Quid Pro Quo*

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Abstract

This paper attempts to shed some new light on two puzzles about Chinese economy: Rapid economic growth despite pandemic corruption; dramatic development of the private sector despite "ownership discrimination" in financial resource allocation. In our model, the productive bribe facilitates the more efficient private firm to obtain the scarce financial resource, either from the bank or from the state-owned enterprise, and corrects the initial allocation distortion. Meanwhile, our model also generates the distortionary and the predatory bribes which hurt the economy.

Keywords: Corruption; Productive bribe; Private sector; State-owned enterprise; Ownership discrimination

JEL Codes: D73; O17; G21

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I. Introduction

Corruption is abuse of public office for private gain. It is usually regarded as one of the most pervasive obstacles to economic growth and social development around the world. Many countries suffering from severe corruption are also accompanied by poor economic performances. However, despite the serious or even pandemic corruption, China had been growing very fast during the past decades. Why?[1]

Economists have broadly explored the relationship between corruption and its impact on the economy. The mainstream literature indicates that corruption is highly costly, and thus slows down the economy. For example, Shleifer and Vishny (1993) point out that the illegality of corruption and the imperative for secrecy make it much more distortionary and costly than taxation. Ehrlich and Lui (1999) and Mo (2001) claim that many valuable (human and non-human) resources have been devoted to seeking corruption rents, which might have been used for production or human capital investment. Most empirical evidence supports the slow-down effect of corruption. For example, Mauro (1995) uses cross-country data to show that corruption reduces the investment and thus prohibits economic growth. Keefer and Knack (1997) present that the pervasiveness of corruption may reduce investment and the ability to absorb technologies from abroad. Li et al. (2000) find that in countries with less equal asset distribution, corruption is associated with a larger drop in growth rates. Méon and Sekkat (2005) document data in countries from 1970 to 1998, and show that corruption "sands the wheels" of economy.[2]

However, China is one of the very corrupted countries (Svensson, 2005),[3] yet China is also one of the fastest-growing economies during the past four decades. Besides China, other eastern Asian countries, such as Indonesia, South Korea, Thailand, and others, had grown well despite high levels of corruption, the so-called "East Asian Paradox" (Wedeman, 2002). Not only eastern Asian countries, but many developed countries had also experienced the coexistence of booming economy and high corruptions in early years, such as the United States in the late 19th century (Glaeser and Goldin, 2006).

[1] Some people might argue that without serious corruption, China can grow even faster. Another casual observation is that Chinese economy has entered into the so-call new normal (a somewhat positive name for the economic slow-down) since the vehement anti-corruption campaign being launched recently. Thousands of corrupted officials have been caught and sentenced into prison, including many high profile cases.

[2] Unlike Mauro (1995) and Keefer and Knack (1997), Méon and Sekkat (2005) state that this impact is independent of corruption's impact on investment.

[3] According to the data of Transparency International in 1995, the Corruption Perception Index of China ranks the last one of the 41 surveyed countries. Until 2021, China ranks 66 out of 180 countries with a score of 45 on a scale from zero (highly corrupted) to 100 (very clean).

Whether corruption, to some extent, "greasing economic wheels," remains controversial. Most corruptions are purely redistributive or predatory, and thus anti-growth and value-destroying. Is it possible that under certain situations, corruptions could be productive, pro-growth, or value-creating? Beginning with Leff (1964) and Huntington (1968), several authors have suggested that corruption might assist economic growth by greasing the wheels of a rigid administration. When there are pre-existing policies that have induced distortion, corruption may bypass the distortion and thus improve welfare (Bardhan, 1997). On the one hand, certain forms of corruption, like "speed money," will enable individuals to surpass bureaucratic delays and get ahead in the queue for public services.[4] Lui (1985) shows that, if bribes are regarded as payments to obtain a better position in the queue, the mechanism becomes a useful auctioning procedure, and the socially optimal outcome can be obtained. On the other hand, corruption may also work as "piece-rate" pay for government officials, and hence, it improves the provision of public services (Mo, 2001). Some cross-country empirical works favor the efficiency-improving effect of corruption. Méon and Weill (2010) find that corruption is less harmful to efficiency when institutions are less effective, and in countries with extremely ineffective institutions, corruption may even improve efficiency. Similar results are found by Cai et al. (2011) in China that, although Entertainment and Travel Costs expenditure overall has a negative impact on the firm performance, some components of it, such as the bribe to officials for better government services, bring positive returns to the firm, especially in cities with weaker institutions. The results of Méndez and Sepúlveda (2006) indicate that the growth-maximizing level of corruption is significantly greater than zero, but when the incidence reaches a high level, corruption is detrimental.

Besides the coexistence of the rapid economic growth and the serious corruption problem in China, another puzzle related to Chinese economy is: Why the private sector develops so fast despite "ownership discrimination," such as facing much more restrictive financial resources constraints compared to the state sector? It is well known that the private sector is the driving force behind China's fast-growing economy. It has expanded steadily at a rate of 20 percent annually since the beginning of the reform and opening-up in the late 1970s, far above the economy's 8 percent average growth for the same period. From almost nothing, the private sector has now accounted for more than 60% of China's GDP, while the state sector's share has dropped from about 80% in 1978 to less than 30% (Tsai, 2002; Allen et al., 2005; Yao et al., 2019). However, for example,

[4]There are also different opinions about this idea. Myrdal (1968) states that officials may, conversely, create red tapes to attract more bribes. This argument is examined by Banerjee (1997).

in the financial area, the government had almost monopolized the financial resources for most of the reform and open-up period.[5] The majority of the bank loans were allocated to state-owned enterprises (SOEs), regardless of their unprofitability, leaving companies in the private sector credit shortage (Boyreau-Debray, 2003; Ayyagari et al., 2010).[6] However, the misallocation of financial resources did not seem to prohibit the fast growth of the private sector.

The existing yet controversial explanation is the critical role of informal financing in helping the development of the private sector (Allen et al., 2005; Song et al., 2011).[7] Trade credit is a typical informal financing mechanism (Nilsen, 2002; Cunat, 2007): On the one hand, the "redistribution view" of trade credit argues that bank credit is redistributed via trade credit by the firms with stronger financial stand to the firms with weaker financial position (Love et al., 2007). On the other hand, compared with banks, suppliers have a comparative advantage in getting information about buyers. The better SOEs know about private firms, the more efficiently they can liquidate assets (Petersen and Rajan, 1997). Fisman and Love (2003) empirically show that, in emerging countries with less developed financial intermediaries, industries that are more dependent on trade credit financing grow relatively more rapidly. Cull et al. (2009) investigate how trade credit works in China under the banking system that is biased towards SOEs, and find that SOEs with access to loans while poorly performing tend to provide trade credit to other firms. They also point out that the trade credit alone may not be a major contributor to China's explosive growth.

The two puzzles about Chinese economy, the fast economic growth despite pandemic corruption, and the dramatic development of the private sector despite ownership discrimination in formal finance, are internally related and can be studied together. But to our knowledge, there is a paucity of literature doing so. In this paper, we build up a theoretical model to shed some new light on the two puzzles. The state-owned bank monopolizes the financial resources, which both the private firm (PF) and the SOE apply for to finance their own projects. The SOE has government bailout, while the PF does not. But the PF can bribe the banker with kickbacks. When the SOE obtains the bank loan, its manager can either execute the project, or re-lend it to the PF for a bribe. Our model generates three types of bribes: Productive, distortionary, and predatory.

The bribe can be productive or efficiency-improving for three reasons. First, it facilitates the more efficient PF to obtain the financial resources, either from the bank or from the SOE. Therefore,

[5]For more and specific institutional background in China financial area during the past three or four decades, please see Yao et al. (2019).

[6]Lu et al. (2005) find evidence that the systematic lending bias is partly induced by the expectation of government's bailout of troubled SOEs, such as takeover of non-performing loans or restructuring of ailing SOEs.

[7]Many disagree. See Ayyagari et al. (2010), for example.

the allocation distortion in which the inefficient SOE uses the bank loan due to government bailout, is corrected. Second, it fills the gap between the social optimal and the private optimal, in the sense that without the bribe, the banker, who does not internalize the externality of lending, may idle the fund even though it should be lent out from the social perspective. Third, it facilitates private information of the SOE to be used in reallocating its bank loan, as the SOE with a bad project may re-lend its fund to the PF. On the contrary, the bribe is distortionary if from the social perspective, the banker should idle the fund or lend it to the SOE; instead, the banker lends it to the PF for large private gain. The bribe can also be predatory or value-destroying in our model, because knowing that the PF will abuse the fund, the banker or the SOE manager still offers it the loan for a bribe.

We also characterize the respective conditions under which each type of bribe happens. The bribe tends to be productive when the return of the project is sufficiently high and the bribe is sufficiently small. The PF will execute the project instead of running away with the loan given the sizable expected return and small bribe to pay. Bribe makes lending to the PF more attractive and therefore directs the loan from the inefficient SOE to the efficient PF. Also, the banker will partially internalize the return of the project via the bribe. The bribe is distortionary when the bribe becomes greater, as some projects with lower expected return will also be funded and executed. Predatory bribe happens when the return of the project is low and the bribe is large, and the PF bribes only for running away with the loan. These results echo with the data of Ang (2020)[8] and call for more empirical studies in this regard.

Our model also produces other interesting results and has strong policy implications for the ongoing anti-corruption campaign. For example, small bailout can be productive under certain circumstances, and the anti-corruption campaign should target more on the predatory and distortionary corruptions. Meanwhile, other institutional reforms are needed to reduce corruption and enhance efficiency, such as reducing or withdrawing the government resource-control or intervention, and strengthening the law enforcement.

