Trust in Lending

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Abstract

This paper develops a theory of trust in lending, and uses it to analyze the potential market segmentation between banks and fintech lenders. Trust enables lenders to have assured access to financing regardless of market conditions, whereas a loss of trust makes this access conditional on market conditions and the perceived incentives of self-interested lenders to make prudent loans. As long as all lenders are viewed as trustworthy and the costs of operation are the same for banks and fintech platforms, banks capture the whole market. If fintech platforms can be operated significantly less expensively than banks, fintech lenders can attract relatively risky borrowers away from banks. But when borrower defaults erode trust in lenders, banks subject to effective regulatory surveillance are able to survive the erosion of trust when fintech lenders do not, and borrowers flee fintech platforms. Effective regulatory surveillance is thus a competitive advantage for banks.

Keywords: Trust, Banks, Fintech, Lending, Financial Intermediation, Credit Market, Financial Crisis

JEL Classification: E44, E51, E52, G21, G23, G28, H12, H81

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1 Introduction

Trust in financial products and institutions is often essential for financial markets to function efficiently. Since the very origins of banking, trust has played a foundational role in banks, with “my word is my bond” defining the very essence of banks with regard to their safekeeping and depository functions. This notion of trust in financial institutions also has deep implications for the credit that lenders provide, since intermediaries use the funds they raise from financiers (depositors and investors) to make loans. For example, if a bank uses the money it raises via deposits to knowingly make a bad loan, then it endangers the trust that depositors place in the bank and hence future funding. In line with this, the concept of trust has emerged in policy discussions regarding the potential impact of non-intermediated credit on banks and the credit market, with particular focus on financial technology (fintech) lenders such as peer-to-peer (P2P) lending platforms (see He et al. (2017)). Even with fintech lending, practitioners and market participants understand the role of trust in enabling fintech firms to compete with banks.1

Trust in lending is therefore central to financial intermediation—it can help us understand the ability of banks and other intermediaries to sustain their funding models. But it can also generate a perspective on the future evolution of the credit market in the face of the growth of non-intermediated credit such as P2P and other fintech lending. Ever since the 2007-2009 financial crisis, P2P lending platforms and other types of lending by fintech companies have been growing at a rapid clip.2 Although still small compared to bank lending, this lending has come at a time when bank lending capacity seems to not be growing (see Fenwick, McCaherty, and Vermeulen (2017)). This has been observed not only in the U.S. but also in Europe, causing many to debate whether fintech companies will eventually replace banks in

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1 For example, Rhydian Lewis, co-founder and chief executive of RateSetter, says “Banks can currently access money more cheaply than marketplace lenders and, in order to be truly competitive, this gap must reduce. The route to this for lending platforms is to build trust and acceptance, which comes with a strong track record” (see Green (2016)).

2 While it initially started as non-intermediated platform-assisted credit transactions between peers, the investors in these platforms are now mainly institutional investors; during the first quarter of 2016, only 15% of Lending Club’s loans came from individuals investing on their own (see Salisbury (2016)).
performing lending and other functions (e.g. Sorkin (2016)). While we have not yet observed any major crises or scandals in fintech lending, there are many ways in which they can create suspicion of being untrustworthy.\textsuperscript{3} Our analysis suggests that the popularity and growth of fintech firms may be halted if there is an event such as a crisis which erodes trust; this would cause funding to dry up and borrowers to turn to banks.

These developments raise a number of important questions: What is the effect of trust on the access to and cost of financing for lenders? What role will lender trust play in the rise of fintech lending relative to bank lending, and the resulting credit market segmentation? What incentives do lenders have to maintain trust and what can erode it?

We develop a theoretical model in order to address these questions. As a starting point, we note that from a functional perspective (e.g. Merton (1990, 1993, 1995) and Merton and Bodie (1995, 2005)), the lending functions that banks and fintech firms perform are essentially the same—both provide debt financing to clients. However, the two types of firms are exposed to different institutional frictions. We therefore take an institutional perspective in order to examine the differences between banks and fintech firms in terms of their ability to endogenously sustain trust.

Our theory is built upon three main ideas. First, banks raise significant financing through deposits. We draw upon the earlier work of Merton (1993, 1995, 1997) and Merton and Thakor (2017) in which the bank’s depositors are viewed as customers who are provided valuable liquidity services and are insulated from the bank’s credit risk through a combination of deposit insurance and the bank’s actions, whereas fintech lenders have no such “customer relationship” with their financiers. This gives banks a potential funding cost advantage over fintech lenders as well as an endogenous economic motivation to act in a more trustworthy manner in investing their funds. Second, banks are regulated entities, whereas fintech lenders

\textsuperscript{3}For example, Lending Club sold a major portfolio of $2.2 million to a large investor and subsequently discovered the loans were neither what Lending Club had advertised nor what the investors had asked for. Lending Club bought back the loans and launched an investigation that led to the firing of three senior executives. See Wallace (2016).
such as P2P platforms are not.\textsuperscript{4} This gives fintech lenders a potential cost advantage. Furthermore, in line with the evidence in Buchak, Matvos, Piskorski, and Seru (2017), we allow fintech lenders to be able to possibly screen borrowers more efficiently (at a lower cost) than banks can. Third, banks are (heavily) leveraged lenders, whereas fintech lenders are “all-equity” financed (see, for example, Philippon (2015, 2016)). This, due to the insured nature of bank liabilities, distorts the bank’s incentives, and can potentially make banks less trustworthy than fintech lenders.

We motivate our modeling of trust by noting a striking feature of the 2007-2009 crisis, namely the alacrity with which the effect of stress was manifested. For example, Gorton and Metrick (2012) document that the average haircut on bilateral repo transactions (excluding U.S. Treasuries) rose from zero in early 2007 to almost 50% at the peak of the crisis in late 2008, with several classes of assets having 100% haircuts, i.e., they were excluded entirely from being used as collateral. Similarly, Iyer, Lopez, Peydro, and Schoar (2013) documented an unexpected and sudden freeze of the European interbank market in August 2007. These are example of discontinuities in pricing that reflect non-Bayesian beliefs by agents about the economic environment. They seem to suggest a situation in which agents believed in a particular model of the economic environment and then, faced with unexpected news, switched to a different model. We believe that such behavior is plausibly understood in a trust framework—economic agents trust that the financial products and institutions they are dealing with have certain attributes, but then that trust is lost when unexpectedly bad news arrives that is incompatible with the initial trust. This can induce a sharp and discontinuous change in prices and trading volume.

In order to model trust, we follow Fehr (2009), who argues that a behavioral definition of trust is the most appropriate and that the development or erosion of trust is often more

\textsuperscript{4}While there are some regulations that affect these platforms, they are far less than what banks face. Each U.S. state has different rules for the regulation of P2P borrowers and investors. Residents of all states except Iowa, Maine, and North Dakota can apply for P2P loans, whereas investors in 30 states can invest in Prosper loans and investors in 26 states can invest in Lending Club. Other than being “accredited investors” ($1 million or more in new worth), there are no specific regulations on these investors. See Knowledge@Wharton, January 8, 2014.
than just inferring *a priori* unknown types from observations.\(^5\) Indeed, trust often has a 0-1 property—you either trust someone or you do not.\(^6\) Unlike Fehr (2009), however, we model trust using Ortoleva’s (2012) model of (partly) non-Bayesian belief revision in which agents face uncertainty both about the correct model of the world (“is the lender trustworthy or self-interested?”) as well as about the lender’s “type” within a given model (if self-interested, is the lender still worth financing?). Within-model uncertainty can be viewed as a reputational effect and is captured by the usual prior beliefs, whereas uncertainty about the true model is captured by a prior over priors. This then leads to a belief revision process that can be non-Bayesian in some states, providing an ideal framework for analyzing lender trust. What it leads to is an analysis in which market conditions and lender performance do not affect the lender’s cost of funding as long as lenders are trusted.\(^7\) But when trust is lost and lenders are viewed as self-interested, market conditions and lender performance (reputation) influence the cost and availability of financing to lenders.

This modeling of trust is intended to capture three features. One is that trust reduces an investor’s perception of the riskiness of a given investment (as in Gennaioli, Shleifer, and Vishny (2015a)) and the pricing of credit seems disassociated from the risk in the environment. Thus, during periods in which lenders are trusted, risk will—from an *ex post* perspective—appear to be underestimated. For example, Coval, Jurek, and Stafford (2009) document that investors underestimated the probability of mortgage defaults in pric-

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5Fehr (2009, p. 238) notes: “An individual...trusts if she voluntarily places resources at the disposal of another party (the trustee) without any legal commitment from the latter. In addition, the act of trust is associated with an expectation that the act will pay off in terms of the investor’s goals. In particular, if the trustee is trustworthy the investor is better off than if trust were not placed, whereas if the trustee is not trustworthy the investor is worse off than if trust were not placed.”

6Fehr (2009) notes that this can be modeled via betrayal aversion, and points out “...people are more willing to take risk when facing a given probability of bad luck than to trust when facing an identical probability of being cheated.”

7In fact, the trust perspective also helps to shed light on a puzzling stylized fact. During the 2007-2009 crisis, although haircuts on bilateral repos rose sharply, haircuts on tri-party repos remained roughly constant (see Copeland, Martin, and Walker (2011), and Sanches (2014)). One possible reason for this is that there are two banks—Bank of New York Mellon and JP Morgan—that act as third-party agents for U.S. tri-party repo transactions, and these institutions maintained the trust of investors during the crisis. Since tri-party agents are involved in collateral selection, payment and settlement as well as essentially financing collateral sellers (borrowers) for most of the day during intraday unwinding and resetting of contracts, investor trust in these tri-party agents is important. Such agents are absent in bilateral repos.
ing mortgage-backed securities.\textsuperscript{8} Second, trust may be lost with a minor perturbation of observed outcomes, but when it is lost it can precipitate a crisis that involves a drying up of funding to lenders, consistent with the sharp discontinuities in prices and trading. Third, a crisis generated by the loss of trust will have the feature that the risks being penalized during the crises were not even contemplated by investors when there was trust.\textsuperscript{9} Lack of contemplation of positive probability events followed by episodes of funding drying up entirely for some institutions when a crisis occurs are not phenomena that can be explained using reputational/career concerns models with Bayesian updating.\textsuperscript{10}

In this sense, our theory is complementary to the “neglected risks” argument in Gennaioli, Shleifer, and Vishny (2015b), who also consider the importance of zero-probability events. A key difference is that their theory, based on the Kahneman and Tversky (1972) idea of “representativeness”, predicts that a crisis will be preceded by a sufficiently long string of bad news, whereas in our model a crisis can occur suddenly in an economic boom with high defaults experienced by lenders.\textsuperscript{11} The use of model uncertainty in Ortoleva’s (2012) non-Bayesian framework allows us to capture all these three features of trust, but in a way that differs from previous approaches.

