BORROWING FROM A BIGTECH PLATFORM

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ABSTRACT

We model competition between banks and a bigtech platform that lend to a merchant with private information and subject to moral hazard. By controlling access to a valuable marketplace for the merchant, the platform enforces partial loan repayments, thus alleviating financing frictions, reducing the risk of strategic default, and contributing to welfare positively. Credit markets become partially segmented, with the platform targeting merchants of low and medium perceived credit quality. However, conditional on observables, the platform lends to better borrowers than banks because bad borrowers self-select into bank loans to avoid the platform's enforcement, causing negative welfare effects in equilibrium.

KEYWORDS: Bigtech, platform, enforcement, adverse selection, moral hazard, advantageous screening, welfare, credit rationing.

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1 INTRODUCTION

Traditionally, bigtech platforms have provided value to merchants by enabling them to transact with buyers. For example, online marketplaces allow sellers to expand the geographical scope of their clientele, whereas payment platforms help merchants optimize their cash and inventory management and improve customer experience. In recent years, platforms, such as Amazon and Paypal, have also started lending to merchants who use their marketplaces or payment services. Loans offered by these platforms have grown at a dramatic pace. Globally, bigtech platforms increased credit more than fiftyfold from 2013 to 2019. In 2019, bigtech firms lent $572 billion, more than twice the amount of non-mortgage credit extended by fintech firms (Cornelli et al., 2021).[1]

Empirically, platforms provide small unsecured loans to small and medium enterprises with short-term financing needs. Typically, platforms do not require information from credit bureaus and, instead, rely on information about the merchant's history of transactions. Finally, platforms often implement revenue-based repayment plans, whereby borrowing merchants pledge a share of their sales on the marketplace as part of the loan repayment.[2]

Because of these unique empirical patterns and the rapid growth of bigtech lending, practitioners and regulators have been paying increasing attention to this phenomenon and its implications for welfare (Adrian, 2021; BIS, 2019; de la Mano and Padilla, 2018; Frost et al., 2019; Financial Stability Board, 2019; Petralia et al., 2019). By bundling traditional platform services with lending and by exploiting economies of scope, platforms may improve access to credit, especially for small and medium enterprises. However, by disrupting the activity of incumbent lenders, bigtech lenders may cause adverse welfare effects. In this paper, we provide a model that rationalizes the observed empirical patterns and we draw welfare implications of a platform entering into the credit market.

We consider a model in which a merchant obtains an uncollateralized loan from competitive banks or a platform. The merchant has private information about future cash

[1] We adopt the distinctions between bigtech and fintech used by Frost et al. (2019) and Stulz (2019). Bigtech firms are "technology companies with established presence in the market for digital services" (Frost et al., 2019). In particular, "these companies are organized around two-sided platforms that include suppliers of goods and purchasers of goods" Stulz (2019). Also Petralia et al. (2019) observe that bigtech firms possess "large, developed customer networks established through, for example, e-commerce platforms or messaging services." A fintech firm, on the other hand, is defined as "a specialized firm that challenges a specific product line of banks" (Stulz, 2019).

[2] For specific examples, please see: https://www.paypal.com/workingcapital/, https://get.doordash.com/en-us/products/capital, https://press.aboutamazon.com/2022/11/amazon-launches-new-merchant-cash-advance-program-provided-by-parafin-doubling-down-on-its-support-for-small-and-medium-sized-businesses, https://pos.toasttab.com/products/capital.

flows and is subject to moral hazard. The merchant obtains higher revenues from selling goods through the platforms than through an outside option. The more the merchant values doing business on the platforms, the higher the share of sales the merchant can credibly pledge to the platform as loan repayment. As a result, the platform can relax financial frictions for merchants who have low credit scores but obtain substantial value from transacting on the platform.

We make three main contributions. First, we show that a platform not only provides value by operating a two-sided market (Weyl, 2010; Armstrong, 2006; Rochet and Tirole, 2002; Jullien et al., 2021), but it can also alleviate financing frictions for platform users. By controlling access to a valuable source of revenues for the borrower, the platform enforces partial loan repayment, reduces default risks, and improves financial inclusion for unbanked merchants. Second, we uncover a mechanism whereby social welfare declines when a lender with superior enforcement ability enters the credit market and directly competes with incumbent lenders. The mechanism applies to any framework with private information and limited commitment in which lenders possess heterogeneous enforcement ability.[3] Third, we identify a novel equilibrium interaction between enforcement and information in a model with credit competition. Because of the equilibrium reaction of incumbent lenders, a lender with superior enforcement power may extract smaller rents from enforcement when it has the option to acquire private information about the borrower.

In our model, financing frictions arise from the merchant's limited commitment and private information. The merchant can borrow from the platform or from competitive banks and she is privately informed about whether her future sales will be high or low.[4] Moreover, the merchant cannot commit to repay the loan. In particular, the merchant has the option to default on the loan balance, abscond with the net revenues, and forfeit the continuation value of production. A merchant with low revenue is more likely to default in equilibrium because her future revenues are insufficient to motivate her to repay the loan. Lenders have a common prior about the merchant's future revenues and we refer to it as the merchant's credit quality.

Unlike traditional lenders, the platform can alleviate financing frictions by exploiting economies of scope between lending and the marketplace, thus enforcing loan repayment. As an optimal response to the limited-commitment problem, the platform charges fees on

[3]For example, heterogeneous enforcement among lenders may originate also from different abilities to extend trade credit (Burkart and Ellingsen, 2004; Petersen and Rajan, 1997), secure digital collateral (Gertler et al., 2021), or provide warehouse banking (Donaldson et al., 2018).

[4]The platform's potential borrowers are typically small businesses, for which uncertain cash flows represent an important source of credit risk.

borrowing merchants and applies them toward loan repayment. These fees are collected when transactions happen, but before the loan is due. We refer to them as *repayment fees* and they are consistent with common practice in bigtech lending. By charging repayment fees, the platform directly enforces a partial repayment from the merchant, even if the latter intends to default. Furthermore, the platform indirectly improves the merchant's ex-post incentives to repay the loan and continue production, thus enforcing full repayment. After paying the fees, the merchant is left with a smaller loan balance and, hence, stronger incentives to repay and continue production. Therefore, because of repayment fees, more income can be credibly pledged to the platform as a lender, thus reducing financing frictions. The platform reduces financing frictions the most for merchants who obtain the highest value from the platform's services because these merchants are willing to pay the highest repayment fees to maintain access to the platform's marketplace or payment system.

When the platform lends in competition with banks, it acquires an additional advantage as a lender, which, however, causes negative welfare effects. In the market, the borrower faces a menu of two contracts: a contract with repayment fees and high enforcement offered by the platform, and a contract with no repayment fees and low enforcement offered by banks. Whereas the high-revenue merchant is indifferent to the level of enforcement, the low-revenue merchant self-selects into the contract offered by banks to minimize fees paid ahead of default.[5] In equilibrium, the platform benefits from *advantageous screening*, whereas banks suffer from *adverse screening*. As a result, banks tighten credit, causing negative welfare effects.

We solve for the mixed-strategy equilibrium in a discontinuous game[6] and we obtain a series of predictions. First, the model predicts credit markets become partially segmented, with the platforms lending to worse borrowers than banks based on observable characteristics. Because of its superior enforcement, the platform possesses a relative advantage when lending to unreliable borrowers. Second, the model predicts that, conditional on observable characteristics, the platform lends to a better pool of borrowers than banks. Because of equilibrium screening, bad borrowers self-select into bank loans to avoid pledging income to the platform before defaulting. Third, we derive predictions on the welfare effects of platform lending. In terms of social welfare, the net effect depends

[5]The platform could offer the same menu of screening contracts. However, such a menu is not optimal. Because low-revenue merchants would self-select into a low-enforcement, the platform would benefit from pooling the two types into a high-enforcement contract with high repayment fees.

[6]Whereas mixed-strategy equilibria are common in the credit-competition literature (Broecker, 1990; Hauswald and Marquez, 2003; He et al., 2023; von Thadden, 2004), the discontinuity in the lenders' objective function and resulting in a discontinuity in the set of equilibrium interest rates are novel features of our framework. These features derive from the borrower's incentives to strategically default.

on the credit quality of the merchant, the value of the platform's service, and the cost of capital of lenders. In terms of the merchant's welfare, the model predicts that, whereas unbanked borrowers benefit from the option to borrow from the platforms, borrowers for which the platform competes with banks suffer from higher rates and more frequent credit rationing. For the latter borrowers, banks tighten credit in response to the adverse effects of equilibrium screening.

We also extend the model and allow the platform to acquire superior information about the borrower's future revenues at a cost, although infinitesimally small.[7] We show a platform with superior enforcement power does not necessarily benefit from possessing superior information about the borrower. Because of banks' equilibrium reaction, the option to acquire information may lower the surplus the platform extracts through better enforcement. Specifically, for some parameters, the platform earns lower equilibrium profits when it has the option to acquire information compared to our main model. This result is new to the credit-competition literature in which lenders have the same enforcement power. In the existing literature, a single lender always benefits from having superior information about the borrower, like in models by Hauswald and Marquez (2003) and He et al. (2023).

1.1 Related Literature

So far, researchers have identified three advantages fintech and bigtech lenders possess over banks: superior information (Buchak et al., 2018; He et al., 2023; Huang, 2021a; Philippon, 2019; Di Maggio and Yao, 2021; Hu and Zryumov, 2022), less stringent regulation (Beaumont et al., 2021; Buchak et al., 2018; Gopal and Schnabl, 2022), and convenience (Fuster et al., 2019). Among those, our work is closely related to the recent literature on payment platforms making loans because of their information advantages (Parlour et al., 2020; Ghosh et al., 2021). However, we focus on a fourth advantage, which is specific to bigtech platforms. According to our model, the bigtech platform's advantage can be primarily attributed to its control over a marketplace. Therefore, we establish a complementarity between lending and operating a product market.

The platform's advantage is thus similar to the advantage of warehouse banks (Donaldson et al., 2018) trade creditors (Biais and Gollier, 1997; Burkart and Ellingsen, 2004; Pe-

[7]Existing literature shows bigtech platforms may also possess information advantage over banks (Frost et al., 2019) because, for example, platforms may use alternative data and methodologies to assess the borrower's future revenues and, hence, default risk. Because we focus on a platform lending to merchants, we focus on information about the merchant. Kirpalani and Philippon (2020) study the equilibrium in the platform's marketplace when the platform acquires information about consumers' tastes but does not lend to merchants.

tersen and Rajan, 1997), and institutions that lend against digital collateral (Gertler et al., 2021). In particular, we micro-found the platform's ability to enforce repayment from a borrowing merchant as a function of the value that the platform provides to the merchant. We analyze how lenders differential enforcement power affects equilibrium outcomes for merchants with different credit risk. Unlike previous contributions, we focus specifically on bigtech firms that, by simply controlling access to a marketplace or a payment system, obtain a crucial advantage as a lender, even without superior information.

In papers related to ours, Huang (2021a) and Boualam and Yoo (2022) study fintech lenders who can seize an exogenous fraction of the borrower's cash flow. Huang (2021a) characterizes the optimal information-acquisition strategy of a fintech lender that competes with banks in a private-value setting in which banks lend against collateral. We study competition for uncollateralized credit under a common-value setting, where lenders have different enforcement powers. Boualam and Yoo (2022) study whether banks and fintech lenders emerge as competitors or partners in equilibrium. Compared to Boualam and Yoo (2022), we introduce credit risk and information asymmetry between lenders and borrowers and we focus on the competition among different lenders. Compared to both these papers, we identify a new channel whereby the platform could lower equilibrium welfare when competing with banks because of its ability to enforce repayments. We also show that, by acquiring private information in a common-value setting, the platform may extract lower rents from enforcement in equilibrium.

Our model builds upon the credit market competition literature (Broecker, 1990). Instead of focusing on lenders who are differentially informed (Hauswald and Marquez, 2003; He et al., 2023; Goldstein et al., 2022), our competing lenders have different degrees of enforcement power. The welfare effects of the platform's better enforcement resemble the effects of a winner's curse among bidders in a common-value auction (Milgrom and Weber, 1982; Engelbrecht-Wiggans et al., 1983; Hausch, 1987; Kagel and Levin, 1999). However, the underlying mechanism is very different. Whereas a winner's curse originates from asymmetric information among bidders, advantageous screening originates because the platform and banks offer contracts that, in equilibrium, screen good and bad borrowers. Banks are then adversely affected by this equilibrium screening and reduce credit in response.

More broadly, our research is also related to the theoretical literature on two-sided markets and lending with limited commitment. In particular, although we take fees as given,[8] our research highlights that a platform profits not only from designing a two-

[8]According to our conversations with practitioners, transaction fees and loan terms are typically set by different divisions within a bigtech firm.

sided market (Weyl, 2010; Armstrong, 2006; Rochet and Tirole, 2002; Jullien et al., 2021), but also from financing the activity of market users. In contemporaneous work, Bouvard et al. (2022) find that a platform can use credit contracts to indirectly discriminate platform participants with different wealth. Huang (2021b) analyzes the synergy between consumer lending and e-commerce. Similar to the limited-commitment literature (Alvarez and Jermann, 2000; Kehoe and Levine, 1993; Kocherlakota, 1996; Ligon et al., 2002), the borrower is motivated to (partially) repay the loan to maintain access to a valuable market which, in our case, is the platform's marketplace instead of the credit market.

The empirical literature studying lending by bigtech and fintech firms is expanding rapidly. Liu et al. (2022) find evidence of advantageous selection for bigtech lenders, whereas Frost et al. (2019), Hau et al. (2019), and Ouyang (2022) provide evidence that bigtech firms expand credit access, consistent with our model that bigtechs are able to reach borrowers who are under-served by traditional banks. Other authors focus on fintech firms lending strategies to consumers (Di Maggio and Yao, 2021; Balyuk, 2022), and the substitutability (Buchak et al., 2018; Eça et al., 2022; Gopal and Schnabl, 2022) or complementarity (Beaumont et al., 2021) between bank and fintech loans. Fuster et al. (2019) find fintech firms process mortgage applications faster but have higher default rates. Agarwal et al. (2021) and Di Maggio and Yao (2021) analyze fintech firms using alternative data to expand credits. Berg et al. (2020) show the alternative footprint data complements the traditional credit bureau information for predicting defaults. Finally, Dai et al. (2023) find fintech lenders can increase repayment likelihood on delinquent loans. Several recent review articles has summarized the developments and the literature on bigtech and fintech lending (Stulz, 2019; Petralia et al., 2019; Allen et al., 2020; Agarwal and Zhang, 2020; Berg et al., 2021).

2 SET-UP

We consider three types of players: a merchant, competitive banks, and a monopolistic platform. The merchant needs to borrow to produce and sell goods, banks provide financing, and the platform provides both financing and a marketplace for the merchant. The merchant has the option to participate in the platform's marketplace or sell through other channels. The merchant is subject to moral hazard in the form of limited commitment and has private information about her future revenues.

Empirical context and motivation. Loans provided by bigtech platforms are usually small and unsecured.[9] Therefore, we assume the borrower has no assets to pledge as collateral and can thus strategically default if the loan balance exceeds her continuation value.[10] Moreover, these loans are short-term, and full repayment is often expected to happen within a year.[11] Hence, we consider a two-period model in which the loan has to be repaid at the end of the first period. The second period provides a micro-foundation for the continuation value of the borrower.[12] Furthermore, borrowers repay platform loans with a fraction of their sales. We will show this contractual feature represents the platform's optimal response to the risk of strategic default. However, because of this repayment fee, borrowers have an incentive to divert sales away from the platform. In fact, lenders explicitly acknowledge this moral hazard issue.[13] Hence, we formally consider the merchants' option to sell outside the platform, which limits the share of sales the merchant can credibly pledge to the platform.

Timing. We consider a model with three dates, $t \in \{0, 1, 2\}$, and two periods. Figure 1 shows the timeline of the model. The first period represents an initial phase when the business borrows from external sources to start production or grow. The second period represents the long-run state of the business. At date $t = 0$, the merchant applies for financing. If the merchant obtains financing, she produces and sells goods between date zero and date one. The merchant chooses whether to sell on the platform or elsewhere. If she sells on the platform, she pays transaction fees over the course of the first period, when revenues are realized. At date $t = 1$, the merchant decides whether to repay the loan or default. If the merchant repays, she produces and sells in the second period. If she defaults, she absconds with the after-fee cash flow generated in the first period and forfeits production in the second period. We normalize all players' discount rates to zero.

[9] For example, PayPal offers working capital loans ranging from $1,000 to $150,000 to first-time borrowers and, according to Doordash, their typical loan ranges from $5,000 to $15,000. See https://www.paypal.com/workingcapital/ and https://get.doordash.com/en-us/products/capital

[10] We focus on small businesses at the startup stage that need financing to acquire working capital or pay current costs. These businesses often lack pledgeable collateral and represent the typical users of platforms' loans, which are often marketed as working-capital loans. See, for example, https://www.paypal.com/workingcapital/. Because these loans are uncollateralized, the limited-commitment problem is an important source of financial frictions.

[11] In its website, Doordash states: "Based on your daily sales revenue, we estimate you will pay back the cash advance within 1 year." See: https://help.doordash.com/dashers/s/article/DoorDash-Capital-FAQ.

[12] One can extend this model to infinite-horizon without altering the main economic mechanism or the predictions of the paper. To streamline the paper, we therefore focus on a simpler two-period framework.

[13] For example, PayPal states: "You cannot deliberately direct customers to use another payment method. We'll monitor accounts for unexpected drops in PayPal sales volume, and your loan will be in default if you move your sales away from PayPal to avoid repayment." See: https://www.paypal.com/workingcapital/faq.

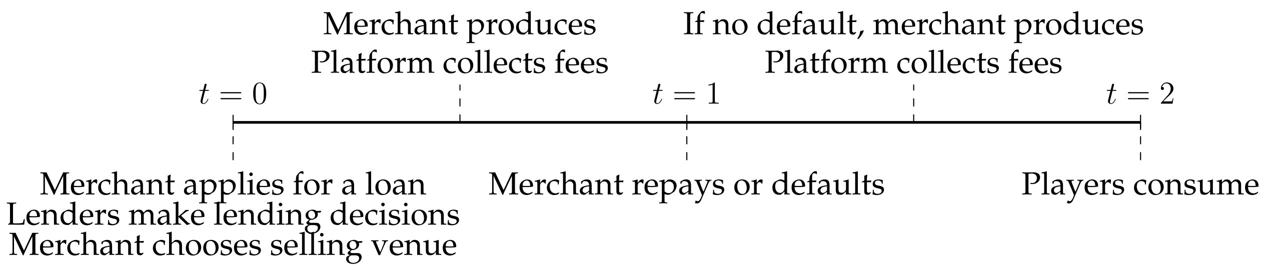


Figure 1: Timeline of the model.

THE MERCHANT. The merchant requires one unit of capital at date $t = 0$ to start or continue her business. If the merchant obtains financing at date zero, she can generate revenues for the subsequent two periods. In the first period, revenues are either high, c_H, or low c_L, with $c_H > c_L$. In the second period, revenues are proportional to the first-period revenues with a constant of proportionality equal to $\alpha > 0$. Therefore, the long-term value of the business is positively correlated with the first-period revenues.[14] At date zero, the merchant possesses private information about the revenues she will generate. We use $\theta \in \{H, L\}$ to denote the merchant's type, and we refer to a merchant as good (bad) if her revenues are high (low) and $\theta = H$ ($\theta = L$). The platform and banks do not know the merchant's type at date $t = 0$, and have common prior beliefs $p := P(\theta = H)$. We denote the revenue generated by type θ merchants in period t as $c_{\theta,t}$. Hence, $c_{\theta,1} = c_\theta$ and $c_{\theta,2} = \alpha c_\theta$. However, lenders observe revenues when they are realized over time. Beliefs p measure the creditworthiness of the merchant.[15] We refer to a merchant with a higher p as having a higher credit quality.

As a seller, the merchant may sell goods either on the platform or elsewhere. On the platform, a merchant of type θ pays a transaction fee f, thus netting $(1 - f)c_{\theta,t}$ at time t. If the merchant sells goods outside the platform, her revenues are equal to $(1 - \eta)c_{\theta,t}$, where $\eta \in [0, 1]$ is common knowledge among all players. We call η the merchant's *relative revenues*, because it measures the proportional increase in gross revenues when a

[14]One can interpret α as the present value of an infinite stream of revenues in a model in which the player's discount rate is $r = \alpha^{-1}$, the borrower produces for infinitely many periods after borrowing, and the numeraire is the consumption at time one. In an infinite-horizon model, the continuation value of the merchant would be proportional to their one-period sales, even in models with possible exclusions from credit markets in the future as punishments for default, such as, Alvarez and Jermann (2000), Kehoe and Levine (1993), Kocherlakota (1996), and Ligon et al. (2002). To streamline the exposition of the model, we interpret our framework as a two-period model with no discounting.

[15]We assume the platform and banks have the same information about the merchant's revenues to highlight how the platform enforces revenue-based repayments by controlling access to the marketplace, and not by possessing superior information about revenues.

merchant sells on the platform.[16] Relative revenues η potentially vary significantly across different merchants and are therefore a key dimension of heterogeneity across merchants. For instance, a local small business can derive substantial advantages from selling on an online marketplace like Amazon and accessing a national market, thereby resulting in a high η. Conversely, an internationally recognized brand, being less reliant on any specific marketplace, tends to have a smaller η. As we show ahead, the advantage of the platform as a lender is larger for borrowers with higher relative revenues.

The merchant is subject to moral hazard in the form of limited commitment. In particular, at date $t = 1$, after revenues are realized, the merchant decides whether to repay the loan or default and cease production. The merchant will only repay if her continuation value, which is the net sales in the second period, is larger than the loan balance due, similar to models of credit with limited commitment (Alvarez and Jermann, 2000; Kehoe and Levine, 1993; Kocherlakota, 1996; Ligon et al., 2002).

THE PLATFORM. The platform operates a marketplace where merchants sell goods. The platform charges a transaction fee $f \in [0, 1)$ on the merchant's revenues to cover its operating costs. Because we focus on the platform's lending decisions, we leave f as exogenous.[17] Transaction fees are allowed to be zero in our model, and the key mechanism behind our results holds even with $f = 0$. We let $f \in [0, 1)$ to be more general.

In response to borrowers' moral hazard problem, the platform may want to implement a revenue-based repayment. Specifically, the platform can increase transaction fees for borrowing merchants from f to $f + f_P$, and apply the difference towards loan repayment. We refer to f_P as the *repayment fees*. Such repayment fees are collected at the time of the transaction, and a merchant cannot abscond with them. A merchant can still default on the remaining balance. However, as we explain later, such repayment fees are endogenously bounded by the merchant's outside option.

To lend to merchants, the platform pays a cost of capital $\bar{R} > 0$. When a merchant applies for a loan, the platform issues a credit decision (d_P, R_P, f_P) with $d_P \in \{0, 1\}$,

[16] By revealed preferences, merchants join marketplaces like Amazon and Doordash or payment services like Paypal because they obtain higher profits compared to alternative options. In addition, Higgins (2022) shows that using payment platforms also increases sales for local retail businesses. Dubey and Purnanandam (2023) find the adoption of digital payment platforms spurs economic growth.

[17] In our framework, the platform sets merchants' and buyers' fees independently of its lending activity. To the best of our knowledge, this is an accurate characterization of the current business model of big-tech lenders. In particular, we assume the number of merchants who need to borrow capital is small relative to the total number of participants. Therefore, a platform first optimally sets fees for merchants and buyers, as in the models by Armstrong (2006), Rochet and Tirole (2002), and Weyl (2010). It then learns about the merchant's outside option and interaction benefits. Finally, a relatively small measure of merchants needs to borrow to operate on the platform.

$R_P, f_P \in \mathbb{R}$. The credit decision specifies whether the platform agrees to lend to the merchant ($d_P = 1$) or not ($d_P = 0$), the gross interest rate on the loan (R_P), and the repayment fee charged to the merchant (f_P).

BANKS. Competitive banks provide loans to the merchant. Although we refer to these lenders as banks, they may represent any traditional lenders that do not provide a marketplace. We allow banks to potentially charge a repayment fee f_B as the merchant's revenue comes into her deposit account. Hence the difference between banks and the platform is not technology or information. However, as we explain in the next section, because banks do not control access to marketplace, the repayment fee is endogenously equal to 0.

Banks obtain funds at a cost of capital $R_D > 0$. If a merchant applies for a loan at a bank, the bank issues a credit decision (d_B, R_B, f_B) with $d_B \in \{0, 1\}$ and $R_B, f_B \in \mathbb{R}$, specifying whether the banks agrees to lend ($d_B = 1$) or not ($d_B = 0$), the gross interest rate (R_B) and the repayment fee (f_B).

MORAL HAZARD AND INCENTIVE COMPATIBILITY. Suppose that, at date $t = 0$, a merchant of type θ borrowed from lender $J \in \{B, P\}$ at rate R_J and with repayment fees f_J. By date $t = 1$, the merchant has accumulated net revenues $(1 - f - f_J)c_\theta$ and she owes balance $R_J - f_J c_\theta$ to the lender. The merchant then decides whether to repay the balance and continue production in the second period, or default, cease future production, and abscond with the revenues accumulated so far. The merchant chooses to repay the loan if future net revenues, $(1 - f)\alpha c_\theta$, exceed the balance due, $R_J - f_J c_\theta$; that is, when

$$((1 - f)\alpha + f_J)c_\theta \geq R_J. \tag{1}$$

Equation (1) is an incentive-compatibility condition that ensures a borrower of type θ will not default. This condition imposes an upper bound on the interest rate R_J, which increases with the repayment fees f_J. In other words, the repayment fee f_J not only directly increases the amount that the lender can recover, it also indirectly increases the amount repaid by reducing the borrower's loan balances and incentive to default. We thus make the following remark.

REMARK 1. By using repayment fees, a lender improves the merchant's ex-post incentives to repay the loan balance.

Although repayment fees reduce ex-post incentives to default, lenders cannot increase the repayment fees without any limit. For the platform, fees must be sufficiently low that a merchant prefers remaining on the platform and pay the additional fees rather than selling outside the platform. This limits the repayment fees that the platform can set. Formally, the platform faces an additional incentive-compatibility constraint summarized in Lemma 1.

LEMMA 1. *A merchant of type $\theta \in \{L, H\}$ has no incentive to divert sales from the platform in the first period if and only if*

$$f_P \leq \eta - f. \tag{2}$$

In setting incentive-compatible repayment fees, the platform accounts for potential double deviations from a merchant who would strategically default after diverting sales. However, the resulting incentive-compatibility condition (2) has a simple intuition: the merchant does not divert sales in the first period if the cost of remaining on the platform and paying the repayment fees $f_P c_\theta$ does not exceed the cost of diverting sales and giving up the one-period net revenues $(\eta - f)c_\theta$.

Because banks do not provide a source of revenues for merchants' revenue, they cannot charge any repayment fees for loan repayment, and hence $f_B = 0$,[18] consistent with empirically observed loan contracts between banks and merchants.[19] In the rest of the paper, we simplify banks' credit decision to the choice of a pair (d_B, R_B).

PARAMETER ASSUMPTIONS. Finally, we focus on parameter values satisfying Assumption 1 to ensure the model's outcomes are not trivial.

ASSUMPTION 1. *We impose the following restrictions on parameter values:*

$$(1+\alpha)c_H > \bar{R} \geq R_D > \alpha c_L \tag{3}$$

$$\alpha(1-f)c_H > R_D, \quad \eta \geq f \tag{4}$$

We assume the platform has no advantage over banks in terms of cost of capital; that is, $\bar{R} \geq R_D$. Our results demonstrate that a platform can profitably compete with banks even if its cost of capital is larger than banks' cost of capital. Next, we assume a good merchant generates enough value over two periods to exceed the cost of capital of the

[18]If a bank sets $f_B > 0$ by charging a fee on incoming deposits, a borrower could avoid this fee by diverting income to another bank. If a merchant bears a cost γ per unit of revenue when switching banks, the incentive-compatibility condition for f_B would be $f_B \leq \gamma$. The key assumption for our mechanism is that this cost, γ, is smaller than the cost of migrating off the platform, $\eta - f$. To streamline the model, we set $\gamma = 0$.

[19]One important feature of bank lending is that banks often lend against physical collateral. Other papers focused on collateral as a difference between bank lending and fintech lending (Huang, 2021a; Boualam and Yoo, 2022). We focus on uncollateralized loans.

platform. That is, $(1+\alpha)c_H > \bar{R}$. Without this assumption, the platform, and possibly banks, would not lend in equilibrium.

For the financing frictions to be relevant in equilibrium, we assume bad merchants always default when they borrow from banks, i.e., $R_D > \alpha c_L$. Because R_D is the lowest rate banks could possibly offer and $f_B = 0$, condition (1) is always violated when banks are the lenders ($J = B$). Moreover, we assume a good merchant is sufficiently profitable that she chooses not to default if banks lend at their cost of capital; that is, $\alpha(1-f)c_H > R_D$.

We make no other parametric assumption when characterizing the equilibrium in the credit market.[20] In our graphical illustrations of the equilibrium, we focus on the two dimensions of heterogeneity: merchant's credit quality p and relative revenue η. As we show ahead, the nature of the equilibrium and its welfare properties vary based on the parameters values and we fully characterize the equilibrium for any set of parameters satisfying Assumption 1.

2.1 BENCHMARK MODELS

We start by considering models in which only the banks or only the platform operates as lenders. With no competition between banks and the platform, we identify the key frictions and illustrate the relative advantages and disadvantages of borrowing from either type of lender.

When banks are the only lenders, because banks are competitive, they earn zero profits in equilibrium and charge the break-even rate $R_B = \frac{R_D}{p}$. Banks agree to lend if a good merchant is willing to borrow and repay the loan at the break-even rate R_B. That is, if $p \geq \frac{R_D}{\alpha(1-f)c_H}$. When $p < \frac{R_D}{\alpha(1-f)c_H}$, banks refuse to lend because the break-even rate is so high that even a good merchant would default. As expected, banks' lending decisions are based on the merchant's credit quality p alone, and are independent of the merchant's relative revenues η. This is in contrast to the case when the platform lends.

2.1.1 PLATFORM AS THE ONLY LENDER

Suppose the platform is a monopolistic lender. The optimal contract it can offer to merchants is a pooling contract with revenue-based repayment fees f_P and interest rate R_P.[21]

[20] In particular, we impose no restriction on the relative value of $(1+\alpha)c_L$ and $\bar{R}$ or R_D. If $(1+\alpha)c_L < R_D$, it is socially inefficient to finance a bad merchant. On the other hand, if $(1+\alpha)c_L > \bar{R}$, it is socially efficient to lend to the merchant, even if she borrowed from the platform.

[21] The platform could offer a menu of contracts to screen borrowers. Because repayment fees are relatively more costly for bad merchants who intend to default, by the single-crossing property, any screening menu would include a contract with lower repayment fees designed to attract the bad borrower. The menu would also include another contract with higher repayment fees but a weakly lower rate designed to attract

The platform chooses the revenue-based repayment fees f_P and issues a credit decision (d_P, R_P) to maximize its profit. Merchants of type θ repay their loans in full if $R_P \leq (\alpha - (1+\alpha)f + f_P)c_\theta$. In particular, if $R_P \leq (\alpha - (1+\alpha)f + f_P)c_L$, both types of merchants repay their loan at $t = 1$ and continue production in the second period. If instead $R_P \in ((\alpha - (1+\alpha)f + f_P)c_L, (\alpha - (1+\alpha)f + f_P)c_H]$, only the good merchant repays at $t = 1$ and continues production in the second period. Therefore, the platform maximizes

$$\max_{f_P, R_P, d_P \in \{0,1\}} \begin{cases} d_P\{R_p - \bar{R} + (1+\alpha)[pc_H + (1-p)c_L]f\} & \text{if } R_P \leq (\alpha - (1+\alpha)f + f_P)c_L \\ d_P\{pR_P + (1-p)f_P c_L - \bar{R} + [(1+\alpha)pc_H + (1-p)c_L]f\} & \text{if } R_P > (\alpha - (1+\alpha)f + f_P)c_L \end{cases} \tag{5}$$

s.t. (2) and $R_P \leq (\alpha - (1+\alpha)f + f_P)c_H$

Because the objective function in problem (5) is weakly increasing in f_P, the incentive-compatibility constraint on the repayment fee f_P, (2), always binds.

Moreover, with no competition from banks, the platform chooses the interest rate on the loan to maximize the expected surplus it extracts from the merchant. In particular, the platform increases the interest rate until either the high-revenue merchant or the low-revenue merchant is indifferent between repaying the loan or defaulting strategically. As a result, the platform sets its interest rate either to $(\alpha - (1+\alpha)f + \eta)c_L$ or to $(\alpha - (1+\alpha)f + \eta)c_H$. If (1) binds for $\theta = L$ and the rate is $(\alpha - (1+\alpha)f + \eta)c_L$, both types repay the loan in full and the platform extracts surplus $(\alpha - (1+\alpha)f + \eta)c_L$ from both types in addition to transaction fees. If (1) binds for $\theta = H$ and the rate is $(\alpha - (1+\alpha)f + \eta)c_H$, only the high-revenue merchant repays the loan and the platform extracts surplus $(\alpha - (1+\alpha)f + \eta)c_H$ from this merchant. However, the platform can extract only repayment fees $(\eta - f)c_L$ as surplus from the low-revenue merchant. We describe the platform's lending behavior in Lemma 2.

LEMMA 2. *When the platform is the only lender, a merchant receives funding if and only if*

$$\max\{p(\alpha + \eta)c_H + (1-p)\eta c_L, (\alpha + \eta)c_L + (1+\alpha)p(c_H - c_L)f\} - \bar{R} \geq 0. \tag{6}$$

the good borrower. However, this screening menu is dominated by a pooling contract with the highest repayment fee and an optimally chosen interest rate. Because of the single-crossing property, repayment fees are more costly for a bad borrower than for a good one. At the same time, repayment fees are most valuable for the platform when it lends to a bad merchant who intends to default. As a result, the optimal contract is a pooling contract with the highest level of enforcement.

The monopolistic platform sets rate $R_P = (\alpha - (1+\alpha)f + \eta)c_H$ *if*

$$p \geq \frac{\alpha c_L}{(\alpha - (1+\alpha)f + \eta)(c_H - c_L) + \alpha c_L}, \tag{7}$$

and it sets rate $R_P = (\alpha - (1+\alpha)f + \eta)c_L$ *otherwise. In particular, if it is efficient to finance bad merchants with the platform's capital, that is, if* $(1+\alpha)c_L > \bar{R}$*, then there exists* $\hat{\eta} \in (0,1)$ *such that the platform lends regardless of credit quality for* $\eta \geq \hat{\eta}$*.*

Lemma 2 is crucial to understanding the platform's unique behavior and advantage as a lender. Whereas banks account only for the merchant's perceived quality in their credit decision, the platform evaluates also the merchant's relative revenue η when deciding whether to lend or not. Everything else equal, a merchant who benefits more from selling on the platform (that is, a merchant with higher η) is more profitable to lend to. In fact, when $(1+\alpha)c_L > \bar{R}$ and η is large enough ($\eta \geq \hat{\eta}$), the platform lends to any merchant, regardless of her credit quality.

Furthermore, conditional on lending, the platform lends at a low interest rate, $R_P = (\alpha - (1+\alpha)f + \eta)c_L$, when the merchant's credit quality is relatively low and condition (7) is not satisfied. In this case, neither types of merchants default on. As a result, the platform is able to reduce default risks conditional on observables and increase total output. Figure 2 provides an illustration of the equilibrium in this case.