Our contribution is as follows. First, we add to the literature on corruption-development debate. In our model, the productive bribe is efficiency-improving and creating values, and thus pro-growth,

[8]Compared to other periods, the growth of China is the fastest in the late 1990s and 2000s. Meanwhile, the amount of corruption cases with small sums is the greatest, both in the absolute number and its share of total cases. After 2010, Chinese economy slowed down. Simultaneously, there is a significant decrease in corruption cases with small sums while those with large sums increased. Moreover, in the 2010s, although corruption cases with exchange for resources were more prevalent than theft, the bribe was of greater size than before, implying a higher possibility of distortion instead of purely productive according to our results.

while the distortionary and predatory ones are doing exactly the opposite. Under different returns of the project and bribe sizes, even the same bribery behavior can be either productive, distortionary, or predatory. By distinguishing three different types of bribes, our model accommodates the two opposite effects of corruptions, the efficiency-improving and the slow-down effects, on the economy. Our results imply that if there are significantly more productive corruptions in a country than the distortionary and predatory ones, the corruption may not hurt the economy, like the cases of China and other eastern Asian countries. On the contrary, if the distortionary and the predatory corruptions are dominant, the economy is doomed.

It is natural to ask why the institutions in China could generate more productive bribes than distortionary and predatory ones, which deserves further research. Our model offers a certain clue, and we can provide some conjectures as well. The background of our research is the transition of China from the planned economy to the market economy, fertilizing the ground for corruption (Dong and Torgler, 2013). Broadly, as studied by Lau et al. (2000), when the market elements[9] were introduced into the planned economy, and given related agents fulfill their obligations, Pareto improvement can be obtained via this dual-track approach, which is prevalent along the reform in China (see Lau et al. (2000) and many others). Specifically, Ang (2020) has studied the "access money," defined as rewards extended by business actors to powerful officials for access and utilizing valuable resources, which is an "exchange" behavior rather than pure theft. According to Ang's 2017 and 2018 survey, access money was the dominant form of corruption in China rather than speed money or theft. During this great transition, officials have been incentivized to develop the economy for their future promotion, which is partially addressed by the performance part of the banker's and SOE manager's utility functions in our paper.[10] Forms of corruption that directly hinder economic development have been strictly curtailed and harshly punished.[11] Therefore, bureaucrats care about their own performances and prefer (bribe-involved) pro-growth behavior to pure stealing (Zheng and Xiao, 2020).

As mentioned above, the idea that the correlation between corruption and economic growth is not purely negative is not new, and is corroborated by Nye (1967), Huntington (1968), Méndez and Sepúlveda (2006), and others. But the cause of pro-growth in their works is different from ours;

[9]It could be the black market for the bank loan via bribery in our paper, which is prohibited by the law but still exists. Some channels are also gradually made legal, e.g., SOE directly lending to the private firm.

[10]Li and Zhou (2005) have provided empirical evidence that, under the personnel control of Chinese government, the promotion of provincial leaders was positively related to the economic performance. Local officials have been pushing the development of infrastructure, business and investment, which stands in contrast with the rent-seeking behavior in other developing economies.

[11]Embezzlement and misappropriation of public funds have declined since 2000 while bribery exploded (Ang, 2020).

they mostly talk about the function of corruption as greasing oil to circumvent the red tapes or speeding up the administration as "piece-rate" pay. In our model, the productive bribe helps to allocate scarce resources from the low efficiency sector (SOEs) to the high efficiency one (private sector). Despite the fact that the private sector was discriminated against and thus highly resource-restricted, bribe and other ways had helped relax such restrictions. For example, in the re-lending case, the fund is eventually channeled to the private sector, although the bank loan is allocated to the SOE initially.

Second, our paper contributes to the literature debating on the formal (Firth et al., 2009; Ayyagari et al., 2010) and informal financing (Allen et al., 2005). We find new channels of formal and informal financing for the private sector, namely, bribing the banker to obtain the bank loan directly, or bribing the SOE manager to obtain the bank loan indirectly. Furthermore, we show that formal and informal financing are not necessarily independent, and they can intertwine together. Funds in forms of informal financing (firm credit) can come from formal financing (bank credit); there are both competition and cooperation between SOE and PF in obtaining bank loans. In this way, our results add to "...a vast portfolio of formal and informal arrangements that sustained Chinese growth during this period" (Cull et al., 2009, page 191).

The rest of this paper is structured as follows: Section II sets up a simple loan allocation game among the state-owned bank, the PF, and the SOE; section III solves this game under different situations; Section IV introduces the re-lending and analyzes its impact; section V concludes.

II. Model

We begin with a simple model that enables us to analyze the influence of bribe on the economy. There are four parties in this model: the banker of a state-owned bank, the owner of a private firm (PF), the manager of a state-owned enterprise (SOE), and the government. We make the last player passive, while the first three engage in a bank loan allocation game as follows: The bank monopolizes the financial resources, and the PF and the SOE compete for the loan to finance their own projects, which can be either good or bad.

More specifically, denoted by 1 the size of the project needed to be financed for both the PF and the SOE. But the bank has only 1 unit loan to be allocated between them, meaning that it can only support one project. Assume that the output of the project will be $Z > 0$ if it is of good nature, or 0 for the bad. The probability of the good project is θ_p for the PF and θ_s for the SOE.

Since the SOEs are usually less efficient than the private firms (Poncet et al., 2010; Guariglia et al., 2011; Chen et al., 2013; Li et al., 2018; and many others), it is reasonable to assume $\theta_p \geq \theta_s$. The interest rate of the bank loan is $i \in [0, 1]$. Presumably, $1 + i \leq Z$, that is, after paying off the loan and the interest, there is still a non-negative surplus for a good project. So far, if the bank is willing to lend, then from the efficiency perspective, the loan should be allocated to the PF. However, the situation is complicated by many other considerations.

On the one hand, for political or social reasons, the government is willing to support the SOE in the following way: If the SOE obtains the loan and in case that its project fails, the government will provide bailout $T \in [0, 1]$ to compensate the bank's loss (Lu et al., 2005; Liu and Subramaniam, 2013). On the other hand, in order to get the loan, the PF may choose to bribe the banker by $B \in [0, 1]$. We further assume $B \leq Z - (1 + i)$ to make the good project profitable for PF even with the bribe.

Ex ante, the information is symmetric. None of the three agents have any private information about the quality of the two projects, except the common knowledge of θ_p and θ_s. The timeline of the game is as follows. First, the banker decides whether to lend, and to whom if lend. When the banker decides not to lend, the game is over. If the banker is willing to lend, after receiving the loan, the quality of the project is revealed to either the PF owner or the SOE manager, whoever obtains the loan. If the SOE receives the loan, it will execute the project no matter good or not.[12] If the PF receives the loan, the owner can execute the project, or run away with it, which is a serious moral hazard problem.[13] The private cost of "running away" for the PF owner is assumed to be $\tau \in (0, 1)$, which reflects the possibility of being caught and punished, or the effectiveness of the law enforcement. At the end of the game, the payoff for each party is realized.

The payoff function for the banker is $U_b = a_b O_b + B$, where $a_b \in [0, 1]$, and O_b is the bank's performance. O_b is defined as

$$O_b = \begin{cases} 1 + i, & \text{when the borrower executes a good project and pays back the debt and interest;} \\ 1, & \text{when the banker lends to neither;} \\ T, & \text{after SOE executing a bad project and the government bailing out;} \\ 0, & \text{when PF owner has either executed a bad project or run away with the loan.} \end{cases}$$

[12] This is due to the aim of the SOE is not only to maximize its profit, but also to achieve political objectives (Shleifer and Vishny, 1994), such as employment or social stability.

[13] Since running away with the bank loan is a serious crime, the person who committed such a crime usually hides (such as fleeing abroad) and disappears from the economy.

Thus, $a_b O_b$ captures the utility the banker has obtained from the bank's performance. $B \geq 0$ is the bribe from the PF if there is. For the SOE manager, the payoff function is $U_s = a_s O_s$, where similarly, $a_s \in [0, 1]$, and O_s is defined as

$$O_s = \begin{cases} Z - (1+i), & \text{when SOE executes a good project and pays back the debt and interest;} \\ 0, & \text{when SOE executes a bad project.} \end{cases}$$

In other words, the SOE manager's payoff is part of the SOE's performance. The payoff for the PF owner is also straightforward. Given PF obtains the loan by bribe B. If the project is good and is executed, the PF owner's payoff is $Z - (1+i) - B$; if the project is bad and is executed, the payoff is $-B$. If instead the owner runs away with the loan, the payoff is always $1 - B - \tau$, regardless of the quality of the project.

Figure 1 is the game tree, and the payoffs are denoted in the game tree, accordingly. The second payoff in the upper half part is for the PF owner, while in the lower half part, it is for the SOE manager.

[Figure 1]

III. Analysis

This section consists of four cases: (A) no bribe and no bailout (benchmark); (B) no bribe but bailout, (C) bribe and bailout, (D) bribe but no bailout. In particular, we focus on the roles of the bribe and the bailout as well as the interaction between them in terms of changing resource allocation. And we compare the welfare consequences of the four cases in detail. At the end of this section, we discuss the possible influence of the anti-corruption campaign conducted by Chinese government in recent years.

A. No Bribe and No Bailout ($B = 0, T = 0$)

We first analyze the benchmark case, no bribe ($B = 0$) and no bailout ($T = 0$), to see how the bank allocates its loan between the PF and the SOE. Using backward induction, we first solve the PF subgame (the upper half part of the game tree in Figure 1), then the SOE subgame (the lower half part of the game tree in Figure 1), and finally the whole game.