Our theory produces the following main results. First, when lenders are trusted, they can raise financing at the lowest possible cost regardless of their prior loan default experience

\textsuperscript{8}As reason for trust being placed in these types of lenders and financial technologies in the first place is likely due to a combination of the technologies working well to begin with, and the technologies being inherently opaque. Indeed, if such technologies were transparent, then there would be no need for trust for them to function.

\textsuperscript{9}In the context of the 2007-2009 crisis, evidence presented by Foote, Gerardi, and Willen (2012) indicates that investors did not even contemplate the magnitude of the home price declines that actually occurred.

\textsuperscript{10}For example, suppose we have a standard model of reputation/career concerns in which the prior probability is 0.95 that a bank is trustworthy and 0.05 that it is not. Suppose trustworthy banks invest in good loans that pay off with probability 0.90 and untrustworthy banks invest in loans that always default. Then if the bank needs to borrow $1 from creditors and has no equity capital, then in a risk-neutral world in which the riskless interest rate is zero and the bank’s creditors must receive an expected return equal to the riskless rate, the bank’s borrowing rate will be 16.6%. Now suppose the bank’s first-period loan defaults. Then Bayesian investors will update their beliefs and the posterior probability that the bank is trustworthy will be 52.67%. Although credit is more expensive, it does not dry up for the bank. A complete drying up of credit is more consistent with assigning zero probability to positive probability events and experiencing “unanticipated” shocks.

\textsuperscript{11}In their model, investors use extrapolative expectations, so they initially under-react to bad news, but then over-react to it when there is a sufficiently long sequence of such news.
and market conditions, so default risk will appear to be underestimated and hence mispriced. Second, if the costs of operating banks and fintech lending platforms are similar, and all lenders are trusted, a fintech lender can never take borrowers away from a bank. Third, when a fintech lender can operate at a sufficiently lower cost than a bank and all lenders are trusted, the fintech lender will peel off the riskiest borrowers from banks; this is consistent with empirical evidence on the types of borrowers that fintech platforms attract (see, for example, Jagtiani and Lemieux (2017)). Fourth, the lender’s ability to maintain the trust of its financiers depends on its default experience and market conditions—trust can be eroded when lenders experience (significant) defaults during an economic boom. We show that when trust is lost, banks will survive the loss of trust and hence continue to operate in circumstances in which fintech lenders are forced to shut down. Finally, banks have stronger endogenous incentives to be trustworthy, so a potential advantage of banks is that they are “trusted lenders”.

In a nutshell, our basic idea is that trust insulates lenders from the adverse reputational consequences of loan defaults, and the degree of insulation depends on market conditions. Banks are inherently more trustworthy than fintech lenders because the customer relationships banks have are a source of rents—unavailable to fintech lenders—that influence banks to make good loans in some states even when they are self-interested. This is what enables banks to survive when trust is lost, a circumstance in which fintech lenders shut down. A key to the greater trustworthiness of banks is that regulatory surveillance of banks is effective in ensuring that the deposit insurance safety net is not abused.12 Thus, while most papers view the fact that being regulated puts banks at a disadvantage relative to fintech lenders, we show that effective regulation can be a competitive advantage for banks.

Our paper is part of a growing literature on the role of non-depository lenders vis a

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12 Two factors generate an endogenous incentive for banks to be more trustworthy than fintech lenders: access to deposit insurance and the ability to provide liquidity services to depositors. The factors that make banks less inclined to be trustworthy are higher regulatory costs and that as levered lenders they have an incentive to exploit the deposit insurance put option. Regulatory surveillance that minimizes this exploitation is therefore important for banks.
vis banks and how this is affecting the credit market. This literature is at present mainly empirical or descriptive. See, for example, Buchak et. al. (2017), Fenwick et. al. (2017), Greenwood and Scharfstein (2013), Phillipon (2016), and Zetzsche et. al. (2017). To the best of our knowledge, ours is the first paper to theoretically model trust-based intermediation and use it to characterize the impact of fintech firms on the credit market.

The rest of the paper is organized as follows. Section 2 develops the model. Section 3 provides an analysis of the first best. Section 4 analyzes the second best. Section 5 concludes. All proofs are included in the Appendix.

2 The Model

There are two time periods. The first period begins at $t = 0$ and ends at $t = 1$, while the second period begins at $t = 1$ and ends at $t = 2$. All agents are risk neutral, and the one-period riskless rate is $r > 0$. The economy has individual agents who can be borrowers or savers (or both), banks that intermediate between borrowers and savers by raising money from depositors and shareholders at $t = 0$ and funding loans with that money, and fintech lending platforms that provide non-intermediated financing (e.g. P2P lending). While lenders (banks and fintech platforms) exist for both periods, each borrower, depositor, and shareholder lives for one period. Thus, there are first-period borrowers and financiers and second-period borrowers and financiers. This means all claims are settled at the end of each period and the only “long-lived” entity is the lender. This allows us to focus on the role of reputation and trust without complications from multiperiod loan contracting issues.

2.1 Agents

Borrowers: At the start of each period, there are agents who have projects, with each project requiring $L$ at the start of the period and paying off at the end of the period. The agents with projects are penniless and need loans to finance these projects—so we call them
borrowers. Each borrower has a good (socially efficient) project that pays off \( x \in \mathbb{R}_+ \) with probability \( q \in (0, 1) \) at the end of the period and 0 with probability \( 1 - q \). The good project is therefore assumed to have a payoff of

\[
qx > L[1 + r]
\]  

(1)

The parameter \( q \) may vary in the cross-section of borrowers over \([q_-, 1]\), so \( q \) may be viewed as the borrower’s observable type.

**The Loan Contract:** Each first-period borrower takes a loan of \( L \) at \( t = 0 \) and promises to repay the lender some amount \( R \) at \( t = 1 \); this amount can be repaid only if the borrower’s project pays off \( x \). Thus, \( q \) can also be viewed as a measure of the borrower’s default risk, with higher \( q \) implying lower default risk. Similarly, each second-period borrower takes a loan of \( L \) and promises to repay some \( R \) at \( t = 2 \).

**Depositors:** These are agents who have liquidity at the start of each period that they can either deposit in a bank or invest in a riskless security that delivers a return of \( r \). If an amount \( D \) is deposited in the bank at \( t = 0 \), it produces liquidity, safekeeping, and transaction services worth \( \overline{\phi}(D) > 0 \) at \( t = 1 \) if the bank is solvent and fully repays depositors, \( \dot{\phi}(D) \in (0, \overline{\phi}(D)) \) at \( t = 1 \) if the bank fails and depositors are paid off by the insurer, and zero at \( t = 1 \) if the bank fails and the depositors receive nothing.\(^{13}\) Here, \( \overline{\phi}(D) > \dot{\phi}(D) \forall D > 0, \overline{\phi}' \geq \dot{\phi}' > r \), and \( \overline{\phi}(0) = \dot{\phi}(0) = 0 \). The same assumptions apply to second-period deposits that arrive at \( t = 1 \) and are paid off at \( t = 2 \).

Depositors play two roles here—they provide financing and they consume services pro-

\(^{13}\)Donaldson, Piacentino, and Thakor (2017) provide a foundational theory of banking in which banks exist to provide safekeeping depository services in an economy with no pledgeability of output. The notion that the value of depository services is lower when the bank fails and depositors are paid off than when the bank is solvent is meant to capture the idea that when a bank fails and the deposit insurer has to step in, there is some disruption in the services that depositors receive, some of it possibly arising from weaker incentives that a bank on the verge of insolvency will have in providing services to its customers (see Merton and Thakor (2017)).
vided by the bank. As in Merton and Thakor (2017), we refer to them as “customers” of the bank. This is in contrast to shareholders who are pure financiers of the bank. This is a feature that distinguishes banks from non-bank lenders—banks receive substantial financing from customers.

**Banks:** There are regulated entities that operate in a competitive credit market, designing loan contracts that maximize the expected utilities of borrowers subject to the participation constraints of depositors and investors. Each bank raises \( D \in (0, L) \) in deposits at the start of each period and the rest of the needed funding from shareholders who require an expected return of \( r \) on the funds they provide. Shareholders who provide funding at \( t = 0 \) are paid off fully at \( t = 1 \), at which time funds are raised from a new group of shareholders. Deposits are partially insured, with the maximum coverage being \( \overline{D} < D \) in case the bank is unable to fully pay off depositors. Without loss of generality, we set the deposit insurance premium at zero.\(^{14}\) Note that banks are raising all of their funding at \( t = 0 \) from only two sources—deposits and equity. This is without loss of generality since our model distinguishes between deposits and funds provided by investors, but there is no difference between the expected returns that need to be provided to shareholders and subordinated debtholders, so the mix of equity and “sub” debt in the bank’s capital structure is irrelevant.

Each bank faces a cost \( K > 0 \), which consists of regulatory costs, and operating costs that include the costs of credit analysis. In general, \( K \) may depend on observable borrower risk characteristics.\(^{15}\) More formally, we will assume that \( K(q) \) is a decreasing function of \( q \), i.e. \( K'(q) < 0 \), \( K'' > 0 \), \( \lim_{q \to q_\text{\tiny -}} K' = \infty \), \( K(1) \equiv K \). This relationship between \( K \) and \( q \) is assumed to be driven by regulatory costs.

**Fintech Lenders:** There is no intermediation with this form of lending and hence non-depository services provided to customers. All financing is raised from investors (sharehold-

\(^{14}\)This is consistent with the institutional reality for U.S. banks over long periods of time. Moreover, as long as the premium is risk-insensitive, it reduces to a constant and does not affect the analysis.

\(^{15}\)That is, the regulatory costs faced by banks may be higher for riskier borrowers.
ers) and loaned to borrowers. That is, as in Philippon (2016), while banks are “levered lenders”, fintech lenders such as P2P platforms are “all-equity” lenders. Although explicit credit screening is suppressed in our formal analysis, we assume that both banks and fintech lenders engage in pre-lending screening of borrowers, which presumes some \textit{ex ante} unobservable heterogeneity among borrowers, with some borrowers being uncreditworthy. We assume that the cost of operating the fintech lending platform, which includes the cost of credit analysis to screen out the uncreditworthy borrowers, is $M > 0$. Since we do not explicitly model the screening process, our maintained assumption throughout is that the uncreditworthy borrowers have been screened out. We assume that $M = K$, which reflects the fact that fintech lenders have a competitive advantage over banks in information technology as well as regulatory costs.\footnote{As Buchak et al. (2016) point out, one of the factors that has facilitated the growth of fintech is information technology, including techniques to analyze big data. Such automated credit analysis does not rely on the generation and interpretation of soft information that has been a competitive advantage for many (especially small) banks. In fact, Buchak et al. (2016) point out that fintech platforms appear to be more proficient than banks in analyzing big data relating to borrower default risk. It should be noted that while banks have been making an effort to adopt the same technology as fintech firms, the assumption that $M = K$ also captures the fact that banks are subject to regulatory costs, as previously described.}

### 2.2 Agent Types and Models of the World

There are two models of the world that financiers (investors and depositors) can have: (1) all lenders are trustworthy (Model I), and (2) all lenders are self-interested (Model II).