2.2 DISCUSSION OF THE BENCHMARK MODELS

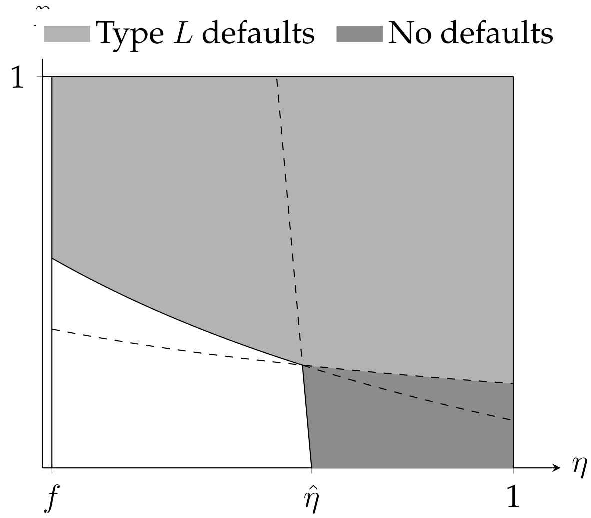
Before analyzing the equilibrium with competition, we discuss the sources of inefficient credit allocation in the model. We then highlight how the platform is able to partially alleviate these inefficiencies due to its control over a valuable marketplace.

FINANCING FRICTIONS AND CREDIT RATIONING. In a frictionless model with full information and income pledgeability, banks should provide financing because their cost of capital is lower. Banks finance good merchants because $(1+\alpha)c_H > R_D$ by Assumption 1. Moreover, if $(1+\alpha)c_L > R_D$, they should finance also bad merchants.

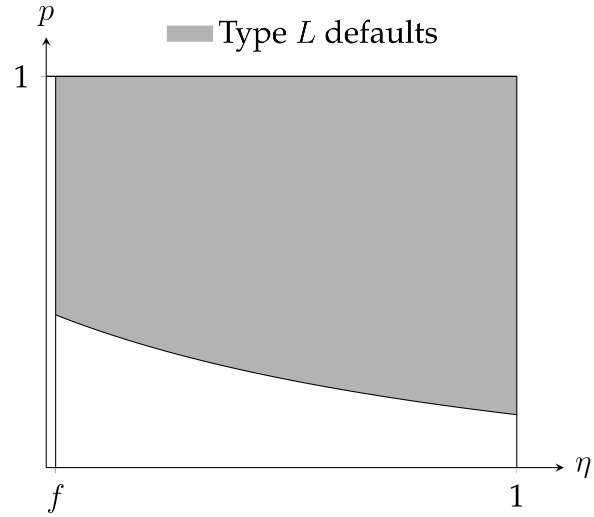
With asymmetric information, banks cannot condition credit on the merchant's type. Therefore, banks would lend if and only if

$$(1+\alpha)(pc_H + (1-p)c_L) \geq R_D. \tag{8}$$

Banks would therefore implement a second-best allocation delivering the same social wel-



(a) $(1+\alpha)c_L \geq \bar{R}$



(b) $(1+\alpha)c_L < \bar{R}$

Figure 2: Equilibrium with the platform as a monopolistic lender. The shaded areas indicate the set of merchants (with different combinations of relative revenues η and credit quality p) that receive financing from the platform. In Figure 2(a), it is socially efficient to lend to bad merchants using the platform's capital ($(1+\alpha)c_L \geq \bar{R}$). In Figure 2(b), it is inefficient to do so ($(1+\alpha)c_L < \bar{R}$). In the light gray areas, the platform lends at rate $R_P = (\alpha - (1+\alpha)f + \eta)c_H$ and bad merchants default. In the dark gray area, the platform lends at rate $R_P = (\alpha - (1+\alpha)f + \eta)c_L$ and no merchant defaults.

fare as the constrained planner's allocation.[22] Furthermore, under limited commitment, each type of merchant can at most pledge their first-period income to banks. Moreover, under Assumption (1), a bad merchant chooses to default when borrowing from banks in equilibrium.[23] Hence, the set of merchants receiving financing is reduced to those satisfying $p\alpha(1-f)c_H \geq R_D$. Welfare declines in general due to credit rationing.

The Platform's Advantage. The platform is subject to similar financing frictions as banks: the platform does not possess better information about the merchant's type, and merchants may still default on their loans from the platform. However, unlike banks, the platform controls access to a valuable source of revenues for merchants. It thus can implement a revenue-based repayment plan by charging repayment fees $f_P = \eta - f$ to partially alleviate the limited-commitment problem. Repayment fees allow merchants to credibly pledge part of their revenues to the platform through a direct channel and an indirect channel. First, even when a merchant defaults, the platform is able to directly collect a partial repayment equal to $f_P c_L$. Second, the repayment fees indirectly improve the merchant's ex-post incentives to repay and continue production, by lowering the end-

[22]See Appendix A for the social planner's solution in the second-best case.

[23]Default is an ex-post welfare loss, even if $(1+\alpha)c_L < R_D$. By defaulting, a merchant forfeits future production opportunities after the capital investment is made.

of-the-period balance. This leads to higher social welfare.

Both channels operate via the repayment fee f_P. Since the repayment fee f_P is limited by the merchant's relative revenue for being on the platform (η), the advantage of the platform as a creditor is particularly strong among merchants with large η.[24]

Better enforcement allows the platform to expand credit and improve welfare compared to banks. Consider the case when $(1+\alpha)c_L > \bar{R}$ and it is efficient to lend to bad merchants. According to Lemma 2, if η is sufficiently large, a merchant receives financing regardless of her credit quality p. Moreover, for small p, no merchant will default. For these merchants, the platform unambiguously improves social welfare compared to banks. However, the platform's allocation is less efficient than the planner's if the cost of capital of the platform exceeds the cost of capital of banks.

3 EQUILIBRIUM WITH COMPETITION

We now study the equilibrium and welfare implications when the platform competes with banks in the credit market. The merchant may receive credit offers from several banks and the platform. Unlike Section 2.1, where lenders use pure strategies, here the equilibrium is characterized by mixed strategies in the region where banks and the platform are competing directly. We start by further specifying the structure of the model at date $t = 0$, when the merchant applies for financing and lenders compete.

3.1 COMPETITION BETWEEN THE PLATFORM AND BANKS

Consider date $t = 0$. First, competitive banks announce their lending mechanisms and commit to them. A lending mechanism specifies the probability the bank offers a loan, $m_B = P(d_B = 1)$, and the distribution of the interest rate R_B offered conditional on extending a loan, $F_B(R) \coloneqq P(R_B \leq R)$. The merchant then chooses the bank offering the best mechanism for the merchant.[25] We label this bank as the merchant's preferred bank.

The platform also selects a lending mechanism in order to compete with the merchant's preferred bank. The platform's lending mechanism specifies the platform's lending probability $m_P = P(d_P = 1)$, and the distribution of rates $F_P(R) \coloneqq P(R_P \leq R)$

[24]Because of the transaction fee f charged to all the merchants, the platform has another advantage over banks which is internalizing the transaction fees the merchant generates over the course of the two production periods. More broadly, a platform may internalize also the network externalities a marginal merchant generates on buyers on the platform.

[25]We assume the merchant suffers a non-pecuniary cost when applying to multiple banks. Typically, when multiple banks pull the credit report of the borrower, the perceived credit quality of the borrower will be negatively affected in the future.

the platform offers, conditional on lending. The platform also charges repayment fees f_P such that the merchant prefers to operate on the platform, i.e. satisfying condition (2). The merchant simultaneously applies for a loan from her preferred bank and the platform. The bank and the platform, therefore, issue their lending decisions, (d_B, R_B) and (d_P, R_P), at the same time.

MERCHANT'S STRATEGY If only one lender grants credit, the merchant borrows from that lender regardless of the merchant's type. If neither lender extends credit, the merchant does not produce goods and generates zero value. If both lenders offer credit, the merchant will choose her best option. However, good and bad merchants face different incentives to repay the loan and may, therefore, choose differently.

In equilibrium, a good merchant who receives offers from both lenders chooses the offer with the lowest rate. If a good merchant borrows from a bank at a rate greater than $\alpha(1-f)c_H$, she will default at date $t = 1$. Therefore, banks will never offer rates above $\alpha(1-f)c_H$ and hence, $F_B(\alpha(1-f)c_H) = 1$. Moreover, without loss of generality, we set $F_B(R_D) = 0$, because banks cannot lend below their cost of capital without experiencing losses. If a good merchant borrows from the platform, she will default if the platform's rate exceeds $(\alpha-(1+\alpha)f+\eta)c_H$. Hence, we have $F_P((\alpha-(1+\alpha)f+\eta)c_H) = 1$. Given these upper limits on the interest rates offered by banks and by the platform, a good merchant who receives offers from both lenders chooses the offer with the lower rate.[26]

The expected profit of a good merchant facing lending mechanisms (m_B, F_B) and (m_P, F_P) is thus

$$
\begin{aligned}
U(m_B, m_P, F_B, F_P) :=\ & \underbrace{[1-(1-m_B)(1-m_P)](1+\alpha)(1-f)c_H}_{\text{expected revenues}} \\
& \underbrace{- m_B(1-m_P)\int_0^{(1-f)\alpha c_H} R\, dF_B(R)}_{\text{expected interest when only bank lends}} \underbrace{- (1-m_B)m_P \int_0^{(\alpha-(1+\alpha)f+\eta)c_H} R\, dF_P(R)}_{\text{expected interest when only platform lends}} \\
& \underbrace{- m_B m_P \int_0^{(\alpha-(1+\alpha)f+\eta)c_H} \int_0^{\alpha(1-f)c_H} \min\{R, R'\}\, dF_B(R)\, dF_P(R')}_{\text{expected interest when both lend}}.
\end{aligned} \tag{9}
$$

In equation (9), the good merchant receives financing and produces revenues for two periods with probability $1-(1-m_B)(1-m_P)$. With probability $m_B(1-m_P)$, the bank is the

[26]In what follows, we assume the good merchant selects the platform if both lenders offer the same rate. This assumption is without loss of generality. In fact, if the merchant's choice were endogenously determined in case of indifference, in equilibrium we would observe the same outcome. Therefore, to streamline the model and the exposition, we directly assume the good merchant borrows from the platform if indifferent between the two offers.

only lender and interest rates are drawn from the distribution F_B. With probability $(1 - m_B)m_P$, the platform is the only lender and interest rates are drawn from the distribution F_P. Finally, with probability $m_B m_P$, both lenders make an offer, with rates drawn from the distributions $F_B(R)$ and $F_P(R)$. In this case, the borrower chooses the lender offering the lowest rate.

Whereas a good merchant always chooses the lender offering the lowest rate, a bad merchant takes into account the option value to default. When both lenders offer rates above $\alpha(1-f)c_L$, the bad merchant always prefers borrowing from the bank and defaulting. To see this, if the bad merchant borrows from the bank, the incentive compatibility condition (1) for $J = B$ is violated, so she always defaults and earns profits $(1-f)c_L$. If the merchant borrows from the platform, regardless of whether she defaults, her profit is less than $(1-f)c_L$ due to the platform's enforcement power. Because $R_D > (1+\alpha)c_L$ from Assumptions 1, banks always offer loans with $R_B > (1-f)\alpha c_L$ in equilibrium. Ahead, in Lemma 3, we show also the platform, in equilibrium, sets $R_P > (1-f)\alpha c_L$. This implies that bad merchants always choose to borrow from the banks and default in equilibrium.

PLATFORM'S PROFIT Because the borrower's choice and default decision depend on the interest rate offered, we need to consider three different regions of interest rates when analyzing the platform's profit. When the platform offers very low interest rates, that is $R \leq (1-f)\alpha c_L$, both types of merchants would produce and pay transaction fees for two periods. Furthermore, both types of merchants will borrow from the platform and not default.[27] The platform's profit when lending at rate $R \leq (1-f)\alpha c_L$ is given by

$$l_P^-(R, m_B, G_B; p) := R - \bar{R} + (1+\alpha)[pc_H + (1-p)c_L]f,$$

where we explicitly denote the dependence of the platform's profits on the merchant's credit quality p. This scenario could only be profitable for the platform if

$$(1-f)\alpha c_L \geq \bar{R} - (1+\alpha)[pc_H + (1-p)c_L]f.$$

In other words, the platform could lend below its cost of capital and still make profit if the transaction fee f is high enough.

In the second scenario, when the platform offers an intermediate interest rate, that is $R \in ((1-f)\alpha c_L, (\alpha - (1+\alpha)f + \eta)c_L]$, a bad merchant who borrows from the platform will repay the balance and continue production in the second period. However, if a bank also makes an offer, the bad borrower prefers to borrow from the bank and default after one

[27] Because $R_D > (1-f)\alpha c_L$, banks always offer rates above $(1-f)\alpha c_L$ in equilibrium.

period. In this case, the platform's expected profit at lending rate $R \in ((1-f)\alpha c_L, (\alpha - (1+\alpha)f + \eta)c_L]$ is

$$l_P^0(R, m_B, G_B; p) := m_B p G_B(R)(R-\bar{R}) + (1-m_B)[R-\bar{R}+(1-p)\alpha c_L f] + [(1+\alpha)pc_H + (1-p)c_L]f,$$

where

$$G_B(R) := P(R_B \geq R) = 1 - \lim_{\varepsilon \to 0^+} F_B(R - \varepsilon).$$

With probability m_B, a bank lends and only good borrowers accept the platform's offer, provided $R_B \geq R$. The good merchant produces and pays transaction fees for two periods. If the merchant is bad, she borrows from banks and defaults, thus paying the transaction fee only in the first period. With probability $(1-m_B)$, the bank denies credit and thus, the merchant necessarily borrows from the platform. Because $R \leq (\alpha - (1+\alpha)f + \eta)c_L$, the rate is sufficiently low that both types of borrowers repay the loan balance. In this case, both borrowers produce and pay transaction fees for two periods.

Finally, if the platform lends at a high rate, that is $R \in ((\alpha - (1+\alpha)f + \eta)c_L, (\alpha - (1+\alpha)f + \eta)c_H]$, the rate is so high that a bad merchant defaults even when she borrows from the platform. Hence, in this case, the platform's expected profit is

$$l_P^1(R, m_B, G_B; p) := m_B p G_B(R)(R-\bar{R}) + (1-m_B)[pR + (1-p)(\eta - f)c_L - \bar{R}] + [(1+\alpha)pc_H + (1-p)c_L]f.$$

Similar to the previous case, with probability m_B a bank lends and the platform attracts only good borrowers provided that $R_B \geq R$. With probability $(1-m_B)$, the bank denies credit. In this case, the good merchant fully repays the loan, but the bad merchant pays only the repayment fees $f_P c_L$ and defaults on the balance. Regardless of the lender, the platform also collects revenues from transaction fees f in both periods from good merchants and for one period from bad merchants.

To summarize, conditional on lending at rate $R \leq (\alpha - (1+\alpha)f + \eta)c_H$, the expected profits of the platform are

$$L_P(R, m_B, G_B; p) := \begin{cases} l_P^-(R, m_B, G_B; p) & \text{if } R \leq (1-f)\alpha c_L \\ l_P^0(R, m_B, G_B; p) & \text{if } R \in ((1-f)\alpha c_L, (\alpha - (1+\alpha)f + \eta)c_L] \\ l_P^1(R, m_B, G_B; p) & \text{if } R > (\alpha - (1+\alpha)f + \eta)c_L. \end{cases} \tag{10}$$

Unlike Section 2.1, where the platform earns zero profits when it does not lend, here the platform enjoys a better outside option. If the platform does not lend, it still earns transaction fees if a bank lends to the merchant, which happens with probability m_B.

Hence, the payoff of a platform that does not lend is $m_B[(1+\alpha)pc_H + (1-p)c_L]f$ instead of zero.

BANK'S PROFIT On the bank side, conditional on lending at rate $R \in [R_D, (1-f)\alpha c_H]$, a bank obtains the following expected profits:

$$L_B(R, m_P, G_P; p) := m_P[pG_P(R)(R-R_D) - (1-p)G_P((1-f)\alpha c_L)R_D] + (1-m_P)(pR-R_D), \tag{11}$$

where

$$G_P(R) := P(R_P > R) = 1 - F_P(R).$$

If the platform offers a loan, with probability p the merchant is good and borrows from the bank only if $R_P > R$. With probability $1-p$, the merchant is bad and she borrows from the bank whenever the platform's rate exceeds $(1-f)\alpha c_L$. If the platform does not offer a loan (with probability $(1-m_P)$), the merchant necessarily borrows from the bank and defaults at date $t=1$. A bank that decides not to lend earns its outside option, which is equal to zero.

Let $\Delta([0, X])$ be the set of non-decreasing, right-continuous functions satisfying $F(x) = 0$ for all $x < 0$ and $F(x) = 1$ for all $x \geq X$ for any $F \in \Delta([0, X])$. We define equilibrium as follows.

DEFINITION 1 (Equilibrium). *An equilibrium is a set of lending probabilities $(m_P^*, m_B^*) \in [0,1]^2$ and rate distributions by the platform and the banks $F_P^* \in \Delta([0, (\alpha-(1+\alpha)f+\eta)c_H])$ and $F_B^* \in \Delta([0, (1-f)\alpha c_H])$ with supports $\mathcal{R}_P^*$ and $\mathcal{R}_B^*$ and with $G_B^*(R) := 1 - \lim_{\varepsilon \to 0^+} F_B^*(R-\varepsilon)$ and $G_P^*(R) := 1 - F_P^*(R)$, such that:*

1. *The platform and competitive banks set rates optimally:*

$$\mathcal{R}_P^* = \arg \max_{R \leq (\alpha-(1+\alpha)f+\eta)c_H} L_P(R, m_B^*, G_B^*; p)$$

$$\mathcal{R}_B^* = \arg \max_{R \in [R_D, (1-f)\alpha c_H]} L_B(R, m_P^*, G_P^*; p)$$

$$\text{s.t. } L_B(R, m_P^*, G_P^*; p) \leq 0.$$

2. *Lenders extend credit optimally:*

$$m_P^* \in \arg \max_{m_P \in [0,1]} m_P L_P(R, m_B^*, G_B^*; p) \qquad \forall R \in \mathcal{R}_P^*$$

$$m_B^* \in \arg \max_{m_B \in [0,1]} m_B L_B(R, m_P^*, G_P^*; p) \qquad \forall R \in \mathcal{R}_B^*.$$

3. *Banks are competitive in the lending market; that is, no lending mechanism* (F_B, m_B) *exists such that* $\int_0^{(1-f)\alpha c_H} L_B(R, m_P^*, G_P^*; p)\, dF_B(R) > 0$ *and* $U(1, m_P^*, F_B, F_P^*) > U(m_B^*, m_P^*, F_B^*, F_P^*)$.

According to part 1, lenders select their rates in the set of best responses. Competitive banks offer rates so that, at best, they break even. According to part 2, lenders decide whether to lend or not optimally when comparing profits from lending activity with their outside option. Hence, we have banks earn zero profits in equilibrium. That is,

$$m_B^* L_B(R_B, m_P^*, G_P^*; p) = 0 \quad \forall R_B \in \mathcal{R}_B^*. \tag{12}$$

Part 3 of the definition specifies that banks offer competitive terms to merchants. In particular, a bank cannot deviate from the equilibrium mechanism and obtain a strictly positive profit while also increasing the good merchant's utility. This condition ensures banks offer the best terms for a good merchant that are compatible with the other equilibrium conditions.

Next, we provide a first characterization of the platform's interest-rate strategy. In particular, we show a platform never offers a rate equal to or below $(1-f)\alpha c_L$. Therefore, the first case in equation (10) is not part of any equilibrium.

LEMMA 3. *For any* $m_B \in [0,1]$ *and* $R \leq (1-f)\alpha c_L$, $L_P(R, m_B, G_B; p) < L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B, G_B; p)$. *Therefore,* $[0, (1-f)\alpha c_L] \cap \mathcal{R}_P^* = \emptyset$.

Thanks to Lemma 3, from now we focus on equilibria in which $R_P > (1-f)\alpha c_L$. Thus, the bad merchant always prefers borrowing from banks and defaulting rather than borrowing from the platform.

3.2 MARKET SEGMENTATION AND ADVANTAGEOUS SCREENING

We begin by exploring some general features of the equilibrium. Lemma 4 establishes that, in equilibrium, the market will be partially segmented based on the merchant's credit quality. Merchants of high credit quality borrow exclusively from banks, whereas merchants of low credit quality borrow exclusively from the platform.

LEMMA 4 (Partial Segmentation)**.** *If* $p < \frac{R_D}{(1-f)\alpha c_H}$, *banks do not lend to the merchant, but if condition* (6) *holds, the platform lends as in Lemma 2. If* $p \geq \frac{R_D}{R}$, *the merchant borrows exclusively from banks that offer loans with probability 1 at rate* $\frac{R_D}{p}$.

If the merchant's credit quality is low, that is, $p < \frac{R_D}{(1-f)\alpha c_H}$, all banks refuse to lend to the merchant because the credit risk is too high. Thus, the platform remains the only lender as long as condition (6) is satisfied. If the merchant's credit quality is very high, that is, $p \geq \frac{R_D}{\bar{R}}$, the platform cannot profitably compete with banks because banks are able to offer very low interest rates to these borrowers. When banks offer loans at their most competitive rate $\frac{R_D}{p}$, the platform could attract good borrowers by matching or undercutting the banks' interest rate. However, if $p \geq \frac{R_D}{\bar{R}}$, the platform's cost of capital is equal to or exceeds the banks' competitive rate. Thus, the platform has no incentives to compete with banks for borrowers of high credit quality.

Markets are only partially segmented because, as we show in Lemma 5, the platform and banks compete for borrowers of intermediate credit quality, $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, R_D/\bar{R}\right)$.

LEMMA 5 (Mixed Strategies)**.** *If* $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, R_D/\bar{R}\right)$*, banks offer loans with probability* $m_B^* \in (0,1)$ *and the platform offers loans with probability* $m_P^* \in (0,1]$*. Moreover, the platform offers rates ranging between* $\min \mathcal{R}_P^* \leq R_D/p$ *and* $\max \mathcal{R}_P^* \geq (1-f)\alpha c_H$*. In particular,* $\min \mathcal{R}_P^*$ *coincides either with* R_D/p *or with* $(\alpha - (1+\alpha)f + \eta)c_L$*. Banks offer rates up to* $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$*.*

The platform and banks compete for borrowers of intermediate credit quality, and any equilibrium in this region is characterized by mixed strategies. Because of competition, the platform lowers interest rates below its monopolistic rate $(\alpha - (1+\alpha)f + \eta)c_H$ with strictly positive probability.[28] At the same time, compared with the bank-only benchmark model, banks increase their rates up to their monopolistic rate $(1-f)\alpha c_H$. Moreover, banks also deny credit with positive probability $1 - m_B^* > 0$.

By implementing revenue-based repayments through increased fees, the platform thus benefits from a form of *advantageous screening*, whereby bad borrowers self-exclude from borrowing from the platform when the bank credit is available. Banks, on the other hand, suffer from *adverse screening*, worsening the adverse-selection problem. As a result, banks ration credit more and increase rates relative to the benchmark model where banks are the only type of lenders. Whereas a good borrower prefers the lender offering the lowest rate, a bad borrower prefers banks in order to avoid the increased fees on the platform.

Interestingly, Lemma 4 shows that the platform tends to lend to merchants of lower credit quality p. That is, based on public information, the platform provides credit to merchants with worse credit credentials. However, once we condition on public information about the merchant's credit quality, the platform's borrowers reveal themselves

[28] In the proof of Lemma 5, we show that

$$p(\alpha+\eta)c_H + (1-p)\eta c_L > (\alpha+\eta)c_L + (1+\alpha)p(c_H - c_L)f$$

when $p \geq \frac{R_D}{(1-f)\alpha c_H}$. For these parameters, if the platform were a monopolistic lender, it would lend at a rate equal to $(\alpha - (1+\alpha)f + \eta)c_H$ or not lend at all.

to be of higher quality than banks' borrowers, on average. We, therefore, summarize the equilibrium prediction of the platform's advantageous screening in the following remark.

REMARK 2. The platform lends to merchants with worse observable credit quality than banks. However, conditional on observable characteristics, the platform lends to a better pool of borrowers because of advantageous screening.

Furthermore, because of advantageous screening, a platform competing with banks lends to a wider set of merchants than a monopolistic platform. Compared with the benchmark model where the platform is the only lender, the platform now extends credit to a merchant even if condition (6) is not satisfied, provided $p \geq \frac{R_D}{(1-f)\alpha c_H}$. In this case, the platform profits from advantageous screening at the expense of banks. We further characterize the platform behavior in Lemma 6.

LEMMA 6 (The Platform's Strategy)**.** *Consider a merchant characterized by* $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$*. If* $p(\alpha+\eta)c_H + (1-p)\eta c_L > \bar{R}$*, the platform lends with probability* $m_P^* = 1$ *and the highest rate it offers is* $\max \mathcal{R}_P^* = (\alpha - (1+\alpha)f + \eta)c_H$*. If* $p(\alpha+\eta)c_H + (1-p)\eta c_L \leq \bar{R}$*, the platform is indifferent between offering a loan or not. Moreover, if* $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$*, the platform's lowest rate is* $\min \mathcal{R}_P^* = R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$*. If* $\bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$ *and* $R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$*,* $\min \mathcal{R}_P^* = R_D/p$*.*

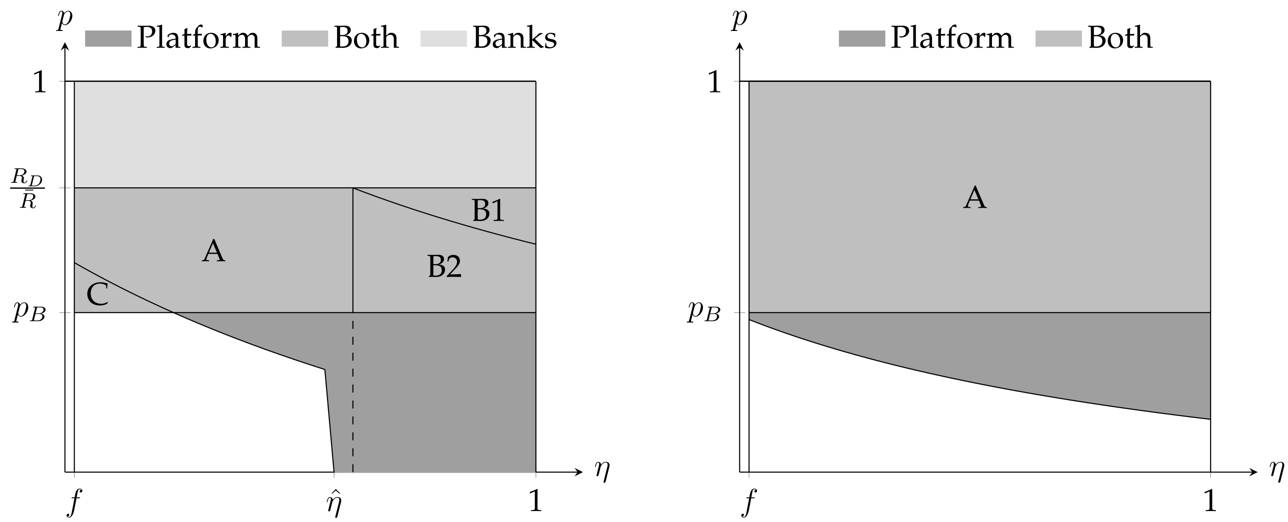
In Lemma 6, we focus on merchants for which the platform and banks compete directly. These are merchants characterized by $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. According to the Lemma, if the platform can profitably lend to the merchant as a monopolistic lender, that is if $p(\alpha+\eta)c_H + (1-p)\eta c_L > \bar{R}$, then the platform will continue lending with probability 1 when it faces competition from the banks. However, if the platform cannot profitably lend as a monopolist lender, that is if $p(\alpha+\eta)c_H + (1-p)\eta c_L \leq \bar{R}$, the platform will now lend when there are also banks making loans. This is because the platform is able to collect rents at the expense of banks due to advantageous screening: the presence of banks increases the quality of the platform's borrower pool endogenously. In equilibrium, the rents are enough to leave the platform indifferent between lending and not lending.

Next, we fully characterize the equilibrium in the region where the banks and the platform compete, that is when $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. Based on Lemma 5 and Lemma 6, we distinguish three cases, with the second one including two sub-cases:

A: $p(\alpha+\eta)c_H + (1-p)\eta c_L > \bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$;

B: $\bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$ and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$

B1: Like case B, but restricted to $p \geq \frac{R_D}{(\alpha-(1+\alpha)f+\eta)c_L}$;



(a) $(1+\alpha)c_L > \bar{R} > R_D$

(b) $(1+\alpha)c_L < \bar{R} = R_D$

Figure 3: Equilibrium with competition. The figure illustrates when the platform, banks, or both lend to a merchant for different combinations of relative revenues η and credit quality p. We define $p_B := \frac{R_D}{(1-f)\alpha c_H}$ as the credit quality cutoff below which banks do not lend. In Figure 3(a), it is efficient to lend to a bad merchant and the platform's cost of capital exceeds the banks'. In Figure 3(b), it is inefficient to lend to a bad merchant and the platform's cost of capital is equal to the banks'.

B2: Like case B, but restricted to $p < \frac{R_D}{(\alpha-(1+\alpha)f+\eta)c_L}$;

C: $p(\alpha+\eta)c_H + (1-p)\eta c_L \leq \bar{R}$ and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$.

Figure 3 provides a graphical illustration of the possible cases for different values of relative revenues η and credit quality p. Although the graphical illustration in the (η, p) space may vary depending on the other parameters, cases A, B1, B2, and C cover all possible combinations of parameters satisfying Assumption 1, and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$ (the region where the two types of lenders directly compete in the credit market.)[29] In particular, we note that case C implies $\bar{R} > R_D$ and, hence, the platform's cost of capital exceeds the banks'. Case B requires $\bar{R} < (1+\alpha)(1-f)c_L \leq (1+\alpha)c_L$, which implies it is socially efficient to finance bad merchants if they produce for two periods.

Next, we characterize the equilibrium for each case in detail and analyze the welfare implication of the platform offering credits. A challenge in characterizing the equilibrium is that the platform's profit function is discontinuous in the interest rate offered. The discontinuity originates from the bad merchant's decision to default strategically when the interest rate exceeds $(\alpha-(1+\alpha)f+\eta)c_L$.

[29]By the observation in footnote 28, case B implies $\bar{R} < p(\alpha+\eta)c_H + (1-p)\eta c_L$, whereas case C implies $\bar{R} > (\alpha-(1+\alpha)f+\eta)c_L$.

3.3 Equilibrium with competition

To fully characterize the equilibrium with competition between banks and the platform, we consider cases A, B, and C separately.

Case A. The merchants in this region have relatively high credit quality and relative revenue, hence the platform optimally lends with probability $m_P^* = 1$. In other words, there is no credit rationing and all the merchants receive credits. Compared with the platform-only benchmark, competition from banks forces the platform to offer lower rates. However, the monopolistic rate $(\alpha - (1+\alpha)f + \eta)c_H$ remains a best response for the platform.

Moreover, the platform never offers a contract that enforces full repayment from bad merchants, because the merchants' relative revenues η are too low compared to its cost of capital. In general, the platform could either offer a high rate, in which case the bad type of merchants will default, but the platform can earn high profit from the good type of merchants, or the platform could offer a low rate, in which case both types of merchants repay. In this region, to enforce full repayment, the platform needs to offer a very low rate, and that is not profit maximizing given the mix of good and bad merchants.

Banks suffer from adverse screening in equilibrium; hence, they deny credit with positive probability $1 - m_B^* \in (0, 1)$. They also offer rates up to their monopolistic rate $(1 - f)\alpha c_H$. The following proposition fully characterizes the equilibrium in this case.

Proposition 1. *Assume parameters satisfy case A. The equilibrium is characterized as follows:*

1. *The platform extends credit with probability $m_P^* = 1$ and, conditional on making an offer, it chooses a rate from $\mathcal{R}_P^* = [R_D/p, (1-f)\alpha c_H] \cup \{(\alpha - (1+\alpha)f + \eta)c_H\}$ so that $P(R_P > R) = G_P^*(R)$, where $G_P^*(\cdot)$ is characterized by* (24) *in Appendix B.*

2. *Banks extend credit with probability $m_B^* \in (0, 1)$, where the expression is given by* (22) *in Appendix B. Conditional on making an offer, they choose a rate from the support $\mathcal{R}_B^* = [R_D/p, (1-f)\alpha c_H]$ so that $P(R_B \geq R) = G_B^*(R)$, where the expression for $G_P^*(\cdot)$ is given by* (23) *in Appendix B.*

In equilibrium, a good merchant never defaults and a bad merchant always defaults on their remaining balances, regardless of who the lender is. Compared with the benchmark model where banks are the only type of lender, the merchant still receives credit offers from at least one lender, but now she pays borrowing costs strictly exceeding R_D/p. Furthermore, banks now lend at their monopolistic rate $(1 - f)\alpha c_H$ with positive probability. By lending at the monopolistic rate, banks obtain profits when the platform denies credit to merchants or offers a higher rate. They use these profits to cover the losses they experience from adverse screening in equilibrium.

CASE B. Merchants in this region have higher relative revenue than those in case A. Similar to case A, the platform optimally lends with probability $m_P^* = 1$, and all merchants receive credit. However, unlike in case A, the platform may now offer a contract that induces full repayment from even the bad merchants; that is, a contract with $R_P \leq (\alpha - (1+\alpha)f + \eta)c_L$. As before, the platform could either offer a high rate with higher default risks or offer a low rate with low default risks. The relative revenue η in this region is high enough such that both strategies could be profit maximizing.

In particular, in case B1 when $R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$, the lowest interest rate that could be offered by banks is below $(\alpha - (1+\alpha)f + \eta)c_L$. To compete, the platform also offers rates lower than $(\alpha - (1+\alpha)f + \eta)c_L$, as we formally showed in Lemma 5. When the interest rate is lower than $(\alpha - (1+\alpha)f + \eta)c_L$, the bad merchant will repay in full if she borrows from the platform. However, she will borrow from the platform only when banks deny credit to her. Similar to what happens in the platform-only benchmark, the platform reduces the default probability of bad merchants and increases output. In this case, social welfare may increase because the bad borrower continues production in the second period. The following proposition describes the equilibrium in case B1.

PROPOSITION 2. *Assume parameters satisfy case B1 and define*

$$T \coloneqq \min\{(\alpha - (1+\alpha)f + \eta)c_L, (1-f)\alpha c_H\}$$

$$U \coloneqq \min\left\{(\alpha - (1+\alpha)f + \eta)c_L + \frac{(1-p)\alpha c_L[(\alpha - (1+\alpha)f + \eta)c_L - \bar{R}]}{p(\alpha - (1+\alpha)f + \eta)c_H - (1-p)\alpha c_L - p\bar{R}}, (1-f)\alpha c_H\right\}.$$

The equilibrium is characterized as follows.