The PF Subgame. When the PF receives the bank loan, it then has private information

about the nature of the project. The PF with a bad project will definitely run away ($1-\tau>0$). To make sure the PF wants to execute the good project when financed, the payoff from the good project ($Z-(1+i)$) should be greater than that from running away ($1-\tau$), or in other words, the return of the project should be high enough:

$$Z \geq 2+i-\tau \equiv Z_1. \tag{NR}$$

This is the no-running constraint (NR henceforth). Notice that if it is easier for the PF to run away (i.e., the cost of running away τ is smaller), the banker will be more cautious about credit granting (i.e., (NR) is stricter). With the existing moral hazard, only the highly profitable project ($Z \geq Z_1$) will be executed by the PF when financed. Given (NR), the banker may lend to the PF when her expected payoff $a_b\theta_p(1+i)$ is greater than that of not lending a_b, or

$$\theta_p \geq \frac{1}{1+i}. \tag{L_p}$$

Condition (L_p) suggests that the probability for the PF holding a good project should be sufficiently high in order to obtain the loan. Regardless of the competition from the SOE, both conditions, (NR) and (L_p), have already set a very high standard for the PF's project to be financed: *It should have a good project with a sufficiently high probability, and this good project should be highly profitable.*

The SOE subgame. After receiving the loan, for political or other reasons, the SOE has no choice but to execute its project. Knowing this information, the banker may lend if the expected payoff of lending is more than that of not lending, or

$$\theta_s \geq \frac{1}{1+i}. \tag{L_s}$$

The whole game. The bank may lend to the PF under (NR) and (L_p), and the SOE under (L_s). When these three constraints are satisfied simultaneously (actually satisfying (NR) and (L_s) is enough), the banker will always choose to lend to the PF as $\theta_p \geq \theta_s$. When (NR) is violated, the bank will lend to the SOE given (L_s), or to neither of them when (L_s) is also violated.

However, the choice made by the banker is different from the social optimum (see Figure 2). From the social perspective, given a no-running PF ((NR) is satisfied), the bank should lend to the PF whenever the possibility of a good project is sufficiently large ($\theta_p \geq \frac{1}{Z}$). If the PF is going to

run ((NR) is violated), the bank should lend to the SOE if it has a good chance of success ($\theta_s \geq \frac{1}{Z}$). As Figure 2 shows, the regions between $\theta_p = \frac{1}{Z}$ and $\theta_p = \frac{1}{1+i}$ (see graph (A) in Figure 2, where (NR) is satisfied), and between $\theta_s = \frac{1}{Z}$ and $\theta_s = \frac{1}{1+i}$ (see graph (B) in Figure 2, where (NR) is violated) are the areas where the welfare can be improved by not idling the fund. The intuition is that the bank only considers its own profit ($\theta(1+i)-1$), $\theta \in \{\theta_s, \theta_p\}$, while the total surplus a project brings to the society is ($\theta Z - 1$). *The bank doesn't internalize the firm's profit, killing the promising projects whose* $\theta \in (\frac{1}{Z}, \frac{1}{1+i})$.

[Figure 2]

B. No Bribe but Bailout ($B = 0, T > 0$)

Next, we analyze the no bribe ($B = 0$) but bailout case. Suppose that for specific political or social reasons, the government will provide bailout $T \in (0, 1]$ to the bank after the failure of the SOE's project. Intuitively, the bailout will relax the restriction of lending to the SOE, because the bank loss from the SOE's bad project decreases. We will not repeat the PF subgame as it is exactly the same as the previous no bribe and no bailout case.

The SOE subgame. After receiving the loan, the SOE executes its project. With probability $1-\theta_s$ the project will fail, and the bank will receive the government bailout T. Hence, the banker will choose to lend if

$$\theta_s \geq \frac{1-T}{1+i-T}. \qquad (\mathrm{L}_s^b)$$

Obviously, this constraint is easier to meet compared to (L_s) in the no bribe and no bailout case. Government bailout relaxes the misgiving of the banker to lend to the SOE.

The whole game. The bank may lend to the PF under (NR) and (L_p) as in the previous case, or to the SOE under (L_s^b). Again, when all these three constraints are satisfied, lending to the PF will be a better choice when the expected payoff from the PF is more than that from the SOE, or

$$\theta_p \geq \theta_s + \frac{T(1-\theta_s)}{1+i} \qquad (\mathrm{L}_p^b)$$

Otherwise, the SOE will obtain the loan. Compared to the condition of $\theta_p \geq \theta_s$, (L_p^b) means that it becomes harder for the PF to obtain the loan against its competitor with the government bailout. On the other hand, the opportunity for the SOE is greater. Figure 3 illustrates the results in detail. Overall, the government bailout generates two effects here: (1) **Chance-shifting effect:**

To reallocate the chance of obtaining a loan from the PF to the SOE, given $Z \geq Z_1$ (the area **D** in part (A) of Figure 3); (2) **Chance-creating effect**: To lend to the SOE in certain circumstances when the bank will lend to neither in the benchmark case (the area **E** in part (A) and the area **F** in part (B) of Figure 3). To put it differently, the bailout increases the bank's expected payoff of lending to the SOE, so that both the SOE's competitiveness against the PF and its own ability to get the loan even without the PF increase.

[Figure 3]

From the efficiency perspective, since lending to the PF is better than lending to the SOE, the chance-shifting effect reduces efficiency. But it is not obvious to determine the influence of the chance-enhancing effect. It can be productive if $\frac{1-T}{1+i-T} \geq \frac{1}{Z}$, or

$$T \leq T_p \equiv 1 - \frac{i}{Z-1}.$$

That is, when the bailout is smaller than T_p, the goals of society and the banker become more compatible. Society wants the bank to accept the welfare-enhancing project, even it may hurt the bank without the bailout. But now given the small bailout, the banker has the incentive to accept more welfare-enhancing projects. Hence the chance-creating effect is firstly productive. If the bailout is greater than T_p, the new distortion appears because heavy bailout motivates the banker to accept an inferior project with a success rate less than $\frac{1}{Z}$.

When the PF owner will not run away ($Z \geq Z_1$, or (NR) is satisfied), the net effect of bailout is determined by both the chance-shifting and the chance-creating effects. If the net effect is positive, we say that the government bailout is productive. Otherwise, the bailout leads to a welfare loss. With a running PF owner ($Z < Z_1$, or (NR) is violated), there is only the chance-creating effect. Hence, a sufficiently small bailout ($T \leq T_p$) improves efficiency.[14]

Proposition 1. *The government bailout generates both the chance-shifting effect and the chance-creating effect: (i) The chance-shifting effect reduces the efficiency by reallocating the fund from the PF to the SOE; (ii) The chance-creating effect further increases the probability that the SOE obtains the otherwise idle fund. And it improves efficiency if* $T \leq T_p \equiv 1 - \frac{i}{Z-1}$. *Otherwise, the new distortion appears.*

[14]However, there are costs of the bailout we do not take into consideration. Besides the opportunity cost of the bailout fund, bailout also leads to the moral hazard problem for both the banker and the SOE manager. (Weylandt, 2016).

C. Bribe and Bailout ($B > 0, T > 0$)

If the government bails out the SOE, the chance-shifting effect reduces PF's chance to get the loan. To surmount this disadvantage, the PF may choose to bribe the banker with $B \in (0, 1]$. We now discuss this bribing scenario. The analysis of the SOE's subgame is the same as the no bribe but bailout case, therefore we only look at the PF subgame.

The PF subgame. The PF will execute the good project if (NR) is satisfied. However, as $1 - B - \tau > -B$, the PF owner with a bad project will certainly run away with the bank loan. The banker may lend to the PF if her expected payoff is greater than that of not lending, or:

$$\theta_p \geq \frac{1 - \frac{B}{a_b}}{1 + i}. \tag{L_p^B}$$

Obviously, the requirement for the success rate of the PF's project is relaxed, compared to (L_p). Intuitively, the banker is more willing to grant credit after receiving the PF's bribe.

The whole game. Given (NR), (L_p^B) and (L_s^b), it is better for the banker to lend to the PF when

$$\theta_p \geq \theta_s + \frac{T(1 - \theta_s) - \frac{B}{a_b}}{1 + i}. \tag{L_p^{bB}}$$

Compared to (L_p^b), (L_p^{bB}) is easier to be satisfied. As expected, the bribe from the PF strengthens the competitiveness of the PF against the adverse impact of the bailout. Furthermore, if B is large enough such that $B \geq a_b T(1 - \theta_s)$, or the banker gets more from the bribe than the bailout, the chance for the PF to obtain the loan is even higher than the no bribe no bailout case. Therefore, bribe dilutes the government bailout.

Now we consider, what would happen if (NR) is violated? In the discussions, without the bribe, the banker will never offer a loan to a PF who is ready to run away. However, in the PF subgame, with the bribe $B > a_b$, that is, when the banker gets more from the bribe than from the idle fund, the PF gets the chance. Now the banker will trade off between income from the SOE project and the PF bribe. Given $B > a_b$, the PF will obtain the loan if

$$B > a_b[\theta_s(1 + i) + (1 - \theta_s)T], \tag{1}$$

or

$$\theta_s < \frac{\frac{B}{a_b} - T}{1 + i - T}. \tag{2}$$

Given (2), the bribe here is then purely **predatory**, where the banker takes the bribe and lends the loan to the private firm, even though the banker knows the money will never come back again. Taking this loan, the PF owner will run away with whatever is left subtracting the bribe. This could happen when the bribe is large enough as (1) shows. Or put it into a different way, the successful rate of SOE project is too low as (2) indicates, given $B > a_b$. The predatory bribe or corruption definitely hurts the economy as there is nothing produced, but purely income redistribution or value-destroying.