In Model I, the lender chooses to always make the good loan. The lender’s type in Model I is referred to as $\tau_0$. In Model II, the lender maximizes a type-dependent utility function that could lead the bank to make a different loan. There are two possible lender types in Model II: $\tau_1$ and $\tau_2$. Both types of lenders can invest in an inefficient loan (“PB” loan) in each period that generates a private benefit, $\tilde{\beta}^t$, in period $t$.\footnote{There are many ways to interpret $\tilde{\beta}^t$. One is that it is a private cost of monitoring the good loan that is avoided with the PB loan which pays the lender less because it is not monitored. The other is that it is literally a rent that accrues to the lender because the loan is made to a friend or relative of the manager of the lender.} For type $\tau_1$, $\tilde{\beta}_1^t \in \{\beta_l, \beta_h\}$, with $0 < \beta_l < \beta_h \ \forall \ t$, $\Pr(\tilde{\beta}_1 = \beta_l) = s$, and $\Pr(\tilde{\beta}_1 = \beta_h) = 1 - s$. In addition to generating this
private benefit, the inefficient loan of type $\tau_1$ pays off a pledgeable amount $x$ with probability $p < q$ and zero with probability $1 - p$, with

$$px + \beta_h < L[1 + r].$$

(2)

For type $\tau_2$, $\bar{\beta}_t^2 = B > \beta_h \forall t$. The PB loan for type-$\tau_2$ lender has a pledgeable payoff of zero almost surely. We assume $p \in (0, q_-)$, and that $B$ is so large that the type $\tau_2$ lender will always make the type-$\tau_2$ PB loan.

Conditional on the “correct” model of the world being Model II, the common prior belief of financiers and borrowers at $t = 0$ is that $\Pr(\tau_1) = r \in (0, 1)$ and $\Pr(\tau_2) = 1 - r$. In Model II, the lender maximizes the following utility function in each period:

$$u_{ij}^t = \alpha_j \sum_{k=1}^{n} \left[ z_{k}^t - \xi_{k}^t + y^t - \bar{y}^t + \psi I^t \right] + \left[ 1 - \alpha_j \right] \bar{\beta}_{j}^t$$

(3)

where the superscript $t$ designates the time period, the subscript $j$ designates the lender’s “type” in Model II, where $j \in \{1, 2\}$ with 1 designating $\tau_1$ and 2 designating $\tau_2$, and $i \in \{b, f\}$ designates “bank” or fintech platform. In (3), $\alpha \in (0, 1)$ is a weighting factor, $z_{k}^t$ is the expected payoff to financier $k$ under the lender’s policy, $\xi_{k}^t$ is the reservation payoff, $y^t$ is the borrower’s expected payoff, and $\bar{y}^t$ is the borrower’s reservation payoff. In (3), $n = 1$ in the case of fintech platforms that are entirely funded by a homogenous group of investors and $n = 2$ for banks which are funded by depositors and shareholders, $I^t$ is the deposit insurer’s expected payoff, and $\psi \in [0, 1]$ is the weight the decision maker attaches to $I^t$. If $\psi = 0$, then the lender ignores the insurer’s welfare, whereas if $\psi = 1$, the lender gives the same weight to the insurer’s welfare as to that of the borrower and financiers.

The common prior belief of borrowers and financiers at $t = 0$ is that the probability is $\zeta^0 \in (0, 1)$ that the true model of the world is Model I and $1 - \zeta^0$ that it is Model II. Whatever model of the world is adopted by borrowers and financiers (“agents” henceforth when referred to collectively as a group), it applies to banks as well as fintech platforms.
This “model uncertainty” plays a key role in the analysis.

Let \( l_{ij} \in \{G, PB\} \) be the choice of loan in period \( t \) by type \( i \in \{\tau_1, \tau_2\} \) of lender \( j \in \{b, f\} \) in Model II. Then in the second period:

\[
l_{ij}^2 \in \arg \max_{\{G, PB\}} u_{ij}^2
\]  

and in the first period:

\[
l_{ij}^1 \in \arg \max_{\{G, PB\}} U_{ij}^0
\]  

where

\[
U_{ij}^0 = u_{ij}^1 + \mathbb{E}[u_{ij}^2(l_{ij}^2)]
\]

is the expected utility of the bank decisionmaker over two periods, and it takes as a given the subgame perfect choice \( l_{ij}^2 \) in the second period.

Our specification of the lender decisionmaker’s preferences in Model II in this manner captures two key ideas. One is that the decisionmaker cares about the total net surplus generated by the lender for its borrower and financiers, as well as possible private benefits to the decisionmaker. This specification of preferences as a weighted average of tangible lender value and managerial (or inside owners’) private benefits is relatively standard. The other key idea captured here is that maximizing the sum of the differences between the expected payoffs and reservation payoffs of the borrower and the financiers is equivalent to maximizing the total net surplus created by the lender. If the appropriate participation constraints are added to this maximization, then it represents maximizing surplus under any credit market competition specification, i.e., maximizing the expected utility of the scarce agent (borrower or financier) subject to the participation constraints of the other agents.

**Macro Uncertainty:** The model also has a macro uncertainty whose realization is observed at the end of each period. The uncertainty represents the state of the overall economy, namely a systematic risk, and we delineate it as a random variable \( \tilde{m} \) with probability den-
sity function $\xi$. Let $\text{supp} \, \xi = [m, \overline{m}]$. The realization of $\bar{m}$ is publicly observed and has a multiplicative effect on the success probability of any investment by the lender. That is, there exists a function:

$$C : [m, \overline{m}] \times [q_-, 1] \to (0, 1)$$

such that for a given $q$ and a realized $m \in [m, \overline{m}]$, the repayment probability of the good loan becomes $C(m, q) \in (0, 1)$, with $\partial C / \partial m > 0$, $C(m, q) < q$, $C(\overline{m}, q) > q$. This means the better the macro state, the higher the success probability of the good project and hence the repayment probability of the good loan. Similarly, for the PB loan of the type $\tau_1$ lender in Model II,

$$C : [m, \overline{m}] \times (0, q_-) \to (0, 1)$$

and again for any $p \in (0, q_-)$, we have $\partial C / \partial m > 0$.

Let

$$\bar{q} \equiv \int_{m}^{\overline{m}} C(m, q) \xi \, dm$$

$$\bar{p} \equiv \int_{m}^{\overline{m}} C(m, p) \xi \, dm$$

Both (1) and (2) are assumed to hold with $\bar{q}$ and $\bar{p}$ replacing $q$ and $p$, respectively.

The Use of Model Uncertainty in the Equilibrium Concept: Introducing model uncertainty and using the equilibrium concept developed by Ortoleva (2012) allows us to model the possible loss of trust in lenders as a discontinuous shift in beliefs about their type or motives, as we explained in the Introduction. This sort of shift better captures loss of trust than would a smooth Bayesian revision of beliefs about types that is more the reputational effects frequently encountered in career-concerns models.\(^{18}\) Within-model uncertainty captures the normal Bayesian revision of beliefs about types that occurs once agents have (re)selected their model of the world based on their posterior beliefs about the

\(^{18}\)For example, Holmstrom and Ricart i Costa (1986) and Milbourn, Shockley, and Thakor (2001).
lender’s type. Since banks and fintech lenders are observationally distinct, revision of beliefs occurs for each as a distinct entity.

2.3 Competitive Structure of the Credit Market

Borrowers are in scarce supply, so banks and fintech platforms compete for borrowers, subject to the participation constraints of their depositary customers and investors. This means that the trustworthy lender’s problem is one of maximizing the surplus accruing to borrowers, subject to feasibility constraints and the participation constraints of depositors and investors.

We assume that borrowers operate within given geographies. Within each geography, there is a sufficiently large number of banks and a sufficiently large number of fintech platforms to make it a competitive credit market at $t = 0$. Thus, at $t = 0$, all banks in the geographic area will offer a given borrower the same price, and all fintech lenders will offer the same price that may differ from the price offered by banks. At $t = 1$, however, when the market for the second period opens after the first-period outcome has been observed, different lenders may offer different prices based on the possibly different outcomes experienced by them on their first-period loans. The lender offering the best price will win the borrower’s business.

**Bank Regulator:** There is a regulator who provides banks with the license to gather deposits. The regulator also sets the bank’s capital requirement, which will determine how much equity capital the bank needs to hold in each period on its balance sheet. Because fintech platforms do not have access to deposits, they are not subject to regulation.

**Zero Lower Bound:** We assume that all interest rates in the economy have a zero lower bound.\(^{19}\)

\(^{19}\)This assumption helps to simplify the algebra, but is not crucial to the analysis.
2.4 Summary of Timing and Actions

There are two time periods, period 1 and period 2, and three dates: $t = 0$, $t = 1$, and $t = 2$. At the start of each period, there are banks and fintech lending platforms that can potentially make loans to borrowers. The banks finance themselves in each period with a mix of deposits and equity. The deposits are partially insured, where $D$ is the amount of deposits raised and $\overline{D} < D$ is the amount of deposits insured. The fintech platform finances itself entirely with equity raised from investors.

Economic agents can put their beliefs on two possible economic models of the world: that lenders are all trustworthy and will make good loans (Model I), or that lenders are self-interested and will take into account their private benefits in choosing what loan to make (Model II). The beliefs of agents are common knowledge at $t = 0$. These beliefs determine the costs of financing for lenders and hence the repayment obligations for borrowers in the first period.

At $t = 0$, each lender, knowing the model of the world adopted by economic agents, posts a price at which it is willing to lend $L$. Each borrower decides whether to borrow from a bank or a fintech lender after observing the posted prices. Also at $t = 0$, banks raise whatever financing they need from deposits and equity to make the first-period loan and satisfy regulatory capital requirements, and fintech platforms raise their necessary financing from investors. Then each lender privately observes its realized $\tilde{\beta}$ and chooses between the good loan and the PB loan, being aware of how the borrower will choose between the good and the risky projects given the repayment obligation in the loan contract.

At $t = 1$, the macro state $\tilde{m}$ is realized and it determines the success probability of the loan made by the bank at $t = 0$. The borrower repays or defaults on its loan and the lender settles the claims of its financiers, with the deposit insurer stepping in for the bank if the borrower defaults. Borrowers and financiers revise their beliefs about the true model of the world, and then arrive at their posterior beliefs about the lender’s type within the model of the world chosen for the second period. Trust in lenders is either maintained or
Borrowers and financiers share common prior beliefs about the true model of the world (i.e. the probability that lenders are trustworthy) and the lender’s type within each model.