1. *The platform extends credit with probability $m_P^* = 1$ and, conditional on making an offer, it offers rates in $\mathcal{R}_P^* = [R_D/p, T] \cup [U, (1-f)\alpha c_H] \setminus \{(1-f)\alpha c_H\} \cup \{(\alpha-(1+\alpha)f+\eta)c_H\}$ so that $P(R_P > R) = G_P^*(R)$, where the expression for $G_P^*(R)$ is given by* (28) *in Appendix B.*

2. *Banks extend credit with probability $m_B^* \in (0,1)$, where its exact expression is given by* (25) *in Appendix B. Conditional on making an offer, they choose a rate from the support $\mathcal{R}_B^* = [R_D/p, T) \cup [U, (1-f)\alpha c_H]$ so that $P(R_B \geq R) = G_B^*(R)$, where $G_B^*(R)$ is characterized by* (30) *and* (31) *in Appendix B.*

Notice that, in equilibrium, the platform's optimal interest-rate strategy $\mathcal{R}_P^*$ may consist of two disconnected regions. The result is determined by the discontinuity of the platform's objective function at $R_P = (\alpha - (1+\alpha)f + \eta)c_L$. By moving from a rate equal to $(\alpha - (1+\alpha)f + \eta)c_L$ to a marginally higher rate equal to $(\alpha - (1+\alpha)f + \eta)c_L + \varepsilon$ for a very small positive ε, the bad merchant switches from repaying the loan in full to defaulting on the remaining balances. Hence, the platform's profits change discontinuously and decline by at least

$$(1-p)(1-m_B^*)\alpha c_L - p[m_B^* p G_B^*((\alpha - (1+\alpha)f + \eta)c_L) + (1-m_B^*)]\varepsilon,$$

which is strictly positive for a small ε. Therefore, profits decline if the platform offers a rate that is marginally above $(\alpha - (1+\alpha)f + \eta)c_L$. As a result, the platform only offers interest rates above $(\alpha - (1+\alpha)f + \eta)c_L$ if such rates are sufficiently high to justify the decline in profits due to worse enforcement. The lowest of such rates, if they exist, is $U \in ((\alpha - (1+\alpha)f + \eta)c_L, (1-f)\alpha c_H)$ such that, by offering interest rate U, the platform's profit is equal to its profit when offering $(\alpha - (1+\alpha)f + \eta)c_L$. That is,

$$l_P^1(U, m_B^*, G_B^*; p) = l_P^0((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p).$$

Furthermore, if the parameter values are such that $(\alpha - (1+\alpha)f + \eta)c_L < (1-f)\alpha c_H$, the platform offers rate $(\alpha - (1+\alpha)f + \eta)c_L$ with strictly positive probability

$$P(R_P = (\alpha - (1+\alpha)f + \eta)c_L) = (1-p)\frac{R_D}{p}\left(\frac{U - (\alpha - (1+\alpha)f + \eta)c_L}{[(\alpha - (1+\alpha)f + \eta)c_L - R_D](U - R_D)}\right) > 0,$$

and banks are thus deterred from offering rates in $((\alpha - (1+\alpha)f + \eta)c_L, U)$.

In case B2, when $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, the lowest interest rate that banks can offer is above $(\alpha - (1+\alpha)f + \eta)c_L$. Hence, the platform does not necessarily need to offer contracts with rates below $(\alpha - (1+\alpha)f + \eta)c_L$, which induce full repayment from bad merchants. However, if R_D/p is not much larger than $(\alpha - (1+\alpha)f + \eta)c_L$, the platform may still choose to undercut banks by offering a rate exactly equal to $(\alpha - (1+\alpha)f + \eta)c_L$, which is lower than R_D/p, with positive probability. This could be profit-maximizing because the bad merchants will repay in full when they borrow from the platform. The following proposition describes the equilibrium in this case.

PROPOSITION 3. *Assume parameters satisfy case B2. If*

$$R_D/p \geq (\alpha - (1+\alpha)f + \eta)c_L \frac{(\alpha - (1+\alpha)f + \eta)c_H - \bar{R} - \frac{1-p}{p}\alpha c_L \frac{\bar{R}}{(\alpha - (1+\alpha)f + \eta)c_L}}{(\alpha - (1+\alpha)f + \eta)c_H - \bar{R} - \frac{1-p}{p}\alpha c_L}, \tag{13}$$

the equilibrium is the same as in case A and it is described by Proposition 1. Otherwise, define

$$V := \min\left\{(1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_L \frac{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p}{p}\alpha c_L \frac{\bar{R}}{(\alpha-(1+\alpha)f+\eta)c_L}}{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p}{p}\alpha c_L}\right\}.$$

the equilibrium is characterized as follows.

1. *The platform extends credit with probability $m_P^* = 1$ and, conditional on making an offer, it offers a rate from the support $\mathcal{R}_P^* = [V, (1-f)\alpha c_H] \cup \{(\alpha-(1+\alpha)f+\eta)c_L, (\alpha-(1+\alpha)f+\eta)c_H\}$ so that $P(R_P > R) = G_P^*(R)$, where $G_P^*(R)$ is given by* (35) *in Appendix B.*

2. *Banks extend credit with probability $m_B^* \in (0,1)$, where the expression for m_B^* is given by* (33)*. Conditional on making an offer, they choose a rate from the support $\mathcal{R}_B^* = [V, (1-f)\alpha c_H]$ so that, if $V \in (R_D/p, (1-f)\alpha c_H)$, $P(R_B \geq R) = G_B^*(R)$, where $G_B^*(R)$ is given by* (34) *in Appendix B. If, instead, $V = (1-f)\alpha c_H$, then $P(R_B = (1-f)\alpha c_H) = 1$.*

To understand the platform's equilibrium strategy, let R^V be the lowest rate in $[R_D/p, (\alpha-(1+\alpha)f+\eta)c_H]$ such that by offering rate R^V, the platform is earning as high of a profit as when offering rate $(\alpha-(1+\alpha)f+\eta)c_L$. That is,

$$l_P^1(R^V, m_B^*, G_B^*; p) \geq l_P^0((\alpha-(1+\alpha)f+\eta)c_L, m_B^*, G_B^*; p).$$

Since $R^V > (\alpha-(1+\alpha)f+\eta)c_L$, the platform receives lower profits from the good merchants when it offers the lower interest rate $(\alpha-(1+\alpha)f+\eta)c_L$. However, at such a rate, it induces full repayment from the bad merchants. The rate R^V corresponds to the rate at which the two effects exactly offset each other.

If $R_D/p \geq R^V$, the lowest possible rate offered by banks is relatively high compared to the rate at which the platform is willing to undercut. Then the platform prefers to match banks' rates rather than undercut them. This is the case when condition (13) is satisfied. The equilibrium is then the same as in case A.

If instead $R^V \in (R_D/p, (1-f)\alpha c_H]$, the platform earns higher profit by undercutting the banks and offering rate $(\alpha-(1+\alpha)f+\eta)c_L$ rather than by matching the banks' rate R_D/p. Hence, the platform offers the lower rate $(\alpha-(1+\alpha)f+\eta)c_L$ with positive probability equal to

$$P(R_P = (\alpha-(1+\alpha)f+\eta)c_L) = 1 - \frac{(1-p)R_D/p}{V - R_D} > 0. \tag{14}$$

where V is the lowest rate that banks are willing to lend at. Because of the platform's undercutting, banks can no longer break even by offering a rate equal to R_D/p. So the lowest rate that banks are willing to offer, V, is higher than R_D/p.

Finally, if $R^V > (1-f)\alpha c_H$, the platform always prefers to undercut banks rather than compete with them. We thus set $V = (1-f)\alpha c_H$. In this case, the platform offers only contracts with a rate equal to either $(\alpha-(1+\alpha)f+\eta)c_L$ or $(\alpha-(1+\alpha)f+\eta)c_H$, each with positive probability.

CASE C. We now consider parameters satisfying case C. Merchants in case C have a low credit quality and low relative revenues. With these parameters, the platform is unwilling to lend to the merchant when it is the only lender in the market. However, as shown in Lemma 6, the platform is now indifferent between lending and not lending in equilibrium. Due to the effect of advantageous screening in equilibrium, the platform is able to extract rents from banks to cover its cost of capital.

PROPOSITION 4 (Equilibrium in Case C)**.** *Assume parameters satisfy case C. The equilibrium is characterized as follows.*

1. *If $p(\alpha+\eta)c_H + (1-p)\eta c_L < \bar{R}$, the platform extends credit with probability $m_P^* \in (0,1)$, with the exact expression given by* (38) *in Appendix B. Conditional on making an offer, it chooses a rate from the support $\mathcal{R}_P^* = [R_D/p, (1-f)\alpha c_H]$ so that $P(R_P > R) = G_P^*(R)$, where G_P^* is given by* (39) *in Appendix B.*

   If $p(\alpha+\eta)c_H+(1-p)\eta c_L = \bar{R}$, there are multiple equilibria indexed by $Q \in \left[0, \frac{(1-p)R_D/p}{(1-f)\alpha c_H - R_D}\right]$ whereby the platform extends credit with probability $m_P^* \in (0,1]$, with the exact expression given by (40) *in Appendix B. Conditional on making an offer, it chooses a rate from the support $\mathcal{R}_P^* = [R_D/p, (1-f)\alpha c_H] \cup \{(\alpha-(1+\alpha)f+\eta)c_H\}$ so that $P(R_P > R) = G_P^*(R)$, where $G_P^*(R)$ is given by* (41) *in Appendix B.*

2. *Banks extend credit with probability $m_B^* \in (0,1)$, where m_B^* is given by* (36) *in Appendix B. Conditional on making an offer, they choose a rate from the support $\mathcal{R}_B^* = [R_D/p, (1-f)\alpha c_H]$ so that $P(R_B \geq R) = G_B^*(R)$, where $G_B^*(R)$ is given by* (37) *in Appendix B.*

If $p(\alpha+\eta)c_H + (1-p)\eta c_L < \bar{R}$, the merchant is rationed with positive probability $(1-m_B^*)(1-m_P^*) > 0$, whereas if banks were the only lenders, the merchants would always obtain financing. Furthermore, conditional on receiving a loan, the rate exceeds R_D/p with strictly positive probability. In this case, the platform lends solely because it expects to profit from advantageous screening at the expense of banks. Therefore, the platform never offers its monopolistic rate $(\alpha-(1+\alpha)f+\eta)c_H$ because it is higher than what banks would offer and the platform is unable to extract any rents from banks at that rate.

If $p(\alpha+\eta)c_H + (1-p)\eta c_L = \bar{R}$, multiple equilibria exist and they are indexed by Q. In the knife-edge equilibrium with $Q = \frac{(1-p)R_D/p}{(1-f)\alpha c_H - R_D}$, the merchant is not rationed, but she is rationed in all the other equilibria with smaller values of Q. We obtain multiple equilibria because the platform is indifferent between lending at the monopolistic rate $(\alpha-(1+\alpha)f+\eta)c_H$ and not lending. Therefore, a continuum combinations of $Q = P(R_P = (\alpha-(1+\alpha)f+\eta)c_H)$ and $m_P^* = P(d_P = 1)$ satisfy the equilibrium conditions.

3.4 Enforcement and Competition

In our model, banks are fully competitive and earn zero profits, hence the benefit of the platform entering the credit market is not to increase competition. Moreover, the platform's cost of capital is weakly larger than banks, so the platform cannot compete on costs. Existing literature assumes fintech lenders enter the credit market because of superior information, regulatory advantage, or consumers' taste. The platform from our model does not benefit from any of these advantages. So, how can the bigtech platform profitably compete with banks?

In addition to having a better enforcement power highlighted in Section 2, when the platform directly competes with banks, it lends also for an additional reason: advantageous screening. Case C is emblematic of how the platform enters the credit market to take advantage of equilibrium screening. As a monopolist, the platform would not lend when parameters satisfy case C. However, when the banks are present, the additional rents accruing from equilibrium screening induce the platform to lend in competition with banks.

With advantageous screening, the platform earns higher profits when banks lend more because the platform can extract larger rents from them. In fact, in case C, the platform's expected profits when lending are given by

$$m_B^*[p(1+\alpha)c_H + (1-p)c_L]f,$$

which is increasing in the probability that banks offer a loan. In contrast, in case A and B, the platform's profit is decreasing in the bank's lending probability m_B because fiercer competition decreases how much surplus the platform can extract from the borrowers. The difference in how banks and the platform interact across different regions is crucial for understanding the role of the platform's informational advantage, which we investigate in Section 4.

In contrast to better enforcement, advantageous screening could lower equilibrium welfare. Because the platform extracts rents from banks, banks lend more conservatively by denying credit with higher probability and by offering higher interest rates, as Lemma 5 shows. The equilibrium effects of the platform's advantageous screening are similar to the effect of a winner's curse on banks. Whereas a winner's curse originates from asymmetric information among lenders or bidders (Milgrom and Weber, 1982; Engelbrecht-Wiggans et al., 1983; Hausch, 1987; Kagel and Levin, 1999), in our model, advantageous screening originates from the platform's superior ability to enforce repayments from a bad merchant. If the bad merchant prefers defaulting to repaying the loan, she chooses to borrow from banks when possible. We formally explore the welfare implications of the platform on credit markets in the next subsection.

3.5 WELFARE

We now evaluate how welfare changes when the platform enters the credit market in competition with banks. Whereas lenders always improve welfare by providing credit to a good merchant, denying credit to a bad merchant is efficient if $(1+\alpha)c_L < R_D$. To properly evaluate the welfare effect of the platform in the credit market, we assess the expected welfare based on public information about the merchant, thus not conditioning on the merchant's type. We then compare the expected welfare when the platform and banks compete to the expected social welfare when banks are the only type of lenders. We consider social welfare and the merchant's welfare. Social welfare is the total expected surplus generated in the market, which is equivalent to the sum of the expected profits of the merchant and the platform (banks earn zero profits in equilibrium). The merchant's welfare is measured by her expected profits.

3.5.1 SOCIAL WELFARE

Changes in expected social welfare are determined by the combination of the positive effects of the platform's better enforcement on the one hand, and the negative effects of the platform's advantageous screening on the other.

If $p < \frac{R_D}{(1-f)\alpha c_H}$, the platform does not compete with banks and, therefore, there is no advantageous screening. If condition (6) is satisfied and the platform lends, then the expected social welfare increases because more cash flow is credibly pledged to the lender. In this case, social welfare strictly increases and it is at least as large as

$$(1+\alpha)pc_H + (1-p)c_L - \bar{R} \geq 0,$$

where the inequality follows from condition (6) and it is strict when (6) holds as a strict inequality or when $\eta < 1$. The increase in social welfare is even larger if $p < \frac{\alpha c_L}{(\alpha-(1+\alpha)f+\eta)(c_H-c_L)+\alpha c_L}$, in which case the equilibrium interest rate is such that even the bad merchant does not default and produces for two periods. The platform lowers the default probability of the bad merchant and increases social welfare even more.

If $p \geq \frac{R_D}{(1-f)\alpha c_H}$, expected social welfare is $(1+\alpha)c_H + c_L - R_D$ when banks are the only lenders. In the region where $p \geq R_D/\bar{R}$, the expected social welfare does not change when the platform enters the credit market because the merchant would keep borrowing exclusively from banks.

In the intermediate region with $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$, when the platform enters the credit market, the change in the expected social welfare is given by

$$\begin{aligned}\Delta W(\bar{R}) = &-\underbrace{(1-m_B^*)(1-m_P^*)[(1+\alpha)pc_H + (1-p)c_L - R_D]}_{\text{credit rationing}} \\ &\underbrace{- m_P^*\left[(1-m_B^*) + m_B^* p\int_{R_D/p}^{(\alpha-(1+\alpha)f+\eta)c_H} G_B^*(R)dF_P^*(R)\right](\bar{R}-R_D)}_{\text{higher cost of capital}} \\ &+\underbrace{(1-m_B^*)m_P^*(1-p)F_P^*((\alpha-(1+\alpha)f+\eta)c_L)}_{\text{lower default risk}},\end{aligned} \tag{15}$$

The change in social welfare depends on three components. First, social welfare declines when credit is rationed in equilibrium. Without a platform, banks always lend to merchants in this region. But, with competition from the platform, lenders may ration credit with positive probability. Second, social welfare declines if $\bar{R} > R_D$ because merchants are financed at a higher cost of capital. This happens when merchants borrow from the platform instead of the banks. Third, social welfare increases when the platform offers contracts satisfying the incentive-compatibility condition (1) for the bad merchant, who will not default when borrowing from the platform. This happens when banks do not lend and the platform offers a rate equal to or below $(\alpha-(1+\alpha)f+\eta)c_L$.

The following corollary establishes how social welfare changes when the platform enters the credit market.

COROLLARY 1 (Social Welfare). *Relative to the bank-only economy, when the platform competes with the banks, social welfare changes as follows.*

1. *For merchants of high credit quality with $p \geq R_D/\bar{R}$, expected social welfare remains unchanged.*

2. *For merchants of low credit quality with $p < \frac{R_D}{(1-f)\alpha c_H}$, expected social welfare increases if*

(6) *is satisfied. Otherwise, expected social welfare remains unchanged.*

3. *For merchants of intermediate credit quality with parameters satisfying case A, expected social welfare declines if* $\bar{R} > R_D$. *Otherwise, expected social welfare remains unchanged.*

4. *For merchants of intermediate credit quality with parameters satisfying B, the change in expected social welfare depends on the platform's cost of capital. In particular, there exists* $\bar{R}^M \in [R_D, R_D/p)$ *such that social welfare increases if* $\bar{R} < \bar{R}^M$*, social welfare remains unchanged if* $\bar{R} = \bar{R}^M$*, and it declines if* $\bar{R} > \bar{R}^M$.

5. *For merchants of intermediate credit quality with parameters satisfying case C, expected social welfare declines.*

The first two parts of the corollary summarize our previous discussion. Social welfare does not change when borrowers of high credit quality continue to borrow exclusively from banks. Social welfare improves for previously unbanked borrowers because the platform improves financial inclusions for merchants satisfying (6). In the remaining parts of the corollary, we evaluate how social welfare changes when the platform directly competes with banks in the credit market.

In case A, $m_P^* = 1$ and $F_P^*((\alpha - (1+\alpha)f + \eta)c_L) = 0$. Hence, the first and third effects in equation (15) are zero. The change in social welfare depends entirely on the difference between the platform's and the bank's cost of capital. In particular, the expected social welfare does not change if the two lenders have the same cost of capital and the expected social welfare declines if the platform's cost of capital exceeds the bank's.

In case B, $m_P^* = 1$ and, hence, credit is not rationed. As shown in Propositions 2 and 3, it is possible that $F_P^*((\alpha - (1+\alpha)f + \eta)c_L) > 0$. In this case, with positive probability, the bad merchant borrows from the platform and produces for two periods. Social welfare depends on the trade-off between the positive effects of the platform's better enforcement on reducing credit risk and the negative effects of equilibrium screening on the cost of capital. If $\bar{R}$ is sufficiently close to R_D, the positive effect of better enforcement dominates, and expected social welfare increases. If $\bar{R}$ is sufficiently high, the negative effects of equilibrium screening prevail over the benefits of enforcement, and welfare declines.

Finally, in case C, we have $F_P^*((\alpha - (1+\alpha)f + \eta)c_L) = 0$; that is, enforcement does not improve when the platform enters the credit market. In addition, merchants are rationed with positive probability under competition, and the platform's cost of capital strictly exceeds the banks'. Hence, for these parameters, social welfare declines unambiguously.

3.5.2 THE MERCHANT'S WELFARE

To conclude, we evaluate how the expected merchant's profits change when the platform enters the credit market. From our discussion of social welfare, we can immediately observe that the merchant's profits will not change if $p \geq R_D/\bar{R}$ because, in this case, the merchants keep borrowing from banks exclusively. Moreover, the expected merchant's profits increase if $p < \frac{R_D}{(1-f)\alpha c_H}$, provided (6) is satisfied. With the platform lending, merchants obtain funding with positive probability, instead of zero, which is the case when banks are the only lenders.

When the platform directly competes with banks for merchants with $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$ we show in the next corollary that merchant's welfare declines unambiguously. The corollary also summarizes our discussion of the previous two cases.

COROLLARY 2 (Merchant's Welfare)**.** *Relative to the bank-only economy, when the platform competes with the banks, the merchant's welfare changes as follows.*

1. *For merchants of high credit quality with $p \geq R_D/\bar{R}$, the merchant's expected welfare remains unchanged.*
2. *For merchants of low credit quality with $p < \frac{R_D}{(1-f)\alpha c_H}$, the merchant's expected welfare increases if* (6) *is satisfied. Otherwise, the merchant's expected welfare remains unchanged.*
3. *For merchants of intermediate credit quality with parameters satisfying $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$, the merchant's expected welfare declines.*

Whereas the effects on social welfare depend on the platform's cost of capital for merchants of intermediate credit quality, the effects on the merchant's welfare are unambiguously negative. In cases A, B1, and C, good borrowers pay higher interest rates than banks' break-even rate, R_D/p, which they would pay if banks were the only lenders. In cases A and C, bad borrowers are also forced to repay $(\eta - f)c_L$ to the platform when they cannot obtain financing from banks, which happens with strictly positive probability $(1 - m_B^*) > 0$. In case B1, a bad borrower produces for two periods after borrowing from the platform at a rate $R_P \leq (\alpha - (1+\alpha)f + \eta)c_L$. However, by doing so, the bad borrower still earns lower profits than she could have earned if she borrowed from banks and defaulted. Moreover, in case C, all borrowers are rationed with positive probability. Finally, in case B2, although, a good merchant obtains loans from the platform at a very low interest rate $(\alpha - (1+\alpha)f + \eta)c_L < R_D/p$ with a positive probability, the platform charges higher rates with sufficiently high probability that it more than offsets the benefits of an occasionally lower rate. In conclusion, the merchant's profit always declines.

4 INFORMATION ACQUISITION

Bigtech platforms may have another advantage over banks because of their superior information. For example, a platform may observe the past history of transactions of the merchant or of similar merchants and infer useful information about a borrower's future sales. In this section, we consider an extension of the model where the platform can acquire superior information about the borrower's type θ.

The platform and banks share a common prior p, but the platform can acquire an informative signal of the borrower's type at a cost. We think of p as the best assessment of the merchant's type based on standard credit-evaluation models, and we interpret the platform's signal-acquisition technology as an evaluation model relying on innovative methodologies or alternative data. The effects discussed in Section 3 remain. Moreover, we find that the ability to acquire information may actually hurt the platform's profit in certain cases, due to banks' response in equilibrium. We briefly describe the setting and the implications here. We leave the details regarding the equilibrium to Appendix C.

4.1 INFORMATION-ACQUISITION TECHNOLOGY

By paying a cost $c > 0$, the platform acquires a private signal s that is informative about the borrower's type θ. Similar to He et al. (2023), we assume the platform may observe either a high or a low signal. That is, $s \in \{h, l\}$. The low signal fully reveals the borrower is bad, whereas the high signal offers increased (although not conclusive) evidence that the merchant is good. That is,

$$P(s = l|\theta = H) = 0 \text{ and } P(s = l|\theta = L) > 0.$$

Let

$$\psi := p + (1 - p)P(s = h|\theta = L)$$

be the probability the platform observes a high signal. Also, let

$$p^h := P(\theta = H|s = h) = \frac{p}{\psi}$$

be the platform's posterior belief about the probability that the merchant generates high revenue after observing a high signal. When the platform observes a low signal, its posterior belief is $p^l := P(\theta = H|s = l) = 0$.

The platform chooses whether to acquire the signal or not at a cost $c > 0$. We study the equilibrium in the limit where $c \to 0$. The merchant and banks do not observe whether the platform acquires information. We allow for mixed strategies, and $a \in [0, 1]$ denotes the probability the platform acquires information. We call a platform *uninformed* when it does not acquire information. If the platform acquires information and observes a high signal, we refer to it as *optimistic*. If it acquires information and observes a low signal, we refer to it as *pessimistic*. We denote the three types of the platform with subscript $i \in \{u, h, l\}$ respectively and define $p^u := p$.

The equilibrium response of banks depends on how the platform uses its superior information. For certain types of merchants, the platform uses the additional information to customize interest rates offered to both good and bad types of merchants. In this case, the banks compete more aggressively and lends with higher probability compared to the baseline case. For other types of merchants, the platform uses the additional information to screen out bad merchants. In this case, banks suffer from *winner's curse* and lend more conservatively when the platform acquires information in equilibrium.

4.2 Information Acquisition and Competition

Like in Section 3, the equilibrium features mixed strategies in the credit decisions of the lenders. The formal definition of the equilibrium is in Definition 2 of Appendix C.

Most of the results we obtained in Section 3 extends to this framework. First, Lemma 16 establishes the same results as Lemma 4, showing that the market is partially segmented in the same way as in Section 3. Second, according to Lemma 17, banks deny credit with positive probability and offer rates up to $(1 - f)\alpha c_H$, as in Section 3. Moreover, the uninformed platform and the optimistic platform combined offer rates span a set similar to that in Lemma 5. However, the uninformed and optimistic platform may offer rates over different supports. Importantly, the platform still benefits from advantageous screening in equilibrium, and Remark 2 applies also to this extension of the model.

Next, we discuss the implications of the option to acquire information when the platform and banks directly compete for merchants of intermediate quality $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. As we show ahead, social welfare and the platform's profits may change in non-trivial ways because of the banks' equilibrium reaction to the platform's information-acquisition strategy.[30] Based on the results in Appendix C, we distinguish three main cases, which are analogous to those we studied in Section 3.

[30]When $p \geq R_D/\bar{R}$, neither welfare nor the platform's profits change with the option to acquire information because banks remain the only lenders. When $p < \frac{R_D}{(1-f)\alpha c_H}$, both welfare and the platform's profits increase with the option to acquire information provided the platform lends. In this case, information alleviates financing frictions between the borrower and the platform, which is the only lender for this merchant.

CASE I.A: $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L > \bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$ **AND** $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. In this case, the platform earns positive profits as a monopolist and always acquires information. However, depending on the platform's cost of capital, the platform either uses the information to screen out bad borrowers or to adjust interest rates and maximize the surplus it extracts from the borrower. When the platform's cost of capital $\bar{R}$ exceeds $(\alpha+\eta)c_L$, the platform denies credit upon receiving a low signal. When $\bar{R} \leq (\alpha+\eta)c_L$, the platform lends at interest rate $R_P = (\alpha - (1+\alpha)f + \eta)c_L$ upon observing a low signal, satisfying the incentive-compatibility condition (1) for $\theta = L$.

In the latter case, the platform charges higher rates after observing good signals in order to extract more surplus from merchants with low risks of strategic default. The platform charges lower rates after observing bad signals to discourage strategic default from low-revenue merchants. Because the platform reduces the risk of strategic default, welfare increases.

The banks' lending probability and distribution of rate offers are identical to those of case A in Section 3, when the platform has no option to acquire information. Moreover, the optimistic platform offers interest rates from the same distribution as the uninformed platform in case A of Section 3.

CASE I.B: $\bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$ **AND** $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. In this case, the merchant's relative revenues are sufficiently high that the platform is always willing to lend, regardless of its posterior. The platform acquires information with positive probability. When it does acquire information, it always uses the information to customize interest rates and maximize the surplus it extracts. In particular, a pessimistic platform offers interest rates satisfying the incentive-compatibility condition (1) for $\theta = L$, thus ensuring a bad merchant always repays in full and improving welfare.

Interestingly, when the platform can acquire information, banks lend with *higher* probability compared to the analogous case B from Section 3.[31] With better information, the platform raises the interest rate charged to the good merchants to extract more surplus, which increases the chance that a bank lends to a good merchant. As a result, banks lend more aggressively to compete with the platform.

CASE I.C: $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L \leq \bar{R}$**,** $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$ In this case, the platform acquires information with positive probability and lends only when it receives a high signal. Upon receiving a high signal, the platform lends with probability 1 and offers rates

[31]Case I.B in the superior information case does not overlap exactly with Case B in the common information case. The comparison here applies only to the over-lapping region.

with the same distribution as described in Proposition 4 of Section 3. The platform remains uninformed with positive probability and, in this case, it denies credit. Overall, the platform denies credit with higher probability compared to the baseline model, because it can better screen out bad merchants.

If the platform were the only lender for a merchant in case I.C, it would deny credit even after observing a high signal. However, similar to case C in Section 3, the platform benefits from advantageous screening when competing with banks. The platform, therefore, lends with positive probability in equilibrium to extract advantageous-screening rents.

In Case I.C, banks lend with lower probability when the platform has the ability to acquire superior information compared to Case C from Section 3.[32] This is because the platform denies credit after observing a low signal, and banks suffer from winner's curse. As both the platform and banks scale back lending, credit is rationed more frequently compared to the baseline case.

THE VALUE OF INFORMATION AND WELFARE. In existing literature, better information increases the informed lender's profit in equilibrium (Hauswald and Marquez, 2003; He et al., 2020). Perhaps surprisingly, in our setting, the ability to acquire superior information does not always increase the platform's profit. In our model, because of banks' equilibrium reaction to the platform information-acquisition strategy, the option to acquire information may lower the rents the platform can extract through its superior enforcement power. In the next Corollary, we identify conditions under which the platform earns lower profits when it has the option to acquire private information.

COROLLARY 3. *If parameters satisfy case I.B with* $p < \frac{R_D}{(\alpha-(1+\alpha)f+\eta)c_L}$ *and* $V^c > R_D/p$*, where* V^c *is defined in Proposition 7 of Appendix C, or if parameters satisfy case I.C, then a platform with the option to acquire private information earns lower profits than a platform that cannot acquire private information.*

The proof is in Appendix D.

In case I.B, the pessimistic platform offers lower rates than an optimistic platform to incentivize full repayment and reduce strategic default. The optimistic platform, instead, offers higher rates to extract more surplus from the borrowers. In response, banks expand lending and compete more aggressively for the good merchant, which leads to lower profits for the platform.

[32]Case I.C in the superior information case does not overlap exactly with Case C in the common information case. The comparison here applies to the overlapping region.

In case I.C, the platform lends solely to extract advantageous-screening rents at the expense of banks. When the platform acquires superior information and denies credit to bad borrowers, banks suffer from a more severe winner's curse and lend more conservatively. As a result, the platform extracts less advantageous-screening rents in equilibrium, and its profits also decline.

The conditions considered in Corollary 3 are sufficient but not necessary for the platform to earn lower profits when it can acquire better information. In general, the standard mechanism whereby a more informed lender can screen out bad borrowers and earn higher profits (Hauswald and Marquez, 2003; He et al., 2020) exists also in our model for certain sets of parameters. This standard mechanism may offset the negative effects of information on profitability described above. For example, when parameters satisfy case A, one can show this mechanism more than offsets the decline in rents from enforcement, and the platform's profits increase with the option to acquire information. In cases other than A and those covered in Corollary 3, the net effect of information on profits depends on parameter values.

Finally, the welfare effect of having better information is also ambiguous. On the one hand, welfare may decline because less informed lenders reduce credit in response to their winner's curse, as in He et al. (2020). On the other hand, better information allows the platform to customize interest rates and discourage a bad merchant from defaulting, thus increasing welfare. The latter effect is unique to our setting because of the platform's better enforcement power, and it serves to alleviate financial frictions.

5 CONCLUSIONS

We study the equilibrium and welfare implications of a bigtech platform entering the credit market and competing with banks. The unique feature of the platform is that it is the monopolistic provider of a valuable marketplace. Because of its control to the marketplace, a platform can implement revenue based repayment plans and better enforce loan repayments. For high-risk borrowers, the platform can incentivize full loan repayment even though the same borrowers would default if they borrowed from banks. As a result, the platform can profitably lend to small businesses of high credit risk, who are traditionally denied credits by banks. When borrowing from the platform, these high-risk merchants are more likely to remain in business and continue production. For such merchants, the platform generally increases welfare.

We also find that when the platform competes directly with banks, the platform benefits from advantageous screening. That is, conditional on the observable characteristics, the platform attracts a better pool of borrowers compared to the banks. As a result, banks scale back lending and increase interest rates. Banks do so to cover the losses they incur when the platform extracts advantageous-screening rents from them. Our theory predicts that the platform lends to a worse pool of borrowers based on observable characteristic than banks. But conditional on observables, the platform lends to a better pool of borrowers than banks. Because banks are adversely affected by equilibrium screening, they lend more conservatively. Social welfare may thus decline when the platform enters the credit market and competes with banks for merchants of intermediate credit quality.

To study the interaction effect between enforcement power and information advantage, we extend the baseline model allowing the platform to acquire superior information about the borrowers at a small cost. We find that the platform's enforcement power and information interact in equilibrium. In particular, conditional on having better enforcement power, additional information advantage does not always increase the platform's profit. Depending on whether the platform uses the information to screen out bad merchants or to tailor interest rates and optimize surplus extraction, banks may either decrease or increase lending in response. As a result of banks' equilibrium reaction, the rents the platform extracts from its superior enforcement may decline

There are many other features unique to platforms making loans. For example, there might be synergies between lending and platform's marketplace business through network effects. It would also be interesting to explore how credit decisions feed back to platform's optimal fee design for different users. We leave these questions for future research.

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A The Planner's Allocation

We consider a social planner who maximizes social welfare while facing the same frictions lenders face. The planner thus implements a second-best allocation. Specifically, the planner lacks information about the merchant's type, and the merchant can strategically default.

The planner offers loans at rate R_S. Because the interest rate R_S represents a transfer from the merchant to the planner, the planner selects a rate that maximizes the merchant's output by discouraging default among bad merchants. Any rate that satisfies $(1-f+f_S)c_L \geq R_S$ is optimal. Without loss of generality, we assume that the planner sets $R_S = 0$. To finance the merchant, the planner obtain capital from banks, who has lower cost of capital.

The planner lends with probability m_S to maximize social welfare:

$$\max_{m_S} m_S \left\{(1+\alpha)\left[pc_H + (1-p)c_L\right] - R_D\right\}.$$

Hence, the planner lends if

$$p \geq p_S := \frac{R_D - (1+\alpha)c_L}{(1+\alpha)(c_H - c_L)}.$$

By setting $R_S = 0$ and incentivizing production for two periods, the planner lends at a financial loss to maximize the value of the merchant's production and, consequently, social welfare. In particular, if the parameter values are such that it is efficient to finance the bad merchant, that is $(1+\alpha)c_L \geq R_D$, the planner lends for any $p \in [0,1]$. Figure 4 provides an illustration of the allocation selected by the social planner for different sets of parameters.

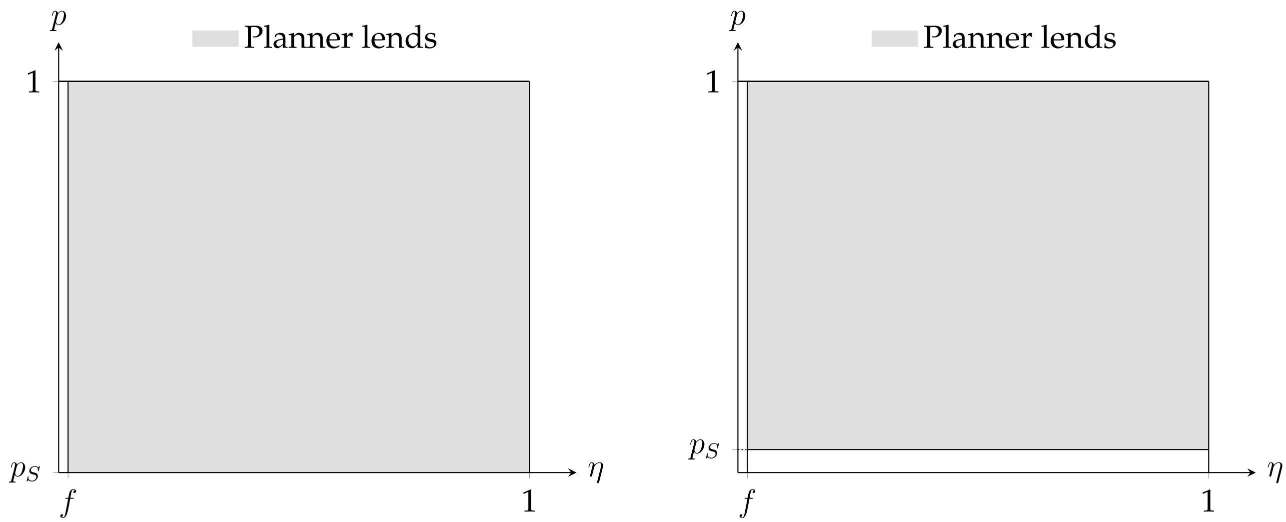
B Proofs for the Main Model

B.1 Proof of Lemma 1

To see condition (2) is the relevant incentive-compatibility constraint, we consider the case when a merchant defaults and the case when a merchant does not default separately.