If (2) is violated, along with the (L_s^b), the condition for the bank to lend to the SOE is:

$$\theta_s \geq \max\{\frac{\frac{B}{a_b} - T}{1 + i - T}, \frac{1 - T}{1 + i - T}\}. \qquad (\mathrm{RL}_s^{bB})$$

If $a_b \geq B$, the right side of (RL_s^{bB}) is $\frac{1-T}{1+i-T}$. If $a_b < B$, the right side of (RL_s^{bB}) is $\frac{\frac{B}{a_b}-T}{1+i-T}$. We summary these conditions in Figure 4 (we distinguish the cases between $a_b \geq B$ and $a_b < B$, on top of $Z \geq Z_1$ and $Z < Z_1$. Therefore, there are four cases now).

[Figure 4]

Like the government bailout, the bribe also has two effects: (1) **Chance-saving effect**: To reverse the distortion in loan allocation brought by the government bailout (see part (A) of Figure 4, where part of or all **D** in (A) of Figure 3 is saved), and the chance-shifting effect of the bailout is totally eliminated if the bribe is sufficiently large or $B \geq a_b T(1 - \theta_s)$; (2) **Chance-enhancing effect**: Like the bailout, to increase the possibility that the bank will not idle its fund (the emerging area of lending to the PF in Figure 4 compared to Figure 3).

We now analyze social welfare. For the case $a_b \geq B$, that is, the banker gets less from bribe than from the idle fund, compared to Figure 3 (the no bribe but bailout case), graph (B) is the same, and graph (A) in Figure 4 is different. In graph (A) of Figure 4, the chance-saving effect always increases efficiency. For the chance-enhancing effect of the bribe, we first define the threshold bribe B_p such that $\frac{1-\frac{B}{a_b}}{1+i} = \frac{1}{Z}$, or:

$$B_p \equiv a_b(1 - \frac{1+i}{Z}).$$

When B increases, the social efficiency increases at first, and after B_p is exceeded, new distortion appears. The intuition here is similar to the bailout's role: The small bribe or bailout makes society's and the banker's goals more compatible, but the heavy bribe or bailout pushes the banker to accept inferior projects. Thus, given (NR), the sufficient condition for the bribe to be productive

is:

$$B \leq B_p.$$

For the case $a_b < B$, if the PF will not run away (graph (C)), the efficiency is totally saved from the chance-shifting effect of the bailout. Nonetheless, distortion occurs when the success rate of the project is lower than $\frac{1}{Z}$. The reason is that the corrupted banker is willing to lend to the PF for any positive bribe. However, if the PF will run away (graph (D)), it is the situation of the predatory bribe as discussed above. The following proposition summarizes the above results:

Proposition 2. *The bribe can be productive, distortionary, or predatory: (i) The chance-saving effect corrects the distortion generated by the government bailout and thus is productive; (ii) Given $Z \geq Z_1$, the chance-enhancing effect is also productive if the bribe is small enough, or $B \leq B_p$, as it helps to utilize the otherwise idle fund and improves social welfare. However, it generates new distortion if $B > B_p$; (iii) It is predatory when $B > \max\{a_b, a_b[\theta_s(1+i)+(1-\theta_s)T]\}$ and $Z < Z_1$, where the banker takes the bribe, and the PF owner runs away with the fund.*

Generally speaking, bribing is bad. Nevertheless, put it into context, Proposition 2 shows us things might be more complicated than expected as the bribe can be productive, distortionary, or predatory. The implication of Proposition 2 can help us to explain why some corruptions can be growth-promoting, and others growth-prohibiting, depending on whether they are productive, distortionary, or predatory. The productive one comes from either correcting the previous distortion due to government intervention, or creating new opportunity to generate values by filling the gap between the private and the social optimum. However, the distortionary one twists the resource allocation thus decreases social welfare. And even worse, the predatory one is not only income redistribution, but also destroying the existing values.

D. Bribe but no bailout ($B > 0, T = 0$)

We now consider the fourth case — what will happen if the government does not bail out the SOE while the PF bribes the banker? The whole process of analysis is the same with the bribe and bailout case after setting T to zero, which we do not repeat here. The role that the bribe is playing is described in the last case. Results are summarized in Figure 5.

[Figure 5]

Compared to other cases, obviously, the bribe increases the chances to allocate the fund to the PF. When (NR) and (L_p^B) hold, the fund will be allocated to PF if

$$\theta_p \geq \theta_s - \frac{B}{a_b(1+i)}.$$

And whether the bribe is productive or distortionary depends on $B \leq B_p$ holds or not.

When (NR) is violated and given $B > a_b$, the PF will obtain the loan if

$$B > a_b\theta_s(1+i).$$

The following Proposition summarizes the results:

Proposition 3. *In the bribe only case, given $Z \geq Z_1$, the bribe is productive if the bribe is small enough, or $B \leq B_p$, while it is distortionary if $B > B_p$. However, given $Z < Z_1$, the bribe is predatory when $B > \max\{a_b, a_b\theta_s(1+i)\}$.*

The bribe alone can still be productive, distortionary, and predatory, even though there is no government bailout to distort the resource allocation.

E. Anti-corruption Campaign in Banking

In this subsection, we explore what will happen if the government commences the anti-corruption campaign in the bank. Along with other fields, anti-corruption in the Chinese financial system has been highlighted by the government and the Communist Party of China since 2012,[15] mainly focusing on the lending process which we have discussed above.[16]

Under the pressure of anti-corruption, suppose that the banker is no longer willing to accept the bribe from the PF, and then the situation is going back to the no bribe but bailout case. From the above discussion, clearly it decreases the chance for the private firm to get the bank loan and the social welfare is distorted if the bribe per se is productive. Lin et al. (2016) employ provincial data

[15] From May 2013 to May 2017, at least 35 officials of financial supervision department and employees of state-owned financial institutions were reported to be corrupted, by the website of Central Commission for Discipline Inspection (CCDI) in China. For more details, please refer to the following websites: `http://fanfu.people.com.cn/n1/2019/0118/c64371-30575971.html`, `https://news.china.com/domesticgd/10000159/20150211/19297286.html`.

[16] In fact, firms sometimes bear the cost to build political connections with the government officials instead of directly bribing the banker, yet it does not change the nature that increases the accessibility for the private firm to obtain the financial resources from banks. Moreover, it will provide the privileged position for these firms to earn other rents from the prevalent administrative approval in the market operations (Guo, 2019). We can extend our model to incorporate them easily.

and find that, the bribery is still a key resource allocation mechanism in the less liberalized (lower-marketization) provinces, and after the anti-corruption, non-SOEs in these regions suffer. Pan and Tian (2020) empirically point out the investment expenditures have been reduced significantly after the arrest of corrupt bureaucrats, especially for the non-SOE sample.[17]. Their regression results also show that, for the non-SOEs, the average investment expenditure declines significantly for event firms after the termination of the political connections compared to non-event firms, while this relationship becomes insignificant for SOEs, which means the influence of the anti-corruption movement is stronger for the private firms. From our model, this phenomenon can be explained by the insufficient financial resource for the PF in the no bribe but bailout case. Guo (2019) documents that there is a positive correlation between the IDPBs (independent directors with political background) and private firms' preferential treatment in banking (higher ratios of bank loans). However, this connection is negatively affected by the anti-corruption campaign.

Given $a_b \geq B$ and $Z \geq Z_1$, when the bribe is within the limit (less than B_p), the anti-corruption campaign is efficiency-reducing. However, when the bribe is large and distortionary (larger than B_p), or when the bribe is purely predatory ($Z < Z_1$ and $a_b < B$), it is better to execute the anti-corruption campaign.

Is there any other policy that leads to better and sound results besides the anti-corruption campaign? There are three ways implied by our model. The first one is to promote the legal system in order to increase τ, the cost of running away. Hence, Z_1 decreases, and more PF's projects will be included as profitable projects. This is efficiency-improving. Second, if $a_b < B$, besides reducing B by the anti-corruption campaign, properly increasing banker's compensation can also curb the banker's tendency to lend to projects with little chance of success, and thus reducing the possibility of the predatory corruption. The third or probably the most important way is to reduce the distortionary government control and intervention such as the heavy bailout, and let the market decide the resource allocation.

IV. Re-lending Mechanism

We define the re-lending activity as the event that SOEs borrow from banks, but rather than financing for their projects, SOEs re-lend their loans to private firms. By doing so, SOEs act as

[17]For event firms, whose manager/director either bribed or was connected with bureaucrats, the investment rate (capital expenditure/total assets in the current quarter) has decreased from 3.41% to 0.89%, while for non-event firms, the investment rate has decreased from 2.49% to 0.93%.

financial intermediaries. These particular shadow banking activities are pervasive in China (Du et al., 2016; Du et al., 2017), and can be either carried out directly or indirectly by SOEs.

As a leading example, entrusted loans work as an indirect vehicle to bypass the regulation permitted by laws. SOEs use commercial banks as intermediaries to lend to specific fund receivers. This market expanded rapidly before 2017 at a rate higher than the growth of total social financing. More entrusted loans are from SOEs to PFs to support their projects. However, with increasing restrictions from the government, this trend slowed down after 2017 and waned in 2018 after the issue of the *Administrative Measures for Entrusted Loans Undertaken by Commercial Banks* (see Figure 6).