These beliefs determine the prices at which banks and fintech lenders raise financing and the repayment obligations they post for their borrowers.

The regulator may impose a capital requirement on banks that can affect the mix of deposits and equity raised by the bank.

Each lender observes its realized private benefit from the PB loan and decides whether to make that loan or the good loan.

Each borrower decides whether to invest in the good or risky project.

The macro uncertainty $\tilde{m}$ is realized and it affects first-period success probabilities.

Borrowers pay off or default on first-period loans. Lenders settle claims with financiers. If the lender collects a profit, it is paid off to shareholders as a dividend. In the case of banks that fail, the deposit insurer covers part of the claim.

Economic agents revise their beliefs about the true model of the world, and their beliefs about lender types within the model. Lenders may lose trust.

Second period begins with new borrowers and new depositors. Shareholders may or may not choose to provide more financing.

Second-period claims are settled after second-period $\tilde{m}$ is realized and loans are repaid or default.

lost. This then determines each lender’s cost of financing in the second period, and hence the price at which the second-period loan can be offered. It is possible that the first-period outcome is such that financiers are unwilling to provide second-period financing. That is, the first-period outcome may lead to a loss of trust that shuts out the lender in the second period. If lending occurs, then all second-period claims are settled at $t = 2$. See Figure 1 which summarizes the sequence of events.
3 Preliminary Analysis

In this section we present some preliminary analysis. We start by describing the first best, then present results regarding the deposit interest rate and the extent of risk exposure for depositors in a setting similar to the one used in Merton and Thakor (2017). We then characterize the fintech platform’s and the bank’s loan obligations in the first-best case. This is followed by a discussion of the equilibrium.

3.1 First Best

This is the case in which the borrower’s project choice and the bank’s loan choice are both observable. The first-best outcome can be trivially shown to be the bank making the good loan, the borrower investing in the good project, and the lenders setting the borrower’s repayment obligations in order to maximize the borrower’s utility while satisfying financiers’ participation constraints. Note that the first-best outcome for a single period is the same as the single-period outcome with trustworthy lenders. Next we have a useful result.

Lemma 1: The deposit interest rate is zero if we assume that depositors’ financial claims are completely insulated from the bank’s credit risk, i.e., deposits are riskfree.

The idea that depositors do not wish to be exposed to the bank’s credit risk builds on the insights of Merton (1989, 1993, 1995, 1997), and most recently, Merton and Thakor (2017). In the next result, we will establish that this is indeed the efficient outcome in our setting here.

Lemma 2: Suppose the deposit insurance coverage, $\bar{D}$, is high enough so that

$$\hat{\phi}(D) > D - \bar{D}$$  \hspace{1cm} (11)

Then it is efficient for the regulator to ask the bank to post enough equity capital to make deposits riskless, given the deposit insurance coverage $\bar{D}$ in the state in which the borrower
defaults.

The intuition behind this result is as follows. Asking the bank to put in enough capital to make deposits riskless means asking for enough capital to cover the shortfall due to incomplete deposit insurance, \( D - \overline{D} \). If the value of depository services when the bank is solvent, \( \hat{\varphi}(D) \), exceeds \( D - \overline{D} \), then it is efficient to ask for the additional capital. Henceforth, we will assume that (11) holds, and will take this capital requirement on the bank as a given.

Next we turn to the borrower’s first-best repayment obligations.

**Lemma 3:** The borrower’s (first-best) repayment obligation to the fintech lender is:

\[
R_{fb}^F = \{ L[1 + r] + M \} \{ \overline{q} \}^{-1} \tag{12}
\]

and to the bank is:

\[
R_{fb}^B = \left\{ L[1 + r] - Dr - \overline{D}[1 - \overline{q}] + K \right\} \{ \overline{q} \}^{-1} \tag{13}
\]

If \( M = K \), the borrower strictly prefers a bank loan to a fintech platform loan.

This result is intuitive and follows from the fact that the bank’s access to deposit funding—which costs less in equilibrium than equity—gives it a cost advantage. This means that one of the keys to the ability of a fintech platform to take business away from a bank is to have \( M \) lower than \( K \).

Our next result is about how the credit market will segment itself in the first-best case.

**Lemma 4:** \( \exists q^* \in (q_-, 1) \) such that borrowers will go to fintech lenders if \( q < q^* \) and to banks if \( q \geq q^* \), where \( \overline{q}^* \) corresponding to \( q^* \) satisfies

\[
\overline{q}^* = \frac{Dr + \overline{D} - [K - M]}{\overline{D}} \tag{14}
\]
This result shows that there is a natural market segmentation between banks and fintech lenders when banks are faced with regulatory costs that are greater for riskier borrowers. These regulatory costs may go up with borrower risk either due to explicit regulations (like greater regulatory scrutiny and proscriptions as borrower risk increases) or simply regulatory “guidance” to avoid excessive credit risk.\textsuperscript{20} Thus, the “safe” borrowers, those with \( q \in [q^*, 1] \) go to banks and the “risky” borrowers, those with \( q \in [q_-, q^*] \), go to fintech platforms.

The intuition is as follows. When the borrower is completely safe (\( q = 1 \)), we know that \( K = M \) and bank lending dominates due to the value of the bank’s depository services. As \( q \) falls, the bank’s relative advantage declines because regulatory costs rise, as reflected in a higher \( K \) for a riskier borrower. Eventually, the bank’s regulatory burden for the riskiest borrowers is such that the prices at which banks are willing to lend to them makes them go to fintech lenders.

3.2 Second Best: Equilibrium Concept

We now define the equilibrium we will use to characterize the strategies of banks and fintech platforms in the second best. One of our main goals is to show how the split between banks and fintech may evolve by focusing on the role that financier trust plays in influencing lender behavior. Many seem to believe that the usurping of bank market share by fintech platforms is only the tip of the iceberg and that eventually banks will lose at least most of their transaction lending to their fintech rivals. Our point is that trust will be an important mediating variable in this dynamic and that banks have a potential advantage as “trusted lenders”.

As we discussed in the Introduction, trust is typically all-or-nothing—one either trusts an agent, or does not. So if we begin with a situation in which a lender is trusted and then we observe an outcome that seems patently incompatible with that trust, then we are essentially observing a zero-probability event. As is well known, Bayes rule for belief revision

\textsuperscript{20}For example, in the current regulatory environment in the U.S., regulatory guidance provided to banks is causing bank credit supply to certain sectors (e.g. payday lenders) to constrict.
is not defined in such a situation.

To model such behavior and its implications for the strategies of lenders, we rely on Ortoleva’s (2012) *Hypothesis Testing Representation* (henceforth HTR) to characterize belief revision. We embed this model in the definition of our equilibrium, which follows a discussion of how beliefs are formed and revised.

**Discussion of Equilibrium Belief Formation:** At \( t = 0 \), all financiers and borrowers (“agents” henceforth) have common prior beliefs that if Model I is the true model of the world, then all lenders are trustworthy, and if Model II is the true model of the world, then there is a probability \( \gamma \in (0, 1) \) that the lender is of type \( \tau_1 \) and a probability \( 1 - \gamma \) that the lender is of type \( \tau_2 \). All financiers also have a prior over priors and believe that \( \zeta \in (0, 1) \) is the probability that Model I is the correct model and \( 1 - \zeta \) is the probability that Model II is the correct model. In the first step, at \( t = 0 \) the agents choose the model to which the prior over priors assigns the highest likelihood, i.e., they adopt Model I for their beliefs if \( \zeta \geq 0.5 \) and Model II if \( \zeta < 0.5 \). They also choose the threshold probability \( \varepsilon \in (0, 1) \) for a future revision of their prior over priors. Given these beliefs, agents determine the price at which financing will be provided to lenders so as to yield each group of financiers an expected return of at least \( r \), with the expectation taken over the beliefs adopted in Step 1. This then determines the repayment obligations banks and fintech platforms announce on their first-period loans to borrowers.

At \( t = 1 \), the macro state realization is observed and also whether the borrower has repaid or defaulted on the first-period loan. Based on this information, in Step 2 agents test their priors to determine if the correct model of the world was used in Step 1. If the probability that the agents’ prior assigned to the observed repayment/default outcome at \( t = 1 \) is above the threshold \( \varepsilon \), then the prior belief chosen in Step 1 is *not* rejected, and beliefs are now updated using Bayes rule, thereby determining the second-period financing costs for lenders and the terms at which the lenders will make second-period loans to borrowers.
If, however, the probability that the agents’ prior assigned to the new information observed at \( t = 1 \) is below the threshold \( \varepsilon \), then the prior is rejected and agents go back to their prior over priors \( \zeta \), update it using Bayes’ rule using the information at \( t = 1 \), and then in Step 3 chooses the prior to which the updated prior over priors assigns the highest likelihood. With these new beliefs, financiers determine the cost at which lenders can raise financing, and lenders determine the terms at which they will lend to second-period borrowers. A visualization of this process is provided in Figure 2.

This means that if the prior “chosen” at \( t = 0 \) is rejected by the data, agents reconsider the prior to use by choosing the new maximum likelihood prior, which is extracted by examining the prior over priors after its updating using Bayes’ rule. As Ortoleva (2012) points out, when \( \varepsilon = 0 \), belief revision is exactly in accordance with Bayes’ rule.\(^{21}\)

Note that in our setting, a model is itself a prior belief over the lender’s type, and \( \zeta \) is the prior over these prior beliefs. Using Ortoleva’s (2012) notation, we therefore define \( \pi \) as the prior belief, which in our model is a vector of two probability distributions over lender types, \( \pi = \{\pi_1, \pi_2\} \), where

\[
\pi_1 = \langle \Pr (\tau_0) = 1, \Pr (\tau_1) = 0, \Pr (\tau_2) = 0 \rangle, \quad (15)
\]

\[
\pi_2 = \langle \Pr (\tau_0) = 0, \Pr (\tau_1) = \gamma \in (0, 1), \Pr (\tau_2) = 1 - \gamma \in (0, 1) \rangle, \quad (16)
\]

where \( \tau_0 \) denotes that the lender is trustworthy, \( \tau_1 \) denotes that the lender is untrustworthy and of type \( \tau_1 \), and \( \tau_2 \) denotes that the lender is untrustworthy and of type \( \tau_2 \). Then the prior over priors says that \( \zeta^0 \) is the prior belief that the correct prior is \( \pi_1 \) and \( 1 - \zeta^0 \) is the prior belief that the correct prior is \( \pi_2 \).

