Private Credit: Risks and Benefits of a Maturity Wall*

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Abstract

Private credit funds are typically finite-lived, creating a maturity wall that introduces refinancing frictions for distressed loans. In the model, this friction makes termination credible even in the presence of continuation vehicles, mitigating borrower moral hazard at the cost of inefficient liquidation. The existence of private credit depends on loan opacity and on limited asset pledgeability. Private credit finances risky borrowers excluded from bank financing, but also steals borrowers from banks. Bank balance sheets shrink and become less procyclical, while aggregate tail risk rises. A menu of funds with different refinancing capacities, alongside bank lending, implements the optimal contract, providing an agency rationale for finite-lived funding vehicles.

Keywords: private credit, maturity wall, continuation vehicles, inefficient liquidation, bank loans, bank balance sheets, systemic risk

JEL Classification: G21, G23, G28

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I Introduction

Private credit has grown from virtually nonexistent in the early 2000s to roughly $1.6 trillion in global assets under management in 2023. The IMF argues that private credit expands financing to firms excluded from bank lending but may also amplify negative aggregate shocks.[1] This raises two related questions: Why can private credit finance borrowers that banks cannot? Why does the resulting expansion of credit make economic downturns more severe? We address these questions by building a model of private credit and its interaction with bank lending.

We answer these questions focusing on a key feature of most private credit funds. Once a fund reaches the end of its life, it cannot itself roll over a loan.[2] This leads to a maturity wall reflecting fund structure rather than necessarily poor borrower fundamentals: while the borrower may refinance elsewhere, it cannot rely on rollover by its incumbent lender and thus cannot be sure its loan gets refinanced. The maturity wall therefore throws "sand in the gears" of refinancing relative to the more seamless rollover available from a long-lived bank. The resulting uncertainty makes termination credible and disciplines borrower effort in a way that banks cannot replicate. Private credit can therefore finance some firms banks would reject but also attracts some borrowers who could otherwise get a bank loan. However, the maturity wall with its credible termination creates aggregate risk: when borrower shocks are correlated, many borrowers hit the refinancing friction simultaneously, generating inefficient liquidation and larger aggregate tail losses. Thus, the maturity wall that makes private credit valuable in normal times also makes the economy more vulnerable to tail events.

We develop a three-period model in which the borrower can choose between bank and private credit financing. The cash flow in the intermediate period is uncertain and depends on the borrower's effort choice. With bank financing, a low cash flow in the interim period can lead to liquidation or renegotiation. If the long-term cash flow is high enough, banks roll over the loan by writing off some of the debt, and thus allow the borrower to survive. In contrast, private credit funds cannot generally roll

[1] See International Monetary Fund (2024).

[2] Most private credit funds are limited partnerships with five- to ten-year lives (Board of Governors of the Federal Reserve System, 2024; Cai and Haque, 2024). Business development corporations, which are generally perpetual, represent only about 20% of the US market (International Monetary Fund, 2024).

over the loans because of their limited lifetime and thus the refinancing of the loan becomes uncertain. In the model, we capture the maturity wall by assuming that loans provided by private credit funds that are not paid back in the interim period can be refinanced, or a continuation vehicle may be created, with some probability, or are otherwise liquidated. We treat the probability of continuing as exogenous in the baseline model to make its consequences more transparent for the borrower's effort choice and the resulting equilibrium allocation of credit. We endogenize the probability of continuation when we solve for the equilibrium in the secondary market for loans. Liquidating projects with high long-term cash flow is inefficient because some portion of the long-term cash flow is lost, putting private credit at a disadvantage relative to bank financing.

There is, however, a benefit to having a maturity wall. When taking loans from private credit funds, borrowers are fully aware that in case of bad interim performance the loan may not be rolled over and the project may be terminated. This threat of termination à la Stiglitz and Weiss (1983) and Bolton and Scharfstein (1990) is made credible ex post by the limited lifetime of private credit funds and induces the borrower to exert high effort leading up to the interim period. Unlike commitment mechanisms studied in the literature, which typically rely on coordination frictions among multiple creditors or on renegotiation-proofness assumptions, the commitment here follows from the fund's own finite investment horizon and the refinancing frictions resulting from that. Given that banks have long-term financing that extends beyond the interim period, they cannot commit to be tough ex post if the project is doing poorly.[3] This creates the possibility that some borrowers benefit from the uncompromising stance of private credit funds given that otherwise they cannot commit to exerting high effort. We thus show that the maturity wall grants private credit funds an advantage over banks for certain borrowers.[4]

The model produces the following taxonomy of borrowers. Borrowers that are very profitable or have low agency costs have no problem committing to high effort and getting bank financing; private credit would be too expensive for them. At the other extreme, borrowers with severe agency issues and weaker long-term profitability can-

[3]Our treatment of banks as flexible lenders follows Chemmanur and Fulghieri (1994) and Bolton and Freixas (2000). For evidence, see Roberts and Sufi (2009), Hu and Varas (2021), and Faria-e-Castro, Paul and Sánchez (2024).

[4]See Ellias and de Fontenay (2024) for a discussion of other advantages and disadvantages of private credit over bank financing.

not get bank loans but instead may be able to get financing from private credit funds. In general, these private credit loans have higher interest rates than high-quality bank loans to compensate for larger losses in downturns. This "democratization of credit" expands economic activity, but at a cost. When shocks between borrowers are correlated, the presence of private credit generates large economic downturns because of the inefficient liquidation of the projects they finance.

There are also borrowers facing severe agency issues that are profitable enough to be funded by a bank, but not profitable enough for the borrower to commit to high effort given the low-powered incentives provided by banks. These bank loans are riskier than other bank loans due to the low effort of the borrower. Private credit funds, on the other hand, can incentivize high effort and make these loans safer, which results in "business stealing". The borrowers that switch from bank funding to private credit funding face a lower probability of failure with private credit and lower interest rates than if they had opted for a bank loan. As such, "business stealing" by private credit takes away riskier loans from banks' balance sheets and can have a stabilizing effect in the banking sector, at the cost of smaller bank balance sheets. However, in case of failure, these private credit loans fare worse than they would have as bank loans due to the inefficient liquidation. Borrowers that switch from bank funding to private credit funding increase the expected payoff from their projects at the cost of larger losses in a tail aggregate event.

To endogenize the viability of continuation vehicles in case of private credit financing, we consider the following frictions in the secondary market: First, incumbent investors of private credit funds might get a liquidity shock at the end of the lifetime of the private credit fund and thus cannot participate in a continuation vehicle. Second, incumbent investors have private information about the quality of the distressed loan that they cannot always credibly communicate to new investors. Third, there is ex ante uncertainty about the aggregate amount of cash available to new investors available for financing continuation vehicles. Solving for the equilibrium in the secondary market for loans, we endogenize the probability that a project financed by a private credit fund is inefficiently liquidated. The model also generates additional empirical implications on continuation vehicles.

We also characterize the optimal second-best contract when borrower effort is unobservable. The optimal contract uses probabilistic termination following low interim cash flow to balance incentive provision against inefficient liquidation. In

addition, we show that bank financing and a menu of private credit funds committed to different continuation probabilities can implement the second-best allocation. These results provide a borrower–lender agency rationale for finite-lived funding vehicles—including venture capital, private equity, and private credit—that complements explanations based on conflicts between general and limited partners and does not rely on regulatory arbitrage. The results also provide a rationale for the existence of multiple institutional arrangements in private credit that have associated different continuation probabilities.

The equilibrium allocations in our model yield several testable predictions. First, private credit finances both borrowers excluded from bank lending and borrowers that switch from banks, and should be more prevalent where cash flows are less pledgeable. Consistent with these predictions, private credit managers report that roughly half of their deals would not have received bank financing; private credit expands following negative shocks to bank credit supply; and direct-lending borrowers are concentrated in intangible-capital industries (Block, Jang, Kaplan and Schulze, 2024; Davydiuk, Marchuk and Rosen, 2024; Jang, Kim, Sufi and Chen, 2025). Second, if banks' loan portfolios mostly consist of higher quality loans, then selection across banks and private credit implies that bank loans have higher recovery upon default and carry lower interest rates on average. Consistent with this prediction, private credit loans have lower recoveries conditional on default and higher interest rates after controlling for observable borrower characteristics (Cai and Haque, 2024; Chernenko, Erel and Prilmeier, 2022). Third, the expansion of private credit shrinks bank balance sheets by removing some relatively risky loans; this makes banks' balance sheets less procyclical but less profitable in expansions. For private credit, better borrower incentives increase expected output, but correlated shocks generate larger tail losses through inefficient liquidation. Fourth, the model predicts that continuation vehicles can arise when initial fund investors are less likely to receive liquidity shocks and loans are more transparent and quality is easier to verify. In addition, continuation vehicles become more likely when the pool of new investors is willing to commit more money in the secondary market for loans — that is, when the entire distribution of potential new money shifts upward — but is less likely if the perceived variance of that new money increases. Finally, in a model extension we allow a borrower to be co-financed. When the senior bank loan is sufficiently small, the disciplining effect of private credit survives: the bank tranche can be risk-free, while the junior private

credit tranche carries a higher interest rate, consistent with the evidence in Haque, Mayer and Stefanescu (2025) and Fillat, Landoni, Levin and Wang (2025). In another extension, we allow for differences in funding costs between banks and private credit funds and show that an increase in bank financing costs causes private credit to expand consistent with the growth in private credit that parallels the increased bank regulations after the great financial crisis.

Section II presents an overview of relevant literature. We present our theoretical model and main results in Section III and derive the refinancing-market equilibrium in Section IV. We characterize the optimal contract in Section V. Section VI and Appendix B present model extensions. Section VII gives empirical implications and Section VIII concludes. Proofs not included in the text are relegated to Appendix A.

II Related literature

The empirical literature provides evidence consistent with a maturity wall. Rintamäki and Steffen (2025) show that payment-in-kind provisions in private credit funds, which defer interest until maturity, predict bankruptcy and therefore indicate rollover risk.[5] The International Monetary Fund (2024) documents higher interest rates and credit losses in private credit.[6] While continuation vehicles can relax the maturity wall, historically they were rare and were more likely when managers could roll previously earned carried interest (Abuzov, Gornall, Shive, Strebulaev and Weisbach, 2025). Their limited use may reflect investor conflicts:[7] Kastiel and Nili (2024) emphasize institutional resistance to continuation funds, while Ivashina, Mayer and Phalippou (2025) model the conditions under which conflicts between general and limited partners permit them.[8]

Our mechanism builds on theories in which termination or rigid financing provides

[5] Jang (2024) shows that private credit funds renegotiate during the fund's life, typically when the private equity owner injects capital. This evidence distinguishes flexibility during a fund's life from the ability to refinance loans when the fund itself reaches maturity, which is the focus of our paper.

[6] Similarly, Heal and Nangle (2026) argue in the Financial Times that private credit default rates are understated because they often exclude PIK and maturity extensions.

[7] In the Financial Times, Heal (2026) documents conflicts over which assets private equity firms transfer to continuation vehicles and the constraints institutional investors place on such transactions.

[8] Related work on private-capital fund structure studies the pre-commitment of capital and capital calls (Axelson, Strömberg and Weisbach, 2009; Maurin, Robinson and Strömberg, 2023).

incentives.[9] We apply this logic to the equilibrium allocation of borrowers between banks and private credit and to its aggregate consequences. Closest to our paper is Donaldson, Piacentino and Thakor (2021) where nonbanks' higher funding costs allow them to commit to terminating low-cash-flow projects. Their nonbank advantage disappears as the funding-cost difference with banks narrows, whereas our advantage arises from finite fund life and implies the opposite. They study competition between banks and nonbanks, including private equity funds, while we study bank balance sheets and aggregate tail risk. Complementarily, Rintamäki (2025) examines how perpetual and finite-lifetime business development corporations select between relationship and multilateral lending.

Finally, our aggregate results connect to work on interactions between banks and private credit. Acharya, Cetorelli and Tuckman (2026) argue that bank and nonbank risks are interwoven, while Haque et al. (2025) document that many private credit borrowers also borrow from banks. Boyarchenko and Elias (2024) shows that nonbank financing depends on bank credit supply, and Chernenko, Ialenti and Scharfstein (2025) finds that business development companies are well capitalized, suggesting that their growth is not simply regulatory arbitrage. Lattanzio (2025) shows how banks and non-banks compete in the face of regulatory arbitrage. We complement this work by showing how the maturity wall reallocates borrowers and risk while increasing expected output but amplifying aggregate tail losses.

