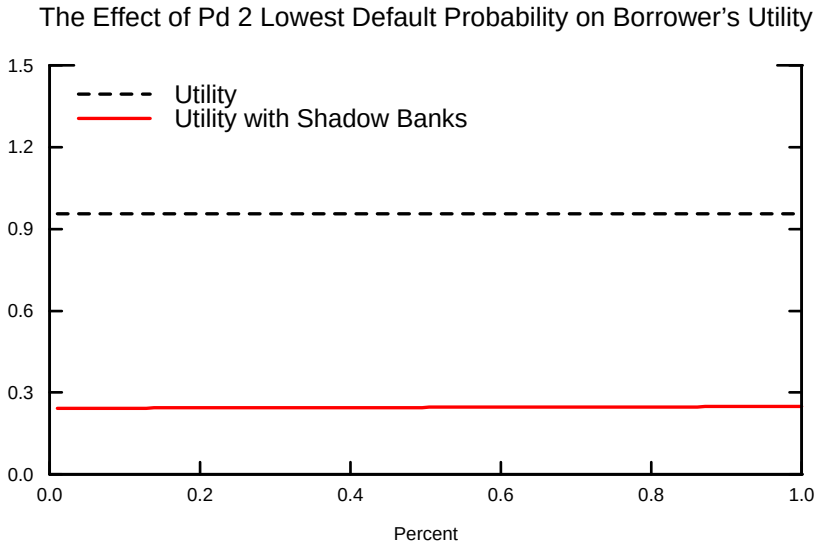
We assume that the borrower's project is initially $1, the loan is $0.8, the shadow bank's cost of financing in both periods is 2.5%, and the bank's cost of financing is 5%. Utility is scaled to become positive.

Figure 4

The Effect of Period 2 Lowest-Default Probability on ex-ante Loan Outcome



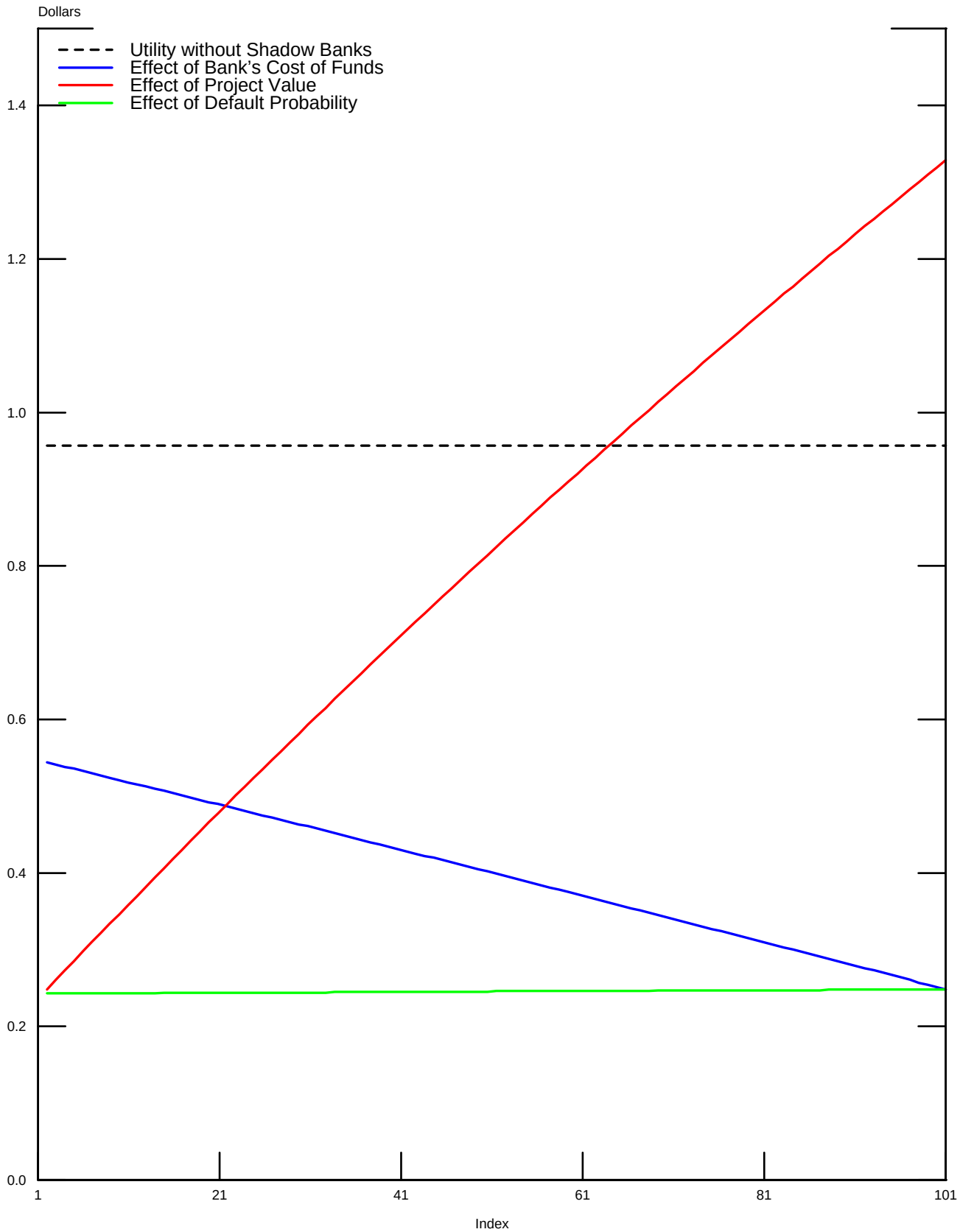




We assume that the borrower's project is $1, the loan is $0.8, the shadow bank's cost of financing in both periods is 2.5%, and the bank's cost of financing is 5%. The probability of the lowest default in period 2 ranges from 0% to 1%. Utility is scaled to become positive.

Figure 5

The Effect on ex-ante Period 1 Expected Utility



We assume that the borrower's project ranges from $1 to $1.1, the loan is $0.8, the shadow bank's cost of financing range from 0% to 5%, and the bank's cost of financing ranges from 2.5% to 5%, and probability of default in period 1 ranges from 0.01% to 1%.
Utility is scaled to become positive.