Before we define the equilibrium formally, some additional notation is useful. We will use the time superscript on the prior to designate the date at which the prior is chosen, i.e., \( \pi^0 \) is the prior chosen at \( t = 0 \) and \( \pi^1 \) the prior chosen at \( t = 1 \). We will use the same date

\(^{21}\)See Ortoleva (2012) for an analysis of the uniqueness properties of this representation.
STEP 1
- All agents (financiers) start with prior over priors about the right model of the world
- The model assigned the highest likelihood by the prior over priors is adopted as the model of the world
- A threshold probability $\varepsilon > 0$ is assigned for hypothesis testing

STEP 2
- Outcomes observed
- Agents test their initial hypothesis that their chosen model was correct

Based on initial model, did observed outcome have probability of occurrence $> \varepsilon$?

Yes

Do not reject initial model and revise beliefs using Bayes’ Rule

No

Reject initial prior and go back and revise prior over priors using Bayes Rule and observed outcome at $t = 1$

STEP 3
- Choose the model to which the updated prior over priors assigns the highest likelihood
nomenclature in assigning superscripts to all the other variables. Let

\[ Q_t^i = \{ q \mid \text{borrower with success probability } q \text{ goes to lender } i \in \{ b, f \} \text{ at date } t \}, \quad (17) \]

and \( Q_t = Q_t^b \cup Q_t^f \), be the set of all choices made by borrowers with observationally distinct values of \( q \) at date \( t \). Let \( \phi_t(q) \) be the strategy chosen by a borrower with success probability \( q \), where the strategy is choice of lender and a probability distribution over the choice of the good project and the risky project. Similarly, \( \phi_t^i(q) \) is the lender’s strategy at date \( t \) when dealing with a borrower with success probability \( q \), and this is a probability distribution over the choice of a good loan and a PB loan. Let \( \omega \) be the observed outcome at \( t = 1 \), where \( \omega \) is the realization of a pair of random variables: \( \omega = \{ \text{borrower defaults or repays, } m \} \). Let \( \Omega \) be the set of \( \omega \)’s for all lenders.

**Definition of Competitive Equilibrium:** A competitive equilibrium consists of a vector of beliefs, prices, and strategies at \( t = 0 \) and a vector of beliefs, prices, and strategies at \( t = 1 \) that can be described as follows:

(i) At \( t = 0 \), for each \( q \), the equilibrium consists of \( \langle \varepsilon, \pi_0, R_0^b(q), R_0^f(q), \phi_0^b, \phi_0^f \rangle \) where \( \varepsilon \) is the threshold probability chosen by agents, \( \pi_0 \in \{ \pi_1, \pi_2 \} \) is the prior belief chosen by agents over lenders’ types, \( R_0^b(q) \) and \( R_0^f(q) \) are the repayment obligations posted by banks and fintech platforms respectively, \( \phi_0^b \) is the strategy of a first-period borrower with success probability \( q \), and \( \phi_0^f \) is the strategy of a lender \( (i \in \{ b, f \}) \). Here \( \pi_0 \) is chosen by agents using the HTR; \( R_0^b(q) \) and \( R_0^f(q) \) are determined to maximize the expected utilities of the \( q \) borrowers while satisfying the participation constraints of shareholders and depositors, taking as a given \( \pi_0 \) and the strategies of \( \phi_0^b \) and \( \phi_0^f \), and \( \phi_0^i \) is chosen by each lender to maximize its expected utility over two periods, given \( \phi_0, \pi_0, \) and \( \pi_1(\omega) \) in each future \( \omega \in \Omega \).

(ii) At \( t = 1 \), for each \( q \) and each \( \omega \in \Omega \), the equilibrium consists of \( \langle \pi_1(\omega), R_1^b(q), R_1^f(q), \phi_1^b, \phi_1^f \rangle \),
where \( \pi_1(\omega) \in \{ \pi_1, \pi_2 \} \) is the updated prior belief over lenders’ types chosen by agents at \( t = 1 \) based on the HTR; \( R_b^1(q) \) and \( R_f^1(q) \) are the repayment obligations posted by banks and fintech platforms respectively; \( \phi^1 \) is the strategy of a second-period borrower with success probability \( q \) and \( \phi^1_i \) is the strategy of a lender in the second period. Note \( \phi^1_i \) could include not extending a loan because the lender is unable to raise financing at \( t = 1 \). All strategies are subgame perfect in the sense that: \( R_b^1 \) and \( R_f^1 \) maximize the expected utilities of second-period borrowers, subject to the participation constraints of second period financiers, taking \( \pi_1(\omega), \phi^1 \), and \( \phi^1_i \) as given; \( \phi^1 \) maximizes the utilities of second-period borrowers, taking all other aspects of the equilibrium as given; and \( \phi^1_i \) maximizes the lender’s utility in the second period, taking all other aspects of the equilibrium as given.

Our focus in the analysis will be on a situation in which agents use the HTR and at \( t = 0 \) choose the prior that lenders are trustworthy.\(^{22}\) We will then examine the behavior of banks and fintech platforms in the first period when they are trusted. This allows us to characterize conditions under which trust can be lost in the second period, which then leads to an analysis of how the potential to lose trust in the future influences lender behavior at \( t = 0 \).

4 Analysis of the Second-Best Equilibrium with Trust

In this section, we establish four general results about trust, how it can be lost, and how banks have an advantage over fintech platforms because of their traditional role as trusted lenders. Our first result has to do with how a lender chooses its second-period strategy, conditional on the strategy it chose in the first period and the first-period outcome.

In preparation for this result, we need to introduce some notation. Recall that \( \zeta^1 \) is the prior over priors at \( t = 1 \) and \( \pi^1(\omega) \) is the prior belief chosen by agents at \( t = 1 \) using the

\(^{22}\)In a sense, we can think of this as corresponding to the current credit market situation in which lenders are trusted by financiers to make good loans.
HTR. Thus, using the notation from (15) and (16):\(^{23}\)

\[
\pi^1(\omega) = \begin{cases} 
\pi_1 & \\
\pi_2 = \langle \mu_{i,1}^l, 1 - \mu_{i,2}^l \rangle & \text{if agents believe at } t = 1 \text{ that lender is not trustworthy}
\end{cases}
\] 

(18)

where

\[
\mu_{i,\omega}^l \equiv \Pr(\text{lender } i \text{ is type } \tau_1 \mid \pi_2 = \pi_2, \omega)
\] 

(19)

where \(i \in \{b, F\}\), and recall that \(\omega \in \Omega\) is the composite state that includes the realized \(\bar{m}\) and whether the first-period borrower repaid the loan or defaulted.

**Theorem 1:** If a lender is able to raise financing in the second period and has a loan applicant, then its second-period strategy is independent of its first-period strategy as well as agents’ second-period beliefs.

The intuition is as follows. The lender’s first-period strategy and the beliefs of agents in the first period will influence agents’ prior over priors in the second period after having observed the realization of the macro state at the end of the first period. This, in turn, will affect the price at which the lender can raise financing in the second period as well as the borrower’s repayment obligation. However, since in equilibrium the financiers always earn the same expected return, conditional on \(\pi^1(\omega)\), and they rationally anticipate the lender’s second-period strategy, \(z_{k}^t - \overline{z}_{k}^t\) in (3) is unaffected by either \(\pi^1(\omega)\) or the lender’s second-period strategy. Although the borrower’s repayment obligation, and hence \(y_{k}^t - \overline{y}_{k}^t\), is affected by \(\pi^1(\omega)\), the sum \(\sum_{k=1}^{n} [z_{k}^t - \overline{z}_{k}^t + y_{k}^t - \overline{y}_{k}^t]\) is not. Moreover, \(\beta_{j}^t\) is also unaffected by either the lender’s first-period strategy or \(\pi^1(\omega)\). Hence, a lender that can finance a second-period loan will choose the strategy that represents a solution to (4) independently of the first-period strategy or \(\pi^1(\omega)\).

\(^{23}\)Specifically, \(\pi_i = \langle \Pr_i(\tau_0), \Pr_i(\tau_1), \Pr_i(\tau_2) \rangle \forall i \in \{1, 2\}\).
Theorem 2: Fix a \( q \). Suppose that lenders start out at \( t = 0 \) with agents choosing

\[
\zeta^0 \in \left( 0.5, [1 - \overline{\mu} C (\overline{m}, q)] [2 - \overline{\mu} C (\overline{m}, q) - C (\overline{m}, q)]^{-1} \right)
\]  

where

\[
\overline{\mu} \equiv \frac{[1 - C (\overline{m}, q)] \gamma}{[1 - C (\overline{m}, q)] \gamma + 1 - \gamma}
\]

Then lenders will be viewed as trustworthy at \( t = 0 \) under the HTR. Whether they lose this trust at \( t = 1 \) is sensitive to the realization of \( \tilde{m} \) and whether the lender experiences default. Trust will not be lost if the borrower repays the lender at \( t = 1 \), but it may be lost if the lender experiences default, depending on \( \tilde{m} \). If

\[
1 - C (\overline{m}, q) < \varepsilon < 1 - C (\overline{m}, q)
\]

then \( \exists m^* \in (\overline{m}, m) \) such that a lender that experiences borrower default at \( t = 1 \) will lose trust in the second period if \( m > m^* \) and not lose trust if \( m \leq m^* \).

This result shows that lenders that fail at the end of the first period are more likely to lose trust if the failure occurs when the macroeconomic state is better. The intuition is that even a good loan is more likely to default in a recession than in a boom, so the hypothesis testing under the HTR at \( t = 1 \) will reject the initial prior over priors that led agents to view the lender as trustworthy in the first period when the bank fails in a boom, but may not do so in a recession. We next have a corollary of this theorem.

Corollary 1: Suppose \( \zeta^0 \) is as in (20) and (22) holds. Then, conditional upon experiencing borrower default at \( t = 1 \): (i) in states \( m > m^* \), all lenders lose trust; and (ii) in states \( m \leq m^* \), no lender loses trust.

The intuition is that if agents believe that lenders are trustworthy in the first period, then they are believed to have made \( G \) loans in the first period. The probability of failure
with the $G$ loan is the same for every lender. Hence, the HTR either rejects the initial prior over priors for all lender or for none. We now come to our final main result.

**Theorem 3:** For a given level of deposit insurance coverage, $\mathcal{D}$, there exists $\psi^\ast (\mathcal{D})$, which is increasing in $\mathcal{D}$, such that, for all $\psi \geq \psi^\ast (\mathcal{D})$, the probability that the $G$ loan will be made by a bank is always greater than or equal to the probability that it will be made by a fintech lender. Thus, conditional on loss of trust (agents’ prior switches to Model II), the probability that the bank will be able to raise second-period financing and continue is always greater than or equal to the probability that a fintech lender will be able to raise second-period financing and continue. If $\psi < \psi^\ast (\mathcal{D})$, the roles of the bank and the fintech lender are reversed.