III A model of private credit

In this section we model bank and private credit interaction taking secondary market outcomes as given and solve the model for a single borrower. We first solve it with only bank financing available and then when private credit financing is also possible. We then discuss cross-sectional and aggregate implications of the equilibrium that results

[9] The incentive effects of termination are studied by Stiglitz and Weiss (1983), Bolton and Scharfstein (1990), Green and Taylor (2016), and Mayer (2022). Creditor structure makes liquidation credible in Berglöf and von Thadden (1994), Repullo and Suarez (1998), and Bolton and Scharfstein (1996). In Bolton and Freixas (2000), bonds provide commitment but lack banks' screening and monitoring abilities. Short-term debt disciplines managers in Jensen (1986), while von Thadden (1995) shows that termination threats can distort firm decisions. Our paper also relates to work on the costs and benefits of rollover risk (Calomiris and Kahn, 1991; Flannery, 1994; Acharya, Gale and Yorulmazer, 2011; He and Xiong, 2012) and to the role of bank flexibility in firms' debt mixes (Hackbarth, Hennessy and Leland, 2007).

from the interaction between private credit and bank financing in case of many types of borrowers. In Section IV, we close the model by endogenizing secondary market outcomes.

III.1 Model setup

There are three time periods $t = 0, 1, 2$. The timeline of the model is depicted in Figure 1. There is a borrower endowed with a project at $t = 0$ that requires one unit of investment. This initial investment must be borrowed from either a bank or a private credit fund. All agents are risk-neutral and there is no discounting. Both banks and private credit funds have sufficient resources and operate in competitive markets and thus break even. They also observe the parameters of the borrowers (i.e., they have perfect screening abilities). The only difference between banks and private credit funds is that banks live until period $t = 2$ while private credit funds have a limited lifetime and thus might have to exit at $t = 1$.[10] The borrower maximizes the payout from the project, and has an outside option worth 0 that can be taken at any time.

We simplify the model by making cash flows trivial in the good state as our focus lies on loans that enter distress. With probability p_1 the project pays off y_1 at $t = 1$ and 0 otherwise. If the project pays y_1 at $t = 1$, its continuation payoff at $t = 2$ is y_2, of which αy_2 is pledgeable to any lender (including a potential new one), where $\alpha \in (0, 1)$. If instead the project pays zero at $t = 1$ – a state we shall interpret as the borrower being in distress – the lender receives a private signal about continuation quality. With probability μ the project is of high continuation value and yields y_2 at $t = 2$, of which again αy_2 is pledgeable. With probability $1 - \mu$ it is of low continuation value and continuing the project yields zero for all. For simplicity we assume the continuation value is independent of the borrower's effort conditional on the realized $t = 1$ cash flow.

As in Holmström and Tirole (1998), moral hazard affects output at $t = 1$ as the borrower's effort is unobservable, hence non-contractable. The probability of success is $p_1 = \pi_1$ if the borrower exerts effort. If the borrower does not exert effort (alternatively, exerts low effort), the probability of success drops to $p_1 = \pi_1 - \Delta_1$, but

[10] To emphasize the role of the maturity wall, we assume the bank and private credit fund are otherwise identical including in their ability to screen project payoffs. For evidence on direct lenders actively monitoring similarly to banks see Jang (2024).

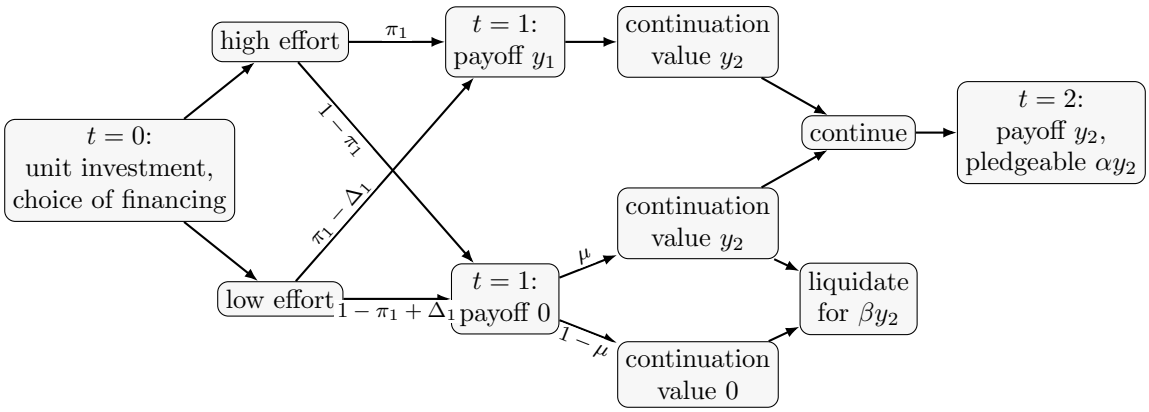


Figure 1: Timeline and decision tree of the model.

the borrower receives private benefit B_1.

The project can be liquidated at $t = 1$ for $\beta y_2 \geq 0$ regardless of its continuation value.[11] A private credit fund can also continue a high-quality project with probability q, otherwise it must exit and either liquidate the project or sell the remaining claim to an uninformed lender.[12] We view the probability of not being able to continue, $1 - q$, as capturing the "sand in the gears" of private credit lending arising as a consequence of its maturity wall. We take q as exogenous in this section and endogenize it in Section IV and discuss its properties.

We make the following parametric assumptions:

Assumption 1. $\pi_1 y_1 \geq 1$,

Assumption 2. $\Delta_1 y_1 > B_1 > 0$,

Assumption 3. $0 < \beta < \alpha < 1$,

Assumption 4. $0 < \mu < \frac{\beta}{\alpha - q(\alpha - \beta)}$,

Assumption 5. $0 < \alpha y_2 < 1$.

Assumption 1 ensures that a lender can break even simply based on high interim cash flows if the borrower exerts effort. This assumption is quite restrictive and unnecessary for our main results; we use it to simplify the presentation of the results.

[11] This means any liquidation procedure that does not leave the borrower in place to collect future income, such as bankruptcy with a change in control.

[12] We assume the uninformed lender that enters at $t = 1$ is also risk neutral and does not discount future cash flows.

In Appendix B.2, we discuss existence of private credit in the absence of Assumption 1 where instead the restriction is that projects have a positive net present value over the two dates with high borrower effort. Assumption 2 implies that shirking is inefficient. Assumption 3 states that liquidating a high-quality project is inefficient, whereas liquidating a low-quality project is efficient. Assumption 4 stipulates that the probability that a loan with no interim cash flow is high continuation value is not too high, thereby allowing us to focus on the relevant case in which selling loans of struggling borrowers is difficult.[13] Assumption 5 simplifies the analysis by excluding projects with high y_2 for which incentivizing effort is trivial.

III.2 Model solution with bank financing only

In this section, we solve for the subgame perfect equilibrium of the model with bank financing only. Denote the promised, combined repayments by the borrower at $t = 1$ and $t = 2$ as R_B, where the subscript 'B' indicates bank financing. R_B is determined in equilibrium. Note that feasibility of bank lending requires $R_B \leq y_1 + \alpha y_2$; no bank lending is feasible if it requires higher interest.

In case of success at time $t = 1$, at most y_1 can be repaid at that date, with any additional repayment promised for $t = 2$ being $R_{B,s} = \max(0, R_B - y_1)$, where the subscript 's' denotes success. Following a zero cash flow at $t = 1$, however, nothing can be repaid at that date. By Assumption 5, we have $\alpha y_2 < 1$, which means that not even the maximum pledgeable cash flow at $t = 2$ is enough to repay the loan following a zero cash flow at $t = 1$ and a portion of the loan must be written off. For a project of high continuation value after the zero interim cash flow, the lender thus receives all remaining pledgeable payoff $R^H_{B,f} = \alpha y_2 < 1$, where the subscript 'f' denotes failure, and the borrower gets $(1 - \alpha)y_2$. For a project of low continuation value, the loan is liquidated, the lender receives the liquidation value $R^L_{B,f} = \beta y_2$, and the borrower gets nothing. By Assumption 3, we have $\alpha > \beta > 0$, thus continuation is optimal after the high-quality signal and liquidation is optimal after the low-quality signal.

Now we turn to the loan contract at $t = 0$. We start with the incentive constraint. The loan is fully repaid by $t = 2$ following success, and the borrower's payoff is $y_1 + y_2 - R_B \geq 0$, where the sign is guaranteed by the feasibility constraint. Following failure at $t = 1$, with probability μ the project is high continuation value, it is rolled

[13] A simpler sufficient condition, independent of q, is $\mu \leq \beta/\alpha$.

over by the bank and the borrower gets $y_2 - R^H_{B,f} = (1-\alpha)y_2$; with probability $1-\mu$, the project is liquidated and the borrower gets zero. The borrower therefore exerts high effort if and only if its payoff is higher than when not exerting effort, yielding the usual incentive constraint

$$(y_1 + y_2 - R_B) - \mu\,(1-\alpha)\,y_2 \geq \frac{B_1}{\Delta_1}. \tag{1}$$

Banks are competitive and break even in expectation, uniquely determining R_B

$$R_B(p_1) = \frac{1-(1-p_1)[\mu\alpha + (1-\mu)\beta]y_2}{p_1}. \tag{2}$$

Combining all of the above yields a cutoff $\bar{y}_2^{B,I}$ for y_2 above which banks can incentivize high borrower effort:

$$y_2 \geq \bar{y}_2^{B,I} \equiv \frac{1-\pi_1\left(y_1 - \frac{B_1}{\Delta_1}\right)}{\pi_1[1-\mu(1-\alpha)] + (1-\pi_1)[\beta + \mu(\alpha-\beta)]}. \tag{3}$$

In a subgame perfect equilibrium, the bank finances one unit of investment and offers the borrower a repayment schedule of $\{R_B\}$ (the values for $\{R_{B,s}, R^H_{B,f}, R^L_{B,f}\}$ are trivially given above) at $t=0$. Given the contract, the borrower exerts high effort if and only if (1) holds. The bank breaks even according to (2), conditional on the borrower's effort choice. If no feasible contract meets these constraints, the project is not financed. The next proposition presents the equilibrium with bank financing.

Proposition 1. Bank financing only.

When only bank financing is available, the project is financed with a

i) low-risk loan if $y_2 \geq \bar{y}_2^{B,I}$: the borrower exerts effort and the project is financed with promised repayment $R_B(\pi_1)$. Following a zero interim cash flow, the bank continues the project if and only if it is high-quality;

ii) high-risk loan if $y_2 \in [\bar{y}_2^{B,P}, \bar{y}_2^{B,I})$: the borrower exerts low effort and the project is financed with promised repayment $R_B(\pi_1 - \Delta_1)$. Following a zero interim cash flow, the bank continues the project if and only if it is high-quality.

If $y_2 < \min\{\bar{y}_2^{B,I}, \bar{y}_2^{B,P}\}$, the project is not financed by the bank. The value $\bar{y}_2^{B,P}$ is given in the proof.

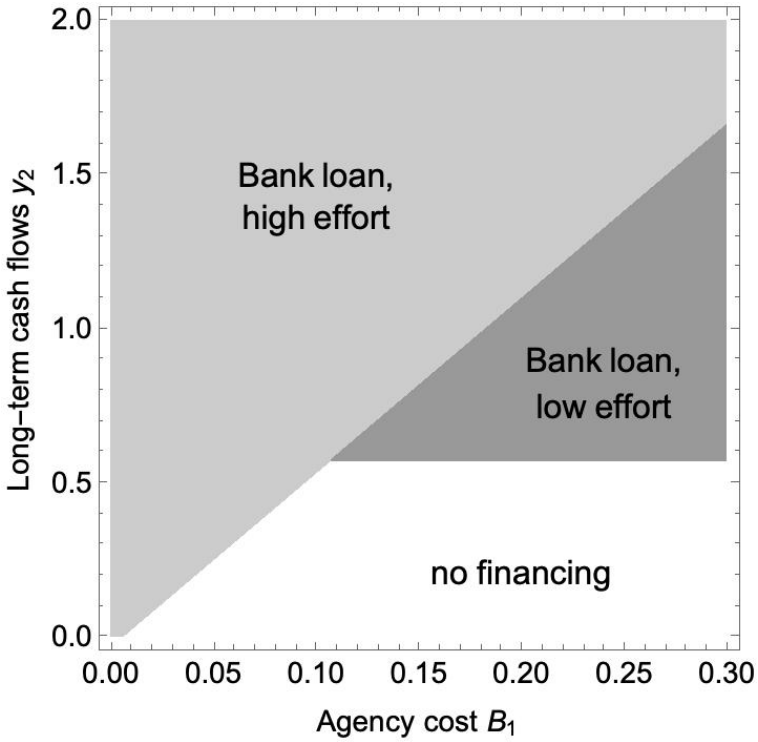


Figure 2: Financing regions with bank financing only.