If a merchant defaults when she sells on the platform, that means condition (1) is violated

$$[(1-f)\alpha + f_P]c_\theta < R_P. \tag{16}$$



(a) $(1+\alpha)c_L \geq R_D$

(b) $(1+\alpha)c_L < R_D$

Figure 4: Second-best allocation. The shaded areas indicate the set of merchants (with different combinations of relative revenues η and credit quality p) that receive financing from the social planner. In Figure 4(a), it is socially efficient to lend to bad merchants ($(1+\alpha)c_L \geq R_D$). In Figure 4(b), it is inefficient to do so ($(1+\alpha)c_L < R_D$).

Then it must be the case that

$$\alpha(1-f)c_\theta < R_P, \tag{17}$$

which means the same merchant also defaults if she sells outside the platform. In this case, an incentive-compatibility condition on f_P imposes that the cost of selling on the platform, $(f+f_P)c_\theta$, does not exceed the cost of selling outside the platform, ηc_θ, leading to condition (2).

If a merchant does not default when selling on the platform, i.e., condition (1) is satisfied, she may still default when she decides to sell outside the platform if $\alpha(1-f)c_\theta < R_P$. In this case, an incentive-compatibility condition imposes that the net revenues from staying on the platform and not defaulting, $(1+\alpha)(1-f)c_\theta - R_P$, should exceed the net revenues of leaving the platform and defaulting, $(1-\eta)c_\theta$; that is, $(\alpha-(1+\alpha)f+\eta)c_\theta \leq R_P$. However, this condition is redundant once we impose conditions (1) and (2).

B.2 Proof of Lemma 2

From the optimization problem (5), we have that the platform offers loans either at rate $(\alpha-(1+\alpha)f+\eta)c_H$ or at rate $(\alpha-(1+\alpha)f+\eta)c_L$. Hence, its optimized profits are given by

$$\max\{p(\alpha+\eta)c_H + (1-p)\eta c_L, (\alpha+\eta)c_L + (1+\alpha)p(c_H-c_L)f\} - \bar{R}.$$

The platform lends only if profits are non-negative, yielding condition (6).

In setting its interest rate, the platform prefers to offer rate $(\alpha - (1+\alpha)f + \eta)c_H$ if

$$p(\alpha+\eta)c_H + (1-p)\eta c_L \geq (\alpha+\eta)c_L + (1+\alpha)p(c_H - c_L)f,$$

which can be rearranged to become (7). Otherwise, the platform optimally offers a rate equal to $(\alpha - (1+\alpha)f + \eta)c_L$.

To conclude the proof, assume $(1+\alpha)c_L > \bar{R}$. Let

$$\hat{\eta} \coloneqq \frac{\bar{R}}{c_L} - \alpha.$$

Note $\hat{\eta} < 1$ because $(1+\alpha)c_L > \bar{R}$. Then, for any $\eta \geq \hat{\eta}$ we have

$$(\alpha+\eta)c_L + (1+\alpha)p(c_H - c_L)f - \bar{R} \geq 0,$$

for all $p \in [0,1]$. Therefore, if $\eta \geq \hat{\eta}$, (6) holds and the platform lends for any $p \in [0,1]$. □

B.3 AUXILIARY LEMMAS

We now introduce some lemmas which will be useful in characterizing the equilibrium with competition.

LEMMA 7. *$m_B^* > 0$ if and only if $p \geq \frac{R_D}{(1-f)\alpha c_H}$.*

Proof. First, we show $m_B^* > 0$ if $p \geq \frac{R_D}{\alpha(1-f)c_H}$. By way of contradiction, suppose $m_B^* = 0$. Then $\mathcal{R}_P^* = \{(\alpha - (1+\alpha)f + \eta)c_H\}$ and $G_P^*(R) = \mathbb{I}(R < (\alpha - (1+\alpha)f + \eta)c_H)$. Then, for any $m_P^* \in [0,1]$ and $\varepsilon \in (0, \alpha(1-f)c_H - R_D/p)$, $L_B(R_D/p+\varepsilon, m_P^*, G_P^*; p) > 0$, contradicting that $m_B^* = 0$ is the bank's equilibrium strategy.

Second, we show $m_B^* = 0$ if $p < \frac{R_D}{\alpha(1-f)c_H}$. When $p < \frac{R_D}{\alpha(1-f)c_H}$, for any $R \leq \alpha(1-f)c_H$ we have

$$L_B(R, m_P^*, G_P^*; p) \leq p(1-f)\alpha c_H - R_D < 0$$

and, by (12), $m_B^* = 0$. □

LEMMA 8. *If $m_B^* \in (0,1)$, then $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$.*

Proof. We proceed by contradiction and assume $\tilde{R} \coloneqq \sup \mathcal{R}_B^* < (1-f)\alpha c_H$. Because $m_B^* \in (0,1)$, by Lemma 7, we have $p \geq \frac{R_D}{(1-f)\alpha c_H}$, which also implies (7). Hence, $L_P(R, m_B^*, G_B^*; p) < L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for any $R \in (\tilde{R}, (\alpha - (1+\alpha)f + \eta)c_H)$. Therefore, an $\varepsilon > 0$ exists such that $L_B(\tilde{R}+\varepsilon, m_P^*, G_P^*; p) > L_B(\tilde{R}, m_P^*, G_P^*; p)$.

Hence, for a small enough ε, a lending mechanism (m_B, F_B) with $m_B = 1$ and with domain $\mathcal{R}_B^* \cup \{\tilde{R}+\varepsilon\}$ exists such that $\int_0^{\hat{R}+\varepsilon} L_B(R, m_P^*, G_P^*; p)dF(R) > 0$ and $U(1, m_P^*, F_B, F_P^*) >$

$U(m_B^*, m_P^*, F_B^*, F_P^*)$, contradicting the assumption that $\mathcal{R}_B^*$ is the domain of the equilibrium lending mechanism offered by banks. □

LEMMA 9. $\inf \mathcal{R}_P^* \in \mathcal{R}_P^*$ *and* $\inf \mathcal{R}_B^* \in \mathcal{R}_B^*$.

Proof. Define $\underline{R}_P := \inf \mathcal{R}_P^*$ and $\underline{R}_B := \inf \mathcal{R}_B^*$ and consider lender $J \in \{P, B\}$ and lender $I \in \{P, B\}$ with $J \neq I$.

If $\underline{R}_J \notin \mathcal{R}_J^*$, then a sequence $(R_n)_{n=0}^{\infty}$ exists such that $R_n > \underline{R}_J$ and $R_n \in \mathcal{R}_J^*$ for all n and $R_n \to \underline{R}_J$ as $n \to \infty$. We, therefore, must have $L_J(\underline{R}_J, m_I^*, G_I^*; p) < \lim_{n\to\infty} L_J(R_n, m_I^*, G_I^*; p)$ which, in turn, implies $G_I^*(\underline{R}_J) < \lim_{n\to\infty} G_I^*(R_n)$. This result, however, contradicts that G_I^* is a weakly decreasing function. Therefore, $\underline{R}_J \in \mathcal{R}_J^*$. □

LEMMA 10. *Assume* $m_P^* > 0$ *and* $m_B^* > 0$. *Then* $\min \mathcal{R}_P^* \leq R_D/p$. *Moreover,* $\min \mathcal{R}_P^* = R_D/p$ *or* $\min \mathcal{R}_P^* = (\alpha - (1+\alpha)f + \eta)c_L$. *Also, if* $\min \mathcal{R}_P^* \neq (\alpha - (1+\alpha)f + \eta)c_L$, *then* $\min \mathcal{R}_B^* = R_D/p$.

Proof. Define $\underline{R}_P := \min \mathcal{R}_P^*$ and $\underline{R}_B := \min \mathcal{R}_B^*$. First, we establish $\underline{R}_P \leq R_D/p$. We proceed by contradiction and assume $\underline{R}_P > R_D/p$. By competition between banks, we thus have $m_B^* = 1$ and $\mathcal{R}_B^* = \{R_D/p\}$. In this case, if $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$, the platform's best response is R_D/p. If instead $R_D/p \geq (\alpha - (1+\alpha)f + \eta)c_L$, the platform's best response could be either R_D/p or $(\alpha - (1+\alpha)f + \eta)c_L$. In both cases, $\underline{R} \leq R_D/p$, contradicting $\underline{R}_P > R_D/p$.

Having established $\underline{R}_P \leq R_D/p$, we now prove $\underline{R}_P = R_D/p$ or $\underline{R} = (\alpha - (1+\alpha)f + \eta)c_L$. If $R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$, then $L_P(R, m_B^*, G_B^*; p) < L_P(R_D/p, m_B^*, G_B^*; p)$ for any $R < R_D/p$, implying $\underline{R}_P = R_D/p$. If instead $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, $L_P(R, m_B^*, G_B^*; p) < L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p)$ for any $R < (\alpha - (1+\alpha)f + \eta)c_L$ and $L_P(R', m_B^*, G_B^*; p) < L_P(R_D/p, m_B^*, G_B^*; p)$ for any $R' \in ((\alpha - (1+\alpha)f + \eta)c_L, R_D/p)$, implying $\underline{R} = R_D/p$ or $\underline{R} = (\alpha - (1+\alpha)f + \eta)c_L$.

To prove the last part of the lemma, consider $\underline{R}_P = R_D/p \neq (\alpha - (1+\alpha)f + \eta)c_L$. We proceed by contradiction and assume $\underline{R}_B > R_D/p$. Because $\underline{R}_P \neq (\alpha - (1+\alpha)f + \eta)c_L$, an $\varepsilon > 0$ exists such that $L_P(R_D/p + \varepsilon, m_B^*, G_B^*; p) > L_P(R_D/p, m_B^*, G_B^*; p)$, contradicting $R_D/p \in \mathcal{R}_P^*$. Hence, if $\underline{R}_P = R_D/p \neq (\alpha - (1+\alpha)f + \eta)c_L$, the $\underline{R}_B = R_D/p$. □

LEMMA 11. *If* $m_B^* > 0$ *and* $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, *then* $(\alpha - (1+\alpha)f + \eta)c_L \notin \mathcal{R}_P^*$.

Proof. Note that $L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p) \leq L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p)$ only if

$$(1-m_B^*)[p(\alpha-(1+\alpha)f+\eta)c_H+(1-p)(\eta-f)c_L] \leq (1-m_B^*)[(\alpha-(1+\alpha)f+\eta)c_L+(1-p)\alpha c_L f] \tag{18}$$

From the proof of Lemma 2, we have that $p(\alpha + \eta)c_H + (1-p)\eta c_L > (\alpha + \eta)c_L + (1+\alpha)p(c_H - c_L)f$ if and only if

$$p > \frac{\alpha c_L}{(\alpha - (1+\alpha)f + \eta)(c_H - c_L) + \alpha c_L}. \tag{19}$$

Note that $R_D > \alpha c_L$ and $(1-f)\alpha c_H < (\alpha - (1+\alpha)f + \eta)(c_H - c_L) + \alpha c_L$. Hence, because we are considering $p \geq \frac{R_D}{(1-f)\alpha c_H}$, inequality (19) is satisfied, which implies inequality (18) is violated. We must thus have $L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^*, G_B^*; p) > L_P((\alpha-(1+\alpha)f+\eta)c_L, m_B^*, G_B^*; p)$ whenever $(\alpha-(1+\alpha)f+\eta)c_L - \bar{R} < 0$. □

LEMMA 12. *If $m_P^* > 0$ and $m_B^* \in (0,1)$, then $\max \mathcal{R}_P^* \in \{(1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_H\}$. Furthermore, if $m_P^* = 1$, then $\max \mathcal{R}_P^* = (\alpha-(1+\alpha)f+\eta)c_H$.*

Proof. First, note $\sup \mathcal{R}_P^* \in \mathcal{R}_P^*$ by the left-continuity of $G_B^*(\cdot)$ and the platform's objective function $L_P(\cdot, m_B, G_B; p)$. Hence, $\sup \mathcal{R}_P^* = \max \mathcal{R}_P^*$. Also note that $L_P(R, m_B^*, G_B^*; p) < L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^*, G_B^*; p)$ for $R \in ((1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_H)$ because $m_B^* \in (0,1)$. Therefore, $((1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_H) \cap \mathcal{R}_P^* = \emptyset$. Finally, by Lemma 8, $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$.

To prove the first part of the lemma, we proceed by contradiction and assume $R^M := \max \mathcal{R}_P^* < (1-f)\alpha c_H$. In this case, $G_P^*(R) = 0$ for all $R \geq R^M$, along with $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$, implies that $(1-f)\alpha c_H \in \mathcal{R}_B^*$ and $R \notin \mathcal{R}_B^*$ for all $R \in (R^M, (1-f)\alpha c_H)$. Otherwise, an $R' \geq R^M$ with $R' \in \mathcal{R}_B^*$ would exist such that $L_B(R', m_P^*, G_P^*; p) \neq 0$, contradicting the definition of equilibrium. Moreover, $L_B((1-f)\alpha c_H, m_P^*, G_P^*; p) = 0$ and $R^M < (1-f)\alpha c_H$ imply $m_P^* \in (0,1)$.

If $R^M > (\alpha-(1+\alpha)f+\eta)c_L$ or if $R^M < (1-f)\alpha c_H \leq (\alpha-(1+\alpha)f+\eta)c_L$ then $L_P((1-f)\alpha c_H, m_B^*, G_B^*; p) > L(R^M, m_B^*, G_B^*; p)$, contradicting $R^M := \max \mathcal{R}_P^*$. It remains to consider $R^M \leq (\alpha-(1+\alpha)f+\eta)c_L < (1-f)\alpha c_H$. In this case, by Lemma 10 we have $\min \mathcal{R}_P^* = R_D/p \leq (\alpha-(1+\alpha)f+\eta)c_L$. Moreover, we have $\bar{R} < R_D/p$. Therefore, $L_P(R_D/p, m_B^*, G_B^*; p) > m_B^*[(1+\alpha)pc_H + (1-p)c_L]f$. But this implies $m_P^* = 1$, which contradicts $L_B((1-f)\alpha c_H, m_P^*, G_P^*; p) = 0$. Hence, $\max \mathcal{R}_P^* \in \{(1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_H\}$

To prove the second part of the lemma for $m_P^* = 1$, we proceed again by contradiction and assume $\mathcal{R}_P^* = (1-f)\alpha c_H$. In this case, $L_B((1-f)\alpha c_H, 1, G_P^*; p) < 0$. Therefore, $G_B^*((1-f)\alpha c_H) = 0$. But then, $L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^*, G_B^*; p) > L_P((1-f)\alpha c_H, m_B^*, G_B^*; p)$, contradicting $\mathcal{R}_P^* = (1-f)\alpha c_H$. Thus, if $m_P^* = 1$ and $m_B^* \in (0,1)$, then $\max \mathcal{R}_P^* = (\alpha-(1+\alpha)f+\eta)c_H$.

□

LEMMA 13. *Suppose $m_B^* \in (0,1)$ and $m_P^* > 0$. If $R_1 \in \mathcal{R}_B^*$ and $R_2 \in \mathcal{R}_B^*$ are such that $R_1 < R_2 \leq (\alpha-(1+\alpha)f+\eta)c_L$ or $(\alpha-(1+\alpha)f+\eta)c_L < R_1 < R_2$, then we must have $[R_1, R_2] \subseteq \mathcal{R}_B^* \cap \mathcal{R}_P^*$.*

Proof. Assume, by contradiction, that an $R^k \in (R_1, R_2)$ exists such that $R^k \notin \mathcal{R}_B^*$. By the right-continuity of $G_P^*(\cdot)$ and $L_B(\cdot, m_P^*, G_P^*; p)$, we have that an $\varepsilon > 0$ exists such that $L_B(R, m_P^*, G_P^*; p) < 0$ for all $R \in (R^k, R^k+\varepsilon)$. Let $R_1' := \sup\{R\colon R \in \mathcal{R}_B^* \text{ and } R < R^k\}$. Hence, $L_B(R, m_P^*, G_P^*; p) < 0$ for all $R \in (R_1', R^k+\varepsilon)$, thus implying

$$G_P^*(R) < \frac{(1-m_P^*)(R_D - pR)}{m_P^* p(R - R_D)} + \frac{(1-p)R_D}{p(R-R_D)} \leq \frac{(1-m_P^*)(R_D - pR_1')}{m_P^* p(R_1' - R_D)} + \frac{(1-p)R_D}{p(R_1'-R_D)}. \quad (20)$$

Because $R \notin \mathcal{R}_B^*$ for all $R \in (R_1', R^k+\varepsilon)$, we must have $R \notin \mathcal{R}_P^*$ for any $R \in (R_1', R^k+\varepsilon)$.

If $R_1' \in \mathcal{R}_B^*$, then the last term in (20) coincides with $G_P^*(R_1')$ and therefore $G_P^*(R) < G_P^*(R_1')$ for any $R \in (R_1', R^k+\varepsilon)$. But this implies that there exists $R' \in (R_1', R)$ such that $R' \in \mathcal{R}_P^*$, contradicting the previous result that $R' \notin \mathcal{R}_P^*$ for any $R' \in (R_1', R^k + \varepsilon)$. If instead, $R_1' \notin \mathcal{R}_B^*$, then we must have $\lim_{R \to R_1'^-} G_P^*(R) > G_P^*(R_1')$, which implies $R_1' \in \mathcal{R}_P^*$. However, if $R_1' \notin \mathcal{R}_B^*$, $L_P(R^k + \varepsilon, m_B^*, G_B^*; p) > L_P(R_1', m_B^*, G_B^*; p)$, generating a contradiction.

Hence, $[R_1, R_2] \subseteq \mathcal{R}_B^*$. In particular, $L_B(R, m_P^*, G_P^*; p) = 0$ for all $R \in [R_1, R_2]$, which implies

$$G_P^*(R) = \frac{(1 - m_P^*)(R_D - pR)}{m_P^* p(R - R_D)} + \frac{(1-p)R_D}{p(R - R_D)}$$

is strictly decreasing for $R \in [R_1, R_2]$.

Suppose now, by way of contradiction, an $R^y \in [R_1, R_2]$ exists such that $R \notin \mathcal{R}_P^*$. By the left-continuity of $G_B^*(\cdot)$ and $L_P(\cdot, m_B^*, G_B^*; p)$, we have that an $\varepsilon > 0$ exists such that $R \notin \mathcal{R}_P^*$ for all $R \in (R^y - \varepsilon, R^y)$. However, this observation implies $G_P^*(R)$ is constant in $(R^y - \varepsilon, R^y)$, contradicting the previous result. Hence, we also obtain $[R_1, R_2] \subseteq \mathcal{R}_P^*$. □

B.4 Proof of Lemma 3

First, note $L_P(R, m_B, G_B; p) < L_P((1-f)\alpha c_L, m_B, G_B; p)$ for any $R < (1-f)\alpha c_L$, and hence $[0, (1-f)\alpha c_L) \cap \mathcal{R}_P^* = \emptyset$. To prove the lemma, it suffices to show that $L_P((1-f)\alpha c_L, m_B, G_B; p) < L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B, G_B; p)$. We proceed by contradiction and assume

$$L_P((1-f)\alpha c_L, m_B, G_B; p) \geq L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B, G_B; p).$$

After some manipulations, this inequality implies

$$(\eta - f)c_L - m_B G_B((\alpha - (1+\alpha)f + \eta)c_L)(1-p)[(\alpha - f + \eta)c_L - \bar{R}] \leq 0.$$

Because $\eta \geq f$, then $(\alpha - f + \eta)c_L - \bar{R} \geq 0$. Hence,

$$\begin{aligned} 0 &\geq (\eta - f)c_L - m_B G_B((\alpha - (1+\alpha)f + \eta)c_L)(1-p)[(\alpha - f + \eta)c_L - \bar{R}] \\ &(\eta - f)c_L - [(\alpha - f + \eta)c_L - \bar{R}] \\ 0 &\geq \bar{R} - \alpha c_L \end{aligned}$$

However, $\bar{R} > c_L$ by Assumption 1.

We therefore conclude that $L_P(R, m_B, G_B; p) < L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B, G_B; p)$ for any any $m_B \in [0, 1]$ and $R \leq (1-f)\alpha c_L$. □

B.5 PROOF OF LEMMA 4

When $p < \frac{R_D}{(1-f)\alpha c_H}$, Lemma 7 implies $m_B^* = 0$. The platform is thus a monopolistic lender for a merchant provided (6) is satisfied, and the results of Lemma 2 apply.

For the rest of the proof, we thus focus on $p \geq R_D/\bar{R}$. By Lemma 7, banks lend with positive probability $m_B^* > 0$. We want to show that $m_B^* = 1$, $\mathcal{R}_B^* = \{R_D/p\}$, and $m_P^*(1 - G_P^*(R_D/p)) = 0$. Together, these conditions imply merchants borrow exclusively from banks when $p \geq R_D/\bar{R}$

As a preliminary observation, notice that, if $m_P^* > 0$, $R_D/p \in \mathcal{R}_P^*$. In fact, if $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, by Lemma 11, $(\alpha - (1+\alpha)f + \eta)c_L \notin \mathcal{R}_P^*$. If instead $\bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$, we have $R_D/p \leq \bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$. By Lemmas 10 and 9, we thus have $R_D/p \in \mathcal{R}_P^*$ in both cases.

Suppose, by way of contradiction, $m_B^* \in (0,1)$. Which, in turn, implies $m_P^* > 0$ and $\underline{R}_P \leq R_D/p$, otherwise competitive banks would offer rate R_D/p with probability one and $m_B^* = 1$. It also implies $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$ by Lemma 8.

First, we exclude $m_P^* = 1$. By the previous observation, $R_D/p \in \mathcal{R}_P^*$. We must therefore have $L_P(R_D/p, m_B^*, G_B^*; p) \geq L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p^i)$, which implies

$$\begin{aligned} &m_B^* \left\{p((\alpha - (1+\alpha)f + \eta)c_H - \bar{R}) - I(R_D/p)(1-p)[R_D/p - (\eta - (1+\alpha)f)c_L]\right\} \\ &\quad \geq p((\alpha - (1+\alpha)f + \eta)c_H - R_D/p) - I(R_D/p)(1-p)[R_D/p - (\eta - (1+\alpha)f)c_L]. \end{aligned} \tag{21}$$

Notice we have $(\alpha - (1+\alpha)f + \eta)c_H \geq R_D/p$ when $p \geq \frac{R_D}{(1-f)\alpha c_H}$ and $\eta \geq f$ and $(\alpha - (1+\alpha)f + \eta)c_H - \bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_H - R_D/p$ because we are considering $\bar{R} \geq R_D/p$. Finally, we also have $p((\alpha - (1+\alpha)f + \eta)c_H - R_D/p) - I(R_D/p)(1-p)[R_D/p - (\eta - (1+\alpha)f)c_L]$ because either $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, or $R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$, along with $p \geq \frac{R_D}{(1-f)\alpha c_H}$, implies $p((\alpha - (1+\alpha)f + \eta)c_H - R_D/p) - I(R_D/p)(1-p)[R_D/p - (\eta - (1+\alpha)f)c_L] > 0$. Therefore, if $p((\alpha - (1+\alpha)f + \eta)c_H - \bar{R}) - I(R_D/p)(1-p)[R_D/p - (\eta - (1+\alpha)f)c_L] \leq 0$, the inequality (21) is a contradiction. If $p((\alpha - (1+\alpha)f + \eta)c_H - \bar{R}) - I(R_D/p)(1-p)[R_D/p - (\eta - (1+\alpha)f)c_L] > 0$, the inequality (21) implies $m_B^* \geq 1$, which contradicts $m_B^* \in (0,1)$. Therefore, when $p \geq R_D/\bar{R}$, $m_B^* = 1$.

Next, we show $m_P^*(1 - G_P^*(R_D/p)) = 0$. Assume, by way of contradiction, $m_P^*(1 - G_P^*(R_D/p)) > 0$. By our previous result in the proof, if $m_P^* > 0$, then $R_D/p \in \mathcal{R}_P^*$. Consider, $p > R_D/\bar{R}$. Because $m_B^* = 1$, the platform's profits from lending are thus $L_P(R_D/p, 1, G_B^*; p) < [(1+\alpha)pc_H + (1-p)c_L]f$, and hence $m_P^* = 0$, contradicting $m_P^*(1 - G_P^*(R_D/p)) = 0$.

Consider now $p = R_D/\bar{R}$, then $L_P(R_D/p, 1, G_B^*; p) = [(1+\alpha)pc_H + (1-p)c_L]f$ and, moreover, $L_P(R, 1, G_B^*; p) \leq L_P(R_D/p, 1, G_B^*; p)$ for any $R > R_D/p$, thus implying $G_B^*(R) \leq 0$.

Hence, banks offer rate R_D/p with probability one, and, for this to be the banks' best response, we must have $m_P^*(1 - G_P^*(R_D/p)) = 0$. □

B.6 Proof of Lemma 5

We prove $m_P^* > 0$. Suppose $m_P^* = 0$, then competitive banks would set $\mathcal{R}_B^* = \{R_D/p\}$ and $m_B^* = 1$. For a small enough $\varepsilon > 0$, $L_P(R_D/p - \varepsilon, 1, G_B^*; p) > [(1+\alpha)pc_H + (1-p)c_L]f$, which contradicts $m_P^* = 0$. Hence $m_P^* > 0$.

By Lemma 7, we have $m_B^* > 0$. We now prove $m_B^* \in (0,1)$. We proceed by contradiction and assume $m_B^* = 1$. In this case, $L_P(R, 1, G_B^*; p) = [(1+\alpha)pc_H + (1-p)c_L]f < L_P(R_D/p, 1, G_B^*; p)$ for any R such that $G_B^*(R) = 0$. Hence, $m_P^* = 1$ but $R \notin \mathcal{R}_P^*$ if $G_B^*(R) = 0$.

Let $\tilde{R} = \sup \mathcal{R}_B^* \leq (1-f)\alpha c_H$. If $\tilde{R} \in \mathcal{R}_B^*$, $L_B(\tilde{R}, 1, G_P^*; p) = 0$ implies $G_P^*(\tilde{R}) > 0$ and an $R > \tilde{R}$ exists with $R \in \mathcal{R}_P^*$. If instead $\tilde{R} \notin \mathcal{R}_B^*$, then $\lim_{R \to \tilde{R}^-} G_P^*(R) > 0$, implying an $R \geq \tilde{R}$ exists with $R \in \mathcal{R}_P^*$. In either case, $G_B^*(R) = 0$, thus contradicting the previous result.

Because $m_B^* \in (0,1)$, Lemma 8 implies $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$, Moreover, by Lemmas 9 and 10, we have that $\min \mathcal{R}_P^* \leq R_D/p$ and $\min \mathcal{R}_P^* \in \{(\alpha - (1+\alpha)f + \eta)c_L, R_D/p\}$. The result that $\max \mathcal{R}_P^* \in \{(1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H\}$ follows from Lemma 12. □

B.7 Proof of Lemma 6

Throughout the proof, recall that $m_B^* \in (0,1)$ and $m_P^* > 0$ by Lemma 5. In particular, an R exists such that $L_P(R, m_B^*, G_B^*; p) \geq m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$.

We first consider a merchant with $p(\alpha+\eta)c_H + (1-p)\eta c_L > \bar{R}$. To establish our claim, it is sufficient to note

$$L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p) > m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$$

because $m_B^* \in (0,1)$ and $p(\alpha+\eta)c_H + (1-p)\eta c_L > \bar{R}$. Therefore, $m_P^* = 1$.

Next, we consider $p(\alpha+\eta)c_H + (1-p)\eta c_L \leq \bar{R}$. Because (7) holds as a strict inequality when $p \geq \frac{R_D}{(1-f)\alpha c_H}$, we also have $R_D/p \geq \bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$. By Lemmas 9, 10, and 11, we thus have $\min \mathcal{R}_B^* \geq R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$.

We proceed by contradiction and assume that $\max_R L_P(R, m_B^*, G_B^*; p) > m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$. In this case $m_P^* = 1$. Moreover, by Lemma 5 we have $R^M := \max \mathcal{R}_P^* \in \{(1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H\}$ and, by the previous result, $R^M \geq \min \mathcal{R}_P^* > (\alpha - (1+\alpha)f + \eta)c_L$.

If $R^M = (\alpha - (1+\alpha)f + \eta)c_H$, then $L_P(R^M, m_B^*, G_B^*; p) \leq m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$, generating a contradiction. We thus consider $R^M = (1-f)\alpha c_H$. In this case, because $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$ and $m_P^* = 1$, we must have $\lim_{R \to (1-f)\alpha c_H^-} G_P^*(R) > 0$ and $G_P^*((1-f)\alpha c_H) = 0$. Therefore, $(1-f)\alpha c_H \notin \mathcal{R}_B^*$ and $G_B^*((1-f)\alpha c_H) = 0$. Hence, $L_P(R^M, m_B^*, G_B^*; p) < L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p) \leq m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$, where the first inequality follows from $(\alpha - (1+\alpha)f + \eta)c_L < R^M < (\alpha - (1+\alpha)f + \eta)c_H$. But this result also generates a contradiction. We therefore obtain $\max_R L_P(R, m_B^*, G_B^*; p) = m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$.

When $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, Lemma 11 implies $\min \mathcal{R}_P^* \neq (\alpha - (1+\alpha)f + \eta)c_L$. Therefore, by Lemmas 9 and 10, we obtain $\min \mathcal{R}_P^* = R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, where the inequality follows because $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$ and $p \leq R_D/\bar{R}$.

Finally, when $R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$, Lemmas 9 and 10 imply $\min \mathcal{R}_P^* = R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$. □

B.8 Proof of Proposition 1

By Lemma 5, $m_B^* \in (0,1)$. Moreover, by Lemma 6, $m_P^* = 1$, $\min \mathcal{R}_P^* = R_D/p$, and $\max \mathcal{R}_P^* = (\alpha - (1+\alpha)f + \eta)c_H$. Hence, $L_P(R_D/p, m_B^*, G_B^*; p) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$, from which we obtain that m_B^* is given by

$$m_B^* = \frac{(\alpha - (1+\alpha)f + \eta)c_H - R_D/p}{(\alpha - (1+\alpha)f + \eta)c_H - \bar{R}} \in (0,1) \tag{22}$$

Because $\min \mathcal{R}_P^* = R_D/p \geq \bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, Lemma 10 implies $\min \mathcal{R}_B^* = R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$. Moreover, $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$ by Lemma 5. Hence, Lemma 13 implies all rates in $[R_D, (1-f)\alpha c_H)$ are best responses for both the platform and banks. From $L_P(R, m_B^*, G_B^*; p) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for $R \in [R_D, (1-f)\alpha c_H)$, we obtain the expression for G_B* in after using (22)

$$G_B^*(R) = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{(\alpha - (1+\alpha)f + \eta)c_H - R}{(\alpha - (1+\alpha)f + \eta)c_H - R_D/p}. \tag{23}$$

Note that $\lim_{R \to (1-f)\alpha c_H^-} G_B^*(R) > 0$, hence $(1-f)\alpha c_H \in \mathcal{R}_B^*$.

From $L_B(R, 1, G_P^*; p) = 0$ for $[R_D, (1-f)\alpha c_H]$ we finally obtain the expression for G_P^*

$$G_P^*(R) = \frac{(1-p)R_D/p}{R - R_D} \quad \text{for } R \in [R_D/p, (1-f)\alpha c_H]. \tag{24}$$

□

B.9 Proof of Proposition 2

Lemmas 5 and 6 imply $m_B^* \in (0,1)$ and $m_P^* = 1$, respectively. By Lemma 6, $\min \mathcal{R}_P^* = R_D/p$ and $\max \mathcal{R}_P^* = (\alpha - (1+\alpha)f + \eta)c_H$. Also, Lemma 10 implies $\min \mathcal{R}_B^* = R_D/p$. Therefore, $l_P^0(R_D/p, m_B^*, G_B^*; p) = l_P^1((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$, from which we obtain the expression for m_B^* in (25).

$$m_B^* = \frac{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R_D/p}{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R_D/p + R_D - p\bar{R}} \in (0,1) \quad (25)$$

Let $T := \min\{(\alpha - (1+\alpha)f + \eta)c_L, (1-f)\alpha c_H\}$. If $T = (1-f)\alpha c_H$, Lemmas 8 and 13 imply all rates in $[R_D/p, (1-f)\alpha c_H)$ are best responses for both the platform and banks. From $l_P^0(R, m_B^*, G_B^*; p) = l_P^1((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for $R \in [R_D, (1-f)\alpha c_H)$, we obtain G_B^* is given by

$$G_B^*(R) = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R}{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R_D/p}$$

$$\text{for } R \in [R_D/p, T] \quad (26)$$

In particular, $\lim_{R \to (1-f)\alpha c_H^-} G_B^*(R) > 0$, hence $(1-f)\alpha c_H \in \mathcal{R}_B^*$. Using $L_B(R, 1, G_P^*; p) = 0$ for $R \in [R_D, (1-f)\alpha c_H]$, we obtain G_P^* is given by the following equation for $R \in [R_D/p, T]$,

$$G_P^*(R) = \frac{(1-p)R_D/p}{R - R_D} \quad (27)$$

We focus the rest of the proof on $T = (\alpha - (1+\alpha)f + \eta)c_L < (1-f)\alpha c_H$. We want to show that any rate in $[R_D/p, (\alpha - (1+\alpha)f + \eta)c_L)$ is a best response for both the platform and banks. It is sufficient to show that $(\alpha - (1+\alpha)f + \eta)c_L = \sup\{\mathcal{R}_B^* \cap [R_D/p, (\alpha - (1+\alpha)f + \eta)c_L]\}$. Lemma 13 will then imply $[R_D/p, (\alpha - (1+\alpha)f + \eta)c_L)$ is a set of best responses for lenders. We proceed by contradiction and assume $\tilde{R}' := \sup\{\mathcal{R}_B^* \cap [R_D/p, (\alpha - (1+\alpha)f + \eta)c_L]\} < (\alpha - (1+\alpha)f + \eta)c_L$. Hence, $l_P^0(R, m_B^*, G_B^*; p) < l_P^0((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p)$ for any $R \in (\tilde{R}', (\alpha - (1+\alpha)f + \eta)c_L)$. Therefore, an $\varepsilon > 0$ exists such that $L_B(\tilde{R}' + \varepsilon, m_P^*, G_P^*; p) > 0 = L_B((1-f)\alpha c_H, m_P^*, G_P^*; p)$, where $\tilde{R}' + \varepsilon < (1-f)\alpha c_H$.