This theorem highlights how the evolution of trust is affected by the two key differences between banks and fintech lenders that we have modeled. One is that banks have access to insured deposits and they provide valuable services to these depository customers. The surplus generated by these services gives banks a powerful economic incentive to maintain agents’ trust in them and makes them innately more trustworthy than fintech lenders. The second is that banks are levered lenders, unlike fintech platforms, with their leverage partially insured by the government. This generates the usual propensity to expropriate wealth from the insurer and makes banks less likely than fintech lenders to make good loans. What this theorem says is that the first incentive will outweigh the second incentive when the bank puts sufficiently high weight ($\psi$) on the deposit insurer’s payoff, e.g., we know that the bank is always more likely than the fintech lender to make the good loan when $\psi = 1$. Following Merton (1978), a useful way to think about the weight $\psi$ is in terms of the effectiveness of the regulator’s surveillance of the bank. More effective surveillance means a higher $\psi$.

In addition to the deposit insurer surveillance interpretation, we can also interpret $\psi$ as a sort of publicly-known attribute of the bank that reflects its prudence in lending (even when

\footnote{An implication of this is that more effective regulatory surveillance of banks can reinforce the role of banks as trusted lenders. These surveillance costs may be part of $K$, so regulation becomes a double-edged sword—it increases the bank’s regulatory burden and hence its operating cost while also reinforcing trust in banks.}
it may not be considered completely trustworthy). We could have alternatively modeled it as a distinct bank type, i.e., the type-\(\tau_1\) banks have \(\psi_1 = 1\), the type-\(\tau_2\) banks have \(\psi_2 < 1\), the type-\(\tau_3\) banks have \(\psi_3 < \psi_2\), and so on. According to the theorem, if the bank has a “reputation” for not exploiting the deposit insurance put option, it is likely to weather a loss of trust more effectively than fintech lenders. But if banks are viewed as being inclined to exploit the deposit insurance put (e.g. as S&Ls did during the 1980s crisis), then financiers and borrowers will flee the banks when trust is lost. It is interesting and intuitive that \(\psi^* (D)\) is increasing in \(D\). The higher the deposit insurance coverage, the stronger has to be the bank’s interest (\(\psi\)) in not exploiting the deposit insurer since a higher coverage creates a greater temptation on the bank’s part to do so.

We can now join together Lemma 4 and Theorem 3 to assess credit market segmentation and the role of lender trust. As long as lenders are trusted, they will be able to raise financing and make loans that borrowers want. From Lemma 4, in such an environment, banks will lend to less risky borrowers and fintech platforms will lend to more risky borrowers as long as these platforms have lower screening and operating costs than the sum of these and regulatory costs borne by banks. But Theorem 3 tells us that this may break down when trust is lost. Although high loan defaults will not necessarily lead to a loss of trust, in the event that trust is lost, it will have an asymmetric effect. Assuming \(\psi \geq \psi^* (D)\), banks are more likely than fintech platforms to be able to withstand a loss of trust and still continue to operate. In short, a loss of trust is predicted to cause a borrower migration from fintech platforms back to banks. This points to a fundamental competitive advantage that banks have as “trusted lenders”, an advantage that exists as long as banks are viewed as not being prone to exploit the deposit insurance safety net.

For what follows, we will assume that:

\[
\frac{(1 - A)\gamma A}{(1 - A)\gamma + [1 - \gamma]} > q
\]  

(23)
where \( A \equiv sC(\overline{m}, q) + [1 - s]C(\overline{m}, p) \).

**Theorem 4 (Bank Lenders):** Suppose \( \psi = 1 \), \( \beta^*_b \in (\beta_l, \beta_h) \) and \( \beta^*_b < \beta^*_l \). Fix a \( q \) for which first-period borrowers go to banks, and assume (20) and (22) are satisfied for that \( q \). Then there exist (deep) parameter values for which the equilibrium is as follows:

(i) At \( t = 0 \), agents believe all banks are trustworthy, i.e., \( \pi^0 = \pi_1 \) and

\[
R^0_b = \frac{L[1 + r] - Dr - D[1 - q] + K}{q} \tag{24}
\]

The strategies of the trustworthy banks are to make good loans in the first period. The strategy of the type-\( \tau_1 \) bank is to make a good loan if \( \bar{\beta} = \beta_l \) and a type-\( \tau_1 \) PB loan if \( \bar{\beta} = \beta_h \). The strategy of a type-\( \tau_2 \) bank is to make the type-\( \tau_2 \) PB loan.

(ii) At \( t = 1 \), all banks whose first-period loans are repaid continue to operate in the second period. In this case, \( R^1_b = R^{FB}_b \). The strategies of all banks in the second period are the same as in the first period. Banks that experience defaults in the first period loans continue to operate in the second period with the same lending strategies and the same cost of funding as in the first period if they do not lose trust, i.e., if \( m \leq m^* \). In this case, their cost of funding is also the same as that of banks that did not experience defaults. If \( m > m^* \) and they lose trust, they experience a discontinuous increase in the cost of funding, and they cannot compete in the second period with lenders who maintain trust. If all lender fail together and lose trust \( (m > m^*) \), the failing banks can continue to operate in the second period in states that represent a subset of \([m^*, \overline{m}]\). The type-\( \tau_1 \) banks make good loans if \( \bar{\beta} = \beta_l \) and PB loans if \( \bar{\beta} = \beta_h \). The strategies of the other types are also the same as in the first period.

**Theorem 5 (Fintech Lenders):**

(i) Fix a \( q \) for which first-period borrowers go to the fintech lenders and assume
again that (20) and (22) hold. At $t = 0$, agents believe all fintech lenders are trustworthy, i.e., $\pi^0 = \pi_1$ and

$$R^0_f = \frac{L[1 + r] + M}{q}$$ (25)

The trustworthy lenders make good loans in the first period. The type-$\tau_1$ fintech lenders make the type-$\tau_1$ PB loans and the type-$\tau_2$ fintech lenders make the type-$\tau_2$ PB loans.

(ii) At $t = 1$, all fintech lenders whose first-period loans are repaid continue to maintain the trust of agents and continue to operate in the second period. In this case, $R^1_p = R^{FB}_p$. There exists $\hat{m}^*$ such that fintech lenders who experience first-period defaults lose trust if $m > \hat{m}^*$ and maintain trust if $m \leq \hat{m}^*$. If they maintain trust, their second-period cost of funding and strategies are the same as their first-period strategies and also the same as that of fintech lenders who did not experience defaults. If they lose trust, they are frozen out of the market in the second period, i.e., they cannot raise second-period financing to make loans.

(iii) There exists some $q^* \in [q_-, 1]$ such that borrowers with $q \in [q^*, 1]$ go to banks in the first period and borrowers with $q \in [q_-, q^*)$ go to fintech lenders.

These theorems essentially consolidate our earlier results for a specific set of deep parameter values, particularly $\psi = 1$ and $\zeta^0 > 0.5$. In this case, all lenders are able to function in the first period because they are viewed as trustworthy. If they maintain trust, they can all function in the second period as well. In both periods the market segments neatly into low-risk borrowers going to banks and high-risk borrowers going to fintech lenders. In some macro states at $t = 1$, lenders experiencing defaults lose agents’ trust. When this happens, fintech lenders are forced to shut down, whereas banks may be able to continue, albeit with elevated financing costs, assuming $\psi > \psi^* (D)$. The reason why fintech lenders are shut
down is that an untrustworthy fintech lender always invests in a PB loan, which is a loan investors never want to finance. So when trust is lost, fintech lenders are out of business. By contrast, even an untrustworthy bank chooses the \( G \) loan with the private benefit is \( \beta_t \), so it is able to raise financing.

What this theorem also shows is that trust can be delicate. If the realized \( m \) is just slightly below \( m^* \), trust is maintained and the cost of funding for banks and fintech lenders will appear highly insensitive to default risk. The second-period cost of funding for lenders will appear to be completely insensitive to their realized first-period defaults. Such risk-insensitive pricing has often been observed prior to crises. But if the realized \( m \) is slightly above \( m^* \), then trust is lost with the same default experience on first-period loans, and the cost of second-period funding for lenders is discontinuously higher than their first-period funding cost. In the case of fintech platforms, it even results in market exclusion in the second period.

If one considers a multi-period extension of our model, then in a period in which \( m \) is slightly below \( m^* \), default risk will appear to be underestimated because trust is maintained, and then in the next period if \( m \) is slightly above \( m^* \), default risk will appear to be overestimated and a crisis may ensue as fintech platforms get frozen out of the market. Thus, the analysis predicts that:

- Trust in lenders will be fragile and will be lost even when observed defaults seem similar to past defaults that did not seem to affect the price of risk.
- Banks will survive a loss of trust more effectively than fintech platforms when deposit insurer surveillance is effective.
- A loss of trust will occur during a relative economic boom and will result in the exclusion of fintech platforms.
5 Conclusion

This paper has developed a theory of trust in lending. Trust enables lenders to have access to financing at rates that are insulated from the adverse reputational consequences of prior loan defaults as well as market conditions. However, trust can be broken. It is most likely to be eroded when the lender experiences relatively high borrower defaults during an economic boom. The incentives of the lender to maintain the trust of its financiers varies across banks and fintech lenders. Thus, the evolution of trust can affect credit market segmentation when banks compete with non-intermediated credit provision by fintech lenders.

We have three main market segmentation results. First, if the cost of operating a fintech platform is not lower than the cost of operating a bank (including regulatory costs), a fintech platform can never take borrowers away from a bank. Second, when a fintech platform can operate at a lower cost, it will peel off the riskiest borrowers from competing banks. Third, banks can prevent loss of trust by their investors more effectively than fintech platforms can, but only if agents believe that there is a low likelihood of banks exploiting the deposit insurance put option, i.e., if there is effective regulatory surveillance of banks. Thus, when lenders are viewed as trustworthy, fintech lenders can outcompete banks for risky borrowers. But when lenders experience default and risk losing trust, borrowers flee fintech lenders and return to banks.