Notes. The y-axis depicts long-term project cash flows y_2 and the x-axis depicts agency cost B_1. Parameters: $\Delta_1 = 0.25, \pi_1 = 0.9, y_1 = 1.2, \beta = 0.45, \alpha = 0.5, \mu = 0.85$, and $q = 0$.

Figure 2 shows the different financing regions in the (B_1, y_2)-space for a set of parameter values. In the upper-left area, where long-run cash flows are high relative to private benefits, the bank finances the project and the borrower exerts effort. Following a zero interim cash flow, the bank efficiently sorts projects: it continues high-quality projects and liquidates low-quality projects. For high B_1 relative to y_2, the bank finances the project but the borrower exerts low effort, so a zero interim cash flow and the associated renegotiation or liquidation occur more often. If y_2 is sufficiently low relative to B_1, no feasible contract allows the bank to break even.

III.3 Model solution with bank and private credit financing

This section introduces private credit funding. Denote the original repayment agreed upon to the private credit fund as R_{PC}, where contract feasibility requires $R_{PC} \leq y_1 + \alpha y_2$. Again, we solve the model backwards. Following a zero interim cash flow, the

private credit fund observes continuation quality. A project with high continuation value can be continued by its incumbent fund with probability q, in which case the fund receives αy_2 and the borrower receives $(1-\alpha)y_2$, as in case of bank financing. However, the next Lemma shows that under Assumption 4, the private credit fund cannot sell its remaining loans as the average quality of these loans is too low and the loans are thus not worth buying; it must therefore liquidate the loans.

Lemma 1. *Private credit funds cannot sell high-quality loans they cannot roll over and thus inefficiently liquidate these projects.*

The private credit fund's expected recovery following a zero interim cash flow is therefore $[\mu q\alpha + (1-\mu q)\beta]y_2$.

Turn now to the contract terms at time $t = 0$. When both bank and private credit financing are available, the borrower may choose to borrow from one or the other. If the borrower chooses the same effort under both contracts, bank financing is preferred because it avoids inefficient liquidation of a fraction $\mu(1-q)$ of projects following a zero interim cash flow. Competitive pricing passes this surplus difference to the borrower. This yields the following lemma.

Lemma 2. *Private credit financing in equilibrium must induce high effort; otherwise it is not chosen by the borrower. Private credit is not chosen if bank financing can induce high effort.*

By exerting effort, the private credit borrower makes success more likely by Δ_1 and receives under success the payoff $y_1 + y_2 - R_{PC}$, which is non-negative because $R_{PC} < y_1$ as implied by the fund's break-even condition and Assumption 1. Note that $R_{PC} < y_1$ implies that under Assumption 1 the whole loan will be fully paid off at $t = 1$ in case the interim cash flow is high and no repayment is left for $t = 2$. Only in case the interim cash flow at $t = 1$ is zero is some of the repayment left for $t = 2$. However, by exerting effort, the borrower makes the payoff under failure less likely by the same amount and gives up the expected payoff under failure, $\mu q(1-\alpha)y_2$. The payoff $(1-\alpha)y_2$ obtains when the project is of high continuation value and the incumbent fund can continue it, an event with conditional probability μq; otherwise the project is liquidated and the borrower receives zero. Hence, the borrower exerts high effort if and only if

$$(y_1 + y_2 - R_{PC}) - \mu q(1-\alpha)y_2 \geq \frac{B_1}{\Delta_1}. \tag{4}$$

Effort raises the probability of the high interim payoff and reduces exposure to both efficient liquidation of low-quality projects and inefficient liquidation caused by the maturity wall, where in both cases the borrower gets zero.

Since private credit funds are competitive and break even in expectation, the interest rate that incentivizes high effort by a private credit borrower is

$$R_{PC}(\pi_1) = \frac{1 - (1-\pi_1)[\mu q\alpha + (1-\mu q)\beta)]y_2}{\pi_1}. \tag{5}$$

Combining all of the above yields a cutoff for y_2 above which private credit funds can incentivize high borrower effort:

$$y_2 \geq \bar{y}_2^{PC,I} \equiv \frac{1 - \pi_1\left(y_1 - \frac{B_1}{\Delta_1}\right)}{\pi_1[1-\mu q(1-\alpha)] + (1-\pi_1)[\beta + \mu q(\alpha-\beta)]}. \tag{6}$$

We now state the formal definition of equilibrium when both bank and private credit financing are available. In a subgame perfect equilibrium, at $t = 0$ a bank offers a feasible contract $\{R_B\}$, and private credit offers a feasible contract $\{R_{PC}\}$; each contract finances one unit of investment. Borrower effort is determined by (1) or (4), and each lender breaks even conditional on that effort choice.

We now pin down the conditions under which private credit financing arises in equilibrium. We give here an heuristic proof and leave all details to the appendix. Comparing $y_2^{PC,I}$ defined by (6) and $y_2^{B,I}$ defined by (3), we see that there can only be private credit financing in equilibrium if there exist borrowers with y_2 for which the private credit fund can incentivize high effort while the bank cannot, i.e., if $y_2^{B,I} > y_2^{PC,I}$. Note that the common numerator is positive by Assumptions 1 and 2. Whenever $\mu > 0$ and $q < 1$, so that there is a non-zero probability that the loan is liquidated when it is worthwhile continuing, this holds if and only if $\pi_1 + (1-\pi_1)\beta > \alpha$. However, for private credit financing to emerge in equilibrium, it also has to be chosen by the borrower and all other parametric assumptions need to hold. Formally, we can show the below sufficient condition:

Proposition 2. Existence of private credit financing.
Let $\mu > 0$ and $q < 1$, so there exist projects worth continuing that are instead liquidated. There exist projects with some (B_1, y_2) parameters that are financed by private

credit if and only if

$$\pi_1 + (1 - \pi_1)\beta > \alpha. \tag{7}$$

Condition (7) offers an economic insight into the existence of private credit.[14] Since $\pi_1 + (1 - \pi_1)\beta < 1$, at least some long-term payoff must be non-pledgeable for private credit to emerge. Thus, unless almost all long-term payoff is pledgeable, private credit can arise in equilibrium.

The result on existence of private credit and pledgeability of the period $t = 2$ payoff does not immediately translate to asset tangibility and collateralizability that are more readily used in the empirical literature. Under the view that asset tangibility and collateralizability contribute to asset pledgeability, if α and β both decrease in the same proportion when asset tangibility or collateralizability decrease, then private credit is also more likely among borrowers with less tangible or collateralizable assets.

The next result describes all the possible regions of bank and private credit financing.

Proposition 3. Bank and private credit financing.
When both bank and private credit are available, the project is financed with a

i) low-risk bank loan if $y_2 \geq \bar{y}_2^{B,I}$: the borrower exerts effort and receives the bank contract stated in Proposition 1;

ii) high-risk bank loan if $y_2 \in [\bar{y}_2^{B,P}, \bar{y}_2^{B,I})$ and either $y_2 < \bar{y}_2^{PC,I}$ or $y_2 \geq \bar{y}_2^{switch}$: the borrower exerts low effort and receives the high-risk bank contract stated in Proposition 1;

iii) Low-risk private credit loan if $y_2 \in [\bar{y}_2^{PC,I}, \bar{y}_2^{B,I})$ and either $y_2 < \bar{y}_2^{B,P}$ or $y_2 < \bar{y}_2^{switch}$: the borrower exerts effort and receives a private credit loan with $R_{PC}(\pi_1)$. Conditional on a zero interim cash flow, a fraction $1-\mu q$ of projects is liquidated, but only the fraction $\mu(1-q)$ represents inefficient liquidation of high-quality projects.

[14] Condition (7) is independent of μ and q as long as $\mu > 0$ and $q < 1$: these parameters scale the difference in continuation capacity between banks and private credit, but do not change its sign. However, the specific values of μ and q matter for how much private credit exists.

If $y_2 < \min\{\bar{y}_2^{PC,I}, \bar{y}_2^{B,P}\}$*, the project cannot be financed by either lender. The thresholds are given in the proof.*

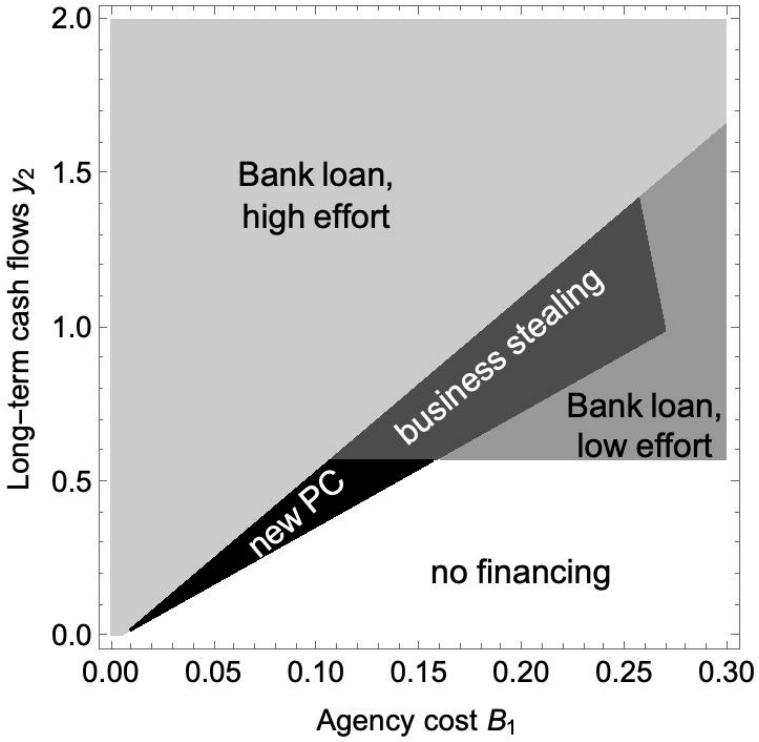


Figure 3: Financing regions if both bank and private credit are available.

Notes. The y-axis depicts long-term project cash flows y_2 and the x-axis depicts agency cost B_1. Parameters: $\Delta_1 = 0.25, \pi_1 = 0.85, y_1 = 1.2, \beta = 0.4, \alpha = 0.5, \mu = 0.75$, and $q = 0$.

We use Figure 3 to illustrate the financing regions that arise in equilibrium in (B_1, y_2)-space for different parameter values. There are five possible financing regions. First, the top left region (labeled low-risk bank loans in the proposition) indicates projects that are always financed by banks (with high effort due to high y_2) even when private credit financing is available. Second, in the bottom right area no financing is available from either source due to high agency B_1 and low long-term payoffs y_2. Third, the triangle on the bottom, nested between the two areas described above, is the "democratization of credit" (denoted by "new PC" in the Figure). These projects cannot get bank financing due to low y_2 and low effort, but can get private credit financing because the threat of ex-post liquidation provides an ex-ante incentive to

exert high effort. Fourth, the area in the middle identifies the "business stealing" projects. If financed by bank loans, these projects face a high probability of becoming non-performing and of having to be renegotiated; they are high-risk bank loans. Private credit financing becomes more advantageous to the borrower because of the incentives to exert effort that it entails and the resulting lower interest rate charged. Fifth, the right-most area, above the no-financing area, contains projects where effort is not exerted that are always bank financed at a high interest rate even if private credit is available (labeled as high-risk bank loans in the proposition).

III.4 Consequences of introducing private credit financing

In this section, we compare the equilibrium with only bank financing to the equilibrium with both bank and private credit financing. Up to now, we concentrated on one single borrower. From here on, we assume there is a continuum of borrowers distributed over borrower parameters $\{y_1, y_2, B_1\}$ in the admissible parameter range. This allows us to think about the implications of the introducing of private credit funds in the economy more generally than using simple comparative statics on one of these parameters alone.

First, we analyze the effect of business stealing. If there is a non-zero mass of projects to be financed in the "business stealing" region, then the introduction of private credit funds decreases the amount of lending by banks, thereby shrinking banks' balance sheets. "Business stealing" involves bank loans for which the borrower exerts low effort with bank financing but exerts high effort with private credit financing. Thus, "business stealing" decreases the expected prevalence of non-performing loans (that need to be renegotiated) on bank balance sheets.[15] Note that borrowers capture all the surplus from the projects since lenders are competitive and always receive one unit in expectation. Thus implies that projects in the "business stealing" region have a higher expected payoff than when financed by banks, leading to a further increase in expected aggregate output when private credit financing is available. In addition, if the "democratization of credit" region has a non-zero measure of borrowers in equilibrium, then expected aggregate payoff increases also due to more projects being financed. Finally, because lenders break even in this model, and the borrower chooses

[15]This statement is only true in a weak sense, since if the entire mass of borrowers is composed of projects for which no effort is exerted, then the expected likelihood of non-performing loans does not change with the introduction of private credit financing.

optimally between private credit and bank lending, aggregate welfare increases relative to a world with bank finance only. We formalize the above insights in the following proposition, which holds for any distribution of borrowers in the admissible range of parameters.