[Figure 6]

Unlike the entrusted loans, direct re-lending that the firms borrow from the bank and then lend to other firms directly is prohibited by laws in China. However, as it is reported,[18] the re-lending process does exist in some famous SOEs. Moreover, direct lending between firms is gradually made legal after 2010 (Du et al., 2016).[19] These two re-lending channels are essential intermediaries for private firms when state-owned banks reject them. Yao et al. (2019) show that all parties involved in this re-lending process are better off, and inefficiency caused by financial repression is mitigated.

We next set up our model with the re-lending choice. In previous sections, once obtaining the loan, the SOE has to execute its project. However, on the one hand, at least it is better for the SOE with the bad project not to do so. On the other hand, the PF rejected by the bank would love to borrow from the SOE, which also wishes to re-lend the loan. Assume that the PF can bribe the manager of the SOE to initiate the re-lending process.[20] Now the SOE which obtains the bank loan has two options: (i) Executing its project, or (ii) Re-lending the bank loan to the private firm.

[18]See "The 'embezzlement' in the banking industry and prevalence of shadow banking," *China Business Journal* (in Chinese), September 12, 2011, `http://dianzibao.cb.com.cn/images/2011-09/12/10/1928a10b.pdf`.

[19]See *Several Opinions on Providing Judicial Guarantee and Services for Accelerating the Transformation of the Economic Development Mode*, *Legally and Properly Hearing Cases on Disputes over Private Lending to Promote Economic Development and Maintain Social Stability*, and *Provisions of the Supreme People's Court on Several Issues concerning the Application of Law in the Trial of Private Lending Cases* issued by the Supreme People's Court issued in 2010, 2011 and 2015, respectively.

[20]Re-lending may charge higher interest rate and is carried out secretly. If the SOE manager benefits from the higher interest charged, directly or indirectly, then it can be regarded as one kind of bribe to motivate the manager to take risk and secretly re-lend. If the SOE benefits little from the higher interest rate, then the bribe may play an important role to incentivize the manager to conduct such secret and illegal re-lending behavior. The bribe is considered to be the key force for some re-lending in reality, for anecdotal evidence, please visit `https://jjjcb.ccdi.gov.cn/epaper/index.html?guid=1409060781894402049` (The official of SOEs bailed out by the government re-lent for bribes and other benefits) and `http://www.hncourt.gov.cn/public/detail.php?id=5851` (The SOE manager transferred money to two firms and accepted bribes from them).

A. Without Bank Credit

Since the analysis of the full game, where the PF can access both the bank credit and the firm credit from the SOE, is rather complicated without adding much insight, we decide to leave it to the next subsection and focus on the firm credit case here.

Now the utility function for the banker is $U_b = a_b O_b$, and for the SOE manager is $U_s = a_s O_s + B$. Since the private firm cannot borrow the bank loan directly, the owner uses the bribe to persuade the manager of the SOE to re-lend. If the private firm has executed a good project, it will pay back $1+i$ to the SOE, and the SOE will return $1+i$ to the bank. The revised game tree of re-lending is in Figure 7. The first payoff in the tree is for the banker, the second is for the SOE manager, and the third is for the PF owner. For example, if the bank offers the loan to the SOE, which re-lend it to the PF for a bribe, and the PF then executes its good project, the payoffs for the banker, the SOE manager, and the PF owner will be $a_b(1+i)$, B, and $Z-(1+i)-B$, respectively, as shown in the tree. Applying the backward induction gives the results. The PF subgame is similar to previous cases. A good project will be executed only if it is sufficiently profitable (i.e., $Z \geq Z_1$). The PF owner will run away with the loan if the project is bad or not profitable enough.

[Figure 7]

The Extended SOE Subgame. With the re-lending choice, we first consider a good project for the SOE. The expected return for the SOE is $a_s[Z-(1+i)]$ to execute or B to re-lend. Hence, if $a_s[Z-(1+i)] \geq B$, or

$$Z \geq \frac{B}{a_s} + 1 + i \equiv Z_2, \tag{NL}$$

a SOE with good project will not re-lend. When this no re-lending constraint is violated, that is, when bribe is attractive or the SOE manager prefers the bribe (a_s is sufficiently small), no matter how profitable the project is, the manager will take the bribe and re-lend. In the second scenario with a bad project, it is easy to see that SOE will re-lend for the bribe.

The Whole Game. Given a highly profitable project $Z \geq \max\{Z_1, Z_2\}$, the expected payoff for the bank to lend is $\theta_s a_b(1+i) + \theta_p(1-\theta_s)a_b(1+i) + (1-\theta_p)(1-\theta_s)a_b T$. Thus, the banker will lend if

$$\theta_s \geq \frac{1-T}{1+i-T} - \frac{\theta_p i}{(1-\theta_p)(1+i-T)}. \tag{L_s^R}$$

Intuitively, since the SOE with a bad project now has one more opportunity to repay the loan, we shall see the bank will not only consider the SOE but the PF's probability of success. Therefore,

the banker is more willing to grant credit to the SOE, that is, (L_s^R) is much more relaxed compared to the (L_s^b), and the spread is $\frac{\theta_p i}{(1-\theta_p)(1+i-T)}$. Interestingly, because the SOE's and PF's chances to get the loan are so related, a higher success rate for the PF will raise the probability for both companies, and greater bailout facilitates both the SOE and the PF to get the loan.

To discuss projects which are not so profitable as above, we need to clarify the relationship between Z_1 and Z_2. Z_1 is the lower bound for a project to be executed by the PF, and Z_2 is the lower bound for the SOE to invest the bank loan in its own project. When $Z_1 < Z_2$ (or $a_s \leq \frac{B}{1-\tau}$, implying the SOE manager is relatively corrupted), consider a project in which $Z_1 \leq Z < Z_2$, the SOE manager will re-lend the loan, and the PF will execute it if it is good and run if it is bad. In other words, the PF in this scenario is actually treated as a SOE, but with a better efficiency θ_p. The government is bailing out the PF. Hence, for the bank to lend, the PF's efficiency matters. The SOE (or PF finally) will get the loan whenever

$$\theta_p \geq \frac{1-T}{1+i-T}.$$

When $Z_1 > Z_2$, given a project that $Z_2 \leq Z < Z_1$, the SOE manager executes the project if it is good and re-lends to a running PF owner if it is bad. For the banker, this case is similar to lending to the SOE without the re-lending choice. The bank lends when

$$\theta_s \geq \frac{1-T}{1+i-T}.$$

Given an unprofitable project with $Z < \min\{Z_1, Z_2\}$, if the SOE gets the bank loan, re-lending happens, and the PF will run away, leaving $a_b T$ for the banker, which is less than the payoff from not lending. Hence, an unprofitable project will never be funded as cases without re-lending.

These scenarios are presented in Figure 8 and we summarize these results in the next proposition compared to cases without re-lending:

[Figure 8]

Proposition 4. *Compared to the bribe and bailout case without re-lending and highly corrupted officials (i.e., $a_b \geq B$), (a) Given a relatively profitable project ($Z \geq \min\{Z_1, Z_2\}$) and the re-lending choice, the SOE has a greater chance to get the bank loan, while the chance for the bank to idle its fund decreases. The final chance for the PF to get the loan may increase due to the re-lending process; (b) When the project is less profitable ($Z < \min\{Z_1, Z_2\}$) and the PF will run*

away, because of the re-lending choice of the SOE's manager, the bank will not lend to anyone.

We now turn to the perspective of social welfare. Given a highly profitable project $Z \geq \max\{Z_1, Z_2\}$, it is socially efficient to lend when the expected payoff for the society, $\theta_s Z + \theta_p Z - \theta_s \theta_p Z$ is greater than 1. Lending is also efficient for $Z \in [Z_1, Z_2)$ when $\theta_p \geq \frac{1}{Z}$, and for $Z \in [Z_2, Z_1)$ when $\theta_s \geq \frac{1}{Z}$. When the project is not profitable, not lending itself is efficient since neither will execute the project. All these boundaries of efficiency are depicted in Figure 8. We could still see that the bailout is productive when T is less than T_p in the first three re-lending cases. When T is greater than this limit, social welfare is distorted.

Compared to cases without re-lending, we have the following proposition, which is still valid when we consider the bank can lend to the PF, and this proposition supports actions the government has taken to legitimize such direct re-lending process:

Proposition 5. *Compared to the bribe and bailout case without re-lending and highly corrupted officials (i.e., $a_b \geq B$), (a) When a relatively profitable project appears ($Z \geq \min\{Z_1, Z_2\}$), the re-lending mechanism makes the society better-off if the bailout and bribe are productive. (b) While for a less profitable project ($Z < \min\{Z_1, Z_2\}$), the re-lending mechanism hinders social efficiency.*

The following proposition clarifies the role of bribe from the welfare perspective:

Proposition 6. *The bribe in re-lending case can be productive, distortionary or predatory. The bribe is productive when $B \leq a_s[Z - (1+i)]$ and $Z \geq Z_1$. The bribe is distortionary when $B > a_s[Z - (1+i)]$ and $Z \geq Z_1$. The bribe is predatory when $Z < Z_1$, and it becomes seriously predatory when $B > a_s[Z - (1+i)]$, which stops the banker from lending.*

Bribe initiates the whole re-lending process, and its size determines Z_2, the lower bound for the SOE to re-lend. Given a highly profitable project $Z \geq \max\{Z_1, Z_2\}$, the re-lending process initiated by a small bribe less than $B \leq a_s[Z - (1+i)]$, which will not make $Z_1 \leq Z < Z_2$, actually enables the SOE's manager to allocate the loan using his private information. Such re-lending does not only increase the probability for the bank to lend, but creates new value from the private information of the SOE, as we can see lending generates $\theta_s Z + \theta_p Z - \theta_s \theta_p Z$, greater than all cases that involve lending before. But interestingly, keeping increasing bribe does not create more chances for the private firm. Conversely, it may hurt its own. Since $Z_2 = \frac{B}{a_s} + 1 + i$, when greater B raises Z_2 over Z, turning (A) into (B) in Figure 8, efficiency is distorted. Intuitively, greater bribe will convince the bank that the SOE is more likely to re-lend rather than execute the project, which wastes the

SOE's good project and increases the possibility of a bad loan. Therefore, the banker is less likely to lend and social welfare is hindered. For the project with a return less than Z_1, predatory corruption happens. The SOE manager knows the loan is not going to be used to finance the project, but still lends to the PF. Therefore, there is no output for society from this corruption.