From a functional perspective, banks and fintech platforms perform similar lending functions. Our analysis thus focuses on two essential institutional differences between banks and fintech lenders. First, banks have access to insured deposits and they provide valuable depository services to their customers. Second, banks are levered lenders, whereas fintech platforms are unlevered lenders. The first distinction makes banks innately more trustworthy than fintech platforms. The second distinction makes banks less trustworthy. For banks to have the competitive advantage of operating as (more) trusted lenders, they must be viewed as not being too eager or able to expropriate wealth from the deposit insurer.
References


Proof of Lemma 1: Since $\varphi' > r$, it follows that

$$\int_0^D \varphi'(y) dy > \int_0^D r dy \quad (A.1)$$

which means that $\varphi(D) > rD$. The depositors’ participation constraint (with riskless deposits) is:

$$D[1 + r_D] + \bar{q}\varphi(D) + [1 - \bar{q}]\hat{\varphi}(D) \geq D[1 + r] \quad (A.2)$$

Since the zero-lower-bound assumption implies that $r_D \geq 0$, if (A.2) holds for $r_D = 0$, then the competitive equilibrium solution must be $r_D = 0$ because maximizing the borrower’s utility implies minimizing the left-hand side of (A.2) while satisfying (A.2). At $r_D = 0$, (A.2) becomes:

$$\bar{q}\varphi(D) + [1 - \bar{q}]\hat{\varphi}(D) \geq rD \quad (A.3)$$

Now, $\bar{q}\varphi(D) + [1 - \bar{q}]\hat{\varphi}(D) > \hat{\varphi}(D) > rD$ by (A.1). Thus, (A.3) holds with $r_D = 0$. ■

Proof of Lemma 2: If deposits are riskless, the value of the bank’s depository services to its customers is

$$\bar{q}\varphi(D) + [1 - \bar{q}]\hat{\varphi}(D) \quad (A.4)$$

where we recognize that when the borrower defaults and deposit insurance kicks in, depositors value the bank’s services only at $\hat{\varphi}(D)$ even though their financial claim is fully covered. If the bank is unable to fully pay off depositors when the borrower defaults, the value of the bank’s depository services to its customers is:

$$\bar{q}\varphi(D) \quad (A.5)$$

Thus, the welfare gain due to making deposits riskless is:

$$[1 - \bar{q}]\hat{\varphi}(D) \quad (A.6)$$
Now, to make the depositors’ financial claim riskless, the regulator will have to ensure that there is a buffer of $D - \overline{D}$ available at the end of the period when depositors need to be paid off. To provide this buffer, the bank will need to raise $[D - \overline{D}] [1 + r]^{-1}$ in additional equity beyond what it needs to fund the loan, and then invest this excess cash in the riskless asset at the beginning of the period. The borrower’s repayment obligation, $R_{FB}^b$, in this case must be set to satisfy the bank’s shareholders’ participation constraint:

$$\bar{q} \left[ R_{FB}^b - D + \{ D - \overline{D} \} \right] - K = [L - D][1 + r] + [D - \overline{D}] \quad (A.7)$$

where we recognize that if the borrower repays the loan, the payoff yielded by the invested buffer, $D - \overline{D}$, is available for payment to the bank’s shareholders, and if the borrower defaults, this payoff goes towards covering the depositors’ claim and the bank’s shareholders thus collect nothing. Solving (A.7) yields:

$$R_{FB}^b = \frac{L[1 + r] + K - Dr - \overline{D}}{\bar{q}} + \overline{D} \quad (A.8)$$

Similarly, if there is no buffer and depositors are only covered up to $\overline{D}$ in the state in which the borrower defaults, the analog of (A.7) is:

$$\bar{q} \left[ \hat{R}_{FB}^b - D \right] - K = [L - D][1 + r] \quad (A.9)$$

which yields

$$\hat{R}_{FB}^b = \frac{[L - D][1 + r] + K}{\bar{q}} + D \quad (A.10)$$

Thus, the increase in the borrower’s repayment obligation due to the buffer is:

$$R_{FB}^b - \hat{R}_{FB}^b = \frac{[D - \overline{D}]}{\bar{q}} + \overline{D} - D = \frac{[D - \overline{D}][1 - \bar{q}]}{\bar{q}} \quad (A.11)$$
The expected increase in the borrower’s repayment obligation is $q \left[ R_b^{FB} - \hat{R}_b^{FB} \right]$. For there to be a social welfare gain from the buffer, we must have:

$$[1 - \bar{q}] \hat{\varphi}(D) > \bar{q} \left[ R_b^{FB} - \hat{R}_b^{FB} \right]$$

$$= [D - \bar{D}] [1 - \bar{q}]$$

(A.12)

which holds given the condition in the lemma. □

**Proof of Lemma 3:** The fintech platform funds the entire loan $L$ with equity. Hence, the first-best loan repayment obligation is the solution to the fintech platform’s participation constraint:

$$\bar{q} R_f^{FB} - M = L[1 + r]$$

(A.13)

which yields (12). Now, we know that the utility of the borrower is strictly decreasing in the repayment obligation. Hence, if $R_b^{FB} < R_f^{FB}$ at $K = M$, the borrower will strictly prefer to go to the bank. Now, using (A.8) and setting $K = M$, we have:

$$R_b^{FB} = \frac{L[1 + r] + M - Dr - \bar{D}[1 - \bar{q}]}{\bar{q}}$$

$$< \frac{L[1 + r] + M}{\bar{q}}$$

$$= R_f^{FB}.$$  

(A.14)

□

**Proof of Lemma 4:** From Lemma 3, we know that when $K = M$, the borrower strictly prefers to borrow from the bank. We also know that at $q = 1$, $K(1) = \bar{K} = M$. Thus, at $q = 1$, the borrower strictly prefers the bank. By continuity, therefore, $\exists q^* < 1$ such that the borrower will prefer the bank $\forall q \in [q^*, 1]$. Moreover, since $K(q_-) = \infty$, we also know that $q^*$ is in the interior of $[q_-, 1]$. □
Proof of Theorem 1: In the second period, the lender solves the problem in (4) subject to the participation constraints of the financiers. Consider the bank first. If it is type $\tau_0$ (trustworthy), then its choice is always the good loan and the theorem is trivially true. Suppose the bank is type $\tau_1$. No matter what it does, the participation constraint of the depositors is always satisfied since the bank is required to keep enough liquidity on hand to make deposits riskless. With a belief of $\pi^1(\omega)$ at $t = 1$, the bank’s shareholders’ participation constraint determines $R^1_b$, the borrower’s repayment obligation:

$$\{\bar{q}I_{\{\pi_1\}}(\pi^1(\omega)) + \mu^b_\omega [1 - I_{\{\pi_1\}}(\pi^1(\omega))] \bar{q} [R^1_b - \bar{D}] \}$$

$$= \left[ L - D \right][1 + r] + \left[ D - \bar{D} \right] + K \quad (A.15)$$

where the indicator function is defined as:

$$I_{\{\pi_1\}}(\pi^1(\omega)) = \begin{cases} 1 & \text{if } \pi^1(\omega) = \pi_1 \\ 0 & \text{otherwise} \end{cases} \quad (A.16)$$

In (A.15), if agents believe at $t = 1$ that the bank is trustworthy, then the expected repayment probability of the good loan is $\bar{q}$. If agents believe the bank is not trustworthy, then the expected repayment obligation is $\mu^b_\omega$ (the probability that the bank is type $\tau_1$) times $\bar{q}$, assuming that a type-$\tau_1$ bank will choose the good loan.

The right-hand-side (RHS) of (A.15) is simply the compounded value of the bank’s shareholders’ investment at $t = 0$, which is $[L - D] + [D - \bar{D}][1 + r]^{-1}$. Thus,

$$R^1_b = \frac{L[1 + r] - Dr - \bar{D} + K}{\bar{q}I_{\{\pi_1\}}(\pi^1(\omega)) + \mu^b_\omega [1 - I_{\{\pi_1\}}(\pi^1(\omega))] \bar{q} + \bar{D}} \quad (A.17)$$

Now if the bank invests in the good loan at $t = 1$, then the excess of each stakeholder’s payoff above the reservation payoff can be written as:
Shareholders:

\[ q \left[ R_b^1 - D + [D - \overline{D}] - [L - D][1 + r] - [D - \overline{D}] - K \right] \]  
(A.18)

Depositors:

\[ D + q \overline{\varphi} + [1 - q] \hat{\varphi} - D[1 + r] \]  
(A.19)

Borrower:

\[ \overline{q} [x - R_b^1] \]  
(A.20)

Deposit Insurer:

\[ - [1 - \overline{q}] \overline{D} \]  
(A.21)

where we assume that the borrower’s payoff is zero if the loan is not financed.

Thus, the expected utility of the bank’s decisionmaker if the good loan is invested in is:

\[ \alpha \left\{ \overline{q} \left[ R_b^1 - \overline{D} \right] - L[1 + r] + Dr + \overline{D} - K + \overline{q} [x - R_b^1] + \overline{q} \overline{\varphi} + [1 - \overline{q}] \hat{\varphi} - Dr - [1 - \overline{q} \overline{D}] \right\} \]  
(A.22)

And if the expected utility of the bank’s decisionmaker if the type-\( \tau_1 \) PB loan is made (when agents believe a good loan will be made) is:

\[ \alpha \left\{ p \left[ R_b^1 - \overline{D} \right] - L[1 + r] + Dr + \overline{D} - K + p [x - R_b^1] + p \overline{\varphi} + [1 - p] \hat{\varphi} - Dr - [1 - p] \overline{D} \right\} \]
\[ + [1 - \alpha] \hat{\beta} \]  
(A.23)

where the \( R_b^1 \) in (A.22) and (A.23) is given by (A.17). The bank will make the good loan if (A.22) exceeds (A.23) and the PB loan when (A.23) exceeds (A.22). The only term in (A.22) and (A.23) that is affected by the beliefs of agents at \( t = 1 (\pi^1(\omega)) \), which in turn are affected by the strategies that they believe lenders adopted at \( t = 0 \) is \( R_b^1 \). However, in both
(A.22) and (A.23), $R^b_1$ drops out, so it does not affect the comparison of (A.22) and (A.23).

Hence, the bank’s first-period strategy and agents’ second-period beliefs do not affect the bank’s second-period strategy.

In the above, we assumed that (A.22) would exceed (A.23) $\forall \tilde{\beta} \in \{\beta_l, \beta_h\}$, so that agents’ conjecture that the type-$\tau_1$ bank will choose $G$ $\forall \tilde{\beta}$ is correct. If the bank selects $G$ when $\tilde{\beta} = \beta_l$ and $PB$ when $\tilde{\beta} = \beta_h$, then in (A.17), $\mu^b_\omega[\bar{s}q + [1 - s]\bar{p}]$ and a similar adjustment would be made in (A.23), but the proof would otherwise remain unaffected. The proof for the fintech lender is very similar. ■

**Proof of Theorem 2:** By the HTR, since $\zeta^0 > 0.5$, the agents’ prior over priors will select $\pi^0 = \pi_1$ and lenders will be viewed as trustworthy in the first period. Since $1 - C(\bar{m}, q) < \varepsilon$, it follows that if the lender experiences default and $\bar{m} = \bar{m}$, then by the HTR agents will reject their initial prior $\pi_1$ and go back to their prior over priors to update using Bayes’ rule. They will compute the posterior belief

$$
\zeta^1 = \frac{[1 - C(\bar{m}, q)]\zeta^0}{[1 - C(\bar{m}, q)]\zeta^0 + q_F(\bar{m})[1 - \zeta^0]} \tag{A.24}
$$

where $q_F(\bar{m})$ is the expected failure probability in macro state $\bar{m}$ if the lender is untrustworthy, given the optimal strategies untrustworthy lenders would have chosen in the first period (with the expectation taken over lender types in Model II) when faced with agents believing them to be trustworthy.