Proposition 4. Bank balance sheet, aggregate output, and welfare. *Compared with the equilibrium with only bank finance, the equilibrium with bank and private credit finance weakly displays:*

i) a decrease in bank balance sheets;

ii) a decrease in the number of non-performing loans on bank balance sheets;

iii) an increase in expected aggregate payoff;

iv) an increase in aggregate welfare.

We emphasize statements i and ii in the proposition and the implied properties about bank versus private credit finance. First, with the introduction of private credit, banks are seen as downsizing and offering a smaller number of their loans at high interest rates. These outcomes are not strategic decisions by banks to aggressively compete with private credit. That is, having a smaller number of high interest rate loans is not a consequence of the need for banks to remain competitive, but rather that private credit takes some of banks' lower quality, high interest rate loans. Instead, the changes to the banking sector are an equilibrium selection effect.

Second, it is not possible to conclude for any general distribution of borrowers that interest rates charged by banks *on average* decrease with the introduction of private credit. This is because banks that lend primarily to low quality borrowers (i.e., with low long-term cash flows) may find themselves with a reduced pool of borrowers composed of the worst of the borrowers (lowest y_2) after losing business to private credit.

III.5 Aggregate fluctuations

To analyze aggregate risk and payoffs across the business cycle, we introduce a simple structure of correlation between individual project outcomes indicated in Assumption 6 below. We assume projects are fully correlated, but the main insights

generally hold for a positive correlation between project outcomes. We also assume that borrower parameters do not depend on the state of the economy.

Assumption 6. Fully correlated projects. *Define three aggregate states in which project success does not directly depend on the choice of financing but only on effort choice:*

i) *Expansion state happens with probability* $\pi_1 - \Delta_1$ *and all projects yield cash flow* y_1 *at* $t = 1$*;*

ii) *Intermediate state happens with probability* Δ_1 *and all projects with high effort yield cash flow* y_1 *at* $t = 1$*, while all projects with low effort yield* 0*;*

iii) *Severe tail event state happens with probability* $1 - \pi_1$ *and all projects yield cash flow* 0 *at* $t = 1$*.*

Conditional on a zero interim cash flow, the cross-sectional fraction of projects with high continuation value is μ *regardless of the state.*

The above assumption simplifies the analysis while capturing realistic features of business cycles, where expansions are characterized by high productivity across a large fraction of the economy, whereas recessions, and especially large left-tail events, are characterized by low productivity across most sectors. The assumption also allows for intermediate recessions/expansions where borrowers exerting high effort succeed but those that shirk fail.

We discuss aggregate risk and payoffs in expansions and recessions comparing the implications of the equilibrium with only bank financing with those of the equilibrium with bank and private credit financing. Note that with the assumption of risk-neutral banks and private credit funds, whether shocks are aggregate or idiosyncratic does not affect the terms of the contract that these lenders give to borrowers.

Projects in the "business stealing" region are high risk bank loans that move to private credit funding when it becomes available. While these loans are more likely to produce high cash flows in the intermediate state due to high effort induced by private credit, in a severe tail event — when interim cash flow is zero — they are more likely to be liquidated and thus produce lower cash flows when financed by private credit. Furthermore in a severe tail event loans in "democratization of credit" region

are also more likely to be liquidated. These two affects jointly imply that aggregate loan losses are higher in a severe tail event when private credit financing is available.

As for average returns across all loans on the banks' balance sheet the results are more nuanced. Business stealing moves some high interest loans from the banking sector to private credit funds, thus aggregate promised interest payments to banks decrease. However, this does not mean the average loan that remains on the banks' balance sheet has a lower interest rate after the introduction to private credit as there are loans that are high risk loans that are not pouched by private credit and some of these have a $y_2 < y_2^{PC,I}$ and thus an even higher promised interest rate than the private credit loans.

Furthermore promised interest payments materialize in expansions, which implies that banks' aggregate payoffs, and thus aggregate profits, decrease in expansions once private credit is available to borrowers. At the same time, since borrowers that are poached from banks are those with lower y_2, the lower bank profits during aggregate upturns are offset by smaller bank losses during recessions in the equilibrium with private credit compared to the equilibrium with bank financing only.

In a severe tail event, both banks and private credit efficiently liquidate the fraction $1-\mu$ of projects with low continuation value. Private credit additionally liquidates the fraction $\mu(1-q)$ of high-quality projects that cannot be continued. Relative to bank financing, the resulting output loss on a private credit loan is therefore

$$\mu(1-q)(1-\beta)y_2. \tag{8}$$

Private credit thus increases expected output by improving effort and expanding credit, but shifts risk away from the bank and adds maturity-wall losses in severe downturns, and bank balance sheets become less procyclical. We formalize these results in Proposition 5.

Proposition 5. Aggregate risk. *The introduction of private credit weakly:*

1. *increases aggregate loan losses in a severe tail event by inefficiently liquidating a fraction $\mu(1-q)$ of high-quality private credit projects;*

2. *decreases banks' average returns on loans in an expansion and decreases banks' average percentage loan losses in a severe tail event if all projects have relatively*

high long-term payoffs $y_2 \geq \bar{y}_2^{PC,I}$.

For completeness, there are two other cases to consider. If banks hold only loans with high long-term payoffs where the borrower exerts effort, because the cross section of projects has $y_2 \geq \bar{y}_2^{B,I}$, introducing private credit has no effect on the financial system as neither business stealing nor democratization of credit arise. Lastly, a somewhat counterintuitive result arises for banks that have a large concentration of high-risk loans (i.e., $y_2 \leq \bar{y}_2^{B,I}$) in their portfolios prior to the introduction of private credit and charge high interest rates. When bank borrowers are mostly lower quality, with lower long-term payoffs y_2, private credit funds steal the better part of these worse loans and leave the rest with banks. This means that bank balance sheets are more procyclical, with higher profits in expansions and larger loan losses (as a percentage of their assets) in downturns after the introduction of private credit.

IV Secondary market for private credit loans

The key assumption in the model of Section III is that private credit funds can commit ex ante to liquidate with (exogenous) probability q struggling projects that fail to generate a cash flow at $t = 1$, even if liquidating high continuation value projects is ex-post inefficient. In this section, we solve for the equilibrium value of q. At $t = 1$, private credit funds can either sell their struggling loans or the manager (general partner) of the private credit fund can set up a new private credit fund as a continuation vehicle. The continuation vehicle is again short lived, from $t = 1$ to $t = 2$, and gets its funding either by allowing incumbent outside investors (limited partners) to invest in the new fund or by drawing in new investors to replace old ones. We treat loan sales of private credit funds and setting up continuation funds by drawing in new investors as the same, as they both entail having to draw in new investors that are less informed than the incumbent investors.[16]

We incorporate two forces that can limit private credit funds' ability to sell their loans. First, there are agency conflicts between the incumbent private credit fund investors and the new investors. If many bad loans are sold it is possible that secondary

[16] We thus abstract from the detailed contracting framework between general partners and limited partners when setting up continuation vehicles and refer the reader to Ivashina et al. (2025) and Abuzov et al. (2025), which assume that general partners have ample funds to put enough skin in the game to overcome any asymmetric information issue.

markets break down. Second, a macroeconomic liquidity shortage or a loss of trust in private credit vehicles might mean the pool of new money available for buying struggling loans from private credit funds that are being wound down is inadequate to support high enough prices in the secondary market, akin to a cash-in-the-market pricing constraint.

IV.1 A detailed model of the secondary market

The model is the same as that outlined in Section III except that here we include a more detailed model of the secondary loan market at $t = 1$ for loans that produce no intermediate cash flows. Each private credit fund is financed by one outside investor and finances one borrower by lending one unit. Private credit funds are simply pass-through vehicles and have no capital of their own. Outside investors in private credit funds are risk-neutral and do not discount future payoffs. A fraction ψ of incumbent outside investors get a liquidity shock at $t = 1$ and must exit their funds. We assume incumbent outside investors, like the private credit funds themselves, have information about the continuation value of the project that gets zero cash flow at $t = 1$. At $t = 1$, a total mass $m \geq 0$ of new outside investors (each with one unit of cash) may buy loans from private credit vehicles or participate in a continuation vehicle where original investors had to exit. For simplicity, we normalize m by the face value of aggregate private credit lending that emerges in equilibrium at $t = 0$. Let $m \sim F$, where F is common knowledge and can be any distribution on $[0, \infty)$.[17] The value of m is realized at $t = 1$.

We assume private credit funds and new outside investors entering at $t = 1$ are randomly matched, and the private credit fund makes a take-it-or-leave-it-offer to these new investors. We also assume there is a costless certification technology. A high continuation value project with low intermediate cash flow can be certified with probability ν, where the private signal about the payoff of the project at $t = 2$ becomes public. Thus ν is a measure of the transparency (conversely, $1 - \nu$ is a measure of opacity) of the private credit fund or its loan. We assume uncertified loans are traded only once the certified market has been cleared and traders prefer to trade if indifferent. The equilibrium of the model using the concept of Perfect

[17] Implicitly, this formulation takes the distribution of F to depend on the equilibrium aggregate face value of private credit. For example, $m = 1$ means that the cash of outside investors is exactly enough to buy all private credit loans at $t = 1$ at face value.

Bayesian Equilibrium is described in the following proposition. As in Section III, for simplicity we only focus on the case where μ is low enough such that the market for uncertified loans collapses.

Proposition 6. Secondary market equilibrium. *Assuming*

$$\mu < \frac{\beta}{\beta + \psi(1-\nu)(\alpha - \beta)} \tag{9}$$

(instead of Assumption 4) the market for uncertified loans breaks down and the continuation probability of high continuation value projects that have no interim cash flow is

$$q = \int_0^\infty \chi(m)\, dF(m), \tag{10}$$

where $\chi(m)$ is the fraction of high continuation value projects that continue when secondary-market cash equals m

$$\chi(m) = \begin{cases} 1 - \psi + \dfrac{m}{\mu}, & \text{if } m < \psi\mu\nu, \\ 1 - \psi + \psi\nu, & \text{if } m \geq \psi\mu\nu. \end{cases} \tag{11}$$

Projects with low continuation value always lead to liquidation. With the above parameter q, the model maps into the reduced-form model of Section III for ex-ante borrower incentives, lender break-even conditions, and expected payoffs.

The proposition provides insights into the feasibility of continuation vehicles. In the proposition, χ is the ex post continuation probability that is renegotiation proof, and q, the average over χ, is the ex ante expectation that matters for incentives. Empirically, an econometrician can observe data on χ but not on q directly.

We start by describing the properties of χ. A fraction μ of all private credit funds is of high continuation value but only $\psi\nu$ of the high quality funds is offered for sale in the certified market by incumbent outside investors who are forced to sell. This implies that the market for secondary funds has enough new outside investors to buy all possible loans that must be sold if $m \geq \mu\psi\nu$. Even if there are enough new outside investors to buy all possible loans that must be sold (i.e., $m \geq \mu\psi\nu$), continuation is not guaranteed due to asymmetric information and $\chi(m) = 1 - \psi + \psi\nu$. In this

case, continuation vehicles exist in funds whose incumbent outside investors do not face liquidity shocks or in funds whose investors face a liquidity shock but loans can be certified.[18] If there are not enough new outside investors (i.e., $m < \mu\psi\nu$), then $\chi(m) < 1 - \psi + \psi\nu$. At the extreme where $m = 0$, $\chi(0) = 1 - \psi$. That is, absent any new money, the continuation probability is the lowest and equals the fraction of funds whose investors do not face liquidity shocks.

Comparative statics on χ reveal that loan opacity is only relevant when macroeconomic conditions deliver a high enough amount of cash in the secondary market m. Ex post, once m is realized at $t = 1$, a high enough value of m implies that increased loan opacity predicts fewer dollars in continuation vehicles. However, when liquidity in the secondary market for loans is low (if m is sufficiently small), then the dollar value of continuation vehicles does not depend on loan opacity. It is perhaps surprising that opacity does not influence the market for secondary loans in periods of low liquidity, when investors should be choosier. This is a feature of the cash-in-the market assumption; when aggregate liquidity in the secondary market for loans is very low, it does not matter how many loans can be certified since most of them cannot be sold anyhow.

Turn now to the properties of q. Even though q is not directly observable, it can provide insights into the private credit sector's ability to incentivize and the size of the market. The proposition shows that while the ex-ante probability of continuation is above zero it is also strictly less than one (unless the average quality of the distressed projects is too high and (9) is violated). The upper bound is $q \leq 1 - \psi + \psi\nu < 1$, where the second inequality holds if $\psi > 0$ and $\nu < 1$. This equilibrium upper bound of q justifies our assumption in Section III.