As many economists have asked, is there an optimal level of corruption in society? Our re-lending model sheds some light on it, suggesting there is an optimal size of bribe, for any size of Z, which is sufficiently small to reduce or eliminate the possibility for (B) and (D) in Figure 8, but greater than zero to initiate the re-lending process. Under a productive bailout, when the bribe size is cut down to near zero, $Z_2 \approx 1 + i$, which is smaller than Z_1. Then, all projects that are previously classified as relatively profitable ($Z_1 \leq Z < Z_2$) are now regarded as highly profitable projects, which is welfare-enhancing. Part of projects with $Z < \min\{Z_1, Z_2\}$ now is greater than Z_2, creating chances for the bank loan and raising the social welfare. The intuition is that reducing the bribe can prevent the SOE from re-lending without considering the nature of its own project. We have the following proposition which justifies the anti-corruption campaign and is also tenable with the PF's access to the bank credit:

Proposition 7. *In the re-lending case, decreasing the bribe may result in a sound result because (a) The SOE manager will consider his project, rather than re-lending regardless of a good project in his hand; (b) The chance of lending to the SOE with a highly profitable project (i.e., $Z \geq \max\{Z_1, Z_2\}$) increases.*

Such slight and productive corruption redistributes resources efficiently and greases economic wheels, echoing with the empirical evidence in Méndez and Sepúlveda (2006) that "the growth-maximizing level of corruption is significantly greater than zero, with corruption beneficial for economic growth at low levels of incidence and detrimental at high levels of incidence."

B. With Bank Credit

We next deal with the other scenario with bank credit. In fact, the re-lending game without bank credit above is the SOE subgame of the whole game now. Adding the PF subgame, we can see the full picture. Naturally with the bank credit, we shall expect a greater chance for the PF to get the loan, but at the same time, the possibility of lending to the SOE will be crowded out. Therefore, the SOE's private information will not be used, which decreases social welfare compared to the re-lending case without bank credit. Because the analysis is rather complicated, we relegate the

dull calculation to Appendix A and summarize results in the following propositions.

Proposition 8. *Compared to the bribe and bailout case without re-lending, (a) Given $a_b \geq B$, with a relatively profitable project ($Z \geq \min\{Z_1, Z_2\}$) and the re-lending choice, the SOE has a greater chance to get the bank loan, while the chance for the bank to idle its fund decreases. Although the chance for the PF to directly get the bank loan wanes, the final chance to get the loan may increase due to the re-lending process. When the project is less profitable ($Z < \min\{Z_1, Z_2\}$) and the PF will run away, because of the re-lending behavior of the SOE's manager, the bank will not lend to anyone; (b) Given $a_b < B$, the chance for the SOE to get the loan is smaller, while the PF has a greater probability of getting the loan.*

Proof. Please see Appendix B. □

Proposition 8 incorporates Proposition 4 as (a). For those profitable projects, this proposition could explain the reason why most financial resources head to SOEs, but the private sector grows so fast.

Proposition 9. *Compared to the bribe and bailout case without re-lending, (a) Given $a_b \geq B$, when a profitable project appears ($Z \geq \min\{Z_1, Z_2\}$), the re-lending mechanism makes the society better-off if the bailout and bribe are productive. While for a less profitable project ($Z < \min\{Z_1, Z_2\}$), social welfare decreases with the re-lending choice; (b) Given $a_b < B$, the re-lending mechanism hinders social efficiency.*

Proof. Please see Appendix B. □

Proposition 5 is (a) of Proposition 9. For $a_b \geq B$, the welfare-enhancing effect comes from the SOE's re-lending choice. It works as a risk-reducing process (this happens when $Z > \max\{Z_1, Z_2\}$) that when the SOE holds a good project, it will be executed; while the SOE holds a bad project, the loan goes to the PF. When the manager only cares about bribe (i.e., $Z_1 < Z \leq Z_2$), the re-lending process reallocates the resource to the better performed PF. At the same time, when the project is relatively profitable (this happens when $Z \geq \min\{Z_1, Z_2\}$), re-lending creates more chances for the banker to lend. However, when the project is not profitable at all (i.e., $Z < \min\{Z_1, Z_2\}$), the banker will not lend to anyone, social welfare drops compared to the bribe and bailout case, since lending only causes that the PF runs away with the loan. If the banker is more corrupted and prefers the bribe (i.e., $a_b < B$), re-lending distorts the social welfare. Since the SOE's manager with a project of which the return is less than $\min\{Z_1, Z_2\}$ will still lend to a running PF owner,

the banker will not lend to the SOE but the running PF directly, increasing the chance of predatory corruption.

In the re-lending case, the corruption's type is summarized in Table 1 for lending to the banker or SOE's manager in every condition. Predatory corruption happens when the banker or the manager knows the loan is not going to be used to invest in the project (when the project is not profitable, i.e., $Z < Z_1$), but still lends to the PF. In the bribe and bailout case, when $a_b \geq B$, the bribe is productive compared to idling the fund when it is less than B_p. However, in the re-lending case, even it is less than B_p, sometimes it distorts the efficiency by reallocating the chance of lending to the SOE, which is the optimal solution (i.e., when $a_b \geq B$ and $Z \geq \max\{Z_1, Z_2\}$), to the PF.

In the re-lending setting with bank credit, the anti-corruption, which decreases the bribe B, still generates some sound results:

Proposition 10. *In the re-lending case, decreasing the bribe may result in a sound result because (a) The predatory corruption of the banker can be eliminated; (b) The SOE manager will consider his project, rather than re-lending regardless of a good project in his hand; (c) The chance of lending to the SOE with a highly profitable project (i.e., $Z \geq \max\{Z_1, Z_2\}$) increases.*

Proof. Please see Appendix B. □

This proposition also incorporates Proposition 7 as (b) and (c), and partly justifies the anti-corruption campaign, which targets to eliminate predatory corruptions.

V. Conclusions

We present a model that a state-owned enterprise with government bailout and a private firm with bribe choice compete for the financial resource from a state-owned bank. The results explain the coexistence of the rapid economic growth, the pandemic corruption, and the misallocation and the reallocation of scarce resources. We distinguish three types of bribes: Productive, distortionary, and predatory. The productive one improves the efficiency in three ways: First, the financial resources could be redistributed to the more efficient private firm; Second, it enables the bank to internalize the externality of lending to the private firm; Third, it facilitates private information of the SOE to be used in distributing resources. The bribes are distortionary or predatory when the bank lends to a private firm that owns an inferior project or will not invest it in any project. Such bribes hurt efficiency and even worse, destroy values. We also discuss the role of the bailout, which is generally

distortionary, but can be productive in some circumstances where it enables the bank to internalize the SOE's gain.

We contribute to the corruption-development debate. Our model accommodates the two opposite effects of corruptions even within the same bribery behavior, the efficiency-improving and the slow-down effects, on the economy. We also contribute to debate on the formal and informal financing. The redistribution role of bribe, which helps to allocate financial resources to high efficiency sector directly from the bank or indirectly from the SOE, is different from previous works. Moreover, we show that formal and informal financing can intertwine together: Funds in forms of informal financing can come from formal financing and there are both competition and cooperation between SOE and PF in obtaining bank loans.

Our results have implications for China's ongoing anti-corruption campaign, and shed some new light on several puzzles regarding China's economy. Our model is ready to be generalized. For example, the banker in our model can be regarded as any official who controls important resources, licenses, permits, and so on. The re-lending process between the SOE and the PF can be used to discuss any resource transfer and reallocation between the state sector and the private sector.

We have no intention to justify any kind of corruptions. Instead, we want to understand some peculiar economic phenomena. China's economy is still under the transition from the planned economy, where the government controls and directs most resource allocation and the state sector monopolizes, to the market economy. This is the institutional background for the coexistence of rapid economic growth and pandemic corruption. Pushing through the institutional transition and eventually finishing it will be the best way to fight against corruption. Our model is simple, and more work, both theoretical and empirical, needs to be done in the near future.

Appendix

A Analysis of the Whole Game with Re-lending

We will discuss the whole game in two cases, respectively: $a_b \geq B$ and $a_b < B$.

1. *Given* $a_b \geq B$.

(1) We first assume $Z_1 \leq Z_2$ or $a_s(1-\tau) \leq B$ (see Figure 9). There are three possible intervals for Z: (i) $Z \geq Z_2$; (ii) $Z_1 \leq Z < Z_2$; (iii) $Z < Z_1$.