Note that $\zeta^1$ is decreasing in $q_F(\bar{m})$. The higher the probability that a type-$\tau_1$ lender makes the $G$ loan in the first period, the lower is $q_F(\bar{m})$ and hence the higher is $\zeta^1$. The maximum probability that a type-$\tau_1$ lender will make the $G$ loan is 1. Thus, if we can establish that $\zeta^1 < 0.5$ with this conjectured first-period strategy chosen by type $\tau_1$, then $\zeta^1 < 0.5$ with any first-period strategy chosen by the type-$\tau_1$ lender.
Now if the type-τ₁ makes the G loan with probability 1 in the first period, then

\[ q_F (\bar{m}) = 1 - \mu_\omega C (q, \bar{m}) \]  \hspace{1cm} (A.25)

where \( \mu_\omega \) is defined in (19), with the superscript \( i \) dropped, and can be written as:

\[
\mu_\omega = \frac{[1 - C (\bar{m}, q)] \gamma}{[1 - C (\bar{m}, q)] \gamma + 1 - \gamma} \\
\equiv \mu
\]  \hspace{1cm} (A.26)

Substituting this in (A.24), the condition for \( \zeta^1 < 0.5 \) becomes:

\[
\frac{[1 - C (\bar{m}, q)] \zeta^0}{[1 - C (\bar{m}, q)] \zeta^0 + [1 - \mu_\omega C (q, \bar{m})][1 - \zeta^0]} < 0.5 
\]  \hspace{1cm} (A.27)

Simplifying this yields

\[
\zeta^0 < \frac{1 - \mu C (\bar{m}, q)}{2 - \mu C (\bar{m}, q) - C (\bar{m}, q)} 
\]  \hspace{1cm} (A.28)

Note that since \( 1 - C (\bar{m}, q) < 1 - \mu C (\bar{m}, q) \), the quantity on the right-hand side of (A.28) is bigger than 0.5. Thus, the interval defined in (20) has positive Lebesgue measure.

So we have proven that at \( \tilde{m} = \bar{m} \), if the lender experiences borrower default, by HTR the prior over priors will reject the initially chosen Model I as the correct belief and the revised prior over priors at \( t = 1 \) will choose Model II as the correct prior for the second period. This holds for any first-period strategy chosen by the lender. By continuity, \( \exists m^* \) in the neighborhood of \( \bar{m} \) for which this will be true as well. Further, given \( \epsilon < 1 - C (m, q) \) in (22), it also follows that the initial prior is not rejected if \( \tilde{m} = \bar{m} \). Thus, \( m^* \in (m, \bar{m}) \).

It is straightforward that the initial prior will not be rejected for any \( \tilde{m} \) if the lender experiences success (borrower-repayment) at \( t = 1 \). ■

**Proof of Corollary 1:** At \( t = 0 \), agents believe that all lenders are trustworthy. Thus, all make G loans and the probability of failure for every lender is \( 1 - C (m, q) \) in every
$m \in [m, m]$. By Theorem 2, if $m > m^*$, then the HTR will reject the initial hypothesis that
the lender is trustworthy if default is experienced, and if $m \leq m^*$, the HTR will not reject
the initial hypothesis. Moreover, since every trustworthy lender had the same strategy in
the first period, $\zeta^1$ (see (A.24)) is also the same for every lender. The result now follows
from Theorem 2. ■

**Proof of Theorem 3:** We saw in the proof of Theorem 1 that the incentive compatibility
(IC) condition for the bank to prefer to make the G loan is that the expression in (A.22)
exceeds that in (A.23). We will now write down the analogous IC constraint for the fintech
lender. If the type-1 fintech lender makes a good loan, then the decisionmaker’s expected
utility is:

$$
\alpha \left\{ \bar{q}R^1_f - L[1 + r] - M + \bar{q} \left[ x - R^1_f \right] \right\} \tag{A.29}
$$

where

$$
R^1_f = \frac{L[1 + r] + M}{\bar{q}I(\pi^1)(\pi^1(\omega)) + \mu^b \left[ 1 - I(\pi^1)(\pi^1(\omega)) \right] \bar{q}} \tag{A.30}
$$

assuming the type-$\tau_1$ fintech lender adopts the same strategy as the bank.

If the type-$\tau_1$ fintech lender makes the PB loan, the analog of (A.23) is:

$$
\alpha \left\{ \bar{p}R^1_f - L[1 + r] - M + \bar{p} \left[ x - R^1_f \right] \right\} + [1 - \alpha] \bar{b} \tag{A.31}
$$

We now solve for $\beta^*_b$ and $\beta^*_f$ as the cut-off values of the private benefit in the case of the
bank and the fintech platform respectively that makes the lender indifferent between the G
and PB loans. Equating (A.22) and (A.23) yields:

$$
\beta^*_b = \frac{\alpha [\bar{q} - \bar{p}] \left[ x - D[1 - \psi] + \varphi - \psi \right]}{1 - \alpha} \tag{A.32}
$$
Similarly, equating (A.29) and (A.31) yields:

$$\beta^*_f = \frac{\alpha [\overline{q} - \overline{p}] x^*}{1 - \alpha}$$  \hspace{1cm} (A.33)$$

Now compare (A.32) and (A.33). If $\psi = 1$, then it is clear that $\beta^*_b > \beta^*_f \forall D$. If $\psi = 0$, then $\beta^*_f > \beta^*_b$ if $\overline{D} > \overline{\varphi} - \overline{\hat{\varphi}}$, and $\beta^*_f < \beta^*_b$ if $\overline{D} < \overline{\varphi} - \overline{\hat{\varphi}}$. Thus, it follows that $\exists$ a strictly increasing function $\psi^*$: $[0, D] \rightarrow [0, 1]$ such that:

$$\beta^*_b > \beta^*_f \text{ if } \psi \in [\psi^*(D), 1]$$  \hspace{1cm} (A.34)$$
$$\beta^*_b < \beta^*_f \text{ if } \psi \in [0, \psi^*(D)]$$  \hspace{1cm} (A.35)$$

For any given $\overline{D} \in [0, D]$, there is a $\psi^*$ such that $\beta^*_b > \beta^*_f$ if $\psi \geq \psi^*$. When $\beta^*_b > \beta^*_f$, it means that it is possible for $\beta^*_b < \beta^*_f$ and $\beta^*_f < \beta^*_l$, or $\beta_h > \beta^*_b > \beta_l > \beta^*_f$. In both cases, the probability that a $G$ loan will be made by the bank is always greater than the probability that it will be made by a fintech lender.

In the case where $\beta^*_f < \beta_l < \beta_h < \beta^*_b$, the type-$\tau_1$ fintech lender will always make a PB loan, whereas a bank will make a $G$ loan. This implies that, conditional on a loss of trust, a bank will be able to raise financing to continue in the second period but a fintech lender will be unable to do so for any given $D$ and $\psi$ high enough, i.e., $\psi \geq \psi^*(D)$. Similarly, if $\beta_h > \beta^*_b > \beta_l > \beta^*_f$, the type-$\tau_1$ fintech lender will always make a $PB$ loan whereas a bank will make a $PB$ loan if $\overline{\beta} = \beta_h$ and a $G$ loan if $\overline{\beta} = \beta_l$. In this case, the probability that a type-$\tau_1$ bank will be able to raise financing and continue in the second period is greater than or equal to the probability that a type-$\tau_1$ fintech lender will be able to do the same. Clearly, if $\psi < \psi^*(\overline{D})$, the roles of the bank and fintech lender are reversed. ■

**Proof of Theorem 4:** Consider the second-period strategies of banks and fintech lenders. By Theorem 1, we know that they are independent of the first-period strategies or agent beliefs. Moreover, we know from the proof of Theorem 3 that if $\beta^*_p < \beta_l$, then a fintech
lender that is untrustworthy will always invest in either a type-$\tau_1$ or type-$\tau_2$ PB loan. Thus, investors will never provide financing to such a lender. The fact that lenders will lose trust when they experience default and $m > m^*$ follows from Theorem 2. Since $\beta_h^* \in (\beta_l, \beta_h)$, it follows from our earlier analysis that the type-$\tau_1$ banks will make $G$ loans when $\tilde{\beta} = \beta_l$ and PB loans when $\tilde{\beta} = \beta_h$. With this also as the first-period strategy, we can express (A.26) as

$$\hat{\mu}_\omega = \frac{[1 - \{sC(m, q) + [1 - s]C(m, p)\}] \gamma}{[1 - \{sC(m, q) + [1 - s]C(m, p)\}] \gamma + 1 - \gamma}$$  \hspace{1cm} (A.36)$$

with

$$\hat{q}_F(m) = 1 - \hat{\mu}_\omega [sC(m, q) + [1 - s]C(m, p)]$$  \hspace{1cm} (A.37)$$

Plugging (A.37) into (A.24), we can verify that $\zeta^1 < 0.5$.

The second-period borrower’s repayment obligation, $R^1_b$, can now be written as the solution to:

$$\hat{\mu}_\omega [sC(m, q) + [1 - s]C(m, p)] \{R^1_b - D\} - K$$

$$= L[1 + r] - Dr - D$$  \hspace{1cm} (A.38)$$

Thus,

$$R^1_b = \frac{L[1 + r] - Dr - D + K}{\hat{\mu}_\omega [sC(m, q) + [1 - s]C(m, p)]} + D$$  \hspace{1cm} (A.39)$$

As long as $R^1_b < x$, we see that the bank will be able to raise the necessary financing and the borrower will be willing to borrow. Given (1) and (23), it follows that $R^1_b < x$. Thus, by continuity $\exists$ a subset of $[m^*, m]$ that has positive measure for which $R^1_b < x$.

The rest of the proof follows in a straightforward manner from the earlier results. The first-period strategies of type-$\tau_1$ banks can be shown to be optimal when $\beta_h$ is high enough (so they will choose the PB loan when $\tilde{\beta} = \beta_h$ despite the higher probability of losing trust at $t = 1$) and those of the type-$\tau_1$ fintech lenders follow when $\beta_p^*$ is low enough. Part (iv) follows arguments similar to those used to prove Lemma 4. ■
Proof of Theorem 5: This proof is along the same lines as the proof of Theorem 4 and based on earlier results. ■