Comparative statics across equilibria reveal that the ex ante continuation probability q increases if transparency ν increases, and if initial investors are less likely to get liquidity shocks (i.e., lower ψ), holding F fixed. Thus, for example, higher opacity leads to lower q, which leads to more inefficient liquidation but yields higher incentive provision. Higher opacity and an investor base that is more prone to liquidity shocks also predict a larger asset value in private credit funds. Perhaps more surprising are the comparative statics of q with properties of F. First, q increases under first-order stochastic dominance improvements in F. That is, a shift in F that puts more probability on higher values of m weakly increases q, because $\chi(m)$ is non-

[18] Recall that under Equation (9) the secondary market breaks down if loans cannot be certified.

decreasing in m. Hence, increases in the likelihood of higher future liquidity lead to higher q and lower total asset value in private credit funds. In addition, q decreases under mean-preserving spreads of F. That is holding expected liquidity constant, if at time $t = 0$ the variance of liquidity at $t = 1$ increases, then the additional risk in m weakly lowers q. Hence, increased expected turbulence in liquidity lowers q and increases total asset value in private credit funds. In summary, total asset value in private credit shrinks with high expected liquidity and expands when there is more uncertainty about future liquidity.

We close this section with a reinterpretation of the results presented in Proposition 6. Consider an economy where different private credit funds can commit to different levels of loan opacity or choose different outside investors through the likelihood of having a liquidity shock (i.e., insurance companies versus individual investors). Each of these different groups of private credit funds would then be able to offer their respective borrowers different levels of q. For example, when m is expected to be sufficiently high, any level $\bar{q}$ can be obtained by a combination of ψ and ν that respects $1 - \psi + \psi\nu = \bar{q}$. A fund may select the level of loan and fund transparency and choose an investor base more or less prone to liquidity shocks and that way commit to a continuation probability $\bar{q}$. Different funds would then be able to offer a different trade off of incentives versus inefficient liquidation.

V Second-best contract and the optimality of the maturity wall

In this section, we explore the optimal financing contract offered by a lender that can commit to any repayment plan.[19] We also show how the second-best contract can be approximated with various types of private credit vehicles.

V.1 Second-best contract

Assume the project payoffs and agency issues are the same as in Section III. In designing the second-best optimal contract, the lender can, at $t = 0$, commit to

[19] A standard result is that the optimal contract has a convertibility component; the lender takes over the firm to capture the long-term cash flows instead of liquidating the firm. However, in our model, the lack of pledgeability of y_2 is akin to the inalienability of long-term cash flows from the borrower.

probabilistic continuation at time $t = 1$ that depends on the realized cash flow and continuation value à la Bolton and Scharfstein (1990). Following a low cash flow at $t = 1$, denote the probability of continuation by $\lambda_H \in [0, 1]$ if the project has high continuation value and by $\lambda_L \in [0, 1]$ if the project has low continuation value. Since a project with low continuation value yields zero if continued but can be liquidated for $\beta y_2 > 0$, it is optimal to set $\lambda_L = 0$. We therefore focus on the choice of λ_H.[20]

Also denote total repayment as R_h in case of high intermediate cash flow (y_1) and R_l in case of low intermediate cash flow (0) if the project has high continuation value and is continued. In case of termination, which occurs with probability $1 - \lambda_H$ for a high-continuation-value project and with probability one for a low-continuation-value project, we assume the lender gets cash flow βy_2, as this is weakly optimal. The optimal contract prescribes the state-contingent repayment $\{R_h, R_l, \lambda_H, \lambda_L = 0\}$ and an effort level. The latter is equivalent to choosing $p_1 \in \{\pi_1 - \Delta_1, \pi_1\}$, where the choice of $p_1 = \pi_1$ corresponds to high effort.

We depict the optimal contract graphically in Figure 4 and leave a statement of the proposition and its proof to Appendix A. Comparing Figures 3 and 4, financing with guaranteed continuation emerges as the optimal contract in the top-left portion of the figure. These high-quality borrowers exert effort and receive low-interest-rate financing. Guaranteed continuation is also optimal for borrowers in the "Continue, low effort" region. These regions overlap with the bank financing regions in the baseline model. The region labeled "Probabilistic termination, high effort" contains the entire private-credit financing region in Figure 3 (with $q = 0$), plus the black area at its right edge. Inside this region, the probability of continuation is increasing in y_2, all else equal: termination becomes more inefficient as y_2 rises and is less necessary to incentivize the borrower.[21] These optimal contracts dominate private credit in our baseline model because they induce borrower effort at lower interest rates. Probabilistic termination also makes high effort feasible when neither bank financing nor private credit can do so. These projects are the black triangle in the figure: long-term cash flows are sufficiently high relative to the agency cost that it is optimal to offer a lower interest rate than the contract with guaranteed continuation and to terminate probabilistically with an optimally chosen probability λ_H after zero

[20] The planner does not want to terminate following a high cash flow at $t = 1$, since doing so decreases expected payoffs and only tightens the incentive constraint.

[21] Contracts at the top portion of this area have $\lambda_H = 1$ — as in bank financing — and contracts at the bottom of the area have $\lambda_H = 0$ — as in private credit financing with $q = 0$.

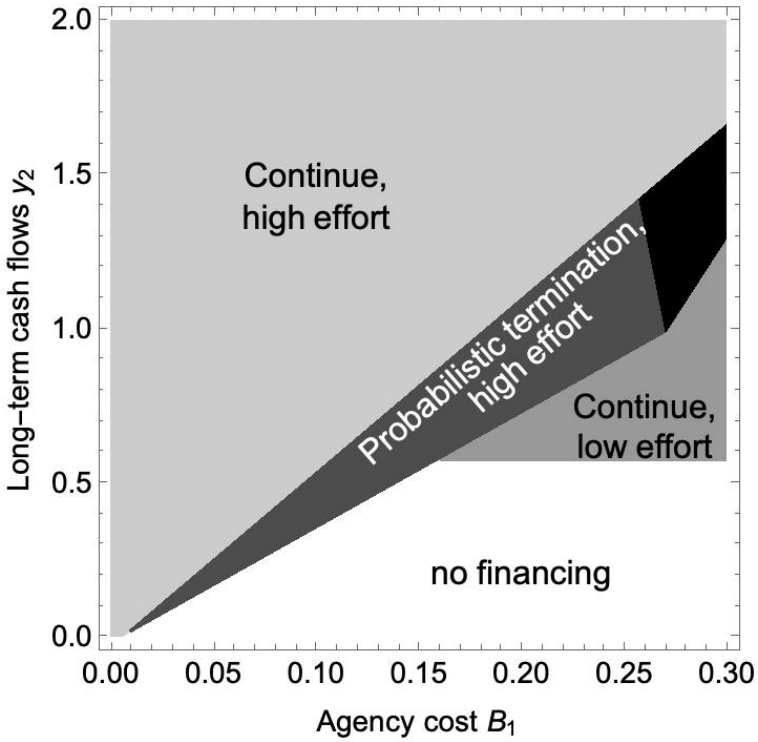


Figure 4: Financing regions with optimal contracting.

Notes. The y-axis depicts long-term project cash flows y_2 and the x-axis depicts agency cost B_1. Parameters: $\Delta_1 = 0.25, \pi_1 = 0.85, y_1 = 1.2, \beta = 0.4, \alpha = 0.5$, and $\mu = 0.75$.

interim cash flow, even in case of high continuation value.

V.2 Implementing the second-best contract

Private credit with a fixed continuation probability q can induce high effort in a similar way as the optimal contract. The optimal contract, however, can induce high effort at lower interest rates for some projects than private credit can and induce high effort to projects where neither bank nor private credit (with fixed q) can because it uses only as much inefficient liquidation as is needed for incentives, as λ_H varies with borrower characteristics.

We now show that a menu of private credit funds with different continuation probabilities q can support high effort for more borrowers than a single fund. In particular, if there is a continuum of private credit funds with continuation probability $q \in [0, 1)$, and if each fund can commit to its own q (e.g., through its funding struc-

ture as discussed above), then the collection of funds can implement the second-best contract. In this implementation the fund with continuation probability q implements the optimal contract at $\lambda_H = q$.

Consider first a borrower who can choose among three funding sources: a bank that always continues the project, a private credit fund with continuation probability q_1, and a second private credit fund with continuation probability $q_2 > q_1$. Figure 5 shows the equilibrium for $q_1 = 0$ and $q_2 = 0.5$. If both private credit funds can induce high effort for a particular borrower, the borrower chooses the fund with the higher q because it delivers the same incentives with less inefficient liquidation. More profitable borrowers with less agency conflicts need less incentivizing and thus prefer a lender with higher q that can offer a loan with a relatively lower interest rate. At the same time, less profitable borrowers with more agency conflicts are not able to select into the high-q fund. It is this matching of borrower type with fund type that permits the implementation of the optimal contract. With a continuum of funds that differ in q, each borrower chooses the lender with the highest continuation probability that still preserves incentives for high effort and thus replicates the borrower-contingent optimal λ_H.

Our model and the proposed implementation of the second-best optimal contract provide a rationale for the observed variety of funding structures in private credit. Some funds might have an investor base that is more likely to be able to participate in continuation funds, others might have more transparent loans that are easier to sell. Different ex ante choices can serve as different commitment technologies to continuation and, together, implement the second-best contract.

One limitation to the suggested implementation of the optimal contract is that a full menu of funds with different q may not be feasible. As we show in Section IV, if q is endogenous due to inefficiencies in the secondary market for loans of struggling borrowers, then the choice of q might not be completely unconstrained. As we show in Proposition 6, e.g. low q close to zero might not be attainable even if the fund can choose its investor base and opaqueness.

VI Extensions

In this section, we discuss extensions to the model. In Section VI.1, we show the consequences of project co-financing by bank and private credit, while in Section VI.2

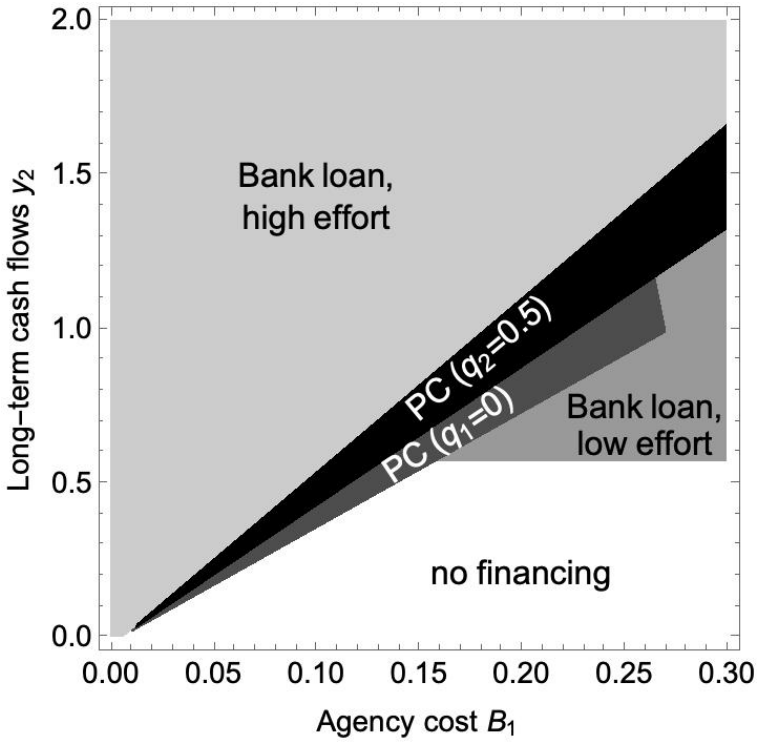


Figure 5: Financing regions with two types of private credit funds.

Notes. The y-axis depicts long-term project cash flows y_2 and the x-axis depicts agency cost B_1. Parameters: $\Delta_1 = 0.25, \pi_1 = 0.85, y_1 = 1.2, \beta = 0.4, \alpha = 0.5, \mu = 0.75, q_1 = 0$, and $q_2 = 0.5$.

we discuss an extension in which the funding costs of private credit and bank financing differ. In the Appendix we discuss additional extensions. In Appendix B.1 we discuss the assumption of limited pledgeability of y_2, i.e., that $\alpha < 1$. In Appendix B.2, we relax Assumption 1 and show our results hold more generally.