Therefore, for a small enough ε, a lending mechanism (m_B, F_B) with $m_B = 1$ and with domain $[R_D/p, \tilde{R}' + \varepsilon]$ exists such that $\int_0^{\hat{R}'+\varepsilon} L_B(R, m_P^*, G_P^*; p)dF(R) > 0$ and $U(1, m_P^*, F_B, F_P^*) > U(m_B^*, m_P^*, F_B^*, F_P^*)$, contradicting the assumption that $\mathcal{R}_B^*$ is the domain of the equilibrium lending mechanism offered by banks. Hence, $(\alpha - (1+\alpha)f + \eta)c_L = \sup \mathcal{R}_B^* \cap [R_D/p, (\alpha - (1+\alpha)f + \eta)c_L]$ and any rate in $[R_D/p, (\alpha - (1+\alpha)f + \eta)c_L)$ is a best response for the lenders.

Hence, from $l_P^0(R, m_B^*, G_B^*; p) = l_P^1((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for $R \in [R_D/p, T)$, we obtain G_B^* is the same as (26). From $L_B(R, 1, G_P^*; p) = 0$ for $[R_D/p, T)$, we obtain G_P^* is given by (27) for $R \in [R_D/p, T)$ as well. To summarize

$$G_P^*(R) = \frac{(1-p)R_D/p}{R - R_D} \quad \text{for } R \in [R_D/p, T] \cup [U, (1-f)\alpha c_H]. \tag{28}$$

Let $U := \min\{\mathcal{R_B}^* \cap ((\alpha - (1+\alpha)f + \eta)c_L, (1-f)\alpha c_H]\}$. Note that such a U exists because $\sup \mathcal{R}_B^* = (1-f)\alpha c_H > (\alpha - (1+\alpha)f + \eta)c_L$ and because of a reasoning analogous to that in Lemma 9. By Lemmas 8 and 13, if $U < (1-f)\alpha c_H$, $[U, (1-f)\alpha c_H)$ is a set of best responses for lenders. Because $l_P^0((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p) > \lim_{R \to (\alpha - (1+\alpha)f + \eta)c_L^+} l_P^1(R, m_B^*, G_B^*; p)$, a $\delta > 0$ exists such that $U \geq (\alpha - (1+\alpha)f + \eta)c_L + \delta$. The same result holds immediately if $U = (1-f)\alpha c_H$.

Also note $l_P^1(U, m_B^*, G_B^*; p) > l_P^1(R, m_B^*, G_B^*; p)$ for all $R \in ((\alpha - (1+\alpha)f + \eta)c_L, U)$. Hence, from $L_B(U, 1, G_P^*; p) = 0$ and $U \geq (\alpha - (1+\alpha)f + \eta)c_L + \delta$, we obtain

$$P(R_P = (\alpha - (1+\alpha)f + \eta)c_L) = \lim_{R \to (\alpha - (1+\alpha)f + \eta)c_L^-} G_P^*(R) - G_P^*(U) > 0,$$

thus implying $(\alpha - (1+\alpha)f + \eta)c_L \in \mathcal{R}_P^*$ and that the platform offers rate $(\alpha - (1+\alpha)f + \eta)c_L$ with positive probability.

Because of this latest result, $G_P^*(U) < \lim_{R \to (\alpha - (1+\alpha)f + \eta)c_L^-} G_P^*(R)$, thus implying $L_B((\alpha - (1+\alpha)f + \eta)c_L, 1, G_P^*; p) < \lim_{R \to (\alpha - (1+\alpha)f + \eta)c_L^-} L_B(R, 1, G_P^*; p) = 0$. Hence, $(\alpha - (1+\alpha)f + \eta)c_L \notin \mathcal{R}_B^*$. Therefore, $G_B^*((\alpha - (1+\alpha)f + \eta)c_L) = G_B^*(U)$.

Let R^U be such that

$$m_B^* p G_B^*((\alpha - (1+\alpha)f + \eta)c_L)(R^U - \bar{R}) + (1 - m_B^*)[pR^U + (1-p)(\eta - f)c_L - \bar{R}] + [p(1+\alpha)c_H + (1-p)c_L]f \\ = l_P^0((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p),$$

from which we obtain

$$R^U := (\alpha - (1+\alpha)f + \eta)c_L + \frac{(1-p)\alpha c_L[(\alpha - (1+\alpha)f + \eta)c_L - \bar{R}]}{p(\alpha - (1+\alpha)f + \eta)c_H - (1-p)\alpha c_L - p\bar{R}} \geq (\alpha - (1+\alpha)f + \eta)c_L$$

after substituting for m_B^*. We thus set $U := \min\{R^U, (1-f)\alpha c_H\}$.

If $R^U \in ((\alpha - (1+\alpha)f + \eta)c_L, (1-f)\alpha c_H)$, then $U = R^U$, and Lemma 13 implies $[U, (1-f)\alpha c_H)$ is a set of best responses for lenders. From $l_P^1(R, m_B^*, G_B^*; p) = l_P^1((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for $R \in [U, (1-f)\alpha c_H)$, we obtain the expression for G_B^* in (29).

$$G_B^*(R) = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{p(\alpha - (1+\alpha)f + \eta)c_H - pR}{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R_D/p}$$

$$\text{for } R \in [U, (1-f)\alpha c_H]. \quad (29)$$

Note that $\lim_{R \to (1-f)\alpha c_H^-} G_B^*(R) > 0$, hence $(1-f)\alpha c_H \in \mathcal{R}_B^*$. From $L_B(R, 1, G_P^*; p) = 0$ for $[R_D, (1-f)\alpha c_H]$ we obtain G_P^* same as in (27) for $R \in [U, (1-f)\alpha c_H]$.

If $R^U \geq (1-f)\alpha c_H$, then $U = (1-f)\alpha c_H$. Banks offer rate $(1-f)\alpha c_H$ with probability $G_B^*((\alpha - (1+\alpha)f + \eta)c_L)$ using the expression for $G_B^*(R)$ in (26). From $L_B((1-f)\alpha c_H, 1, G_P^*; p) = 0$, we obtain $P(R_P = (\alpha - (1+\alpha)f + \eta)c_H) = G_P^*(U)$ as given in (28). In particular, the platform offers rates in $\mathcal{R}_P^* = [R_D/p, (\alpha - (1+\alpha)f + \eta)c_L] \cup \{(\alpha - (1+\alpha)f + \eta)c_H\}$.

To summarize,

$$G_B^*(R) = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R}{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R_D/p}$$

$$\text{for } R \in [R_D/p, T] \quad (30)$$

and, if $U < (1-f)\alpha c_H$,

$$G_B^*(R) = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{p(\alpha - (1+\alpha)f + \eta)c_H - pR}{p(\alpha - (1+\alpha)f + \eta)c_H + (1-p)(\eta - (1+\alpha)f)c_L - R_D/p}$$

$$\text{for } R \in [U, (1-f)\alpha c_H] \quad (31)$$

□

B.10 Proof of Proposition 3

By Lemmas 5 and 6, we have, $m_B^* \in (0,1)$, $m_P^* = 1$ and $\max \mathcal{R}_P^* = (\alpha - (1+\alpha)f + \eta)c_H$.

Let $V' := \min \mathcal{R}_B^*$. Note that such a V' exists because $\sup \mathcal{R}_B^* = (1-f)\alpha c_H > (\alpha - (1+\alpha)f + \eta)c_L$ and because of a reasoning analogous to that in Lemma 9. Note also that $V' \geq R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$. By Lemmas 8 an 13, if $V' < (1-f)\alpha c_H$, $[V', (1-f)\alpha c_H)$ is a set of best responses for lenders. Because $l_P^0((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p) > \lim_{R \to (\alpha - (1+\alpha)f + \eta)c_L^+} l_P^1(R, m_B^*, G_B^*; p)$, a $\delta > 0$ exists such that $V' \geq (\alpha - (1+\alpha)f + \eta)c_L + \delta$. The same result holds immediately if $V' = (1-f)\alpha c_H$.

Because $L_B(V', 1, G_P^*; p) = 0$ and because $l_P^1(R, m_B^*, G_B^*; p) < l_P^1(V', m_B^*, G_B^*; p)$ for all

$R \in ((\alpha - (1+\alpha)f + \eta)c_L, V')$, we have

$$P(R_P = (\alpha - (1+\alpha)f + \eta)c_L) = \frac{V' - R_D/p}{V' - R_D}. \tag{32}$$

In particular, if $V' > R_D/p$, we must have $P(R_P = (\alpha - (1+\alpha)f + \eta)c_L) > 0$ and hence, $(\alpha - (1+\alpha)f + \eta)c_L \in \mathcal{R}_P^*$.

Because $\max \mathcal{R}_P^* = (\alpha - (1+\alpha)f + \eta)c_H$, we must have $L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p) \geq L_P(\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p)$, which implies

$$m_B^* \leq \frac{p(\alpha - (1+\alpha)f + \eta)(c_H - c_L) - (1-p)\alpha c_L}{p(\alpha - (1+\alpha)f + \eta)c_H - (1-p)\alpha c_L - p\bar{R}}.$$

If $V' > R_D/p$, this expression holds as an equality.

Moreover, from $L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p) \geq L_P(V', m_B^*, G_B^*; p)$, we obtain

$$m_B^* \leq \tilde{m}_B(V') := \frac{(\alpha - (1+\alpha)f + \eta)c_H - V'}{(\alpha - (1+\alpha)f + \eta)c_H - \bar{R}}.$$

By Lemma 13, if $V' < (1-f)\alpha c_H$, this expression holds as an equality.

Let R^V be defined so that

$$\tilde{m}_B(R^V) = \frac{p(\alpha - (1+\alpha)f + \eta)(c_H - c_L) - (1-p)\alpha c_L}{p(\alpha - (1+\alpha)f + \eta)c_H - (1-p)\alpha c_L - p\bar{R}},$$

which implies

$$R^V = (\alpha - (1+\alpha)f + \eta)c_L \frac{(\alpha - (1+\alpha)f + \eta)c_H - \bar{R} - \frac{1-p}{p}\alpha c_L \frac{\bar{R}}{(\alpha - (1+\alpha)f + \eta)c_L}}{(\alpha - (1+\alpha)f + \eta)c_H - \bar{R} - \frac{1-p}{p}\alpha c_L} > (\alpha - (1+\alpha)f + \eta)c_L.$$

The rate V' is thus determined as $V' := \min\{(1-f)\alpha c_H, \max\{R_D/p, R^V\}\}$.

If $V' = R_D/p$, then $\min \mathcal{R}_P^* = \min \mathcal{R}_B^* = R_D/p$ and the equilibrium is as described in Proposition 1.

If $V' \in (R_D/p, (1-f)\alpha c_H)$, then by Lemma 13, all rates in $[V', (1-f)\alpha c_H)$ are best responses for the lenders. Moreover, the platform offer rate $(\alpha - (1+\alpha)f + \eta)c_L$ with positive probability given by (32). In particular,

$$P(R_P = (\alpha - (1+\alpha)f + \eta)c_L) = 1 - P(R_P > (\alpha - (1+\alpha)f + \eta)c_L) = \frac{(1-p)R_D/p}{V' - R_D},$$

For ease of exposition, define $V \equiv V'$ in this case. From $L_P((\alpha - (1+\alpha)f +$

$\eta)c_L, m_B^*, G_B^*; p) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ we obtain m_B^* as

$$m_B^* = \frac{p(\alpha - (1+\alpha)f + \eta)(c_H - c_L) - (1-p)\alpha c_L}{p(\alpha - (1+\alpha)f + \eta)c_H - (1-p)\alpha c_L - p\bar{R}} \in (0,1) \tag{33}$$

From $L_P(R, m_B^*, G_B^*; p) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for $R \in [V, (1-f)\alpha c_H)$ we obtain the expression for G_B^*

$$G_B^*(R) = \frac{p(\alpha - (1+\alpha)f + \eta)c_L - p\bar{R}}{p(\alpha - (1+\alpha)f + \eta)(c_H - c_L) - (1-p)\alpha c_L} \frac{(\alpha - (1+\alpha)f + \eta)c_H - R}{R - \bar{R}} \quad \text{for } R \in [V, (1-f)\alpha c_H]. \tag{34}$$

This also implies $P(R_B = (1-f)\alpha c_H) > 0$ and, hence, $(1-f)\alpha c_H \in \mathcal{R}_B^*$. From $L_B(R, 1, G_B^*; p) = 0$ for $R \in [V, (1-f)\alpha c_H]$ we instead obtain G_P^* is given by

$$G_P^*(R) = \frac{(1-p)R_D/p}{R - R_D}$$

Hence, to summarize

$$G_P^*(R) = \begin{cases} \frac{(1-p)R_D/p}{V - R_D} & \text{if } R = (\alpha - (1+\alpha)f + \eta)c_L \\ \frac{(1-p)R_D/p}{R - R_D} & \text{if } R \in [V, (1-f)\alpha c_H]. \end{cases} \tag{35}$$

Finally, if $V = (1-f)\alpha c_H$, the platform offers only rates $(\alpha - (1+\alpha)f + \eta)c_L$ and $(\alpha - (1+\alpha)f + \eta)c_H$, with probabilities given by (35) after we use $V = (1-f)\alpha c_H$. From $L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^*, G_B^*; p) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ we again obtain m_B^* is as in (33), but now banks lend at rate $(1-f)\alpha c_H$ with probability 1. □

B.11 Proof of Proposition 4

To begin with, we observe that, in case C, $R_D/p \geq \bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$. Next, by Lemmas 5 and 6, the platform is indifferent between lending at rate R_D/p and not lending. Therefore, $L_P(R_D/p, m_B^*, G_B^*; p) = m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$ from which we obtain

$$m_B^* = \frac{\bar{R} - R_D - (1-p)(\eta - f)c_L - [p(1+\alpha)c_H + (1-p)c_L]f}{(1-p)[\bar{R} - (\eta - f)c_L] - [p(1+\alpha)c_H + (1-p)c_L]f} \in (0,1) \tag{36}$$

Next, by Lemma 10, $\min \mathcal{R}_B^* = R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$. Furthermore, Lemma 5 implies $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$. Therefore, by Lemma 13, all rates in $[R_D, (1-f)\alpha c_H)$ are best responses for both the platform and banks.

Because $[R_D/p, (1-f)\alpha c_H) \subseteq \mathcal{R}_P^*$, we have that

$$L_P(R, m_B^*, G_B^*; p) = m_B^*[p(1+\alpha)c_H + (1-p)c_L]f \quad \text{for all } R \in [R_D/p, (1-f)\alpha c_H).$$

We therefore solve for $G_B^*(R)$

$$G_B^*(R) = -\frac{1-m_B^*}{m_B^*}\frac{pR + (1-p)(\eta - f)c_L - \bar{R} + [p(1+\alpha)c_H + (1-p)c_L]f}{p(R-\bar{R})}$$

for any $R \in [R_D/p, (1-f)\alpha c_H)$, after substituting for m_B^*, we obtain

$$G_B^*(R) = \frac{R_D/p - \bar{R}}{R - \bar{R}}\frac{\bar{R} - pR - (1-p)(\eta - f)c_L - [p(1+\alpha)c_H + (1-p)c_L]f}{\bar{R} - R_D - (1-p)(\eta - f)c_L - [p(1+\alpha)c_H + (1-p)c_L]f} \quad \forall R \in \mathcal{R}_B^*. \tag{37}$$

Because $G_B^*(\cdot)$ is left-continuous, $G_B^*((1-f)\alpha c_H) = \lim_{\varepsilon \to 0^+} G_B^*((1-f)\alpha c_H - \varepsilon) > 0$. Therefore, $(1-f)\alpha c_H \in \mathcal{R}_B^*$ and, in particular, $\mathcal{R}_B^* = [R_D/p, (1-f)\alpha c_H]$.

Using the left-continuity of $G_B^*(\cdot)$ again, we obtain

$$L_P((1-f)\alpha c_H, m_B^*, G_B^*; p) = \lim_{R \to (1-f)\alpha c_H^-} L_P(R, m_B^*, G_B^*; p) = m_B^*[p(1+\alpha)c_H + (1-p)c_L]f.$$

Therefore, $\mathcal{R}_P^* = [R_D/p, (1-f)\alpha c_H]$.

To derive the platform's strategy, we first consider $p(\alpha+\eta)c_H + (1-p)\eta c_L < \bar{R}$. In this case, $(\alpha - (1+\alpha)f + \eta)c_H \notin \mathcal{R}_P^*$ because

$$\begin{aligned} &L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p) \\ &\quad = (1-m_B^*)[p(\alpha+\eta)c_H + (1-p)\eta c_L - \bar{R}] + m_B^*[p(1+\alpha)c_H + (1-p)c_L]f \\ &\quad < m_B^*[p(1+\alpha)c_H + (1-p)c_L]f. \end{aligned}$$

Therefore, $G_P^*((1-f)\alpha c_H) = 0$. Using this result in equation 12 for $R = (1-f)\alpha c_H \in \mathcal{R}_B^*$, we obtain

$$m_P^* = 1 - \frac{(1-p)R_D}{p[(1-f)\alpha c_H - R_D]},$$

after some manipulation, we get

$$m_P^* = \frac{(1-f)\alpha c_H - R_D/p}{(1-f)\alpha c_H - R_D} \in (0,1) \tag{38}$$

Moreover, using equation 12 again for all $R \in \mathcal{R}_B^* = [R_D/p, (1-f)\alpha c_H]$, we have

$$G_P^*(R) = 1 - \frac{R - R_D/p}{m_P^*(R - R_D)},$$

after substituting for m_P^* and rearranging, we get

$$G_P^*(R) = \frac{(1-p)R_D}{p(1-f)\alpha c_H - R_D} \frac{(1-f)\alpha c_H - R}{R - R_D} \quad \forall R \in \mathcal{R}_P^*. \tag{39}$$

Next, we consider $p(\alpha+\eta)c_H + (1-p)\eta c_L = \bar{R}$. Now, we cannot conclude $(\alpha - (1+\alpha)f + \eta)c_H \notin \mathcal{R}_P^*$ because $L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^*, G_B^*; p) = m_B^*[p(1+\alpha)c_H + (1-p)c_L]f$. Therefore, let $P(R_P = (\alpha - (1+\alpha)f + \eta)c_H) = G_P^*((1-f)\alpha c_H) = Q \in \left[0, \frac{(1-p)R_D/p}{(1-f)\alpha c_H - R_D}\right]$. Using equation 12 for $R = (1-f)\alpha c_H \in \mathcal{R}_B^*$, we get

$$m_P^* = \frac{(1-f)\alpha c_H - R_D/p}{(1-Q)[(1-f)\alpha c_H - R_D]} \in (0,1] \tag{40}$$

Because $Q \in \left[0, \frac{(1-p)R_D/p}{(1-f)\alpha c_H - R_D}\right]$, $m_P^* \in [0,1]$. We then use equation 12 for all $R \in \mathcal{R}_B^* = [R_D/p, (1-f)\alpha c_H]$, from which we obtain the following after substituting for the value of m_P^*

$$G_P^*(R) = \begin{cases} \frac{(1-p)R_D[(1-f)\alpha c_H - R] + Q[p(1-f)\alpha c_H - R_D](pR - R_D)}{(R-R_D)[p(1-f)\alpha c_H - R_D]} & \text{if } R \in [R_D/p, (1-f)\alpha c_H) \\ Q & \text{if } R \in [(1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H). \end{cases} \tag{41}$$

□

B.12 Proof of Corollary 1

The proof for parts 1, 2, 3, and 5 is included in the discussion that precedes Corollary 1 in section 3.5. We, therefore, prove part 5 of the corollary.

If parameters satisfy case C, $m_P^* = 1$ and $L_P(R, m_B^*, G_B^*; p) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p)$ for all $R \in [R_D/p, (1-f)\alpha c_H]$. Hence, the function $G_B^*(\cdot)$ can be written as $G_B^*(R) = \frac{1-m_B^*}{m_B^*}\frac{A(R)}{R-\bar{R}}$, for some positive function $A(\cdot)$. Therefore, the welfare change can be written as

$$\Delta W(\bar{R}) = -(1-m_B^*)w(\bar{R}).$$

where

$$w(\bar{R}) := (\bar{R}-R_D)\int_{R_D/p}^{(\alpha-(1+\alpha)f+\eta)c_H}\left(\frac{A(R)}{R-\bar{R}}+1\right)dF_P^*(R)-(1-p)F_P^*((\alpha-(1+\alpha)f+\eta)c_L)c_L$$

Given the parameter values considered in case A2, $\bar{R}$ may range from R_D to R_D/p. Note that $w(R_D) > 0$ because $F_P^*((\alpha-(1+\alpha)f+\eta)c_L) > 0$ in case A2. Moreover,

$$w(R_D/p) = \frac{1}{p}\Bigg[(1-p)R_D\int_{R_D/p}^{(\alpha-(1+\alpha)f+\eta)c_H}\left(\frac{A(R)}{R-R_D/p}+1\right)dF_P^*(R) \\ -(1-p)pF_P^*((\alpha-(1+\alpha)f+\eta)c_L)c_L\Bigg] > 0$$

where the inequality follows because $R_D > c_L$ by Assumption 1 and $\int_{R_D/p}^{(\alpha-(1+\alpha)f+\eta)c_H}\left(\frac{A(R)}{R-R_D/p}+1\right)dF_P^*(R) > 1 > pF_P^*((\alpha-(1+\alpha)f+\eta)c_L)$.

The function $w(\cdot)$ is also continuous and strictly increasing, with

$$w'(\bar{R}) = \int_{R_D/p}^{(\alpha-(1+\alpha)f+\eta)c_H}\left(\frac{A(R)(R-R_D)}{(R-\bar{R})^2}+1\right)dF_P^*(R) > 0.$$

By the intermediate value theorem and because $w(\cdot)$ is strictly increasing, there exists $\bar{R}^W \in (R_D, R_D/p)$ such that $\Delta W(\bar{R}) > 0$ if $\bar{R} \in (R_D, \bar{R}^W)$, $\Delta W(\bar{R}) = 0$ if $\bar{R} = \bar{R}^W$, and $\Delta W(\bar{R}) < 0$ if $\bar{R} \in (\bar{R}^W, R_D/p)$. □

B.13 PROOF OF COROLLARY 2

The proof for parts 1 and 2 is included in the discussion that precedes Corollary 2 in section 3.5. We, therefore, prove part 3 of the corollary. We, therefore, focus on merchants satisfying $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. We show that both good and bad borrowers are unambiguously worse off when the platform enters the credit market.

We start by considering bad borrowers. When banks are the only lenders, a bad borrower obtains profits equal to $(1-f)c_L$ because she produces for one period and defaults on the loan. If the bad merchant borrows from the platform, she obtains a payoff which can be written as $(1-f)c_L - \Delta$, where $\Delta \in (0, (1-f)c_L)$ is an equilibrium quantity. That is, the bad merchant earns lower profits when borrowing from the platform than when borrowing from banks. Specifically, $\Delta = (\eta - f)c_L$ if the bad borrower chooses to default; and $\Delta = R_P - (1-f)\alpha c_L > 0$ if the bad merchant does not default, where the inequality follows from Lemma 3. Therefore, when the platform competes with banks, bad borrowers obtain a payoff equal to

$$m_B^*(1-f)c_L + (1-m_B^*)m_P^*[(1-f)c_L - \Delta] < (1-f)c_L$$

where the strict inequality follow because $\Delta > 0$ and $m_B^* \in (0,1)$.

Next, we show the good borrower is also unambiguously worse off. When banks are the only lenders, a good borrower earns profits $(1+\alpha)(1-f)c_H - R_D/p$. When the platform competes with banks, the good borrower's profits are given by $U(m_B^*, m_P^*, F_B^*, F_P^*)$, where the function U is defined in (9). We write it more succinctly as

$$[1-(1-m_B^*)(1-m_P^*)](1+\alpha)(1-f)c_H - \hat{R}_C$$

where

$$\begin{aligned}\hat{R}_C :=& m_B^*(1-m_P^*)\int_0^{(1-f)\alpha c_H} R\, dF_B^*(R) + (1-m_B^*)m_P^*\int_0^{(\alpha-(1+\alpha)f+\eta)c_H} R\, dF_P^*(R) \\ &+ m_B^* m_P^* \int_0^{(\alpha-(1+\alpha)f+\eta)c_H}\int_0^{(1-f)\alpha c_H} \min\{R,R'\}\, dF_B^*(R)\, dF_P^*(R')\end{aligned}$$

represents the expected cost of borrowing.

In cases A, B1, and C, lenders offer rates above R_D/p with positive probability; that is, $F_B^*(R_D/p) < 1$ and $F_P^*(R_D/p) < 1$. As a result $\hat{R}_C > R_D/p$. Moreover, in case C, we also have $[1-(1-m_B*^)\,(1-m_P^*)] < 1$. Hence, in cases A, B1, and C,

$$[1-(1-m_B^*)(1-m_P^*)](1+\alpha)(1-f)c_H - \hat{R}_C < (1+\alpha)(1-f)c_H - R_D/p$$

In case B2, the merchant is never rationed, that is $[1-(1-m_B^*)(1-m_P^*)] = 1$, and profits decline only if the expected cost of borrowing increases. If (13) holds, then the equilibrium is similar to case A and, as just discussed, the good merchant's profits decline. If (13) does not hold, the platform offers rates below R_D/p with positive probability. Specifically, it offers rate $(\alpha-(1+\alpha)f+\eta)c_L < R_D/p$ with probability equal to (14). We show that this probability is insufficiently low to compensate for the higher rates lenders offer in equilibrium. Specifically, note $F_B^*(R_D/p) = 0$ and banks offer rates $R_B \geq V > R_D/p$, whereas the platform either offers rate $(\alpha-(1+\alpha)f+\eta)c_L < R_D/p$ or it offers rates $R_P \geq V > R_D/p$. Therefore,

$$\hat{R}_C > m_B^*(1-m_P^*)V + (1-m_B^*)m_P^*\left[\left(1-\frac{(1-p)R_D/p}{V-R_D}\right)(\alpha-(1+\alpha)f+\eta)c_L + \frac{(1-p)R_D/p}{V-R_D}V\right]$$

$$+ m_B^* m_P^* \left[\left(1 - \frac{(1-p)R_D/p}{V - R_D}\right)(\alpha - (1+\alpha)f + \eta)c_L + \frac{(1-p)R_D/p}{V-R_D}V\right]$$

which implies

$$\hat{R}_C > \left(1 - \frac{(1-p)R_D/p}{V - R_D}\right)(\alpha - (1+\alpha)f + \eta)c_L + \frac{(1-p)R_D/p}{V-R_D}V$$

because $V > (\alpha - (1+\alpha)f + \eta)c_L$.

To show the good borrower's welfare declines also in this case, we need to show $\hat{R}_C > R_D/p$. To show this result, note

$$\begin{aligned}
&\left(1 - \frac{(1-p)R_D/p}{V - R_D}\right)(\alpha - (1+\alpha)f + \eta)c_L + \frac{(1-p)R_D/p}{V-R_D}V \\
&= (\alpha - (1+\alpha)f + \eta)c_L - R_D/p - \frac{R_D/p - R_D}{V - R_D}(\alpha - (1+\alpha)f + \eta)c_L + \frac{R_D/p - R_D}{V - R_D}V + R_D/p \\
&= \frac{[(\alpha - (1+\alpha)f + \eta)c_L - R_D](V - R_D/p)}{V - R_D} + R_D/p.
\end{aligned}$$

In case B2 we have $(\alpha - (1+\alpha)f + \eta)c_L \geq \bar{R}$. When (13) does not hold, the inequality must be strict. Moreover, from Assumptions 1, we have $\bar{R} \geq R_D$. As a result, even in case B2 when (13) does not hold, we have $\hat{R}_C > R_D/p$ and, hence, the good merchant is worse off when the platform enters the credit market. □

C COMPETITION WITH INFORMATION ACQUISITION

We solve for the equilibrium in the credit market when the platform has the option to acquire information with the same technology described in section 4.1.

C.1 EQUILIBRIUM WITH INFORMATION ACQUISITION

Similar to Section 3, each bank announces a lending mechanism for which it lends with probability $m_B = E[d_B] \in [0,1]$ and offers rates according to the distribution $F_B(R) := P(R_B \leq R)$. The merchant chooses one bank to apply for credit. We maintain the assumption the merchant faces large non-pecuniary costs that prevent him from applying to multiple banks.

After receiving an application, the platform privately acquires the signal with probability a. A platform of type $i \in \{u, h, l\}$ chooses a lending mechanism whereby it lends with probability $m_{P,i} \in [0,1]$ and offers rates according to a distribution $F_{P,i} := P(R_{P,i} \leq$

0) for $i \in \{u, h, l\}$. Like in section 3, we define

$$G_B(R) := P(R_B \geq R) = 1 - \lim_{\varepsilon \to 0^+} F_B(R - \varepsilon)$$
$$G_{P,i}(R) := P(R_{P,i} > R) = 1 - F_{P,i}(R) \quad \text{for } i \in \{u, h, l\}.$$

The merchant simultaneously receives credit decisions from the bank and the platform. If both extend credit, a good merchant selects the offer with the lowest rate. We maintain the convention that, if rates are identical, the good merchant borrows from the platform. A bad merchant always selects the bank's offer if both lenders offer credit. The good merchant chooses the lender offering the lowest rate and her expected utility is

$$U^I(a, m_B, m_{P,u}, m_{P,h}, m_{P,l}, F_B, F_{P,u}, F_{P,h}, F_{P,l}) :=$$
$$(1-a)U(m_B, m_{P,u}, F_B, F_{P,u}) + a[\psi U(m_B, m_{P,h}, F_B, F_{P,h}) + (1-\psi)U(m_B, m_{P,h}, F_B, F_{P,h})],$$

which is equal to $U(m_B, m_P^A, F_B, F_P^A)$, where U is defined as in equation (9) and

$$m_P^A := (1-a)m_{P,u} + a[\psi m_{P,h} + (1-\psi)m_{P,u}]$$
$$F_P^A(R) := \{(1-a)m_{P,u}F_{P,u}(R) + a[\psi m_{P,h}F_{P,h}(R) + (1-\psi)m_{P,u}F_{P,l}(R)]\}/m_P^A$$

Given posterior p^i, the platform's profits conditional on lending at rate R are still given by the function $L_P(R, m_B, G_B; p^i)$ defined in equation (10) in Section 3. In fact, conditional on lending at a given rate R, profits vary across platform types only because different types possess different beliefs.

Conditional on lending at rate R, a bank's profits now depend on the distribution of lending decisions of the three types of platform and on the probability the platform acquires information, a. If a bank offers a loan at rate R, its expected profits are thus

$$\begin{aligned} L_B^I(R, a, m_{P,u}, m_{P,h}, G_{P,u}, G_{P,h}; p) :=& (1-a)p\,\{m_{P,u}G_{P,u}(R)(R-R_D) + (1-m_{P,u})(R-R_D)\} \\ &+ a\psi p^h\,\{m_{P,h}G_{P,h}(R)(R-R_D) + (1-m_{P,h})(R-R_D)\} \\ &- (1-p)R_D. \end{aligned}$$

With probability $1-a$, the platform does not acquire information, and if the merchant is good, she chooses the bank only if $R < R_P$ or if the platform does not lend, that is, $d_P = 0$. With probability a, the platform acquires information and, with probability ψ, it observes a high signal. A good merchant will, once again, choose the bank only if $R < R_P$ or $d_P = 0$. Regardless of whether the platform acquires information or not, a bad merchant always borrows from the bank and never repays. The platform's profits are also equal to $L_B(R, m_P^a, G_P^a; p)$, where L_B is defined in equation (11), $m_P^a := (1-a)m_{P,u} + am_{P,h}$, and $G_P^a(R) := [(1-a)m_{P,u}G_{P,u}(R) + am_{P,h}G_{P,h}(R)]/m_P^a$.

In this framework, we define an equilibrium when the platform can acquire information at cost c.

DEFINITION 2 (Equilibrium with Information Acquisition). *An equilibrium with information acquisition is an information-acquisition probability $a^{I*} \in [0,1]$, lending probabilities for the three platforms types and for banks, $(m_{P,u}^{I*}, m_{P,h}^{I*}, m_{P,l}^{I*}, m_B^{I*}) \in [0,1]^4$, distributions of the rates offered by the three types of the platform and by banks, $(F_{P,u}^{I*}, F_{P,h}^{I*}, F_{P,l}^{I*}, F_B^{I*}) \in \Delta([0, 1-f])^4$ with supports $\mathcal{R}_{P,u}^{I*}$, $\mathcal{R}_{P,h}^{I*}$, $\mathcal{R}_{P,l}^{I*}$, and $\mathcal{R}_B^{I*}$ and with $G_B^{I*}(R) := 1 - \lim_{\varepsilon\to 0^+} F_B^{I*}(R-\varepsilon)$, $G_{P,i}^{I*}(R) := 1 - F_{P,i}^{I*}(R)$, and*

$$\begin{aligned}
m_P^{a*} &:= (1-a^{I*})m_{P,u}^{I*} + a^{I*}m_{P,h}^{I*} \\
G_P^{a*}(R) &:= [(1-a^{I*})m_{P,u}^{I*}G_{P,u}^{I*}(R) + a^{I*}m_{P,h}^{I*}G_{P,h}^{I*}(R)]/m_P^{a*} \\
m_P^{A*} &:= (1-a^{I*})m_{P,u}^{I*} + a^{I*}[\psi m_{P,h}^{I*} + (1-\psi)m_{P,l}^{I*}] \\
F_P^{A*}(R) &:= \{(1-a^{I*})m_{P,u}^{I*}F_{P,u}^{I*}(R) + a^{I*}[\psi m_{P,h}^{I*}F_{P,h}^{I*}(R) + (1-\psi)m_{P,l}^{I*}F_{P,l}^{I*}(R)]\}/m_P^{A*}
\end{aligned}$$

such that:

1. *The platform and competitive banks set rates optimally:*

$$\begin{aligned}
\mathcal{R}_{P,i}^{*I} &= \arg\max_{R\le(\alpha-(1+\alpha)f+\eta)c_H} L_P(R, m_B^{I*}, G_B^{I*}; p^i) \quad \textit{for } i \in \{u,h,l\} \\
\mathcal{R}_B^{I*} &= \arg\max_{R\in[R_D,(1-f)\alpha c_H]} L_B(R, m_P^{a*}, G_P^{a*}; p) \\
&\qquad\qquad \textit{s.t. } L_B(R, m_P^{a*}, G_P^{a*}; p) \le 0.
\end{aligned}$$

2. *Lenders extend credit optimally:*

$$m_{P,i}^{I*} \in \arg\max_{m_P\in[0,1]} \left\{m_P L_P(R, m_B^{I*}, G_B^{I*}; p^i) + (1-m_P)m_B^{I*}[p^i(1+\alpha)c_H + (1-p^i)c_L]f\right\} \quad \forall R \in \mathcal{R}_P^*$$

for $i \in \{u,h,l\}$, and

$$m_B^{I*} \in \arg\max_{m_B\in[0,1]} m_B L_B(R, m_P^{a*}, G_P^{a*}; p) \quad \forall R \in \mathcal{R}_B^*.$$

3. *The platform acquires information optimally:*

$$\begin{aligned}
a^{I*} \in \arg\max_{a\in[0,1]} \Big\{ & a[\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c] \\
& + (1-a)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u)\Big\},
\end{aligned} \tag{42}$$

where

$$L_P^{I*}(m_B^{I*}, G_B^{I*}; p^i) := m_{P,i}^{I*} L_P(R, m_B^{I*}, G_B^{I*}; p^i) + (1 - m_{P,i}^{I*}) m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$$
$\forall R \in \mathcal{R}^{P,i}, i \in \{u, h, l\}$.