[Figure 9]

- (i) When $Z \geq Z_2$, if (L_p^B) and (L_s^R) are both satisfied, the bank may lend to the PF when the payoff from the SOE, $a_b\left\{\theta_s(1+i)+(1-\theta_s)[\theta_p(1+i)+(1-\theta_p)T]\right\}$, is less than the payoff from the PF, $B+a_b\theta_p(1+i)$, or put it differently,

$$\theta_p \geq 1-\frac{\frac{B}{a_b}}{\theta_s(1+i-T)+T}. \tag{RL}$$

  Intuitively, as a result of the SOE's re-lending choice, it is less likely for the PF to get the loan directly from the bank under this constraint, compared to (L_p^{bB}):

Lemma A1. *Given $a_b \geq B$ and $Z_1 \leq Z_2$, when $Z \geq Z_2$, the probability for the PF to get the loan directly from the bank is less than that in bribe and bailout case, while the SOE has more chances to get it. The chance of not lending is curtailed.*

Proof. When $\theta_s = 0$, the right side of (L_p^{bB}) is $\frac{T}{1+i}-\frac{B}{a_b(1+i)}$, while the right side of (RL) is $1-\frac{B}{a_bT}$. The ratio between them (following the order) is $\frac{T}{1+i}<1$. When $\theta_s = 1$, similarly, the ratio becomes 1. Because the right side of (RL) is strictly concave, we have the result that the probability of lending to the PF is curtailed in the re-lending case. This variation in probability is transferred to SOE. Moreover, the chance of not lending decreases because of the relaxed constraint of lending to the SOE in its subgame (L_s^R). Therefore, the SOE has more chances to get the loan. □

- (ii) When $Z_1 \leq Z < Z_2$, i.e. (NL) is violated, to a certain extent, lending to the SOE is the same as lending to the PF without asking for a bribe. However, when the project failed, the government will bail out. Therefore, in order to get the loan, the payoff of lending to the SOE, $a_b[\theta_p(1+i)+(1-\theta_p)T]$, should be greater than the payoff of lending directly to the PF, which is $B+a_b\theta_p(1+i)$, or

$$\theta_p \leq 1-\frac{B}{a_bT}.$$

  If $B \geq a_bT$, the banker will not lend to the SOE. It is valuable to notice that the chance for the SOE to get the loan is enhanced:

Lemma A2. *Given $a_b \geq B$ and $Z_1 \leq Z_2$, when $Z_1 \leq Z \leq Z_2$, the probability for the PF to get the loan directly from the bank is less than that in bribe and bailout case, while the SOE has more chances to get it. The chance of not lending is curtailed.*

Proof. The border of (L_p^{bB}) — $\theta_p = \theta_s + \frac{T(1-\theta_s)-\frac{B}{a_b}}{1+i}$ — crosses $\theta_p = \theta_s$ at $(1-\frac{B}{a_bT}, 1-\frac{B}{a_bT})$, which is on the border of $\theta_p \leq 1-\frac{B}{a_bT}$. This result suggests that, in the feasible area $\theta_p \geq \theta_s$, the constraint for the SOE to get the loan is relaxed (while for the PF, the constraint is tighter). Moreover, re-lending decreases the chance for the banker to idle her fund ($\theta_p < \frac{1-T}{1+i-T}$). □

- (iii) When $Z < Z_1$, the payoff of lending to the SOE and the PF for the banker is a_bT and B, respectively. Both are less than 1; therefore, the bank will not lend.

The social welfare is listed in Table 2. When $Z \geq Z_2$, lending to the SOE is better than lending to the PF. Lending to the SOE is better than lending to neither when

$$\theta_s Z + \theta_p Z - \theta_s \theta_p Z \geq 1.$$

Notice the (L_s^R) that the condition for lending to the SOE is $\theta_s(1+i)+(1-\theta_s)\theta_p(1+i)+(1-\theta_s)(1-\theta_p)T \geq a_b$. When $T = T_p = 1-\frac{i}{Z-1}$, (L_s^R) has the same expression with the above productive condition. For $Z_1 \leq Z < Z_2$, lending to the SOE is the same with lending to the PF. For a bailout to be productive, $\frac{1}{Z} \leq \frac{1-T}{1+i-T}$, or $T \leq T_p = 1-\frac{i}{Z-1}$. Therefore, the productive bailout constraint is compatible with the cases where there is no re-lending.

Given the bailout is productive, for $Z \geq Z_1$, the society is better-off compared to the bribe and bailout situation. While for the less profitable project $Z < Z_1$, because of the potential predatory corruption of the SOE's manager, the banker will not lend to anyone. Then society is worse-off:

Lemma A3. *Assume the bailout is productive. Compared to the bribe and bailout case, given $a_b \geq B$ and $Z_1 \leq Z_2$, when $Z \geq Z_1$, social welfare is enhanced; When $Z < Z_1$, social welfare is reduced.*

Proof. When $Z \geq Z_2$, we take two steps to prove the efficiency is enhanced: First, the chance of not lending decreases because of the relaxed constraint of lending to the SOE in its subgame (L_s^R) (while the constraint of lending to the PF in its subgame remains unchanged), which enhances social welfare; Second, the (RL) constraint reallocates the chance for the PF to the SOE, which also improves the social efficiency. Therefore, welfare is enhanced when $Z \geq Z_2$. When $Z_1 \leq Z < Z_2$, the distortion caused by the chance-shifting effect of the bailout is eliminated, and re-lending even creates more chances for the banker to lend ($\theta_p \geq \frac{1-T}{1+i-T}$). Therefore, when $Z_1 \leq Z < Z_2$, welfare is also increased (but possibly not strictly if the bailout in the bribe and bailout case is sufficiently

small that will not change the banker's behavior, which is performed in the bribe but no bailout case). However, when $Z < Z_1$, since the banker believes the SOE will re-lend the money to the PF who is ready to run, lending to neither will decrease the social welfare compared to the bribe and bailout case. □

(2) Next we assume $Z_1 > Z_2$ or $a_s(1-\tau) < B$ (see Figure 10). Similarly, three intervals for Z should be taken into account: (i) $Z \geq Z_1$; (ii) $Z_2 \leq Z < Z_1$; (iii) $Z < Z_2$.

[Figure 10]

- (i) When $Z \geq Z_1$, if (L_p^B) and (L_s^R) are both satisfied, the bank may lend to the PF when (RL) is satisfied. Similarly, we can prove:

Lemma A4. *Given $a_b \geq B$ and $Z_1 > Z_2$, when $Z \geq Z_1$, the probability for the PF to get the loan directly from the bank is less than that in bribe and bailout case, while the SOE has more chances to get it. The chance of not lending is curtailed.*

Proof. The proof is similar to Lemma A1. Thus we do not repeat. □

- (ii) When $Z_2 \leq Z < Z_1$, i.e. (NR) is violated, the constraint of lending to the SOE is (L_s^b), which is the same compared to the bribe and bailout case.

- (iii) When $Z < Z_2$, the bank won't lend.

The social welfare is listed in Table 3. The analysis does not change compared to it when $a_b \geq B$ and $Z_1 \leq Z_2$, except when $Z_2 \leq Z < Z_1$, it is the same with the bribe and bailout case. Therefore, we have the following lemma:

Lemma A5. *Assume the bailout is productive. Compared to the bribe and bailout case, given $a_b \geq B$ and $Z_1 > Z_2$, when $Z \geq Z_2$, social welfare is enhanced; When $Z < Z_2$, social welfare is reduced.*

Proof. The proof is same with that for Lemma A2 when $Z \geq Z_1$ and $Z \geq Z_2$. If $Z \in [Z_2, Z_1)$, nothing changes compared to the bribe and bailout case. When $Z < Z_2 < Z_1$, the banker will not lend, therefore, the welfare decreases. □

2. *Given $a_b < B$* (i.e. lending to the PF is better than lending to neither).

(1) We still first assume that $Z_1 \leq Z_2$ or $a_s(1-\tau) \leq B$. Again, there are three possible intervals for Z: (i) $Z \geq Z_2$; (ii) $Z_1 \leq Z < Z_2$; (iii) $Z < Z_1$.

- (i) When $Z \geq Z_2$, if (L_p^B) and (L_s^R) are both satisfied, the banker will lend to the PF under

$$\theta_p \geq 1 - \frac{\frac{B}{a_b}}{\theta_s(1+i-T)+T}.$$

With $i \leq 1$, this constraint is always attained:

Lemma A6. *Given $a_b < B$ and $Z_1 \leq Z_2$, when $Z \geq Z_2$, only the PF will get the loan.*

Proof. The right hand side is increasing in θ_s. Since when $\theta_s = \frac{1-T}{1+i-T}$, the right hand side is negative, we only need to prove when $\theta_s \in (\frac{1-T}{1+i-T}, 1)$, the right hand is strictly less than θ_s. This is equivalent to prove that $(1+i-T)\theta_s^2 + [2T-(1+i)]\theta_s - T + \frac{B}{a_b} > 0$ for $\theta_s \in (\frac{1-T}{1+i-T}, 1)$. Let $f(\theta_s) = (1+i-T)\theta_s^2 + [2T-(1+i)]\theta_s - T + \frac{B}{a}$. $f(\frac{1-T}{1+i-T}) = \frac{-i}{1+i-T} + \frac{B}{a_b} > 0$. Take the first derivative and find the minimum is obtained when $\theta_s = \frac{\frac{1+i}{2}-T}{1+i-T} \leq \frac{1-T}{1+i-T}$. Therefore, $f(\theta_s) > 0$ for $\theta_s \geq \frac{1-T}{1+i-T}$. □

- (ii) When $Z_1 \leq Z < Z_2$, lending to the PF yields $a_b\theta_p(1+i)+B$ while lending to the SOE yields $a_b[\theta_p(1+i)+(1-\theta_p)T]$. Therefore, the condition for the banker to lend to the SOE is

$$\theta_p \leq 1 - \frac{B}{a_b T}.$$

However, since $a_b < B$, the banker will only lend to the PF.