VI.1 Borrowing jointly from a bank and private credit

In this section, we study the possibility of joint financing by a bank and a private credit fund. For simplicity, we focus on the case $q = 0$. We assume the bank loan has seniority over the private credit loan in co-financed deals (see Fillat et al. (2025) and Haque et al. (2025)). Consider first that the borrower gets a bank loan up to $\beta y_2 < 1$ while the other part of the loan $1 - \beta y_2$ comes from the private credit fund. The bank is always fully repaid and thus the loan from the bank is risk-free with zero interest

rate. As a consequence, the bank is completely indifferent between liquidation and refinancing over the loan of the borrower when intermediate cash flow is zero. On the other hand, the private credit fund only values cash flow at $t = 1$ (recall that for simplicity we have assumed $q = 0$) and thus if the bank loan is less than βy_2, the private credit fund only receives some payout if it liquidates the project. Thus for any joint financing which involves bank borrowing of less than βy_2, the only equilibrium at $t = 1$ is the one in which the borrower without intermediate cash flow is liquidated. If the bank loan is exactly equal to βy_2 then both liquidating and refinancing are equilibria. In case the initial borrowing from the bank is above βy_2, the private credit fund is indifferent between refinancing and liquidating while the bank strictly prefers rolling over the debt if it can do so. Overall, bank borrowing up to βy_2 implies that the disciplining effect of the private credit fund prevails.

Thus, the presence of a private credit fund as a junior lender lending at least $1-\beta y_2$ is enough for the bank to be able to commit to liquidating the project with low intermediate cash flows and thus provide strong incentives for the borrower to exert effort ex ante. Since both private credit and banks are competitive and break even in expectation, if both have the same financing cost, then the borrower is indifferent between a loan purely from a private credit fund or borrowing jointly from both a bank and a private credit fund. The total repayment to lenders will be the same in the co-financing model but the bank will charge the risk-free rate (zero in our case) on its loan, while the private credit will charge a higher interest rate than it would as the sole lender, as its loan is now made riskier by the presence of the bank as a senior lender. The model is thus consistent with the evidence in Haque et al. (2025) that private credit lenders charge relatively higher interest rates than banks in co-financed deals. If the bank's financing cost is even only a bit lower than that of the private credit fund, then the borrower will strictly prefer involving some bank financing up to βy_2 instead of borrowing only from the private credit fund.

The above joint financing can be implemented in different ways. The bank can either lend alongside the private credit fund, with the latter as a junior partner, or it can lend directly to the private credit fund in effect achieving seniority to cash flow claims vis-à-vis the private credit investors. The latter gives rise to an interwoven structure of bank and private credit funding as documented by Acharya et al. (2026). In our model, this structure does not arise from regulatory arbitrage but is an efficient way of combining market discipline with somewhat lower funding costs of banks.

VI.2 Different cost of bank and private credit financing

The model assumes that outside investors in banks and in private credit funds have the same expected returns. To introduce differences in expected returns, denote $\rho_B \geq 0$ the discount rate of banks and $\rho_{PC} \geq 0$ the discount rate for private credit funds from $t = 0$ to $t = 1$. For simplicity assume banks still do not discount cash flows from $t = 1$ to $t = 2$. The main insights can be discussed without presenting the solution of the whole model.

As ρ_B increases, the bank's break-even condition (2) implies that R_B increases for risky loans as $R_{B,f} = \alpha y_2$ is capped. Since the constraints with private credit financing are not affected, this implies the borrowers' incentive compatibility constraint (1) is more binding, thus the diagonal line separating bank financing and private credit financing in Figure 3 moves up and left, thus expanding the area with private credit financing. Furthermore, private credit financing becomes cheaper compared to risky bank financing and thus the upper right line on Figure 3 separating high-risk bank financing from private credit financing also moves up and right, potentially generating more business stealing. Thus if bank financing becomes costlier, private credit expands taking over previous bank loans. This model extension can explain the recent expansion of private credit at the expense of bank financing as the costs of bank financing increased relative to those of private credit financing. These conclusions hold even if private credit loans have a higher expected return and the increase in bank expected returns merely decreases the wedge in expected costs.

VII Empirical Implications and Evidence

Here, we summarize and discuss the model's testable predictions, and where there already exists empirical evidence, we discuss how to interpret the evidence in light of our model.

Business stealing and democratization of credit. Propositions 2 and 3 imply that private credit financing consists of both new loans a bank would not grant (democratization of credit) and loans that displace bank financing (business stealing). The survey of Block et al. (2024) includes both US and European private creditors; of the U.S. respondents only 40% are business development companies. Consistent with our model, they show that private credit fund managers report that about half

of their deals would not have gotten a bank loan, while the other half would have but the borrower still chose private credit.

Consistent with the prediction of "democratization of credit," Davydiuk et al. (2024) show that private credit funds substitute for bank financing after a negative credit supply shock to bank funding. In addition, Section VI.2 shows that the growth in the private credit market can be associated with the increase in bank regulation that took place since the Global Financial Crisis and the consequent increase in bank funding costs.

Loan quality and interest rates. Our model has more nuanced implications showing that private credit loans that replace bank lending are in general made to more profitable companies with more severe agency issues (higher y_2 and B_1) compared to private credit loans that banks would not make. Our model also implies that loans that are stolen by private credit from banks become safer. This might explain why in loan-level data, Cai and Haque (2024) find that private credit loans have lower probability of default than comparable bank loans.[22]

Proposition 2 highlights that private credit is more likely when pledgeability of cash flows is lower. This latter implication is in line with the finding of Cai and Haque (2024) that "more than half of all value-weighted private credit is provided to borrowers in sectors with relatively low collateralizable or tangible assets such as software, financial services or healthcare services" (see also International Monetary Fund (2024), and Jang et al. (2025)).

Proposition 5 implies that if banks' loan portfolios mostly consist of higher quality loans, then in equilibrium banks charge lower average interest rates than private credit funds. Indeed, the International Monetary Fund (2024) shows that the average interest rate charged on private credit loans is higher than that for leveraged loans. Chernenko et al. (2022) show that the interest rate is higher for private credit loans than bank loans even after controlling for observable borrower characteristics. While it may seem surprising that rates are higher even after controlling for borrower characteristics, this result can be explained in our model with the "democratization of credit" loans. The non-existence of these loans in bank portfolios induces a selection

[22]However, note that the definition of default might be different for bank loans and private credit loans. For example, payment-in-kind, a feature common in private credit that allows postponing of interest payments without entering into default, is generally considered default in commercial bank loans.

effect and the higher interest rates.

Recently, banks have tried to participate in lending with private credit funds. One way in which this has occurred is via bank lending to PCs. Effectively, this gives banks seniority over limited partners in the PC fund, allows greater leverage by PC funds and higher rates of return in good times. We have shown that such co-financing deals can occur without destroying the incentive effects of the maturity wall and in these cases private credit charges relatively higher interest rates than banks. This prediction is consistent with evidence in Haque et al. (2025).

When taking this implication to the data, it is important to keep in mind that business development companies, which are perpetual entities, are overrepresented in loan-level data. Fund-level data have good coverage of private credit funds structured both as limited partnerships and business development companies, whereas loan-level data are scarcer with more readily available data being from business development corporations due to regulatory requirements in the US, especially when they are publicly traded.

Bank balance sheet implications. We start with the cross-sectional implications. Bank balance sheets shrink with the introduction and growth of private credit, but differentially for different banks. Banks with a high-quality loan portfolio — charging low interest rates on average — experience a reduction of risk in their loan portfolio and also lower profitability in expansions due to business stealing. On the other hand, banks that have a high share of high-risk loans — and thus charge high interest rates on average — experience the opposite when private credit is also available.

Consider now the aggregate implications to banks. With bank portfolios being of relative high quality prior to the introduction of private credit, the presence of private credit reduces the procyclical nature of bank balance sheets. Proposition 4 shows that private credit steals loans from banks and thus reduces banks' balance sheets. These poached loans are among the riskier bank loans. According to Proposition 5, this has the effect of creating bank outcomes that are less dispersed over the business cycle: bank returns and profitability are not as high in expansions but losses are also reduced in recessions when private credit is present.

Private credit continuation vehicles. Proposition 6 shows that even if there is abundant liquidity in the secondary market for funds, continuation vehicles are not

guaranteed. The likelihood of a continuation vehicle increases with a fund's ability to certify its loan portfolio quality (loan transparency) and decreases with the fraction of incumbent fund investors that face liquidity shocks and must sell. If there is a shortage of liquidity in the market for secondary loans, then the likelihood of a continuation vehicle does not depend on loan opacity, though it still decreases with the fraction of fund investors with a liquidity shock.

Ex ante, the likelihood of continuation vehicles also increases with transparency of the loan portfolio and decreases with the fraction of fund investors with a liquidity shock. Also as expected, an increase in the likelihood of higher future liquidity in the secondary market for loans increases the ex ante probability of continuation vehicles. More surprising though is that holding expected liquidity constant, an anticipation of higher variance in liquidity in the secondary market leads to lower ex ante probability of continuation vehicles.

Aggregate risk. Proposition 4 implies that the variability of aggregate output increases with the introduction of private credit. Democratization of credit and business stealing lead to increased output in expansions but to inefficient liquidations in recessions, representing significant drops in activity. This implies that aggregate risk increases once private credit is introduced and this risk is concentrated in private credit loans.

While output variance increases with the expansion of private credit, Proposition 5 implies that private credit loans should be more sensitive to aggregate risk, especially to the risk of large, tail events. Consistent with this prediction, Erel, Flanagan and Weisbach (2024) show that private credit fund returns have high systematic risk.

VIII Conclusion

This paper studies the credit allocation between bank financing and private credit financing. The model's main assumption is that private credit introduces "sand in the gears" of refinancing when the borrower's project fails; the difficulty of refinancing a loan at that stage is motivated by the limited lifetime of private credit closed-end funds, the uncertain availability of new investors once the fund's life ends, and the opacity of the loans. In contrast to private credit, banks' longer horizon allows for relatively easier renegotiation of non-performing bank loans. The limited ability

to refinance private credit loans beyond their maturity generates incentives to exert effort at the cost of excessive liquidation when projects fail in the interim period.

We show that introducing private credit may lead to "democratization of credit" — where projects that could not obtain a bank loan, can obtain a loan from a private credit fund — and "business stealing" — where borrowers that could obtain a bank loan, though at a high interest rate, prefer to be financed by a private credit loan at a lower interest rate. These features of the equilibrium with private credit financing are intrinsically linked to the maturity wall of private credit funds.

Democratization of credit and "business stealing" by private credit funds are responsible for several new predictions about the distribution of loan losses between banks and private credit funds, and banks' smaller but less risky balance sheets, findings relevant to the understanding of the stability of the banking sector.

Continuation vehicles exist in our model and are likely when private credit funds have more transparent loan portfolios and an investor base that is less likely to face liquidity shocks. But the anticipation of periods of uncertainty in liquidity in the secondary market for loans reduces the ex ante probability of continuation vehicles.

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Appendix A Mathematical Appendix

Proof of Lemma 1: *The private credit fund would like to sell any other type of loan –high continuation value loan that cannot be continued (occurs with probability $\mu(1-q)$) and low quality loan (occurs with probability $1-\mu$). This implies that a loan that a private credit fund would like to sell is of high continuation value with probability $\frac{\mu(1-q)}{1-\mu+\mu(1-q)} = \frac{\mu(1-q)}{1-\mu q}$. We assume that potential outside investors cannot observe the incumbent lender's quality signal which implies that their maximum expected recovery from purchasing a loan is $\frac{\mu(1-q)}{1-\mu q}\alpha y_2$. Under Assumption 4, this amount is no greater than the incumbent lender's liquidation payoff, βy_2. No price can therefore make both the outside investor and the incumbent lender strictly prefer a sale.* □

Proof of Lemma 2: *Fix an effort choice. Following a zero interim cash flow, expected project output under bank financing is $[\mu+(1-\mu)\beta]y_2$, whereas under private credit it is $[\mu q+(1-\mu q)\beta]y_2$. Their difference is $\mu(1-q)(1-\beta)y_2 > 0$. Because both lenders break even, the borrower receives this surplus difference and strictly prefers bank financing whenever the two contracts induce the same effort. Therefore private credit must induce high effort and cannot be chosen when bank financing also induces high effort.* □

Proof of Proposition 1: *As argued in the text, $R_B > 1 > \alpha y_2 > \beta y_2$, so $R^H_{B,f} = \alpha y_2$ and $R^L_{B,f} = \beta y_2$. The bank breaks even in expectation, yielding*

$$p_1 R_B + (1-p_1)[\beta + \mu(\alpha-\beta)]y_2 = 1, \tag{A1}$$

which yields (2) in the text.

The full borrower incentive constraint is

$$\pi_1(y_1+y_2-R_B) + (1-\pi_1)\mu(y_2 - R^H_{B,f}) \geq \\ (\pi_1-\Delta_1)(y_1+y_2-R_B) + (1-\pi_1+\Delta_1)\mu(y_2-R^H_{B,f}) + B_1. \tag{A2}$$

Rearranging and substituting yields $R^H_{B,f} = \alpha y_2$ and thus (1) in the text.