4. *Banks are competitive in the lending market; that is, no lending mechanism* (F_B, m_B) *exists such that* $\int_0^{(1-f)\alpha c_H} L_B(R, m_P^{a*}, G_P^{a*}; p)\, dF_B(R) > 0$ *and* $U(m_B, m_P^{A*}, F_B, F_P^{A*}) > U(m_B^{I*}, m_P^{A*}, F_B^{I*}, F_P^{A*})$,.

Similar to Section 3, competitive banks earn zero profits in equilibrium; that is,

$$m_B^{I*} L_B^I(R, a^{I*}, m_{P,u}^{I*}, m_{P,h}^{I*}, G_{P,u}^{I*}, G_{P,h}^{I*}; p) = 0 \quad \text{for any } R \in \mathcal{R}_B^{I*}.$$

Before solving for the equilibrium fully, we characterize some general properties in a series of lemmas. We first show that, if the platform acquires information in equilibrium, it lends with probability one after observing a high signal. All the proofs are in Appendix D.

LEMMA 14 (Lending with Optimistic Beliefs)**.** *If* $a^{I*} \in (0, 1]$*, then* $m_{P,h}^{I*} = 1$*. That is, if the platform acquires information with positive probability, then it lends after observing a high signal.*

Intuitively, if the platform weakly prefers to abstain from lending after observing good news about the borrower, it would strictly prefer to deny credit with no or worse news. Because not lending is the platform's optimal strategy regardless of information, costly information acquisition is sub-optimal. We, therefore, rule out equilibria where the platform denies credit after acquiring a high signal. Thus, hereafter, we consider $m_{P,h}^{I*} = 1$.

To characterize the equilibrium, we first describe the platform's strategy when it is a monopolistic lender, i.e. when banks do not lend and $m_B^{I*} = 0$. The optimal strategy of the platform depends on two considerations analogous to those in Lemma 2 of Section 2.1.1. First, if

$$\max\{p^i(\alpha + \eta)c_H + (1 - p^i)\eta c_L, (\alpha + \eta)c_L + (1 + \alpha)p^i(c_H - c_L)f\} - \bar{R} \geq 0 \qquad (43)$$

the platform earns profits by lending when its beliefs are equal to p^i. If this inequality if violated, the platform prefers not to lend to a merchant whose perceived quality is p^i. Second, if

$$p^i > \frac{\alpha c_L}{(\alpha - (1 + \alpha)f + \eta)(c_H - c_L) + \alpha c_L}, \qquad (44)$$

the platform's unique profit-maximizing rate is $(\alpha - (1 + \alpha)f + \eta)c_H$; otherwise, the platform offers a rate equal to $(\alpha - (1 + \alpha)f + \eta)c_L$, with indifference between the two rates in case $p^i = \frac{\alpha c_L}{(\alpha-(1+\alpha)f+\eta)(c_H-c_L)+\alpha c_L}$. The following lemma characterizes the equilibrium when the platform is a monopolistic lender

LEMMA 15. *In any equilibrium with $m_B^* = 0$, the following holds.*

1. *If $\max\{p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L, (\alpha+\eta)c_L + (1+\alpha)p^h(c_H - c_L)f\} - \bar{R} < 0$ the platform does not acquire information and does not lend to the merchant.*

2. *If $\max\{p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L, (\alpha+\eta)c_L + (1+\alpha)p^h(c_H - c_L)f\} - \bar{R} \geq 0$ but $(\alpha + \eta)c_L - \bar{R} < 0$ the platform acquires information with probability 1 and does not lend after observing a low signal. After observing a high signal, it lends at rate $(\alpha-(1+\alpha)f+\eta)c_H$ if* (44) *holds for $i = h$, otherwise it lends at rate $(\alpha-(1+\alpha)f+\eta)c_L$.*

3. *If $\max\{p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L, (\alpha+\eta)c_L + (1+\alpha)p^h(c_H - c_L)f\} - \bar{R} \geq 0$, $(\alpha+\eta)c_L - \bar{R} \geq 0$, and* (44) *holds for $i = h$, the platform acquires information with probability 1 and lends regardless of the signal. It lends at rate $(\alpha-(1+\alpha)f+\eta)c_H$ if the signal is high, whereas it lends at rate $(\alpha-(1+\alpha)f+\eta)c_L$ if the signal is low.*

4. *If $\max\{p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L, (\alpha+\eta)c_L + (1+\alpha)p^h(c_H - c_L)f\} - \bar{R} \geq 0$, $(\alpha+\eta)c_L - \bar{R} \geq 0$, and* (44) *does not hold for $i = h$, the platform does not acquire information and lends with probability one at rate $(\alpha-(1+\alpha)f+\eta)c_L$.*

Next, we observe the results in Lemmas 3 and in Section 3 hold also for an equilibrium with information acquisition. The results hold for any p, and thus apply also to an informed platform.

We also obtain a Lemma identical to Lemma 4. We state it below because its proof is different from Lemma 4 because we need to account for the platform's option to acquire information.

LEMMA 16 (Partial Segmentation with Information Acquisition)**.** *If $p < \frac{R_D}{(1-f)\alpha c_H}$, banks do not lend to the merchant, but if* (44) *holds as a weak inequality, the platform lends in the way described in Lemma 15. If $p \geq \frac{R_D}{\bar{R}}$, the merchant borrows exclusively from banks that offer loans with probability 1 at rate $\frac{R_D}{p}$.*

Hence, when $p > \frac{R_D}{\bar{R}}$, banks remain the only lenders because the platform's cost of capital exceeds banks' competitive rate R_D/p. When $p < \frac{R_D}{(1-f)\alpha c_H}$, banks are unwilling to enter the lending market because the merchant's creditworthiness is too low to justify the loan, even if the platform were not competing. Hence, like in 3, the platform is a monopolistic lender when $p < \frac{R_D}{(1-f)\alpha c_H}$.

We also obtain the counterpart of Lemma 5.

LEMMA 17 (Mixed Strategies with Information Acquisition)**.** *If $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, R_D/\bar{R}\right)$ and c is sufficiently small, banks offer loans with probability $m_B^{I*} \in (0,1)$ and the platform acquires information with probability $a^{I*} > 0$ and offers loans so that $(1-a^{I*})m_{P,u}^{I*} + a^{I*}m_{P,h}^{I*} \in (0,1]$.*

Moreover, the uninformed and optimistic platform offer rates ranging between $\min\{\mathcal{R}^*_{P,u}\cup\mathcal{R}^*_{P,h}\} \leq R_D/p$ *and* $\max\{\mathcal{R}^*_{P,u}\cup\mathcal{R}^*_{P,h}\} \geq (1-f)\alpha c_H$*. In particular,* $\min\{\mathcal{R}^*_{P,u}\cup\mathcal{R}^*_{P,h}\}$ *coincides either with* R_D/p *or with* $(\alpha-(1+\alpha)f+\eta)c_L$*. Banks offer rates up to* $\sup\mathcal{R}^{I*}_B = (1-f)\alpha c_H$*.*

Like in section 3, banks always deny credit with positive probability and offer rates up to $(1-f)\alpha c_H$ when they directly compete with the platform of merchants of intermediate credit quality. Moreover, the ex-ante set of rates offered by the platform coincides with the set identified in Lemma 5. However, the uninformed platform and the optimistic platform may offer different rates.

Lemma 17 also indicates the platform still benefits from advantageous selection when competing with banks. In particular, the platform lends with positive probability when $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L < \bar{R}$, but $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, R_D/\bar{R}\right)$. According to Lemma 15 the platform would not lend in this situation when $m^{I*}_B = 0$. Remark 2 thus also apply to this extension of the model.

We also obtain a result similar to those in Lemma 6 about the equilibrium strategy of the platform.

LEMMA 18 (The Platform's Strategy with Information Acquisition)**.** *Consider a merchant characterized by* $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$ *and assume* c *is sufficiently small. If* $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L > \bar{R}$*, the platform acquires information and lends so that* $(1-a^{I*})m^{I*}_{P,u} + a^{I*}m^{I*}_{P,h} = 1$ *and* $\max\mathcal{R}^{I*}_{P,h} = (\alpha-(1+\alpha)f+\eta)c_H$*. If* $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L \leq \bar{R}$*, the platform is indifferent between acquiring information and not lending. Moreover, if* $\bar{R} > (\alpha-(1+\alpha)f+\eta)c_L$*, then* $\min\mathcal{R}^*_{P,u} = \min\mathcal{R}^*_{P,h} = R_D/p > (\alpha-(1+\alpha)f+\eta)c_L$*. If* $\bar{R} \leq (\alpha-(1+\alpha)f+\eta)c_L$ *and* $R_D/p < (\alpha-(1+\alpha)f+\eta)c_L$*,* $\mathcal{R}^*_{P,h} = R_D/p$*.*

We focus on the region where the banks and the platform compete for borrowers; that is, we focus on borrowers with intermediate credit quality $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$. Using results from Lemma 17 and 27, we consider cases analogous to those we had in section 3.

- I.A: $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L > \bar{R} > (\alpha-(1+\alpha)f+\eta)c_L$, and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$;
- I.B: $\bar{R} \leq (\alpha-(1+\alpha)f+\eta)c_L$ and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$
  - I.B1: Like case I.B, but restricted to $p \geq \frac{R_D}{(\alpha-(1+\alpha)f+\eta)c_L}$;
  - I.B2: Like case I.B, but restricted to $p < \frac{R_D}{(\alpha-(1+\alpha)f+\eta)c_L}$;
- I.C: $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L \leq \bar{R}$ and $p \in \left[\frac{R_D}{(1-f)\alpha c_H}, \frac{R_D}{\bar{R}}\right)$.

C.2 Equilibrium in Case I.A

First, we consider case I.A. If $\bar{R} > (\alpha + \eta)c_L$, the platform obtains positive profits only when lending to a good borrower. Hence, after acquiring information, a platform will deny credit if the merchant is revealed to be bad. It will extend credit if the signal is good. For an arbitrarily low cost of information acquisition c, the value of potentially screening borrowers exceeds the information cost. Hence the platform always acquires information.

If instead, $\bar{R} \in ((\alpha - (1+\alpha)f + \eta)c_L, (\alpha + \eta)c_L]$, the platform obtains positive profits even when lending to a bad merchant by setting a rate equal to $(\alpha - (1+\alpha)f + \eta)c_L$. However, because $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, an optimistic platform has no incentive to undercut banks by setting a rate equal to $(\alpha - (1+\alpha)f + \eta)c_L < R_D/p$.

The following proposition characterizes the equilibrium.

Proposition 5. *Consider a merchant with parameters satisfying I.A. There exists $\epsilon > 0$ such that, for any $c \in (0, \epsilon)$, the equilibrium is characterized uniquely as follows.*

1. *Banks lend as described in Proposition 1.*
2. *The platform acquires information with probability $a^{I*} = 1$.*
3. *If $\bar{R} > (\alpha + \eta)c_L$, a pessimistic platform offers loans with probability $m^{I*}_{P,l} = 0$. If $\bar{R} \in ((\alpha - (1+\alpha)f + \eta)c_L, (\alpha + \eta)c_L]$, a pessimistic platform offers loans with probability $m^{I*}_{P,l} = 1$ and offers rate $(\alpha - (1+\alpha)f + \eta)c_L$.*
4. *An optimistic platform lends with probability $m^{I*}_{P,h} = 1$ and offers rates with the same distribution described in equation* (24) *of Proposition 1.*

The banks' lending probability and distribution of rate offers are identical to case A in Section 3. Moreover, the optimistic platform offers interest rates from the same distribution as the uninformed platform in case A of Section 3, when the platform had no option to acquire information. However, when $\bar{R} > (\alpha + \eta)c_L$, the platform lends only with probability $\psi < 1$, because it refuses to lend if the merchant is revealed to be bad.

C.3 Equilibrium in Case I.B

In case I.B, the platform may profitably offer rates equal to or below $(\alpha - (1+\alpha)f + \eta)c_L$ because $(\alpha - (1+\alpha)f + \eta)c_L \geq \bar{R}$. Moreover, the platform can profitably lend after observing a low signal by offering rates equal to $(\alpha - (1+\alpha)f + \eta)c_L$.

In case I.B1, competitive banks do force the platform to offer rates weakly below $(\alpha - (1+\alpha)f + \eta)c_L$. After observing a low signal, the platform thus lends at rate $(\alpha - (1+\alpha)f + \eta)c_L$ to maximize the surplus extracted from a bad merchant when banks do not lend. After observing a high signal, the platform faces a trade-off: either it offers low rates to compete with banks for a borrower of high perceived quality, or it offers high rates to extract more surplus from the borrower. Because information allows the platform to customize interest rates, the platform will acquire information in equilibrium with positive probability. The next proposition characterizes the equilibrium in case I.B1.

PROPOSITION 6. *Assume parameters satisfy case I.B1 and define*

$$T := \min\{(\alpha - (1+\alpha)f + \eta)c_L, (1-f)\alpha c_H\}$$
$$U^c := \min\left\{(\alpha - (1+\alpha)f + \eta)c_L + \frac{(1-p^h)\alpha c_L[(\alpha - (1+\alpha)f + \eta)c_L - \bar{R}]}{p^h(\alpha - (1+\alpha)f + \eta)c_H - (1-p^h)\alpha c_L - p\bar{R}}, (1-f)\alpha c_H\right\}$$

There exists $\epsilon > 0$ such that, for any $c \in (0, \epsilon)$, there exists a unique equilibrium characterized by the following:

1. *Banks extend credit with probability*

$$m_B^{I*} = \frac{p^h(\alpha - (1+\alpha)f + \eta)c_H + (1-p^h)(\eta - (1+\alpha)f)c_L - R_D/p}{p^h(\alpha - (1+\alpha)f + \eta)c_H + (1-p^h)(\eta - (1+\alpha)f)c_L - R_D/p + p^h R_D/p - p^h \bar{R}} \in (0,1). \tag{45}$$

Compared with m_B^* in Proposition 2, we have $m_B^{I*} > m_B^*$. Conditional on making an offer, they choose a rate from the support $\mathcal{R}_B^* = [R_D/p, T) \cup [U^c, (1-f)\alpha c_H]$ so that, if $(1-f)\alpha c_H < (\alpha - (1+\alpha)f + \eta)c_H$,

$$G_B^{I*} = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{p^h(\alpha - (1+\alpha)f + \eta)c_H + (1-p^h)(\eta - (1+\alpha)f)c_L - R}{p^h(\alpha - (1+\alpha)f + \eta)c_H + (1-p^h)(\eta - (1+\alpha)f)c_L - R_D/p} \quad \text{for } R \in [R_D/p, T]. \tag{46}$$

If, instead, $T = (\alpha - (1+\alpha)f + \eta)c_L$, G_B^{I*} coincides with equation (46) above for $R \in [R_D/p, R^c]$, where

$$R^c := (\alpha - (1+\alpha)f + \eta)c_L - \frac{c}{(1-\psi)(1-m_B^{I*})}, \tag{47}$$

whereas for $R \in [R_c, (\alpha - (1+\alpha)f + \eta)c_L]$, G_B^{I*} is given by

$$G_B^{I*}(R) = \frac{R_D/p - \bar{R}}{R - \bar{R}} + \frac{1 - m_B^{I*}}{m_B^{I*}} \frac{\psi R_D/p + (1-\psi)(\alpha - (1+\alpha)f + \eta)c_L - R}{p(R - \bar{R})} - \frac{c}{m_B^{I*} p(R - \bar{R})}. \tag{48}$$

Furthermore,

$$G_B^{I*}(R) = \frac{R_D/p - \bar{R}}{(R - \bar{R})} \frac{p^h(\alpha - (1+\alpha)f + \eta)c_H - p^h R}{p^h(\alpha - (1+\alpha)f + \eta)c_H + (1-p^h)(\eta - (1+\alpha)f)c_L - R_D/p}$$

$$\textit{for } R \in [U^c, (1-f)\alpha c_H]. \quad (49)$$

2. *If* $T = (1-f)\alpha c_H < (\alpha-(1+\alpha)f+\eta)c_L$, *the platform acquires information with probability* $a^{I*} = 1$. *If* $T = (\alpha - (1+\alpha)f + \eta)c_L$, *the platform acquires information with probability*

$$a^{I*} = 1 - \frac{U^c - R^c}{U^c - R^D}\frac{(1-p)R_D/p}{R^c - R_D} \in (0, 1). \quad (50)$$

3. *The pessimistic platform offers loans with probabilities* $m^{I*}_{P,l} = 1$ *at a rate equal to* $(\alpha - (1 + \alpha)f + \eta)c_L$.

4. *An optimistic platform lends with probability* $m^{I*}_{P,h} = 1$. *If* $T = (1-f)\alpha c_H < (\alpha - (1 + \alpha)f + \eta)c_L$, *it offers rates in* $\mathcal{R}^{I*}_{P,h} = [R_D/p, (1-f)\alpha c_H) \cup \{(\alpha - (1+\alpha)f + \eta)c_H\}$ *so that* $P(R_P > R) = G^{I*}_P(R)$, *where*

$$G^*_{P,h}(R) = \frac{(1-p)R_D/p}{R - R_D} \textit{for } R \in [R_D/p, (1-f)\alpha c_H]. \quad (51)$$

If $T = (\alpha - (1 + \alpha)f + \eta)c_L$, *the platform offers rates in* $\mathcal{R}^{I*}_{P,h} = [R_D/p, R^c] \cup [U^c, (1-f)\alpha c_H] \setminus \{(1-f)\alpha c_H\} \cup \{(\alpha - (1+\alpha)f + \eta)c_H\}$ *so that* $P(R_P > R) = G^*_P(R)$, *where*

$$G^*_{P,h}(R) = \begin{cases} \frac{1}{a^{I*}}\frac{(1-p)R_D/p}{R-R_D} & \textit{for } R \in [R_D/p, R^c] \\ \frac{1}{a^{I*}}\frac{(1-p)R_D/p}{R-R_D} & \textit{for } R \in [U^c, (1-f)\alpha c_H]. \end{cases} \quad (52)$$

5. *If* $T = (\alpha-(1+\alpha)f+\eta)c_L$, *the uniformed platform extends credit with probability* $m^{I*}_{P,u} = 1$ *and offers rates in* $\mathcal{R}^{I*}_{P,u} = [R^c, (\alpha - (1 + \alpha)f + \eta)c_L]$, *so that*

$$G^{I*}_{P,u} = \frac{(1-p)R_D/p}{(1-a^{I*})(R-R_D)} - \frac{a^{I*}G^{I*}_{P,h}(U^c)}{1-a^{I*}} \quad \textit{for } R \in [R^c, (\alpha - (1+\alpha)f + \eta)c_L). \quad (53)$$

Competition between banks and the platform forces lenders to offer rates in $[R_D/p, T]$. If $T = (1 - f)\alpha c_H < (\alpha - (1 + \alpha)f + \eta)c_L$, the optimistic and pessimist platform offer different rates and the platform thus acquires information with positive probability. If $T = (\alpha - (1 + \alpha)f + \eta)c_L$, the incentive to customize is limited because, if the platform always acquired information, the optimistic and pessimist platform would share a best response. Hence, in equilibrium, the platform remains uniformed with positive probability and the uninformed platform offers different rates from both the optimistic and pessimistic one.

In case I.B2, the optimal response of a pessimistic platform remains to lend at rate $(\alpha - (1+\alpha)f+\eta)c_L$ to maximize the surplus it extracts from a bad borrower when banks do not lend. Although the platform would like to offer high rates to extract more surplus from the merchant after observing a high signal, competition from banks force the platform to offer rates down to R_D/p, which, if close enough to $((\alpha-(1+\alpha)f+\eta)c_L$, may be dominated by the latter rate. The following proposition describes the equilibrium in this case.

PROPOSITION 7. *Assume parameters satisfy case I.B2. If*

$$R_D/p \geq (\alpha-(1+\alpha)f+\eta)c_L \frac{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p^h}{p^h}\alpha c_L \frac{\bar{R}}{(\alpha-(1+\alpha)f+\eta)c_L}}{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p^h}{p^h}\alpha c_L},$$

the equilibrium is the same as in case I.A and it is described by Proposition 5. Otherwise, define

$$V^c := \min\left\{(1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_L \frac{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p^h}{p^h}\alpha c_L \frac{\bar{R}}{(\alpha-(1+\alpha)f+\eta)c_L}}{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p^h}{p^h}\alpha c_L}\right\}$$

In this case, there exists $\epsilon > 0$ such that, for any $c \in (0, \epsilon)$, there exists an equilibrium characterized as follows:

1. *Banks extend credit with probability*

$$m_B^{I*} = \frac{p^h(\alpha-(1+\alpha)f+\eta)(c_H-c_L) - (1-p^h)\alpha c_L - c/\psi}{p^h(\alpha-(1+\alpha)f+\eta)c_H - (1-p^h)\alpha c_L - p^h\bar{R}} \in (0,1). \tag{54}$$

   Compared with m_B^* in Proposition 3, we have $m_B^{I*} > m_B^*$. Conditional on making an offer, they choose a rate from the support $\mathcal{R}_B^* = [V^c, (1-f)\alpha c_H]$ so that, if $V^c \in (R_D/p, (1-f)\alpha c_H)$, $P(R_B \geq R) = G_B^{I*}(R)$, where

$$G_B^{I*}(R) = \frac{p^h(\alpha-(1+\alpha)f+\eta)c_L - p^h\bar{R} + c/\psi}{p^h(\alpha-(1+\alpha)f+\eta)(c_H-c_L) - (1-p^h)\alpha c_L} \frac{(\alpha-(1+\alpha)f+\eta)c_H - R}{R-\bar{R}} \quad \text{for } R \in [V^c, (1-f)\alpha c_H]; \tag{55}$$

   if, instead, $V^c = (1-f)\alpha c_H$, $P(R_B = (1-f)\alpha c_H) = 1$.

2. *The platform acquires information with probability*

$$a^{I*} = \frac{(1-p)R_D/p}{V^c - R_D} \in (0,1). \tag{56}$$

3. *The pessimist and the uniformed platform offer loans with probabilities $m_{P,l}^{I*} = m_{P,u}^{I*} = 1$ at a rate equal to $(\alpha-(1+\alpha)f+\eta)c_L$.*

4. *An optimistic platform lends with probability $m_{P,h}^{I*} = 1$ and offers rates with the same distribution described in Proposition 3 for the uniformed platform.*

When $V^c > R_D/p$, the pessimistic and uniformed platform offer rate $(\alpha-(1+\alpha)f+\eta)c_L$ with positive probability, thus deterring banks from offering rates below V^c. The platform thus uses information to offer customized interest rates and to extract surplus based on the default risk of the merchant.

C.4 Equilibrium in Case I.C

We now study a merchant whose parameters satisfy I.C. The following proposition characterizes the equilibrium and shows that the platform acquires information with probability strictly between zero and one.

Proposition 8. *Assume parameters satisfy case I.C. There exists $\epsilon > 0$ such that, for any $c \in (0,\epsilon)$, the equilibrium is characterized as follows.*

1. *The bank lends with probability $m_B^{I*} \in (0,1)$ given by*

$$m_B^{I*} = \frac{\bar{R} - R_D/\psi - (1-p^h)(\eta - f)c_L - [(1+\alpha)p^h c_H + (1-p^h)c_L]f + c/\psi}{(1-p^h)\bar{R} - (1-p^h)(\eta - f)c_L - [(1+\alpha)p^h c_H + (1-p^h)c_L]f}. \quad (57)$$

and, conditional on lending, they offer rates in $\mathcal{R}_B^{I*} = [R_D/p, (1-f)\alpha c_H]$ so that $P(R_B \geq R) = G_B^{I*}(R)$ where

$$G_B^{I*}(R) = \frac{(1-m_B^{I*})[\bar{R} - p_h R - (1-p^h)(\eta - f)c_L - ((1+\alpha)p^h c_H + (1-p^h)c_L)f] + c/\psi}{m_B^{I*} p^h (R - \bar{R})}. \quad (58)$$

2. *Compared to m_B^* in Proposition 4, $m_B^{I*} < m_B^*$.*

3. *The platform acquires information with probability $a^{I*} \in (0,1)$ equal to m_P^* from Proposition 4.*

4. *The uninformed and the pessimistic platform do not lend; that is, $m_{P,u}^{I*} = m_{P,l}^{I*} = 0$.*

5. *The optimistic platform lends with probability $m_{P,h}^{I*} = 1$ and offers rates with the same distribution described in Proposition 4 for the uninformed platform.*

The platform acquires information with probability a^{I*} that is equal to its lending probability in case C of Section 3. However, it denies credit at a higher probability, equal to $1 - a^{I*}\psi$. Moreover, banks offer loans with lower probability than in case C. Therefore, credit is rationed more often when the platform can acquire information, because of the combined effect of the platform's better screening and of banks' reluctance to lend because of their winner's curse.

When $p^h(\alpha+\eta)c_H+(1-p^h)\eta c_L = \bar{R}$, multiple equilibria still exist and they are indexed by $Q \in \left[0, \frac{(1-p)R_D/p}{(1-f)\alpha c_H - R_D}\right]$ whereby $P(R_P = (\alpha-(1+\alpha)f+\eta)c_L) = Q$ and a^{I*} is given by the right-hand side of equation (40) in Proposition 4.

D PROOFS FOR THE INFORMATION ACQUISITION EXTENSION

D.1 PROOF OF LEMMA 15

First, we consider $\max\{p^h(\alpha+\eta)c_H+(1-p^h)\eta c_L, (\alpha+\eta)c_L+(1+\alpha)p^h(c_H-c_L)f\}-\bar{R} < 0$. In this case, even after observing a high signal, the platform has no incentive to lend. Therefore, the platform does not acquire information.

Next, $\max\{p^h(\alpha+\eta)c_H+(1-p^h)\eta c_L, (\alpha+\eta)c_L+(1+\alpha)p^h(c_H-c_L)f\}-\bar{R} \geq 0$ but $(\alpha+\eta)c_L - \bar{R} < 0$. In this case, the platform can profitably lend after observing a high signal but prefers to deny credit after a low signal. Therefore, for a sufficiently small c,

$$\begin{aligned}
L_P(R, m_B^{I*}, G_B^{I*}; p^u) &= \max\{\max\{p^u(\alpha+\eta)c_H+(1-p^u)\eta c_L, (\alpha+\eta)c_L+(1+\alpha)p^u(c_H-c_L)f\}-\bar{R}, 0\} \\
&< \psi\left\{\max\{p^h(\alpha+\eta)c_H+(1-p^h)\eta c_L, (\alpha+\eta)c_L+(1+\alpha)p^h(c_H-c_L)f\}-\bar{R}\right\}+(1-\psi)0-c \\
&= \psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c,
\end{aligned}$$

and the platform acquires information with probability $a^{I*} = 1$.

We now consider $\max\{p^h(\alpha+\eta)c_H+(1-p^h)\eta c_L, (\alpha+\eta)c_L+(1+\alpha)p^h(c_H-c_L)f\}-\bar{R} \geq 0$, $(\alpha+\eta)c_L - \bar{R} \geq 0$, and assume (44) holds for $i = h$. Now, the platform optimally lends regardless of the signal it receives because $(\alpha+\eta)c_L - \bar{R} \geq 0$. However, the optimal rate for an optimistic platform is $(\alpha-(1+\alpha)f+\eta)c_H$, whereas the optimal rate for a pessimistic platform is $(\alpha-(1+\alpha)f+\eta)c_L$. Let $R_U \in \{(\alpha-(1+\alpha)f+\eta)c_H, (\alpha-(1+\alpha)f+\eta)c_L\}$ be the optimal rate for an uninformed platform. For a small enough c we have

$$\begin{aligned}
L_P(R_U, m_B^{I*}, G_B^{I*}; p^u) &= \psi L_P(R_U, m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P(R_U, m_B^{I*}, G_B^{I*}; p^u) \\
&< \psi L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p^u) - c \\
&= \psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(R, m_B^{I*}, G_B^{I*}; p^u) - c,
\end{aligned}$$

and the platform thus acquires information with probability $a^{I*} = 1$.

Finally, we consider $\max\{p^h(\alpha+\eta)c_H+(1-p^h)\eta c_L, (\alpha+\eta)c_L+(1+\alpha)p^h(c_H-c_L)f\}-\bar{R} \geq 0$, $(\alpha+\eta)c_L - \bar{R} \geq 0$, and assume (44) does not hold for $i = h$. In this case, the rate $(\alpha-(1+\alpha)f+\eta)c_L$ is optimal for the platform regardless of the information it possesses. Therefore, for any positive cost of information acquisition, c, the platform does not acquire information and lends with probability one at rate $(\alpha - (1+\alpha)f + \eta)c_L$. $\square$

D.2 Auxiliary Lemmas

We now introduce some lemmas which will be useful in characterizing the equilibrium with competition. Some lemmas contain new results which are specific to a model with information acquisition. Others are extensions or modifications of lemmas derived in the main model with no information acquisition.

Lemma 19. *Consider $p^i > 0$. If $R > (\alpha - (1+\alpha)f + \eta)c_L$ and $R \in \mathcal{R}^*_{P,i}$, then for any $R' < (\alpha - (1+\alpha)f + \eta)c_L$, we have $R' \notin \mathcal{R}^*_{P,y}$ for $p^y > p^i$. Moreover, $R \in \mathcal{R}^*_{P,y}$ for $p^y > p^i$.*

Proof. Note

$$\begin{aligned} &L(R, m_B, G_B; p^i) \\ &= m_B G_B(R)(R - \bar{R}) + (1 - m_B)[p^i R + (1 - p^i)(\eta - f)c_L - \bar{R}] + [(1+\alpha)p^i c_h + (1 - p^i)c_L]f \\ &\qquad + I(R)(1 - m_B)(1 - p^i)\{R - (\eta - f)c_L + f\alpha c_L\} \end{aligned}$$

where $I(R) \coloneqq \mathbb{I}[R \le (\alpha - (1+\alpha)f + \eta)c_L]$. Because $L(R, m_B, G_B; p^i) \ge L(R', m_B, G_B; p^i)$ for any R',

$$\begin{aligned} &m_B[G_B(R)(R - \bar{R}) - G_B(R')(R' - \bar{R})] \\ &\ge -(1 - m_B)(R - R') - (1 - m_B)\frac{1 - p^i}{p^i}\{I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL)\} \end{aligned}$$

Now consider $L(R, m_B, G_B; p^y) - L(R', m_B, G_B; p^y)$, which is equal to

$$\begin{aligned} &p^y m_B[G_B(R)(R - \bar{R}) - G_B(R')(R' - \bar{R})] + (1 - m_B)(R - R') \\ &\qquad + (1 - m_B)1 - p^y\{I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL)\} \\ &\ge p^y(1 - m_B)\left(1 - \frac{p^y}{p^i}\right)\{I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL)\} \end{aligned}$$

If $R > (\alpha - (1+\alpha)f + \eta)c_L$ and $R' \le (\alpha - (1+\alpha)f + \eta)c_L$, then $I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL) < 0$. If $p^y > p^i$, then $1 - p^y/p^i < 0$. Hence $L(R, m_B, G_B; p^y) - L(R', m_B, G_B; p^y) > 0$ and R' cannot be a best response for $p^y > p^i$.

Therefore, $\mathcal{R}R^{I*}_{P,y} \subseteq ((\alpha - (1+\alpha)f + \eta)c_L, (\alpha - (1+\alpha)f + \eta)c_H]$. For $R > (\alpha - (1+\alpha)f + \eta)c_L$, we have $\arg\max_{R > (\alpha - (1+\alpha)f + \eta)c_L} L(R, m_B^{I*}, G_B^{I*}; p^i) = \arg\max_{R > (\alpha - (1+\alpha)f + \eta)c_L} L(R, m_B^{I*}, G_B^{I*}; p^y)$. Hence, $R \in \mathcal{R}^*_{P,y}$ for $p^y > p^i$.

$\square$

Lemma 20. *If $R \le (\alpha - (1+\alpha)f + \eta)c_L$ and $R \in \mathcal{R}^*_{P,i}$, then for any $R' < R$ and $R' > (\alpha - (1+\alpha)f + \eta)c_L$, we have $R' \notin \mathcal{R}^*_{P,y}$ with $p^y < p^i$.*

Proof. Because $L(R, m_B, G_B; p^i) \geq L(R', m_B, G_B; p^i)$ for any R',

$$m_B[G_B(R)(R - \bar{R}) - G_B(R')(R' - \bar{R})]$$
$$\geq -(1-m_B)(R-R') - (1-m_B)\frac{1-p^i}{p^i}\left\{I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL)\right\},$$

where $I(R) \coloneqq \mathbb{I}[R \leq (\alpha - (1+\alpha)f + \eta)c_L]$

Now consider $L(R, m_B, G_B; p^y) - L(R', m_B, G_B; p^y)$, which is equal to

$$p^y m_B[G_B(R)(R - \bar{R}) - G_B(R')(R' - \bar{R})] + (1 - m_B)(R - R')$$
$$+ (1 - m_B)1 - p^y \{I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL)\}$$
$$\geq p^y(1 - m_B)\left(1 - \frac{p^y}{p^i}\right)\{I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL)\}$$

If $p^y < p^i$, then $1 - p^y/p^i > 0$. If $R \leq (\alpha - (1+\alpha)f + \eta)c_L$ and $R' < R$, then $I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL) > 0$. If $R' > (\alpha - (1+\alpha)f + \eta)c_L$, then $I(R)(R + ((1+\alpha)f - \eta)cL) - I(R')(R' + ((1+\alpha)f - \eta)cL) > 0$. Hence, in either case, $L(R, m_B, G_B; p^y) - L(R', m_B, G_B; p^y) > 0$ and R' cannot be a best response for $p^y < p^i$. □

LEMMA 21. *Suppose $R \geq \bar{R}$. $L_P(R, m_B, G_B; x) - m_B^{I*}[(1+\alpha)xc_H + (1-x)c_L]f$ is increasing in x. Moreover, if $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^i) = m_B^{I*}[(1+\alpha)p^i c_H + (1-p^i)c_L]f$, then $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^y) = m_B^{I*}[(1+\alpha)p^i c_H + (1-p^i)c_L]f \geq \max_R L_P(R, m_B^{I*}, G_B^{I*}; p^y)$ for all $p^y < p^i$, with strict inequality if $R > \bar{R}$ and $m_B^{I*} \in (0,1)$.*

Proof. Define $I(R) = \mathbb{I}(R \leq (\alpha - (1+\alpha)f + \eta)c_L)$. One can immediately verify

$$L_P(R, m_B, G_B; x) - m_B^{I*}[(1+\alpha)xc_H + (1-x)c_L]f$$
$$= m_B x G_B(R)(R-\bar{R}) + (1-m_B)[x(R+(1+\alpha)c_H f) + (1-x)\eta c_L - \bar{R}] + I(R)(1-x)[R-(\eta-(1+\alpha)f)c_L]$$

is increasing in x. Using this observation, we obtain that, if $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^i) = m_B^{I*}[(1+\alpha)p^i c_H + (1-p^i)c_L]f$ and $p^y < p^i$, then

$$0 = L_P^{I*}(m_B^{I*}, G_B I*; p^i) - m_B^{I*}[(1+\alpha)p^i c_H + (1-p^i)c_L]f$$
$$\geq L_P^{I*}(m_B^{I*}, G_B I*; p^y) - m_B^{I*}[(1+\alpha)p^y c_H + (1-p^y)c_L]f$$

for $p^y < p^i$. If $R > \bar{R}$ and $m_B^{I*} \in (0,1)$, the last inequality is strict. □

LEMMA 22. $m_B^{I*} > 0$ *if and only if* $p \geq \frac{R_D}{(1-f)\alpha c_H}$.

Proof. First, we show $m_B^{I*} > 0$ if $p \geq \frac{R_D}{(1-f)\alpha c_H}$. By way of contradiction, suppose $m_B^{I*} = 0$. Then $\mathcal{R}_{P,u}^{I*} = \mathcal{R}_{P,h}^{I*} = \{(\alpha - (1+\alpha)f + \eta)c_H\}$ and $G_P^{a*}(R) = \mathbb{I}(R < (\alpha - (1+\alpha)f + \eta)c_H)$. Then, for any $m_P^{a*} \in [0,1]$ and $\varepsilon \in (0, (1-f)\alpha c_H - R_D/p)$, $L_B(R_D/p + \varepsilon, m_P^{a*}, G_P^{a*}; p) > 0$, contradicting that $m_B^{I*} = 0$ is the bank's equilibrium strategy.

Second, we show $m_B^{I*} = 0$ if $p < \frac{R_D}{(1-f)\alpha c_H}$. When $p < \frac{R_D}{(1-f)\alpha c_H}$, for any $R \leq (1-f)\alpha c_H$ we have

$$L_B(R, m_P^{a*}, G_P^{a*}; p) \leq p(1-f)\alpha c_H - R_D < 0$$

and, by (12), $m_B^{I*} = 0$. □

LEMMA 23. *If* $m_B^{I*} \in (0,1)$, *then* $\sup \mathcal{R}_B^{I*} = (1-f)\alpha c_H$.

Proof. We proceed by contradiction and assume $\tilde{R} := \sup \mathcal{R}_B^{I*} < (1-f)\alpha c_H$. Because $m_B^{I*} \in (0,1)$, by Lemma 7, we have $p \geq \frac{R_D}{(1-f)\alpha c_H}$, which also implies (7). Hence, $L_P(R, m_B^*, G_B^*; p^i) < L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^*, G_B^*; p^i)$ for any $R \in (\tilde{R}, (\alpha - (1+\alpha)f + \eta)c_H)$ and for $i \in \{u, h\}$. Therefore, an $\varepsilon > 0$ exists such that $L_B(\tilde{R} + \varepsilon, m_P^{a*}, G_P^{a*}; p^i) > L_B(\tilde{R}, m_P^{a*}, G_P^{a*}; p^i)$ for $i \in \{u, h\}$.

Hence, for a small enough ε, a lending mechanism (m_B, F_B) with $m_B = 1$ and with domain $\mathcal{R}_B^{I*} \cup \{\tilde{R} + \varepsilon\}$ exists such that $\int_0^{\hat{R}+\varepsilon} L_B(R, m_P^{a*}, G_P^{a*}; p) dF(R) > 0$ and $U(1, m_P^{A*}, F_B, F_P^{A*}) > U(m_B^{I*}, m_P^{A*}, F_B^I, F_P^{A*})$, contradicting the assumption that $\mathcal{R}_B^{I*}$ is the domain of the equilibrium lending mechanism offered by banks. □

LEMMA 24. *Suppose* $m_B^{I*} \in (0,1)$ *for all* $c > 0$. *Then a* $\bar{m} \in (0,1)$ *exists such that* $m_B^{I*} \leq \bar{m}$ *for any* $c > 0$. *That is, as* $c \to 0$, $\limsup m_B^{I*} < 1$.

Proof. We proceed by contradiction and assume a sequence $(c_n)_{n=0}^{\infty}$ with $c_n > 0$ and $c_n \to 0$ such that $m_{B,n}^{I*} \to 1$, where $m_{B,n}^{I*}$ is the equilibrium value of m_B^{I*} when $c = c_n$. In this case, for any $i \in \{u, h\}$ and for a sufficiently large N, $L_P(R, m_{B,N}^{I*}, G_B^{I*}; p^i) = (1 - m_{B,N}^{I*})[(1+\alpha)pc_H + (1-p)c_L]f < L_P(R_D/p, 1, G_B^{I*}; p^i)$ for any R such that $G_B^{I*}(R) = 0$. Hence, $m_{P,i}^{I*} = 1$ but $R \notin \mathcal{R}_{P,i}^{I*}$ if $G_B^{I*}(R) = 0$.

By Lemma 23, $\sup \mathcal{R}_B^{I*} = (1-f)\alpha c_H$. If $(1-f)\alpha c_H \in \mathcal{R}_B^{I*}$, $L_B((1-f)\alpha c_H, 1, G_P^{a*}; p) = 0$ implies $G_P^{a*}(\tilde{R}) > 0$ and an $R > (1-f)\alpha c_H$ exists with $R \in \mathcal{R}_{P,i}^{I*}$ for some $i \in \{u, h\}$. If instead $(1-f)\alpha c_H \notin \mathcal{R}_B^{I*}$, then $\lim_{R \to \tilde{R}^-} G_P^{a*}(R) > 0$, implying an $R \geq (1-f)\alpha c_H$ exists with $R \in \mathcal{R}_{P,i}^{I*}$ for some $i \in \{u, h\}$. In either case, $G_B^{I*}(R) = 0$, thus contradicting the previous result. □

LEMMA 25. $\inf \mathcal{R}_{P,i}^{I*} \in \mathcal{R}_{P,i}^{I*}$ *for* $i \in \{u, l, h\}$ *and* $\inf \mathcal{R}_B^{I*} \in \mathcal{R}_B^{I*}$.

Proof. Define $\underline{R}_{P,i} := \inf \mathcal{R}_{P,i}^{I*}$ and $\underline{R}_B := \inf \mathcal{R}_B^{I*}$. If $\underline{R}_B \notin \mathcal{R}_B^{I*}$, then a sequence $(R_n)_{n=0}^{\infty}$ exists such that $R_n > \underline{R}_B$ and $R_n \in \mathcal{R}_B^{I*}$ for all n and $R_n \to \underline{R}_B$ as $n \to \infty$. We therefore must have

$$L_B(\underline{R}_B, m_P^{a*}, G_P^{a*}; p) < \lim_{n \to \infty} L_B(R_n, m_P^{a*}, G_P^{a*}; p)$$

which, in turn, implies $G_P^{a*}(\underline{R}_J) < \lim_{n\to\infty} G_P^{a*}(R_n)$. This result, however, contradicts that G_P^{a*} is a weakly decreasing function. Hence, $\underline{R}_B \in \mathcal{R}_B^{I*}$.

Similarly, if $\underline{R}_{P,i} \notin \mathcal{R}_{P,i}^{I*}$, a sequence $(R_n)_{n=0}^{\infty}$ exists such that $R_n > \underline{R}_{P,i}$ and $R_n \in \mathcal{R}_{P,i}^{I*}$ for all n and $R_n \to \underline{R}_{P,i}$ as $n \to \infty$. Using a similar reasoning to the one above, we would then conclude $G_B^{I*}(\underline{R}_J) < \lim_{n\to\infty} G_B^{I*}(R_n)$, contradicting that G_B^{I*} is a weakly decreasing function. Hence, $\underline{R}_{P,i} \in \mathcal{R}_{P,i}^{I*}$ for $i \in \{u, l, h\}$. □

LEMMA 26. *Assume* $m_P^{a*} > 0$ *and* $m_B^{I*} > 0$. *Then* $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} \leq R_D/p$. *Moreover, either* $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} = R_D/p$ *or* $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} = (\alpha - (1+\alpha)f + \eta)c_L$. *Finally, if* $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} \neq (\alpha - (1+\alpha)f + \eta)c_L$, *then* $\min \mathcal{R}_B^{I*} = R_D/p$.

Proof. Define $\underline{R}_P := \min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\}$ and $\underline{R}_B := \min \mathcal{R}_B^{I*}$. First, we establish $\underline{R}_P \leq R_D/p$. We proceed by contradiction and assume $\underline{R}_P > R_D/p$. By bank competition, we thus have $m_B^{I*} = 1$ and $\mathcal{R}_B^{I*} = \{R_D/p\}$. In this case, if $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$, the uniformed and optimistic platform's best response is R_D/p. If instead $R_D/p \geq (\alpha - (1+\alpha)f + \eta)c_L$, the platform's best response could be either R_D/p or $(\alpha - (1+\alpha)f + \eta)c_L$. In both cases, $\underline{R} \leq R_D/p$, contradicting $\underline{R}_P > R_D/p$.

Having established $\underline{R}_P \leq R_D/p$, we now prove $\underline{R}_P = R_D/p$ or $\underline{R} = (\alpha - (1+\alpha)f + \eta)c_L$. If $R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$, then $L_P(R, m_B^{I*}, G_B^{I*}; p^i) < L_P(R_D/p, m_B^{I*}, G_B^{I*}; p)$ for any $R < R_D/p$ and any $i \in \{u, h\}$, implying $\underline{R}_P = R_D/p$. If instead, $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, $L_P(R, m_B^{I*}, G_B^{I*}; p^i) < L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^{I*}, G_B^{I*}; p^i)$ for any $R < (\alpha - (1+\alpha)f + \eta)c_L$ and $L_P(R', m_B^{I*}, G_B^{I*}; p^i) < L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^i)$ for any $R' \in ((\alpha - (1+\alpha)f + \eta)c_L, R_D/p)$, implying $\underline{R} = R_D/p$ or $\underline{R} = (\alpha - (1+\alpha)f + \eta)c_L$.

To prove the final part of the lemma, consider $\underline{R}_P = R_D/p \neq (\alpha - (1+\alpha)f + \eta))c_L$. We proceed by contradiction and assume $\underline{R}_B > R_D/p$. Because $\underline{R}_P \neq (\alpha - (1+\alpha)f + \eta)c_L$, an $\varepsilon > 0$ exists such that $L_P(R_D/p + \varepsilon, m_B^{I*}, G_B^{I*}; p^i) > L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^i)$ for $i \in \{u, h\}$, contradicting $R_D/p \in \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\}$. Hence, if $\underline{R}_P = R_D/p \neq (\alpha - (1+\alpha)f + \eta)c_L$, the $\underline{R}_B = R_D/p$.

□

LEMMA 27. *Assume* $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} = R_D/p \neq (\alpha - (1+\alpha)f + \eta)c_L$. *If* $(1 - a^{I*})m_{P,u}^{I*} = 0$, *then* $R_D/p \in \mathcal{R}_{P,h}^{I*}$, *whereas if* $a^{I*}m_{P,h}^{I*} = 0$, *then* $R_D/p \in \mathcal{R}_{P,u}^{I*}$. *Furthermore, if* $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, *then* $\min \mathcal{R}_{P,h}^{I*} = R_D/p$. *Similarly, if* $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$, *but* c *is sufficiently small, then* $\min \mathcal{R}_{P,h}^{I*} = R_D/p$.

Proof. For the first part of the lemma, notice that, if $(1 - a^{I*})m_{P,u}^{I*} = 0$ and $\min\{\mathcal{R}_{P,h}^{I*}\} > R_D/p$, then an $\varepsilon > 0$ exists such that $L_B(R_D/p + \varepsilon, m_P^{a*}, G_P^{a*}; p) > 0$, thus contradicting part 4 of the equilibrium definition 2. A similar reasoning can be used to rule out $a^{I*}m_{P,h}^{I*} = 0$ and $\min\{\mathcal{R}_{P,u}^{I*}\} > R_D/p$.

To prove the next part of the lemma, we proceed by contradiction and assume $\min \mathcal{R}_{P,h}^{I*} \neq R_D/p$, thus implying $R_D/p \notin \mathcal{R}_{P,h}^{I*}$. Hence, we must have $R_D/p = \min \mathcal{R}_{P,u}^{I*}$. If $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, Lemma 19 implies $R_D/p \in \mathcal{R}_{P,h}^{I*}$, thus generating a contradiction.

We now focus on $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$. If $a^{I*} = 1$, the first result of this lemma shows $\min\{\mathcal{R}_{P,h}^{I*}\} = R_D/p$. If instead $a^{I*} \leq 1$, consider $R \in \mathcal{R}_{P,h}^{I*}$. Then, for a sufficiently small c,

$$\begin{aligned}
\psi L_P(R, m_B^{I*}, G_B^{I*}; p^h) &\leq L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^u) - (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + c \\
&\leq L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^u) - (1-\psi)L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h) \\
&\qquad - (1 - m_B^{I*})[(\alpha - (1+\alpha)f + \eta) - R_D/p] + c \\
&< \psi L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h),
\end{aligned}$$

where the last inequality equality follows from $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$ and Lemma 24. Therefore, $\min \mathcal{R}^{I*}_{P,h} = R_D/p$ when $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$, but c is sufficiently small. $\square$

LEMMA 28. *If $m^{I*}_B > 0$ and $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, then $(\alpha - (1+\alpha)f + \eta)c_L \notin \mathcal{R}^{I*}_{P,i}$ for $i \in \{u, h\}$.*

Proof. Note that $L_P((\alpha-(1+\alpha)f+\eta)c_H, m^{I*}_B, G^{I*}_B; p^i) \leq L_P((\alpha-(1+\alpha)f+\eta)c_L, m^{I*}_B, G^{I*}_B; p^i)$ if and only if

$$\begin{aligned}&(1 - m^{I*}_B)[p^i(\alpha + \eta)c_H + (1 - p^i)\eta c_L] \\ &\qquad \leq m^{I*}_B p^i[(\alpha - (1+\alpha)f + \eta)c_L - \bar{R}] + (1 - m^{I*}_B)[(\alpha + \eta)c_L + (1+\alpha)p^i(c_H - c_L)f]\end{aligned}$$

We have that $p^i(\alpha + \eta)c_H + (1 - p^i)\eta c_L > (\alpha + \eta)c_L + (1+\alpha)p^i(c_H - c_L)f$ if an only if (44) holds.

Note that $R_D > c_L$ and $(1-f)\alpha c_H < (\alpha - (1+\alpha)f + \eta)(c_H - c_L) + \alpha c_L$. Hence, because we are considering $p \geq \frac{R_D}{(1-f)\alpha c_H}$, the inequality (44) is satisfied for $i \in \{u, h\}$. We must therefore have $L_P((\alpha-(1+\alpha)f+\eta)c_H, m^{I*}_B, G^{I*}_B; p^i) > L_P((\alpha-(1+\alpha)f+\eta)c_L, m^{I*}_B, G^{I*}_B; p^i)$ for for $i \in \{u, h\}$ whenever $(\alpha - (1+\alpha)f + \eta)c_L - \bar{R} < 0$. $\square$

LEMMA 29. *Assume $\bar{R} \leq R_D/p$. If $m^{a*}_P > 0$ and $m^{I*}_B \in (0, 1)$, then $\max\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\} \in \{(1-f)\alpha c_H, (\alpha-(1+\alpha)f+\eta)c_H\}$. Moreover, if $m^{a*}_P = 1$ then $\max \mathcal{R}^{I*}_{P,h} = (\alpha-(1+\alpha)f+\eta)c_H$.*

Proof. First, note $\sup \mathcal{R}^{I*}_{P,i} \in \mathcal{R}^{I*}_{P,i}$ for $i \in \{u, l, h\}$ by the left-continuity of $G^{I*}_B(\cdot)$ and the platform's objective function $L_P(\cdot, m_B, G_B; p^i)$. Hence, $\sup \mathcal{R}^{I*}_{P,i} = \max \mathcal{R}^{I}_{P,i}*$. Also note that $L_P(R, m^{I*}_B, G^{I*}_B; p^i) < L_P((\alpha - (1+\alpha)f + \eta)c_H, m^{I*}_B, G^{I*}_B; p^i)$ for $R \in ((1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H)$ because $m^{I*}_B \in (0, 1)$. Hence $((1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H) \cap \mathcal{R}^{I*}_{P,i} = \emptyset$. Finally, by Lemma 23, $\sup \mathcal{R}^{I*}_B = (1-f)\alpha c_H$.

To prove the first part of the lemma, we proceed by contradiction and assume $R^M := \{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\} < (1-f)\alpha c_H$. In this case, $G^{a*}_P(R) = 0$ for all $R \geq R^M$, along with $\sup \mathcal{R}^{I*}_B = (1-f)\alpha c_H$, imply that $(1-f)\alpha c_H \in \mathcal{R}^{I*}_B$ and $R \notin \mathcal{R}^{I*}_B$ for all $R \in (R^M, (1-f)\alpha c_H)$. Otherwise, an $R' \geq R^M$ with $R' \in \mathcal{R}^{I*}_B$ would exist such that $L_B(R', m^{a*}_P, G^{a*}_P; p) \neq 0$, contradicting the definition of equilibrium. Moreover, $L_B((1-f)\alpha c_H, m^{a*}_P, G^{a*}_P; p) = 0$ and $R^M < (1-f)\alpha c_H$ imply $m^{a*}_P \in (0, 1)$.

If $R^M > (\alpha - (1+\alpha)f + \eta)c_L$ or if $R^M < (1-f)\alpha c_H \leq (\alpha - (1+\alpha)f + \eta)c_L$ then $L_P((1-f)\alpha c_H, m^{I*}_B, G^{I*}_B; p^i) > L(R^M, m^{I*}_B, G^{I*}_B; p^i)$ for $i \in \{u, h\}$, contradicting $R^M := \max\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\}$. It remains to consider $R^M \leq (\alpha - (1+\alpha)f + \eta)c_L < (1-f)\alpha c_H$. In this case, because $m^{I*}_B \in (0, 1)$ and $\bar{R} \leq R_D/p$, $L_P(R_D/p, m^*_B, G^*_B; p^i) > m^*_B[(1+\alpha)pc_H + (1-p)c_L]f$ for $i \in \{u, h\}$. But this implies $m^{a*}_P = 1$, which contradicts $L_B((1-f)\alpha c_H, m^{a*}_P, G^{a*}_P; p) = 0$. Hence, $\max\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\} \in \{(1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H\}$

To prove the second part of the lemma for $m^{a*}_P = 1$, we proceed again by contradiction and assume $(\alpha - (1+\alpha)f + \eta)c_H \notin \mathcal{R}^{I*}_{P,h}$. By Lemma 19, this observation also implies $(\alpha - (1+\alpha)f + \eta)c_H \notin \mathcal{R}^{I*}_{P,u}$ and, therefore, $G^{a*}_P((1-f)\alpha c_H) = 0$. Furthermore, from the previous results, $(1-f)\alpha c_H = \max\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\}$. Hence, $L_B((1-f)\alpha c_H, 1, G^{a*}_P; p) < 0$. Therefore, $G^{I*}_B((1-f)\alpha c_H) = 0$. But then, $L_P((\alpha - (1+\alpha)f + \eta)c_H, m^{I*}_B, G^{I*}_B; p^i) > L_P((1-$

$f)\alpha c_H, m_B^{I*}, G_B^{I*}; p^i)$ for $i \in \{u,h\}$, contradicting that $\max\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} = (1-f)\alpha c_H$. Thus, if $m_P^{a*} = 1$ and $m_B^{I*} \in (0,1)$, then $\max \mathcal{R}_{P,h}^{I*} = (\alpha - (1+\alpha)f + \eta)c_H$.

□

LEMMA 30. *Suppose $m_B^{I*} \in (0,1)$ and $m_P^{a*} > 0$. If $R_1 \in \mathcal{R}_B^{I*}$ and $R_2 \in \mathcal{R}_B^{I*}$ such that $R_1 < R_2 \leq (\alpha - (1+\alpha)f + \eta)c_L$ or such that $(\alpha - (1+\alpha)f + \eta)c_L < R_1 < R_2$, then we must have $[R_1, R_2] \subseteq \mathcal{R}_B^{I*} \cap \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$. In particular, $G_P^{a*}(\cdot)$ and $G_B^{I*}(\cdot)$ are strictly decreasing in $[R_1, R_2]$.*

Proof. Assume, by way of contradiction, that an $R^k \in (R_1, R_2)$ exists such that $R^k \notin \mathcal{R}_B^{I*}$. By the right-continuity of $G_P^{a*}(\cdot)$ and $L_B(\cdot, m_P^{a*}, G_P^{a*}; p)$, we have that an $\varepsilon > 0$ exists such that $L_B(R, m_P^{a*}, G_P^{a*}; p) < 0$ for all $R \in (R^k, R^k+\varepsilon)$. Let $R_1' \coloneqq \sup\{R\colon R \in \mathcal{R}_B^{I*} \text{ and } R < R^k\}$. Hence, $L_B(R, m_P^{a*}, G_P^{a*}; p) < 0$ for all $R \in (R_1', R^k+\varepsilon)$, thus implying

$$G_P^{a*}(R) < \frac{(1-m_P^{a*})(R_D - pR)}{m_P^{a*}p(R-R_D)} + \frac{(1-p)R_D}{p(R-R_D)} \leq \frac{(1-m_P^{a*})(R_D - pR_1')}{m_P^{a*}p(R_1'-R_D)} + \frac{(1-p)R_D}{p(R_1'-R_D)}. \quad (59)$$

Because $R \notin \mathcal{R}_B^{I*}$ for all $R \in (R_1', R^k+\varepsilon)$, we must have that $R \notin \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$ for any $R \in (R_1', R^k+\varepsilon)$.

If $R_1' \in \mathcal{R}_B^{I*}$, then the last term in equation (59) coincides with $G_P^{a*}(R_1')$ and, therefore, $G_P^{a*}(R) < G_P^{a*}(R_1')$ for any $R \in (R_1', R^k+\varepsilon)$. But this implies there exists $R' \in (R_1', R)$ such that $R' \in \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$, contradicting the previous result that $R' \notin \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$ for any $R' \in (R_1', R^k+\varepsilon)$. If instead, $R_1' \notin \mathcal{R}_B^{I*}$, then we must have $\lim_{R \to R_1'^-} G_P^{a*}(R) > G_P^{a*}(R_1')$, which implies $R_1' \in \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$. However, if $R_1' \notin \mathcal{R}_B^{I*}$, $L_P(R^k+\varepsilon, m_B^{I*}, G_B^{I*}; p) > L_P(R_1', m_B^{I*}, G_B^{I*}; p)$, generating a contradiction.

Hence, $[R_1, R_2] \subseteq \mathcal{R}_B^{I*}$. In particular, $L_B(R, m_P^{a*}, G_P^{a*}; p) = 0$ for all $R \in [R_1, R_2]$, which implies

$$G_P^{a*}(R) = \frac{(1-m_P^{a*})(R_D - pR)}{m_P^{a*}p(R-R_D)} + \frac{(1-p)R_D}{p(R-R_D)}$$

is strictly decreasing for $R \in [R_1, R_2]$.

Suppose now, by way of contradiction, an $R^y \in [R_1, R_2]$ exists such that $R \notin \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$. By the left-continuity of $G_B^{I*}(\cdot)$ and $L_P(\cdot, m_B^{I*}, G_B^{I*}; p^i)$ for $i \in \{u,h\}$, we have that an $\varepsilon > 0$ exists such that $R \notin \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$ for all $R \in (R^y - \varepsilon, R^y)$. However, this observation implies $G_P^{a*}(R)$ is constant in $(R^y - \varepsilon, R^y)$, contradicting the previous result. Hence, we also obtain that $[R_1, R_2] \subseteq \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$. □

D.3 PROOF OF LEMMA 14

To prove the first part, we proceed by contradiction and assume that $L_P(R, m_B^{I*}, G_B^{I*}; p^h) \leq m_B^{I*}[p^h(1+\alpha)c_H + (1-p^h)c_L]f$ for all R. By Lemma 21, we have $L_P(R, m_B^{I*}, G_B^{I*}; p^i) \leq m_B^{I*}[p^h(1+\alpha)c_H + (1-p^h)c_L]f$ for $i \in \{u,l\}$. Therefore, for $i \in \{u,h,l\}$, $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^i) = m_B^{I*}[p^i(1+\alpha)c_H + (1-p^i)c_L]f$ and the maximizer in (42) is $a^{I*} = 0$, contradicting $a^{I*} \in (0,1]$.

To prove the second part, we proceed again by contradiction and assume an R exists such that $R \in \mathcal{R}^{I*}_{P,i}$ and $L_P(R, m^{I*}_B, G^{I*}_B; p^i) \geq m^{I*}_B[p^i(1+\alpha)c_H + (1-p^i)c_L]f$ for $i \in \{l, h\}$. In this case, for any $c > 0$,

$$\begin{aligned} L^{I*}_P(m^{I*}_B, G^{I*}_B; p^u) &\geq L_P(R, m^{I*}_B, G^{I*}_B; p^u) \\ &= \psi L_P(R, m^{I*}_B, G^{I*}_B; p^h) + (1-\psi) L_P(R, m^{I*}_B, G^{I*}_B; p^l) \\ &> \psi L_P(R, m^{I*}_B, G^{I*}_B; p^h) + (1-\psi) L_P(R, m^{I*}_B, G^{I*}_B; p^l) - c, \end{aligned}$$

contradicting that $a^{I*} > 0$.

□

D.4 PROOF OF LEMMA 16

When $p < \frac{R_D}{(1-f)\alpha c_H}$, Lemma 22 implies $m^{I*}_B = 0$. The platform is thus a monopolistic lender for a merchant provided (43) is satisfied for $i = h$, and the results of Lemma 15 apply.

For the rest of the proof, we thus focus on $p \geq R_D/\bar{R}$. By Lemma 22, banks lend with positive probability $m^*_B > 0$. We want to show that $m^{I*}_B = 1$, $\mathcal{R}^{I*}_B = \{R_D/p\}$, and $m^{a*}_P(1 - G^{a*}_P(R_D/p)) = 0$. Together, these conditions imply merchants borrow exclusively from banks when $p \geq R_D/\bar{R}$

As a preliminary observation, notice that, if $m^{a*}_P > 0$, $R_D/p = \min\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\}$. In fact, if $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, by Lemma 28, $(\alpha - (1+\alpha)f + \eta)c_L \notin \mathcal{R}^{I*}_{P,i}$ for $i \in \{u, h\}$. If instead $\bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$, we have $R_D/p \leq \bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_L$. By Lemmas 26, we thus have $R_D/p = \min\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\}$ in both cases.

Suppose, by way of contradiction, $m^{I*}_B \in (0, 1)$. Which, in turn, implies $m^{a*}_P > 0$, otherwise competitive banks would offer rate R_D/p with probability one and $m^{I*}_B = 1$. It also implies $\sup \mathcal{R}^{I*}_B = (1-f)\alpha c_H$ by Lemma 23.

First, we exclude $m^{a*}_P = 1$. By the previous observation, $R_D/p = \min\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\}$. Hence, $R_D/p \in \mathcal{R}^{I*}_{P,i}$ for some $i \in \{u, h\}$. We must therefore have $L_P(R_D/p, m^{I*}_B, G^{I*}_B; p^i) \geq L_P((\alpha - (1+\alpha)f + \eta)c_H, m^{I*}_B, G^{I*}_B; p^i)$, which implies

$$\begin{aligned} & m^{I*}_B \left\{p^i((\alpha - (1+\alpha)f + \eta)c_H - \bar{R}) - I(R_D/p)(1-p^i)[R_D/p - (\eta - (1+\alpha)f)c_L]\right\} \\ & \quad \geq p^i((\alpha - (1+\alpha)f + \eta)c_H - R_D/p) - I(R_D/p)(1-p^i)[R_D/p - (\eta - (1+\alpha)f)c_L], \end{aligned} \tag{60}$$

where $I(R) = \mathbb{I}(R \leq (\alpha - (1+\alpha)f + \eta)c_L)$. Notice we have $(\alpha - (1+\alpha)f + \eta)c_H \geq R_D/p$ when $p \geq \frac{R_D}{(1-f)\alpha c_H}$ and $\eta \geq f$ and $(\alpha - (1+\alpha)f + \eta)c_H - \bar{R} \leq (\alpha - (1+\alpha)f + \eta)c_H - R_D/p$ because we are considering $\bar{R} \geq R_D/p$. Finally, we also have $p^i((\alpha - (1+\alpha)f + \eta)c_H -$

$R_D/p) - I(R_D/p)(1-p^i)[R_D/p - (\eta-(1+\alpha)f)c_L]$ because either $R_D/p > (\alpha-(1+\alpha)f+\eta)c_L$, or $R_D/p \leq (\alpha-(1+\alpha)f+\eta)c_L$, along with $p \geq \frac{R_D}{(1-f)\alpha c_H}$, implies $p^i((\alpha-(1+\alpha)f+\eta)c_H - R_D/p) - I(R_D/p)(1-p^i)[R_D/p-(\eta-(1+\alpha)f)c_L] > 0$. Therefore, if $p^i((\alpha-(1+\alpha)f+\eta)c_H - \bar{R}) - I(R_D/p)(1-p^i)[R_D/p-(\eta-(1+\alpha)f)c_L] \leq 0$, the inequality (60) is a contradiction. If $p^i((\alpha-(1+\alpha)f+\eta)c_H - \bar{R}) - I(R_D/p)(1-p^i)[R_D/p-(\eta-(1+\alpha)f)c_L] > 0$, the inequality (60) implies $m_B^{I*} \geq 1$, which contradicts $m_B^{I*} \in (0,1)$. Therefore, when $p \geq R_D/\bar{R}$, $m_B^{I*} = 1$.

Next, we show $m_P^{a*}(1 - G_P^{a*}(R_D/p)) = 0$. Assume, by way of contradiction, $m_P^{a*}(1 - G_P^{a*}(R_D/p)) > 0$. By our previous result in the proof, if $m_P^{a*} > 0$, then $R_D/p \in \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\}$. Consider, $p > R_D/\bar{R}$. Because $m_B^{I*} = 1$, the profits from lending for the platform are $L_P(R_D/p, 1, G_B^{I*}; p^i) < [p^i(1+\alpha)c_H + (1-p^i)c_L]f$ for an $i \in \{u, l\}$, and hence $m_{P,i}^{I*} = 0$. By Lemma 27, we must therefore have $R_D/p \in \mathcal{R}_{P,y}^{I*}$ for $y \in \{u, l\}$ and $y \neq i$. But this would also imply $m_{P,i}^{I*} = 0$, thus contradicting $m_P^{a*}(1 - G_P^{a*}(R_D/p)) = 0$.

Consider now $p = R_D/\bar{R}$, then for an $i \in \{u, l\}$ $L_P(R, 1, G_B^{I*}; p^i) \leq L_P(R_D/p, 1, G_B^{I*}; p^)$ for any $R > R_D/p$, thus implying $G_B^{I*}(R) \leq 0$. Hence, banks offer rate R_D/p with probability one, and, for this to be the banks' best response, we must have $m_P^{a*}(1 - G_P^{a*}(R_D/p)) = 0$. □

D.5 Proof of Lemma 17

We prove $m_P^{a*} > 0$. Suppose $m_P^{a*} = 0$, then competitive banks would set $\mathcal{R}_B^{I*} = \{R_D/p\}$ and $m_B^{I*} = 1$. For a small enough $\varepsilon > 0$, $L_P(R_D/p - \varepsilon, 1, G_B^{I*}; p^i) > [p(1+\alpha)c_H + (1-p)c_L]f$ for $i \in \{u, h\}$, which contradicts $m_P^{a*} = 0$. Hence $m_P^{a*} > 0$.

By Lemma 22, we have $m_B^{I*} > 0$. We now prove $m_B^{I*} \in (0,1)$. We proceed by contradiction and assume $m_B^{I*} = 1$. In this case, for any $i \in \{u, h\}$, $L_P(R, 1, G_B^{I*}; p^i) = [p(1+\alpha)c_H + (1-p)c_L]f < L_P(R_D/p, 1, G_B^{I*}; p^i)$ for any R such that $G_B^{I*}(R) = 0$. Hence, $m_{P,i}^{I*} = 1$ but $R \notin \mathcal{R}_{P,i}^{I*}$ if $G_B^{I*}(R) = 0$.

Next, we show $a^{I*} > 0$. Assume, by contradiction, that $a^{I*} = 0$. Then, the equilibrium is described by one of the cases of Section 3. In each of those cases, an $R \in \mathcal{R}_{P,u}^{I*} = \mathcal{R}_P^*$ exists such that $R \neq (\alpha - (1+\alpha)f + \eta)c_L$. Therefore, for a sufficiently small c,

$$\begin{aligned}
&\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c \\
&\qquad > \psi L_P(R, m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P(R, m_B^{I*}, G_B^{I*}; p^l) \\
&\qquad = L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u)
\end{aligned}$$

where the strict inequality follows because $R \neq (\alpha - (1+\alpha)f + \eta)c_L$ and Lemma 24, contradicting $a^{I*} = 0$.

Let $\tilde{R} = \sup \mathcal{R}_B^{I*} \leq (1-f)\alpha c_H$. If $\tilde{R} \in \mathcal{R}_B^{I*}$, $L_B(\tilde{R}, 1, G_P^{a*}; p) = 0$ implies $G_P^{a*}(\tilde{R}) > 0$ and an $R > \tilde{R}$ exists with $R \in \mathcal{R}_{P,i}^{I*}$ for some $i \in \{u, h\}$. If instead $\tilde{R} \notin \mathcal{R}_B^{I*}$, then $\lim_{R \to \tilde{R}^-} G_P^{a*}(R) > 0$, implying an $R \geq \tilde{R}$ exists with $R \in \mathcal{R}_{P,i}^{I*}$ for some $i \in \{u, h\}$. In either case, $G_B^{I*}(R) = 0$, thus contradicting the previous result.

Because $m_B^{I*} \in (0,1)$, Lemma 23 implies $\sup \mathcal{R}_B^* = (1-f)\alpha c_H$, Moreover, by Lemmas 25 and 26, we have that $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} \leq R_D/p$ and $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} \in \{(\alpha - (1+\alpha)f + \eta)c_L, R_D/p\}$. The result that $\max \min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} \in \{(1-f)\alpha c_H, (\alpha - (1+\alpha)f + \eta)c_H\}$ follows from Lemma 29. □

D.6 PROOF OF LEMMA 18

Throughout the proof, recall that $m_B^{I*} \in (0,1)$, $m_P^{a*} > 0$, and $a^{I*} > 0$ by Lemma 17. In particular, an R exists such that $L_P(R, m_B^{I*}, G_B^{I*}; p^h) \geq m_B^{I*}[p^h(1+\alpha)c_H + (1-p)c_L]f$.

We first consider a merchant with $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L > \bar{R}$. Suppose, by contradiction, that $m^{a*} \in (0,1)$. By Lemma 14, we must have $a^{I*} \in (0,1)$ and $m_{P,u}^{I*} \in (0,1)$. By Lemma 21, we derive also $m_{P,l}^{I*} = 0$. Note that

$$
\begin{aligned}
&L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) - m_B^{I*}[p^h(1+\alpha)c_H + (1-p^h)c_L]f \\
&\qquad \geq L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^{I*}, G_B^{I*}; p^h) - m_B^{I*}[p^h(1+\alpha)c_H + (1-p^h)c_L]f \\
&\qquad\qquad = (1 - m_B^{I*})[p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L - \bar{R}] > 0
\end{aligned}
$$

where the second inequality follows from $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L > \bar{R}$. Therefore, for a sufficiently small $c > 0$,

$$
\begin{aligned}
&\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c \\
&\quad \geq m_B^{I*}[p^h(1+\alpha)c_H + (1-p^h)c_L]f + (1-m_B^{I*})[p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L - \bar{R}] - c \\
&\qquad = L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) + (1-m_B^{I*})[p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L - \bar{R}] - c \\
&\qquad \geq L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) + (1-\bar{m})[p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L - \bar{R}] - c \\
&\qquad\qquad > L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u),
\end{aligned}
$$

where the second inequality follows from Lemma 24 and the last one from c being sufficiently small. However, this result contradicts $a^{I*} \in (0,1)$. Therefore, $m_P^{a*} = 1$.