If the borrower exerts high effort, substitute $p_1 = \pi_1$, (2) and into (1). High effort is incentive compatible if and only if (3) holds. When this inequality fails, a bank that anticipates low effort sets $p_1 = \pi_1 - \Delta_1$ in (2). Substituting the feasibility condition $R_B \leq y_1 + \alpha y_2$ into the bank's break even condition (A1) yields

$$y_2 \geq \bar{y}_2^{B,P} = \frac{1-(\pi_1-\Delta_1)y_1}{(\pi_1-\Delta_1)\alpha + (1-\pi_1+\Delta_1)[\beta+\mu(\alpha-\beta)]}. \tag{A3}$$

These two inequalities yield the regions in the proposition. □

For Propositions 1 to 3, should the borrower be indifferent between any two loans, we assume for simplicity the following tiebreaker rules: the borrower first prefers to be financed, second it prefers

to exert effort, and lastly, it prefers bank financing to private credit. At $t = 1$, an incumbent lender liquidates rather than sells when the two options yield the same payoff.

Proof of Proposition 2:

We first show that (7) is a necessary condition. The thresholds (3) and (6) have the same numerator and due to Assumption 1 the numerator is positive. The private credit denominator minus the bank denominator equals

$$\mu(1-q)\left[\pi_1 + (1-\pi_1)\beta - \alpha\right]. \tag{A4}$$

Because $\mu > 0$ and $q < 1$, private credit can induce high effort for some borrowers for which a bank cannot if and only if $\pi_1 + (1-\pi_1)\beta > \alpha$. If the inequality is reversed, whenever private credit can induce effort, bank financing can do so as well; Lemma 2 then rules out private credit.

We now show that (7) is a sufficient condition. We have to show there exists admissible (B_1, y_2) values inside the cone defined by $y_2 \in [y_2^{PC,PI}(B_1), \bar{y}_2^{B,I}(B_1))$ for which the participation constraint of the borrower holds and the borrower chooses private credit over risky bank financing if the latter is also available.

First note that Assumption 1 ensures that the borrower participates, since the $\pi_1 y_1$ is a lower bound on its expected cash flow from the project and the expected repayment to the private credit fund is one, leaving the borrower with at least $\pi_1 y_1 - 1 > 0$.

Second, we show that there exists (B_1, y_2) values inside the cone $y_2 \in [y_2^{PC,I}(B_1), \bar{y}_2^{B,I}(B_1))$ such that the borrower is better off taking a private credit loan than a high-risk bank loan. Because lenders break even and the original investment is 1, their expected payoff equals 1. Thus the borrower's expected payoff equals expected project output minus 1, plus any private benefit. Under bank financing that does not induce high effort, the expected payoff of the borrower is,

$$B_1 + (\pi_1 - \Delta_1)(y_1 + y_2) + (1 - \pi_1 + \Delta_1)[\mu + (1-\mu)\beta]y_2 - 1, \tag{A5}$$

whereas under high-effort private credit financing it is

$$\pi_1(y_1 + y_2) + (1-\pi_1)[\mu q + (1-\mu q)\beta]y_2 - 1. \tag{A6}$$

Hence private credit is preferred if and only if

$$\Delta_1 y_1 - B_1 \geq (1-\beta)\left[\mu(1-q)(1-\pi_1) - \Delta_1(1-\mu)\right] y_2, \tag{A7}$$

yielding

$$y_2 \leq y_2^{switch} \equiv \frac{\Delta_1 y_1 - B_1}{(1-\beta)\left[\mu(1-q)(1-\pi_1) - \Delta_1(1-\mu)\right]}. \tag{A8}$$

The expression in square brackets in the denominator is positive if and only if

$$\mu > \frac{\Delta_1}{\Delta_1 + (1-q)(1-\pi_1)} \tag{A9}$$

If (A9) is violated, Assumption 2 implies that every borrower for which private credit can induce high effort prefers private credit financing to a bank loan that does not induce high effort and we have proven the proposition. If (A9) holds, (A8) places an upper bound on y_2. Note that as $B_1 \to \Delta_1\left(y_1 - \frac{1}{\pi_1}\right) > 0$ from above, then both (3) and (6) yield y_2 arbitrarily close to 0. The numerator of (A8) then converges to $\Delta_1/\pi_1 > 0$ and since the denominator of (A8) is strictly positive and bounded away from zero, thus the borrowers with y_2 arbitrarily close to zero but within the cone must choose private credit. □

Proof of Proposition 3: *Following a zero interim cash flow, the private credit fund receives αy_2 from a high-quality project that it can continue and βy_2 otherwise. Its break-even condition therefore gives (5). The borrower's full incentive constraint is*

$$\begin{aligned}\pi_1(y_1 + y_2 - R_{PC}) + (1-\pi_1)\mu q(1-\alpha)y_2 \geq \\ (\pi_1 - \Delta_1)(y_1 + y_2 - R_{PC}) + (1 - \pi_1 + \Delta_1)\mu q(1-\alpha)y_2 + B_1,\end{aligned} \tag{A10}$$

which reduces to (4). Substituting the high-effort break-even repayment (5) into (4) gives (6) in the text. By Assumption 1, the corresponding repayment is feasible and satisfies $R_{PC} \leq y_1$.

Now we show that when private credit or bank financing induce high effort, then the participation constraint of the borrower holds. To see this, first note that Assumption 1 ensures that the borrower participates, since the $\pi_1 y_1$ is a lower bound on its expected cash flow from the project and the expected repayment to the private credit fund is one, leaving the borrower with at least $\pi_1 y_1 - 1 > 0$.

If $y_2 \geq \bar{y}_2^{B,I}$, bank financing induces high effort and is preferred by Lemma 2. If $y_2 < \bar{y}_2^{PC,I}$, private credit cannot induce high effort and is likewise not chosen. Thus private credit can be selected only for $y_2 \in [\bar{y}_2^{PC,I}, \bar{y}_2^{B,I})$. Within that interval, private credit is chosen whenever $y_2 < \bar{y}_2^{B,P}$, because a low-effort bank loan is then infeasible. If instead $y_2 \geq \bar{y}_2^{B,P}$, both contracts are feasible and private credit is chosen exactly when its high-effort surplus exceeds the surplus from low-effort bank financing, which is condition (A8). Therefore, the remaining projects in $[\bar{y}_2^{B,P}, \bar{y}_2^{B,I})$ receive high-risk bank financing, and projects below both financing thresholds receive no financing. This establishes all regions in the proposition. □

Proof of Proposition 6: *Conditional on a zero interim cash flow, a mass μ of projects has high continuation value and a mass $1-\mu$ has low continuation value. Among the high continuation value projects, a mass $\mu(1-\psi)$ is held by private credit funds funded by outside investors that do not experience a liquidity shock and is therefore continued by the incumbent outside investor, e.g., as a continuation fund. A mass $\psi\mu$ of high continuation value projects is held by investors that experience a liquidity shock. Of these projects, a mass $\psi\mu\nu$ is certified, while a mass $\psi\mu(1-\nu)$ remains uncertified. Certification reveals that continuation generates pledgeable cash flow αy_2. Because we*

assume the incumbent private credit fund has full bargaining power, certified loans trade at the buyer's reservation price αy_2. Note that we assumed each new outside investor has a unit of cash which by Assumption 5 is sufficient to buy the loan at this price.

Purchasing all certified loans requires a measure of $\psi\mu\nu$ new outside investors. If $m < \psi\mu\nu$, outside investors purchase a random fraction $m/(\psi\mu\nu)$ of certified loans. The mass of high continuation value projects that is continued divided by the total mass μ of high continuation value projects, given m, is

$$\chi(m) = 1 - \psi + \frac{m}{\mu}. \tag{A11}$$

Suppose next that $m \geq \psi\mu\nu$, so that all certified loans are purchased. The uncertified pool contains a mass $1-\mu$ of low-continuation-value projects and a mass $\psi\mu(1-\nu)$ of high continuation value projects. Using Bayes' rule, the expected pledgeable payoff from an uncertified loan is

$$\frac{\psi\mu(1-\nu)\alpha}{1-\mu+\psi\mu(1-\nu)} y_2. \tag{A12}$$

An incumbent lender must be able to receive at least the liquidation value βy_2 to sell. Hence, if (9) holds, no price can make both the incumbent lender and an outside investor willing to trade, and the uncertified market breaks down. All certified loans are then purchased whenever $m \geq \mu\psi\nu$, implying

$$\chi(m) = 1 - \psi + \psi\nu. \tag{A13}$$

This establishes (11).

We now show the model maps exactly into that of the reduced form model of Section III. For this we need to show the cash flows to the private credit fund and the investor are exactly like in the original model and thus incentives and participation constraints are unchanged. The expected recovery of the private credit lender following a zero interim cash flow is

$$[\beta + \mu q(\alpha - \beta)]\, y_2. \tag{A14}$$

This is exactly the recovery used in the baseline model: a fraction μq of projects has high continuation value and continues, generating pledgeable cash flow αy_2, while all remaining projects are liquidated for βy_2. As for the borrower, it gets to continue after zero interim cash flow with probability q and in case of continuation gets $(1-\alpha)y_2$ and zero if it gets terminated, both as in the reduced-form model. □

Proposition 7. Optimal financing contract with commitment. *In the optimal contract, the project is financed with:*

i) Low-risk loan with continuation if $y_2 \geq \bar{y}_2^{B,I}$: the borrower exerts effort and the project is financed by a loan with $\lambda_H = 1$ and $\lambda_L = 0$;

ii) High-risk loan with continuation if $y_2 \in \left[\bar{y}_2^{B,P}, \max\left(\bar{y}_2^{PC,I}(0), \bar{y}_2^{switch,o}\right)\right)$: the borrower exerts

low effort and the project is financed by a loan with $\lambda_H = 1$ and $\lambda_L = 0$;

iii) *Low-risk loan with probabilistic liquidation* *if* $y_2 \in \left[\max\left(\bar{y}_2^{PC,I}(0), \bar{y}_2^{switch,o}\right), \bar{y}_2^{B,I}\right)$*: the borrower exerts effort and the project is financed by a loan with* $\lambda_H \in [0,1]$ *and* $\lambda_L = 0$*. Furthermore,* λ_H *is strictly increasing in* y_2*,* $\lambda_H = 1$ *when* $y_2 = \bar{y}_2^{B,I}$*, and* $\lambda_H = 0$ *when* $y_2 = \bar{y}_2^{PC,I}(0)$*.*

If $y_2 < \min\left(\bar{y}_2^{PC,I}(0), \bar{y}_2^{B,P}\right)$*, the project is not financed. The threshold* $\bar{y}_2^{switch,o}$ *is defined in the proof of the proposition.*

Proof of Proposition 7: *Since lenders are competitive, the optimal contract maximizes the expected payoff of the borrower subject to the lender's break-even condition, the feasibility of state-contingent repayment, and the borrower's incentive constraint if high effort is chosen,*

$$\pi_1(y_1 + y_2 - R_h) + (1-\pi_1)\mu\lambda_H(y_2 - R_l) \geq \\ (\pi_1 - \Delta_1)(y_1 + y_2 - R_h) + (1 - \pi_1 + \Delta_1)\mu\lambda_H(y_2 - R_l) + B_1. \quad \text{(A15)}$$

Formally,

$$\max_{R_h, R_l, \lambda_H, p_1} p_1(y_1 + y_2) + (1-p_1)\left\{\mu\lambda_H y_2 + (1-\mu\lambda_H)\beta y_2\right\} - 1 + \mathbb{1}_{p_1 = \pi_1 - \Delta_1} B_1, \quad \text{(A16)}$$

subject to:

$$p_1 R_h + (1-p_1)\left\{(1-\mu\lambda_H)\beta y_2 + \mu\lambda_H R_l\right\} = 1,$$

$$R_h \leq y_1 + \alpha y_2,$$

$$R_l \leq \alpha y_2,$$

$$\mathbb{1}_{p_1 = \pi_1}\left(y_1 + (1-\mu\lambda_H)y_2 - R_h + \mu\lambda_H R_l - \frac{B_1}{\Delta_1}\right) \geq 0.$$

A project with low continuation value yields zero if continued, whereas liquidation yields $\beta y_2 > 0$*. Continuation in this state also provides no incentive benefit. Hence, it is optimal to set* $\lambda_L = 0$*.*

If $R_l < \alpha y_2$*, then* R_l *can be increased and* R_h *decreased so as to keep the break-even constraint unchanged. This relaxes the incentive constraint. Hence, setting* $R_l = \alpha y_2$ *is weakly optimal.*