Next, we consider $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L \leq \bar{R}$. Because (44) holds for $i = h$ when $p \geq \frac{R_D}{(1-f)\alpha c_H}$, we also have $R_D/p \geq \bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$. By Lemmas 25, 26, and 28, we thus have $\min \mathcal{R}_{P,i}^{I*} \geq R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$ for $i \in \{u, h\}$.

Because $a^{I*} > 0$, we need to rule out $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) < \psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1 -$

$\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c$ by contradiction. If this inequality holds, then also $m_P^{a*} = 1$ because $m_{P,h}^{I*} = 1$. From Lemma 29, 19, and $R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, we obtain $\max \mathcal{R}_{P,h}^{I*} = (\alpha - (1+\alpha)f + \eta)c_H$. But then

$$L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) = L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^{I*}, G_B^{I*}; p^h) \leq m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f.$$

By Lemma 21, $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^i) = m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$ also for $i \in \{u, l\}$, contradicting $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) < \psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c$.

We therefore have $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) = \psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c$. It remains to show that $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) = m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$. We proceed by contradiction and assume $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) > m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$. Then, $m_{P,u}^{I*} = 1$ and $m_P^{a*} = 1$. From the previous reasoning, we would then conclude $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) \leq m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$, which implies $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u) = m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$ by Lemma 21, thus generating a contradiction. Therefore, when $p^h(\alpha+\eta)c_H + (1-p^h)\eta c_L \leq \bar{R}$, we have

$$\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c = m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f = L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u)$$

When $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$, Lemma 28 implies $\min \mathcal{R}_{P,i}^{*I} \neq (\alpha - (1+\alpha)f + \eta)c_L$ for $i \in \{u, h\}$. Therefore, by Lemmas 25, 26, and 27, we obtain $\min \mathcal{R}_{P,h}^{*} = \min \mathcal{R}_{P,u}^{*} = R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$, where the inequality follows because $\bar{R} > (\alpha - (1+\alpha)f + \eta)c_L$ and $p \leq R_D/\bar{R}$.

Finally, when $R_D/p < (\alpha - (1+\alpha)f + \eta)c_L$, Lemmas 25, 26, and 27 imply $\min \mathcal{R}_{P,h}^{I*} = R_D/p \leq (\alpha - (1+\alpha)f + \eta)c_L$ when c is sufficiently small. □

D.7 PROOF OF PROPOSITION 5

By Lemmas 14, 17 and 18, we have $m_{P,h}^{I*} = m_P^{a*} = 1$, $a^{I*} > 0$, $m_B^{I*} \in (0,1)$, and $\min\{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,h}^{I*}\} = R_D/p > (\alpha - (1+\alpha)f + \eta)c_L$. Because $\arg\max_{R > (\alpha-(1+\alpha)f+\eta)c_L} L_P(R, m_B, G_B; p^i)$ does not depend on p^i, $\mathcal{R}_{P,u}^{*} = \mathcal{R}_{P,h}^{*}$.

First notice,

$$L_P(R, m_B^{I*}, G_B^{I*}; p^l) < L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^{I*}, G_B^{I*}; p^l) \tag{61}$$

for all $R \neq (\alpha - (1+\alpha)f + \eta)c_L$. Thus, if $\bar{R} > (\alpha + \eta)c_L$, $m_{P,l}^{I*} = 0$. If, instead, $\bar{R} \in ((\alpha - (1+\alpha)f + \eta), (\alpha + \eta)c_L]$, $m_{P,l}^{I*} = 1$ and $\mathcal{R}_{P,l}^{I*} = \{(\alpha - (1+\alpha)f + \eta)c_L\}$.

Because $\mathcal{R}^*_{P,u} = \mathcal{R}^*_{P,h}$, consider $R \in \mathcal{R}^*_{P,u}$. Then, for a sufficiently small c,

$$\begin{aligned}\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c \\ > \psi L_P(R, m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P(R, m_B^{I*}, G_B^{I*}; p^l) \\ = L_P(R, m_B^{I*}, G_B^{I*}; p^u) = L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h)\end{aligned}$$

where the strict inequality follows from (61) and Lemma 24. Hence, $a^{I*} = 1$.

Using Lemma 26 and 23, we obtain $(\alpha - (1+\alpha)f + \eta)c_L < R_D/p = \min \mathcal{R}_B^{I*} \leq \sup \mathcal{R}_B^{I*} = (1-f)\alpha c_H$. By Lemma 30 we have $G_{P,h}^{I*}(\cdot)$ and $G_B^{I*}(\cdot)$ are strictly decreasing in $[R_D/p, (1-f)\alpha c_H]$ because $a^{I*} = 1$. Moreover, by 29, we have $(\alpha - (1+\alpha)f + \eta)c_H \in \mathcal{R}_{P,h}^{I*}$.

The rest of the proof is thus identical to the proof of Proposition 1 with m_B^{I*} replacing m_B^*, G_B^{I*} replacing G_B^*, and $G_{P,h}^{I*}$ replacing G_P^*. □

D.8 Proof of Proposition 6

By Lemmas 14, 17 and 18, we have $m_{P,h}^{I*} = m_P^{a*} = 1$, $a^{I*} > 0$, and $m_B^{I*} \in (0,1)$. By 29, we have $(\alpha - (1+\alpha)f + \eta)c_H \in \mathcal{R}_{P,h}^{I*}$. Finally note that, because $\bar{R} < (\alpha+\eta)c_H$, $m_{P,l}^{I*} = 1$ and $\mathcal{R}_{P,l}^{I*} = \{(\alpha - (1+\alpha)f + \eta)c_L\}$. Thus, by 14, $(\alpha - (1+\alpha)f + \eta)c_L \notin \mathcal{R}_{P,h}^{I*}$.

First, we observe that, because $\bar{R} < R_D/p < (\alpha+\eta)c_H$, $m_{P,l}^{I*} = 1$ and $\mathcal{R}_{P,l}^{I*} = \{(\alpha - (1+\alpha)f + \eta)c_L\}$.

Next, by Lemma 26 , $\min \mathcal{R}_{P,h}^{I*} = R_D/p$. By Lemma 29, $\max \mathcal{R}_{P,h}^{I*} = (\alpha - (1+\alpha)f + \eta)c_H$. From $L_P((\alpha - (1+\alpha)f + \eta)c_H, m_B^{I*}, G_B^{I*}; p^h) = L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h)$, we thus obtain m_B^{I*} is given by (45).

We first consider $T = (1-f)\alpha c_H < (\alpha - (1+\alpha)f + \eta)c_L$. We want to show that, in this case, $a^{I*} = 1$. Suppose, by way of contradiction, that $a^{I*} \in (0,1)$. I want to show that, if $R < (\alpha - (1+\alpha)f + \eta)c_L$, then $R \notin \mathcal{R}_{P,u}^{I*}$ for a sufficiently small c. We proceed by contradiction and assume an $R < (\alpha - (1+\alpha)f + \eta)c_L$ exist such that $R \in \mathcal{R}_{P,u}^{I*}$ for all c. Then

$$\begin{aligned}\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) &\geq L_P(R, m_B^{I*}, G_B^{I*}; p^h) \\ &= L_P(R, m_B^{I*}, G_B^{I*}; p^u) - (1-\psi)L_P(R, m_B^{I*}, G_B^{I*}; p^l) \\ &> L_P^{I*} m_B^{I*}, G_B^{I*}; p^u) - (1-\psi)L_P^{I*} m_B^{I*}, G_B^{I*}; p^l) + c\end{aligned}$$

where strict inequality follows because $R < (\alpha - (1+\alpha)f + \eta)c_L$ and because of Lemma 24. But this result contradicts $a^{I*} < 1$. Hence, for a sufficiently small c, $\min \mathcal{R}_{P,u}^{I*} > (1-f)\alpha c_H$. Because (44) holds for $i = u$, we must thus have $\mathcal{R}_{P,u}^{I*} = \{(\alpha - (1+\alpha)f + \eta)c_H\}$, thus contradicting the previous result that $\mathcal{R}_{P,u}^{I*} \subseteq [R^c, (\alpha - (1+\alpha)f + \eta)c_H]$.

Therefore, if $T = (1-f)\alpha c_H < (\alpha - (1+\alpha)f + \eta)c_L$, we have $a^{I*} = 1$. The rest of the results can then be derived as in the proof of Proposition 2 when $T < (\alpha - (1+\alpha)f + \eta)c_L$ with m_B^{I*} replacing m_B^*, G_B^{I*} replacing G_B^*, and $G_{P,h}^{I*}$ replacing G_P^*. In particular, using $L_P(R, m_B^{I*}, G_B^{I*}; p^h) = L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h)$ for all $R \in [R_D/p, T]$, we obtain (46). Using using $L_B(R, 1, G_{P,h}^{I*}; p) = L_B(R_D/p, 1, G_{P,h}^{I*}; p^h)$ for all $R \in [R_D/p, T]$, we obtain $G_{P,h}^{I*}$ is given by (51).

Next, we consider $T \geq (\alpha - (1+\alpha)f + \eta)c_L$. By a reasoning identical to the one in the proof of Proposition 2, we have $(\alpha-(1+\alpha)f+\eta)c_L = \sup\{\mathcal{R}_B^{I*} \cap [R_D/p, (\alpha-(1+\alpha)f+\eta)c_L]\}$. By Lemma 30, $[R_D/p, (\alpha - (1+\alpha)f + \eta)c_L] \subseteq \mathcal{R}_B^{I*}$ and $[R_D/p, (\alpha - (1+\alpha)f + \eta)c_L] \subseteq \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$. By the left-continuity of G_B^{I*}, an $R^c \in [R_D/p, (\alpha - (1+\alpha)f + \eta)c_H)$ exists such that $R^c = \max\{\mathcal{R}_{P,h}^{I*} \cap [R_D/p, (\alpha - (1+\alpha)f + \eta)c_L]\}$. Otherwise, we would have $(\alpha - (1+\alpha)f + \eta)c_L \in \mathcal{R}_{P,h}^{I*}$, contradicting a result we established earlier.

Because $(\alpha - (1+\alpha)f + \eta)c_L > R_D/p \in \mathcal{R}_{P,h}^{I*}$, Lemma 20 implies $R \notin \mathcal{R}_{P,u}^{I*}$ for all $R > (\alpha - (1+\alpha)f + \eta)c_L$. Furthermore, by the same Lemma and because $[R_D/p, (\alpha - (1+\alpha)f + \eta)c_L] \subseteq \{\mathcal{R}_{P,u}^{I*} \cup \mathcal{R}_{P,u}^{I*}\}$, we must also have $\mathcal{R}_{P,u}^{I*} = [R^c, (\alpha - (1+\alpha)f + \eta)c_H]$. Finally, because $G_P^{a*}(R)$ is strictly decreasing from $R \in [R_D/p, (\alpha - (1+\alpha)f + \eta)cL]$, but $R \notin \mathcal{R}_{P,h}^{I*}$ for $R \in (R^c, (\alpha - (1+\alpha)f + \eta)cL]$, then $a^{I*} \in (0,1)$.

Because, $a^{I*} \in (0,1)$, $R_D/p \in \mathcal{R}_{P,h}^{I*}$, $R^c \in \mathcal{R}_{P,i}^{I*}$ for $i \in \{u, h\}$, and $(\alpha - (1+\alpha)f + \eta)c_L \in \mathcal{R}_{P,i}^{I*}$, for $i \in \{u, l\}$, we use the following system of equations to determine $G_B^{I*}((\alpha - (1+\alpha)f + \eta)c_L)$, $G_B^{I*}(R^C)$, and R^c respectively:

$$\begin{aligned}
L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^{I*}, G_B^{I*}; p^u) &= \psi L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h) \\
&\quad + (1-\psi)L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^{I*}, G_B^{I*}; p^l) - c \\
L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h) &= L_P(R^c, m_B^{I*}, G_B^{I*}; p^h) \\
L_P(R^c, m_B^{I*}, G_B^{I*}; p^u) &= L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^{I*}, G_B^{I*}; p^u).
\end{aligned}$$

In particular, we obtain R^c is given by (47) and the the first equation implies

$$G_B^{I*}((\alpha - (1+\alpha)f + \eta)c_L) > 0. \tag{62}$$

From $L_P(R, m_B^{I*}, G_B^{I*}; p^h) = L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h)$ for all $R \in [R_D/p, R^c]$, we obtain G_B^{I*} coincides with the expression in (46) for $R \in [R_D/p, R^c]$. From $L_P(R, m_B^{I*}, G_B^{I*}; p^u) = L_P((\alpha - (1+\alpha)f + \eta)c_L, m_B^{I*}, G_B^{I*}; p^u)$ for all $R \in [R^c, (\alpha - (1+\alpha)f + \eta)c_L]$, we obtain G_B^{I*} coincides with (48) for $R \in [R^c, (\alpha - (1+\alpha)f + \eta)c_L]$.

Let $U^c := (1-f)c_L$ if $(1-f)\alpha c_H = (\alpha - (1+\alpha)f + \eta)c_L$; otherwise let $U^c := \min\{\mathcal{R_B}^{I*} \cap$

$((\alpha-(1+\alpha)f+\eta)c_L,(1-f)\alpha c_H]\}$ if $(1-f)\alpha c_H > (\alpha-(1+\alpha)f+\eta)c_L$. In the first case with $(1-f)\alpha c_H = (\alpha-(1+\alpha)f+\eta)c_L$, (62) implies $P(R_B=(1-f)\alpha c_H) = G_B^{I*}((\alpha-(1+\alpha)f+\eta)c_L) > 0$.

In the second case with $(1-f)\alpha c_H > (\alpha-(1+\alpha)f+\eta)c_L$, note that such a U^c exists because $\sup \mathcal{R}_B^{I*} = (1-f)_H > (\alpha-(1+\alpha)f+\eta)c_L$ and because of a reasoning analogous to that in Lemma 25. By Lemmas 23, 30, and 20, if $U^c < (1-f)\alpha c_H$, $[U,(1-f)\alpha c_H)$ is a set of best responses for banks and the optimistic platform. Because $l_P^0((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p^h) > \lim_{R\to(\alpha-(1+\alpha)f+\eta)c_L^+} l_P^1(R, m_B^{I*}, G_B^{I*}; p^h)$, a $\delta > 0$ exists such that $U^c \geq (\alpha-(1+\alpha)f+\eta)c_L+\delta$. The same result holds immediately if $U^c = (1-f)\alpha c_H$. Also note $l_P^1(U, m_B^{I*}, G_B^{I*}; p^h) > l_P^1(R, m_B^{I*}, G_B^{I*}; p^h)$ for all $R \in ((\alpha-(1+\alpha)f+\eta)c_L, U^c)$. Hence, from $L_B(U^c, 1, G_P^{a*}; p) = 0$ and $U^c \geq (\alpha-(1+\alpha)f+\eta)c_L+\delta$, we obtain

$$(1-a^{I*})P(R_{P,u}=(\alpha-(1+\alpha)f+\eta)c_L) = \lim_{R\to(\alpha-(1+\alpha)f+\eta)c_L^-} G_P^{a*}(R) - G_P^{a*}(U^c) > 0. \quad (63)$$

Hence, $G_P^{a*}(U^c) < \lim_{R\to(\alpha-(1+\alpha)f+\eta)c_L^-} G_P^{a*}(R)$, thus implying $L_B((\alpha-(1+\alpha)f+\eta), 1, G_P^{a*}; p) < \lim_{R\to(\alpha-(1+\alpha)f+\eta)c_L^-} L_B(R, 1, G_P^{a*}; p) = 0$. This result implies $(\alpha-(1+\alpha)f+\eta)c_L \notin \mathcal{R}_B^{I*}$ and $G_B^{I*}((\alpha-(1+\alpha)f+\eta)c_L) = G_B^{I*}(U^c)$.

Let R^{Uc} be such that

$$\begin{aligned} m_B^{I*}p^h G_B^{I*}((\alpha-(1+\alpha)f+\eta)c_L)(R^{Uc}-\bar{R}) + (1-m_B^{I*})[p^h R^{Uc} + (1-p^h)(\eta-f)c_L - \bar{R}] \\ + [(1+\alpha)p^h c_H + (1-p^h)c_L]f \\ = l_P^0((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p^h), \end{aligned}$$

from which we obtain

$$R^{Uc} := (\alpha-(1+\alpha)f+\eta)c_L + \frac{(1-m_B^{I*})(1-p^h)\alpha c_L}{p^h[m_B^{I*}G_B^{I*}((\alpha-(1+\alpha)f+\eta)c_L) + (1-m_B^{I*})]} > (\alpha-(1+\alpha)f+\eta)c_L.$$

We thus set $U^c := \min\{R^{Uc}, (1-f)\alpha c_H\}$.

If $R^{Uc} \in ((\alpha-(1+\alpha)f+\eta)c_L, (1-f)\alpha c_H)$, then $U^c = R^{Uc}$, and Lemma 30 implies $[U,(1-f)\alpha c_H)$ is a set of best responses for banks and the optimistic platform. From $l_P^1(R, m_B^{I*}, G_B^{I*}; p^h) = l_P^1((\alpha-(1+\alpha)f+\eta)c_H, m_B^{I*}, G_B^{I*}; p)$ for $R \in [U,(1-f)\alpha c_H)$, we obtain the expression for G_B^{I*} in (49). Note that $\lim_{R\to(1-f)\alpha c_H^-} G_B^{I*}(R) > 0$, hence $(1-f)\alpha c_H \in \mathcal{R}_B^{I*}$. From $L_B(R, 1, G_P^{a*}; p) = 0$ and $G_{P,u}^{I*}(R) = 0$ for $R \in [U^c, (1-f)\alpha c_H]$ we obtain $G_{P,h}^{I*}$ as in (52) for $R \in [U^c, (1-f)\alpha c_H]$.

If $R^{Uc} \geq (1-f)\alpha c_H$, then $U^c = (1-f)\alpha c_H$. Banks offer rate $(1-f)\alpha c_H$ with probability $G_B^{I*}((\alpha-(1+\alpha)f+\eta)c_L) > 0$ and, from $L_B((1-f)\alpha c_H, 1, G_P^{a*}; p) = 0$, we obtain $P(R_{P,h} =$

$(\alpha-(1+\alpha)f+\eta)c_H) = G_P^{a*}(U)$.

To characterize the distribution of the optimistic and informed platform when $T \geq (\alpha-(1+\alpha)f+\eta)c_L$, $L_B(R,1,G_P^{a*};p) = 0$ for all $R \in [R_D/p, (\alpha-(1+\alpha)f+\eta)c_L)$. If $R \in [R_D/p, R^c]$, $G_P^{I*}(R) = 1$ and we obtain the first case in (52) for $G_{P,h}^{I*}(R)$. If $R \in [R^c, (\alpha-(1+\alpha)f+\eta)c_L,$, $G_{P,h}^{I*}(R) = G_{P,h}^{I*}(U^c)$ and we obtain (53) for $G_{P,h}^{I*}(R)$.

To pin down a^{I*} when $T \geq (\alpha-(1+\alpha)f+\eta)c_L$, note $G_{P,u}^{I*}(R^c) = 1$ and

$$G_{P,h}^{I*}(R^c) = G_{P,h}^{I*}(U^c) = \frac{1}{a^{I*}}\frac{(1-p)R_D/p}{U^c - R_D}.$$

Using $L_B(R^c,1,G_P^{a*};p) = 0$, we obtain

$$-(1-p)R_D + (1-a^{I*})p(R^c - R_D) + (1-p)R_D\frac{(1-p)R_D}{U^c - R_D},$$

which yields (50).

Finally, we compare m_B^{I*} with m_B^* from Proposition 2. Let

$$M_{B1}(x;c) := \frac{x(\alpha-(1+\alpha)f+\eta)c_H + (1-x)(\eta-(1+\alpha)f)c_L - R_D/p}{x(\alpha-(1+\alpha)f+\eta)c_H + (1-x)(\eta-(1+\alpha)f)c_L - R_D/p + xR_D/p - x\bar{R}}$$

and notice $m_B^{I*} = M_{B1}(p^h;c)$ and $m_B^* = M_{B1}(p;0)$. Taking the derivative for $c = 0$, we have

$$\frac{dM_{B1}(x;0)}{dx} = \frac{(R_D/p - \bar{R})[(R_D/p - (\eta-(1+\alpha)f)c_L)]}{\left\{x(\alpha-(1+\alpha)f+\eta)c_H + (1-x)(\eta-(1+\alpha)f)c_L - R_D/p + xR_D/p - x\bar{R}\right\}^2} > 0$$

because $R_D/p > \bar{R}$ and $R_D/p \geq R_D > c_L \geq (\eta-(1+\alpha)f)c_L)$. Hence, for a sufficiently small c, $m_B^{I*} = M_{B1}(p^h;c) > M_{B1}(p;0) = m_B^*$. □

D.9 Proof of Proposition 7

By Lemmas 14, 17 and 18, we have $m_{P,h}^{I*} = m_P^{a*} = 1$, $a^{I*} > 0$, and $m_B^{I*} \in (0,1)$. By 29, we have $(\alpha-(1+\alpha)f+\eta)c_H \in \mathcal{R}_{P,h}^{I*}$. Finally note that, because $\bar{R} < (\alpha+\eta)c_H$, $m_{P,l}^{I*} = 1$ and $\mathcal{R}_{P,l}^{I*} = \{(\alpha-(1+\alpha)f+\eta)c_L\}$. Thus, by 14, $(\alpha-(1+\alpha)f+\eta)c_L \notin \mathcal{R}_{P,h}^{I*}$.

We proceed as in the proof of Proposition 3. Specifically, Let $V^c := \min \mathcal{R}_B^{I*}$. Note that such a V^c exists because $\sup \mathcal{R}_B^{I*} = (1-f)_H > (\alpha-(1+\alpha)f+\eta)c_L$ and because of a reasoning analogous to that in Lemma 25. Note also that $V^c \geq R_D/p > (\alpha-(1+\alpha)f+\eta)c_L$. By Lemmas 23 an 30, if $V^c < (1-f)\alpha c_H$, $[V^c, (1-f)\alpha c_H)$ is a set of best responses for lenders. Because $l_P^0((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p^i) > \lim_{R\to(\alpha-(1+\alpha)f+\eta)c_L^+} l_P^1(R, m_B^*, G_B^*; p^i)$ for any $i \in \{u,h\}$, a $\delta > 0$ exists such that $V^c \geq (\alpha-(1+\alpha)f+\eta)c_L + \delta$. The same result holds immediately if $V^c = (1-f)\alpha c_H$.

Because $L_B(V^c, 1, G_P^{a*}; p) = 0$, we have $G_P^{a*} = \frac{(1-p)R_D/p}{V^c - R_D}$. We thus observe that $l_P^1(R, m_B^{I*}, G_B^{I*}; p^i) < l_P^1(V, m_B^{I*}, G_B^{I*}; p^i)$ for all $R \in ((\alpha-(1+\alpha)f+\eta)c_L, V)$ and all $i \in \{u, h\}$, and $l_P^0(R', m_B^{I*}, G_B^{I*}; p^i) < l_P^0((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p^i)$ for all $R < (\alpha-(1+\alpha)f+\eta)c_L$. After recalling $(\alpha-(1+\alpha)f+\eta)c_L \notin \mathcal{R}_{P,h}^{I*}$, we conclude

$$(1-a^{I*})P(R_{P,u} = (\alpha-(1+\alpha)f+\eta)c_L) = \frac{V^c - R_D/p}{V - R_D}. \tag{64}$$

In particular, if $V^c > R_D/p$, we must have $(1-a^{I*})P(R_{P,u} = (\alpha-(1+\alpha)f+\eta)c_L) > 0$ and hence, $(\alpha-(1+\alpha)f+\eta)c_L \in \mathcal{R}_{P,u}^{I*}$.

For a sufficiently small c, because $\max \mathcal{R}_{P,h}^{I*} = (\alpha-(1+\alpha)f+\eta)c_H$ and $(\alpha-(1+\alpha)f+\eta)c_L \notin \mathcal{R}_{P,h}^{I*}$, we must have $L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^{I*}, G_B^{I*}; p) \geq L_P((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p^h) + c/\psi$, which implies

$$m_B^{I*} \leq \frac{p^h(\alpha-(1+\alpha)f+\eta)(c_H-c_L) - (1-p^h)\alpha c_L - c/\psi}{p^h(\alpha-(1+\alpha)f+\eta)c_H - (1-p^h)\alpha c_L - p^h\bar{R}}.$$

If $V^c > R_D/p$ and hence, $(1-a^{I*})P(R_{P,u} = (\alpha-(1+\alpha)f+\eta)c_L) > 0$, this expression holds as an equality because it is equivalent to

$$\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h) + (1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) - c = L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u).$$

Moreover, from $L_P((\alpha-(1+\alpha)f+\eta)c_H, m_B^{I*}, G_B^{I*}; p^h) \geq L_P(V^c, m_B^{I*}, G_B^{I*}; p^h)$, we obtain

$$m_B^{I*} \leq \tilde{m}_B(V^c) := \frac{(\alpha-(1+\alpha)f+\eta)c_H - V^c}{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R}}.$$

By Lemmas 30 and 19, if $V^c < (1-f)\alpha c_H$, $V^c \in \mathcal{R}_{P,h}^{I*}$ and this expression holds as an equality.

Let $R^{V,c}$ be defined so that

$$\tilde{m}_B(R^{Vc}) = \frac{p^h(\alpha-(1+\alpha)f+\eta)(c_H-c_L) - (1-p^h)\alpha c_L - c/\psi}{p^h(\alpha-(1+\alpha)f+\eta)c_H + (1-p^h)\alpha c_L + p^h\bar{R}},$$

which implies

$$R^{Vc} = (\alpha-(1+\alpha)f+\eta)c_L \frac{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p^h}{p^h}\alpha c_L \frac{\bar{R}}{(\alpha-(1+\alpha)f+\eta)c_L}}{(\alpha-(1+\alpha)f+\eta)c_H - \bar{R} - \frac{1-p^h}{p^h}\alpha c_L} > (\alpha-(1+\alpha)f+\eta)c_L.$$

The rate V^c is thus determined as $V^c \coloneqq \min\{(1-f)\alpha c_H, \max\{R_D/p, R^{Vc}\}\}$.

If $V^c = R_D/p$, then $\min \mathcal{R}^{I*}_{P,h} = \min \mathcal{R}^{I*}_B = R_D/p$ and the equilibrium is as described in Proposition 5.

If $V^c \in (R_D/p, (1-f)\alpha c_H)$, by Lemmas 13 and 19, all rates in $[V, (1-f)\alpha c_H)$ are best responses for banks and the optimistic platform. Therefore, for any $R \in \mathcal{R}^{I*}_{P,h}$,

$$\begin{aligned}L_P(R, m^{I*}_B, G^{I*}_B; p^h) &= L_P((\alpha-(1+\alpha)f+\eta)c_H, m^{I*}_B, G^{I*}_B; p^h) \\ &= L_P((\alpha-(1+\alpha)f+\eta)c_L, m^{I*}_B, G^{I*}_B; p^h) + c/\psi,\end{aligned}$$

as previously discussed. From the last equality, we obtain m^{I*}_B is given by (54). From the first equality, we obtain G^{I*}_B is given by (34).

Furthermore, by Lemma 21, for a sufficiently small c, $L_P(R, m^{I*}_B, G^{I*}_B; p^u) < L_P((\alpha-(1+\alpha)f+\eta)c_L, m^{I*}_B, G^{I*}_B; p^u)$. Hence, for all $\mathcal{R}^{I*}_{P,u} = \{(\alpha-(1+\alpha)f+\eta)c_L\}$. From 64 with $P(R_{P,u} = (\alpha-(1+\alpha)f+\eta)c_L) = 1$, we obtain (56).

The rest of the proof for the case $V^C \in (R_D/p, (1-f)\alpha c_H)$ is identical to the proof of Proposition 3 with m^{I*}_B replacing m^*_B, G^{I*}_B replacing G^*_B, and $G^{I*}_{P,h}$ replacing G^*_P.

Finally, if $V^c = (1-f)\alpha c_H$, we have $\mathcal{R}^{I*}_{P,h} = (\alpha-(1+\alpha)f+\eta)c_L$, $\mathcal{R}^{I*}_{P,u} = (\alpha-(1+\alpha)f+\eta)c_H$, a^{I*} is still given by (56), and m^{I*}_B is given by (54). Banks lend at rate $(1-f)\alpha c_H$ with probability 1.

To conclude, we compare m^{I*}_B with m^*_B from Proposition 3. Let

$$M_{B2}(x; c) \coloneqq \frac{x(\alpha-(1+\alpha)f+\eta)(c_H-c_L)-(1-x)\alpha c_L - c/\psi}{x(\alpha-(1+\alpha)f+\eta)\alpha c_H-(1-x)c_L - x\bar{R}}$$

and notice $m^{I*}_B = M_{B2}(p^h; c)$ and $m^*_B = M_{B2}(p; 0)$. Taking the derivative for $c = 0$, we have

$$\frac{dM_{B2}(x;0)}{dx} = \frac{c_L[(\alpha-(1+\alpha)f+\eta)c_L - \bar{R}]}{\left\{x(\alpha-(1+\alpha)f+\eta)c_H-(1-x)\alpha c_L - x\bar{R}\right\}^2} > 0$$

because $\bar{R} < (\alpha-(1+\alpha)f+\eta)c_L$ when $R^{Vc} > R_D/p \geq (\alpha-(1+\alpha)f+\eta)c_L$. Hence, for a sufficiently small c, $m^{I*}_B = M_{B2}(p^h; c) > M_{B2}(p; 0) = m^*_B$. □

D.10 Proof of Proposition 8

By Lemmas 14, 17 and 18, we have $m^{I*}_{P,h} = 1$, $a^{I*} > 0$, $m^{I*}_B \in (0,1)$, and $\min\{\mathcal{R}^{I*}_{P,u} \cup \mathcal{R}^{I*}_{P,h}\} = R_D/p > (\alpha-(1+\alpha)f+\eta)c_L$. Notice $\arg\max_{R>(\alpha-(1+\alpha)f+\eta)c_L} L_P(R, m_B, G_B; p^i)$ does not depend on p^i. Therefore, $\mathcal{R}^*_{P,u} = \mathcal{R}^*_{P,h}$.

For a sufficiently small c, by Lemma 18 we have

$$\psi L_P^{I*}(m_B^{I*}, G_B^{I*}; p^h)+(1-\psi)L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l)-c = m_B^{I*}[p(1+\alpha)c_H+(1-p)c_L]f = L_P^{I*}(m_B^{I*}, G_B^{I*}; p^u).$$

By Lemma 21, we also have $L_P^{I*}(m_B^{I*}, G_B^{I*}; p^l) = m_B^{I*}[p(1+\alpha)c_H+(1-p)c_L]f$. Using $R_D/p \in \mathcal{R}_{P,h}^*$,

$$\psi L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^h) = \psi m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f + c,$$

from which we obtain (57). The previous equation also implies that, for a sufficiently small c, $L_P(R_D/p, m_B^{I*}, G_B^{I*}; p^u) < \psi m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f$ and, hence, $m_{P,u}^{I*} = 0$.

Using Lemma 26 and 23, we obtain $(\alpha-(1+\alpha)f+\eta)c_L < R_D/p = \min \mathcal{R}_B^{I*} \leq \sup \mathcal{R}_B^{I*} = (1-f)\alpha c_H$. By Lemma 30 we have $G_{P,h}^{I*}(\cdot)$ and $G_B^{I*}(\cdot)$ are strictly decreasing in $[R_D/p, (1-f)\alpha c_H]$ because $(1-a^{I*})m_{P,u}^{I*} = 1$. Further note $m^{a*} = a^{I*}$ and $G_P^{a*}(\cdot) = G_{P,h}^{I*}(\cdot)$. Hence, the rest of the proof is identical to the proof of Proposition 4 with a^{I*} replacing m_P^*, $G_{P,h}^{I*}$ replacing G_P^*, and G_B^{I*} replacing G_B^{I*}. In particular, from $L_P(R, m_B^{I*}, G_B^{I*}; p^h) = m_B^{I*}[p(1+\alpha)c_H + (1-p)c_L]f + \frac{c}{\psi}$ we obtain (58).

We then need to compare m_B^{I*} with m_B^* from Proposition 4. Let

$$M_C(x;c) := \frac{\bar{R} - xR_D/p - (1-x)(\eta-f)c_L - [(1+\alpha)xc_H + (1-x)c_L]f + c/\psi}{(1-x)\bar{R} - (1-p^h)(\eta-f)c_L - [(1+\alpha)xc_H + (1-x)c_L]f}$$

and notice $m_B^{I*} = M_C(p^h; c)$ and $m_B^* = M_C(p; 0)$. Taking the derivative for $c = 0$, we have

$$\frac{dM_C(x;0)}{dx} = \frac{[\bar{R}-\eta c_L](\bar{R}-R_D/p)}{\left\{(1-x)\bar{R} - (1-p^h)(\eta-f)c_L - [(1+\alpha)xc_H + (1-x)c_L]f\right\}^2} < 0$$

because $\bar{R} \geq R_D/p > \eta c_L$ and $\bar{R} < R_D/p$. Hence, for a sufficiently small c, $m_B^{I*} = M_C(p^h; c) < M_C(p; 0) = m_B^*$. □

D.11 Proof of Corollary 3

We start by making a preliminary observation. Specifically, we observe that, if $R \in [\bar{R}, (\alpha-(1+\alpha)f+\eta)c_L]$, $L_P(R_D/p, m_B, G_B; p)$ is decreasing in m_B. Note

$$L_P(R, m_B, G_B; p) = m_B pG_B(R)(R-\bar{R}) + (1-m_B)[R+(1-p)f\alpha c_L - \bar{R}] + [(1+\alpha)pc_H + (1-p)c_L]f.$$

In this case,

$$pG_B(R)(R_D/p - \bar{R}) \leq p(R_D/p - \bar{R}) < R_D/p - \bar{R} + (1-p)f\alpha c_L$$

and thus, $L_P(R, m_B, G_B; p)$ increases if m_B declines.

We then consider parameters satisfying I.B2 with $V^c > R_D/p$. Note that, by comparing V and V^c from Propositions 3 and 7, we also have $V \geq V^c > R_D/p$. In this case, $a^{I*} \in (0, 1)$, by Proposition 7. Hence, the platform's profits are

$$L((\alpha-(1+\alpha)f+\eta)c_L, m_B^{I*}, G_B^{I*}; p) < L((\alpha-(1+\alpha)f+\eta)c_L, m_B^{*}, G_B^{I*}; p) = L((1-2f+\eta)c_L, m_B^{*}, G_B^{*}; p)$$

The inequality comes from the fact that $m_B^{I*} > m_B^*$ and the preliminary observation we made above. The equality follows from $G_B^{I*}((\alpha - (1+\alpha)f + \eta)c_L) = G_B^*((\alpha - (1+\alpha)f + \eta)c_L) = 1$. Hence, the platform earns lower profits with the option to acquire information.

In case I.C, the platform's profits are $m_B^{I*}[(1+\alpha)pc_H + (1-p)c_L]f$, whereas, without the option to acquire information, its profits are $m_B^*[(1+\alpha)pc_H + (1-p)c_L]f$. Because $m_B^{I*} < m_B^*$ by Proposition 8, the platform earns lower expected profits when it has the option to acquire information.