Since liquidation of a project with high continuation value is inefficient, the optimal contract chooses the largest λ_H*, i.e., the highest continuation probability for a project with high continuation value, consistent with the incentive constraint. Therefore, in the probabilistic-termination region, the incentive constraint binds.*

We now prove the regions one by one:

i) *Low-risk loan with continuation*

Whenever the incentive constraint can be satisfied with $\lambda_H = 1$*, high effort with* $p_1 = \pi_1$ *will be chosen. The choice* $p_1 = \pi_1 - \Delta_1$ *is not optimal in this case, as switching to* $p_1 = \pi_1$ *increases expected payoff, while the break-even constraint can be satisfied by choosing a lower*

R_h. Substituting $\lambda_H = 1$ and $\lambda_L = 0$ into the incentive constraint and using the break-even constraint to determine R_h shows that high effort with efficient continuation is possible if

$$y_2 \geq \bar{y}_2^{B,I} = \frac{1 - \pi_1 \left(y_1 - \frac{B_1}{\Delta_1} \right)}{\pi_1[1 - \mu(1-\alpha)] + (1-\pi_1)[\beta + \mu(\alpha - \beta)]}. \tag{A17}$$

ii) <u>High-risk loan with continuation</u>

Whenever the incentive constraint cannot be satisfied even with $\lambda_H = 0$, low effort with $p_1 = \pi_1 - \Delta_1$ has to be chosen. The lowest y_2 for which $\lambda_H = 0$ still provides incentives to exert effort is obtained by combining the break-even constraint with the incentive constraint:

$$y_2 \geq \bar{y}_2^{PC,I}(0) = \frac{1 - \pi_1 \left(y_1 - \frac{B_1}{\Delta_1} \right)}{\pi_1 + (1-\pi_1)\beta}. \tag{A18}$$

Thus, whenever $y_2 < \bar{y}_2^{PC,I}(0)$, even $\lambda_H = 0$ cannot incentivize the borrower. Given low effort, liquidation of a project with high continuation value has no incentive benefit, so the optimal contract sets $\lambda_H = 1$.

In this case, the break-even condition yields

$$R_h = \frac{1 - (1 - \pi_1 + \Delta_1)[\beta + \mu(\alpha - \beta)]y_2}{\pi_1 - \Delta_1}. \tag{A19}$$

The feasibility constraint $R_h \leq y_1 + \alpha y_2$ must also be satisfied, yielding

$$y_2 \geq \bar{y}_2^{B,P} = \frac{1 - (\pi_1 - \Delta_1)y_1}{(\pi_1 - \Delta_1)\alpha + (1 - \pi_1 + \Delta_1)[\beta + \mu(\alpha - \beta)]}. \tag{A20}$$

The borrower may nevertheless prefer not to be incentivized when $y_2 \leq \bar{y}_2^{switch,o}$, where $\bar{y}_2^{switch,o}$ is derived below.

iii) <u>Low-risk loan with probabilistic liquidation</u>

Since the borrower wants to maximize the probability of continuation λ_H following a high-continuation-value signal, the incentive constraint binds in this region. It is given by

$$y_1 + (1 - \mu\lambda_H)y_2 - R_h + \mu\lambda_H \alpha y_2 = \frac{B_1}{\Delta_1},$$

while the lender's break-even condition is

$$\pi_1 R_h + (1 - \pi_1)y_2 \left[(1 - \mu\lambda_H)\beta + \mu\lambda_H \alpha \right] = 1.$$

Combining the two yields

$$R_h = \frac{B_1(\pi_1 - 1)(\alpha - \beta) + \Delta_1 \left[\beta\pi_1 y_1 + \alpha \left(-\pi_1 y_1 + (\beta - 1)(\pi_1 - 1)y_2 + y_1 + 1 \right) - \beta y_1 - 1 \right]}{\Delta_1[\alpha - \beta + (\beta - 1)\pi_1]}. \tag{A21}$$

Moreover,

$$\lambda_H = \frac{1}{\mu}\left[1 - \frac{\Delta_1(\pi_1 y_1 + \alpha y_2 - 1) - B_1\pi_1}{\Delta_1 y_2[\alpha - \beta + (\beta - 1)\pi_1]}\right]. \tag{A22}$$

If both probabilistic termination with high effort and efficient continuation with low effort are available, the borrower chooses probabilistic termination if and only if it yields a higher expected payoff. Using Equation (A16), this condition is

$$\begin{aligned}\pi_1(y_1 + y_2) + (1 - \pi_1)\left[\mu\lambda_H y_2 + (1 - \mu\lambda_H)\beta y_2\right] - 1 \geq \\ B_1 + (\pi_1 - \Delta_1)(y_1 + y_2) + (1 - \pi_1 + \Delta_1)[\mu + (1 - \mu)\beta]y_2 - 1.\end{aligned} \tag{A23}$$

Using Equation (A22), this condition becomes

$$y_2 \geq \bar{y}_2^{switch,o} = \frac{[\alpha - \beta + (\beta - 1)\pi_1](\Delta_1 y_1 - B_1) + (1 - \beta)(1 - \pi_1)\left[1 - \pi_1\left(y_1 - \frac{B_1}{\Delta_1}\right)\right]}{(1 - \beta)\left\{(1 - \pi_1)\alpha - [\alpha - \beta + (\beta - 1)\pi_1](1 - \mu)(1 - \pi_1 + \Delta_1)\right\}}. \tag{A24}$$

The derivative of the optimal λ_H with respect to y_2 in this region is

$$\frac{\partial\lambda_H}{\partial y_2} = -\frac{B_1\pi_1 - \Delta_1\pi_1 y_1 + \Delta_1}{\mu\Delta_1 y_2^2[\alpha - \beta + (\beta - 1)\pi_1]}. \tag{A25}$$

We have $\frac{\partial\lambda_H}{\partial y_2} > 0$. The numerator is positive because

$$1 - \pi_1\left(y_1 - \frac{B_1}{\Delta_1}\right) > 0$$

in the relevant region, where $\bar{y}_2^{B,I} > \bar{y}_2^{PC,I}(0) > 0$. The denominator is negative because the condition in Proposition 2, for the $q = 0$ contract, reduces to

$$\alpha < \beta(1 - \pi_1) + \pi_1.$$

In the unconstrained probabilistic-liquidation contract, $\lambda_H = 0$ at $y_2 = \bar{y}_2^{PC,I}(0)$ and $\lambda_H = 1$ at $y_2 = \bar{y}_2^{B,I}$.

□

Appendix B Model extensions

B.1 Non-pledgeable income

In the baseline model, only α fraction of the $t = 2$ income is pledgeable. Proposition 2 implies that this is a crucial assumption as $\alpha < 1$ is needed for private credit financing to emerge in equilibrium.

In this section, we provide a simple microfoundation for limited pledgeability that preserves the reduced-form assumption that α is constant across borrowers.

Assume that if the entrepreneur exhibits high effort from $t = 1$ to $t = 2$, the payoff at $t = 2$ is y_2 for sure. With low effort the borrower collects private benefit proportional to the project size, $B_2 = b_2 y_2$ (where $b_2 > 0$), and the probability of getting payoff y_2 drops to $1 - \Delta_2$, while with probability Δ_2 the payoff at $t = 2$ is zero. We assume effort is efficient, thus $b_2 < \Delta_2$. For high effort to be chosen in equilibrium, any promised repayment R from $t = 1$ to $t = 2$ (after potential renegotiation) has to satisfy the incentive compatibility constraint in the interim period thus

$$y_2 - R \geq (1 - \Delta_2)(y_2 - R) + b_2 y_2, \tag{A26}$$

which is equivalent to

$$R \leq \left(1 - \frac{b_2}{\Delta_2}\right) y_2. \tag{A27}$$

Thus the maximum pledgeable repayment at $t = 2$ is αy_2 with $\alpha = 1 - \frac{b_2}{\Delta_2}$, where the condition $0 < b_2 < \Delta_2$ implies $\alpha \in (0, 1)$. Note that the lender can get $(1 - \Delta_2)y_2$ without inducing effort thus more pledgeable income can be attained with high effort than without if and only if $1 - \Delta_2 < 1 - \frac{b_2}{\Delta_2}$ which holds for $\sqrt{b_2} < \Delta_2$. Given that $b_2 < \Delta_2 < 1$, this is a tighter condition than the condition that requires effort to be efficient. Under this tighter condition, the pledgeable income can indeed be written as an $\alpha < 1$ fraction of the expected cash flow y_2, the exact simplification we use in the baseline model.

B.2 Relaxing Assumption 1

In this section, we replace the original Assumption 1 (i.e., $\pi_1 y_1 \geq 1$) by a less restrictive assumption only requiring that projects where the borrower exerts high effort have positive net present value with private credit financing even if $q = 0$:

Assumption 7. $\pi_1(y_1 + \alpha y_2) + (1 - \pi_1)\beta y_2 \geq 1$.

Under Assumption 7, and contrary to Assumption 1, the intermediate cash flow in the good state y_1 might not be enough to cover repayment to the private credit fund even in case it is realized at $t = 1$. Because repayment to lender is not guaranteed at $t = 1$ even in the good state, we must determine the condition of sale of a loan in that state of the world, something we need not do under the original Assumption 1. We assume that in case of high interim cash flow, the project is automatically certified in the language of Section IV and can be refinanced by new outside investors for sure without any frictions (in practice assuming $q = 1$ conditional on high interim cash flow). This assumption is realistic in that only struggling borrowers face refinancing frictions, while those in good financial health do not.

We refrain from formally restating and proving the counterpart of Proposition 3 in this case as it is quite cumbersome and instead just show a numerical example to illustrate that similar financing

regions hold as before and thus all the insights derived from the model using Assumption 1 continue to hold. Figure 6 shows the counterpart of the original Figure 3, with the only change in parameters being a lower y_1 in the new figure.

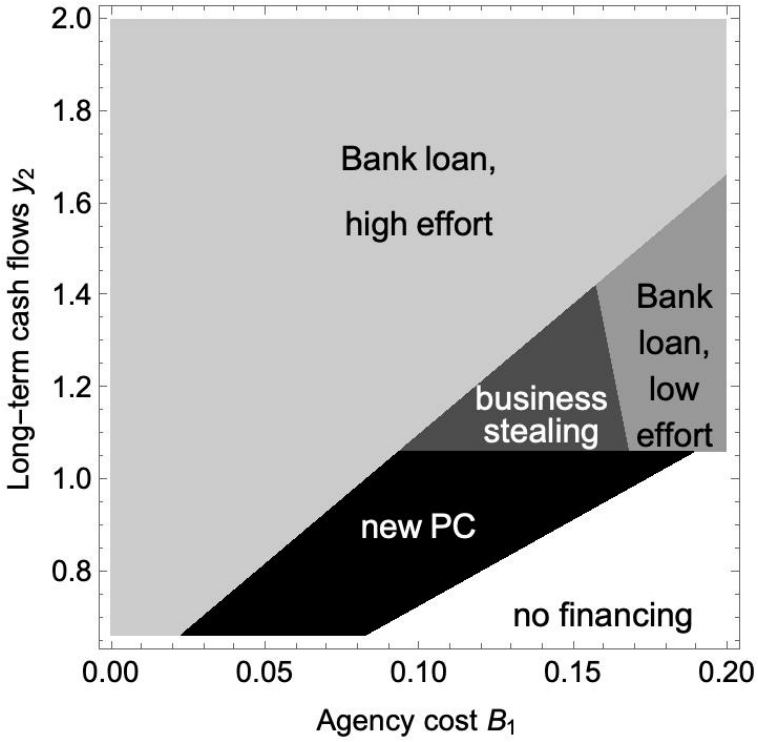


Figure 6: Financing regions if both bank and private credit are available once Assumption 1 is relaxed.

Notes. The y-axis depicts long-term project cash flows y_2 and the x-axis depicts agency cost B_1. Parameters: $\Delta_1 = 0.25, \pi_1 = 0.85, y_1 = 0.8, \beta = 0.4, \alpha = 0.5, \mu = 0.75$, and $q = 0$.

Note first the difference in units in the x-axis and y-axis between the two figures. These differences come from two sources. A lower y_1 implies that it is harder to incentivize the borrower (note that Assumption 2 implies a tighter upper bound on B_1 that can support high effort by bank or private credit financing). Furthermore Assumption 7 imposes a lower bound on y_2.

Figure 6 confirms that regions of "democratization of credit"and "business stealing" continue to exist even when Assumption 1 is weakened. The existence of private credit, and hence these two regions, continues to be determined by two main forces. On the one hand, lower interim cash flow makes incentivizing the borrower harder. Since private credit exists if the bank cannot incentivize the borrower to exert high effort, then a lower y_1 contributes to relatively more private credit. On the other hand, private credit may not be feasible since now overall cash flows decreased (note some bank loans may also no longer be feasible as y_1 decreases).