- (iii) When $Z < Z_1$, the banker will only lend to the PF for the bribe.

The social welfare is listed in Table 4. From the discussion in this case, clearly the social efficiency is distorted because of the re-lending choice of the SOE compared to the bribe and bailout case.

(2) Assume that $Z_1 > Z_2$ or $a_s(1-\tau) > B$ (see Figure 11), there are three possible intervals for Z: (i) $Z \geq Z_1$; (ii) $Z_2 \leq Z < Z_1$; (iii) $Z < Z_2$.

[Figure 11]

- (i) When $Z \geq Z_1$, same with the last case, only the PF will get the loan.

Lemma A7. *Given $a_b < B$ and $Z_1 > Z_2$, when $Z \geq Z_1$, only the PF will get the loan.*

Proof. The proof is the same with Lemma A6. □

- (ii) When $Z_2 \leq Z < Z_1$, lending to the PF yields B while lending to the SOE yields $a_b[\theta_s(1+i)+(1-\theta_s)T]$. Therefore, the condition for the banker to lend to the PF is

$$\theta_s \leq \frac{\frac{B}{a_b} - T}{1+i-T}.$$

  Nothing changes compared to the bribe and bailout case.

- (iii) When $Z < Z_1$, the banker will only lend to the PF.

The social welfare is listed in Table 5. Compared to the bribe and bailout case, when $Z < Z_2$, the welfare decreases because of the re-lending choice of the SOE. The welfare outcome is summarized in Proposition 9.

B Proofs of Propositions

Proof of Proposition 8

Proof. For $a_b \geq B$, when $Z_1 \leq Z_2$, $Z \geq \min\{Z_1, Z_2\} = Z_1$. From Lemma A1 and Lemma A2, we have the SOE will have a greater chance to get the loan, while the chance for the PF drops, and the probability for idling the loan is also decreasing. When $Z < Z_1 \leq Z_2$, because the PF will run away and the manager of the SOE will re-lend, the banker will not lend.

When $Z_1 > Z_2$, $Z \geq \min\{Z_1, Z_2\} = Z_2$. From Lemma A4, given $Z \geq Z_1$, we also have this result. When $Z \in [Z_2, Z_1)$, nothing changes from the bribe and bailout case. When $Z < Z_2 < Z_1$, because the PF will run away and the manager of the SOE will re-lend, the banker will not lend.

For $a_b < B$, if $Z_1 \leq Z_2$, the only difference from the bribe and bailout case happens when $Z < Z_1$, where the banker will not lend to the SOE anymore. If $Z_1 > Z_2$, the only difference from the bribe and bailout case is, when $Z < Z_2 < Z_1$, the banker will not consider SOE anymore. The chance which is lost for the SOE goes to the PF. Therefore, the chance for the SOE to get the loan is smaller than that in the bribe and bailout case, while the PF has a higher probability of getting the loan. □

Proof of Proposition 9

Proof. Given $a_b \geq B$, if $Z_1 \leq Z_2$, from Lemma A3, we have the result that when $Z \geq Z_1$, social welfare is enhanced; When $Z < Z_1$, social welfare is reduced. If $Z_1 > Z_2$, $\min\{Z_1, Z_2\} = Z_2$. From

Lemma A5, we have the same result.

Assume that $a_b < B$ and $Z_1 \leq Z_2$. Compared to the bribe and bailout case, when $Z \geq Z_1$, nothing changed; When $Z < Z_1$, the welfare decreases, because even the banker gives a chance to the SOE, predatory corruption will occur since the manager will still reallocate this resource to the PF, who is about to run. If $Z_1 > Z_2$, compared to the bribe and bailout case, the situation only changes when $Z < Z_2$. As it increases the probability of predatory corruption, social welfare is decreasing. □

Proof of Proposition 10

Proof. The predatory corruption of the banker is eliminated when $B \leq a_b$, which means if the PF owner will run away, the banker will not lend the loan to him. Therefore, we have proven the first point.

Next, reducing the bribe B decreases Z_2, therefore relaxes (NL), implying the SOE with a good project, which brings Z to social welfare, will not give the loan to the PF, which will bring $\theta_p Z$ or 0 to social welfare. Hence, we complete the proof for the second point.

There are two aspects of the third point. First, when $Z \geq \max\{Z_1, Z_2\}$ lending to the SOE is better than lending to the PF, decreasing B will reallocate the chance from the PF to the SOE. Second, decreasing B also lowers Z_2, and more projects will be recognized as a highly profitable project (projects previously classified to scenario (B) will be re-classified to (A) in Figure 9). Therefore, social welfare is improved, and we have proven the third point. □

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Tables

TABLE 1: Types of Corruption in Different Conditions

Borrower	Banker	SOE's manager
$a_b \geq B,\ Z \geq Z_2$	Productive or distortionary	Productive
$a_b \geq B,\ Z_1 \leq Z < Z_2$	Productive or distortionary	Productive
$a_b \geq B,\ Z < Z_1$		
$a_b \geq B,\ Z \geq Z_1$	Productive or distortionary	Productive
$a_b \geq B,\ Z_2 \leq Z < Z_1$		Predatory
$a_b \geq B,\ Z < Z_2$		
$a_b < B,\ Z \geq Z_2$	Distortionary	
$a_b < B,\ Z_1 \leq Z < Z_2$	Distortionary	
$a_b < B,\ Z < Z_1$	Predatory	
$a_b < B,\ Z \geq Z_1$	Distortionary	
$a_b < B,\ Z_2 \leq Z < Z_1$	Predatory	Predatory
$a_b < B,\ Z < Z_2$	Predatory	

Note: The blanket area in the table means the banker does not lend to the corresponding borrower.

TABLE 2: Social Welfare by the Borrower: $a_b \geq B,\ a_s(1-\tau) \leq B$

Borrower	PF	SOE	$Neither$
$Z \geq Z_2$	$\theta_p Z$	$\theta_s Z + (1-\theta_s)\theta_p Z$	1
$Z_1 \leq Z < Z_2$	$\theta_p Z$	$\theta_p Z$	1
$Z < Z_1$			1

TABLE 3: Social Welfare by the Borrower: $a_b \geq B,\ a_s(1-\tau) > B$

Borrower	PF	SOE	$Neither$
$Z \geq Z_1$	$\theta_p Z$	$\theta_s Z + (1-\theta_s)\theta_p Z$	1
$Z_2 \leq Z < Z_1$		$\theta_s Z$	1
$Z < Z_2$			1

TABLE 4: Social Welfare by the Borrower: $a_b < B,\ a_s(1-\tau) \leq B$

Borrower	PF	SOE	$Neither$
$Z \geq Z_1$	$\theta_p Z$		
$Z < Z_1$	0		

TABLE 5: Social Welfare by the Borrower: $a_b < B,\ a_s(1-\tau) > B$

Borrower	PF	SOE	$Neither$
$Z \geq Z_1$	$\theta_p Z$		
$Z_2 \leq Z < Z_1$	0	$\theta_s Z$	
$Z < Z_2$	0		

FIGURE 1: GAME TREE

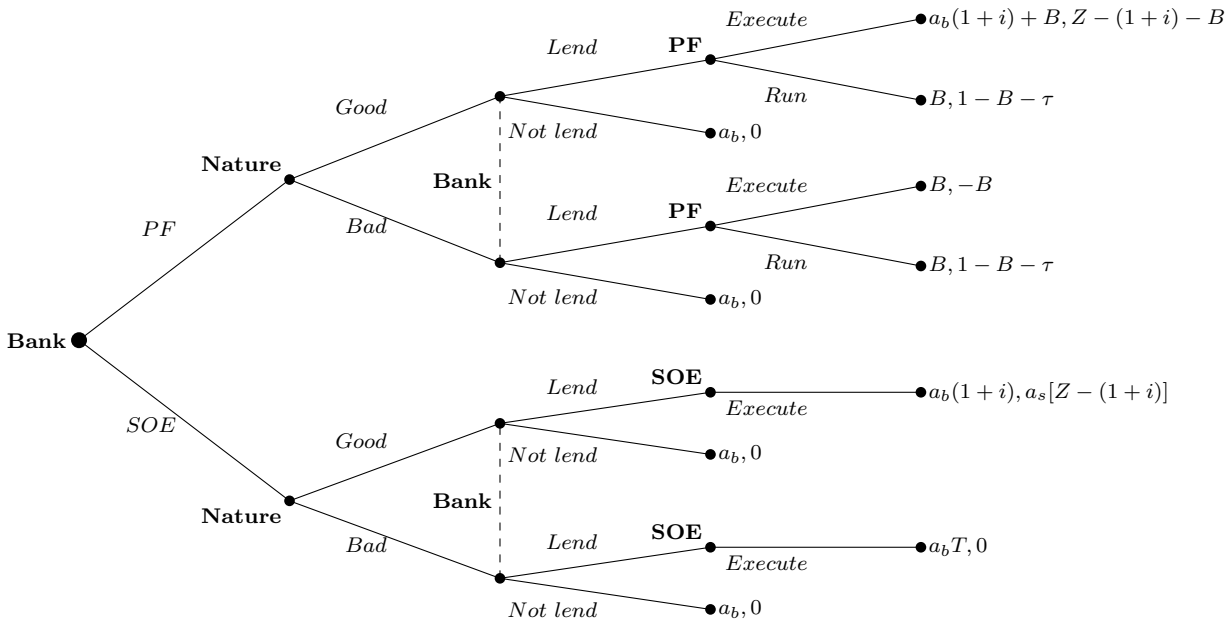
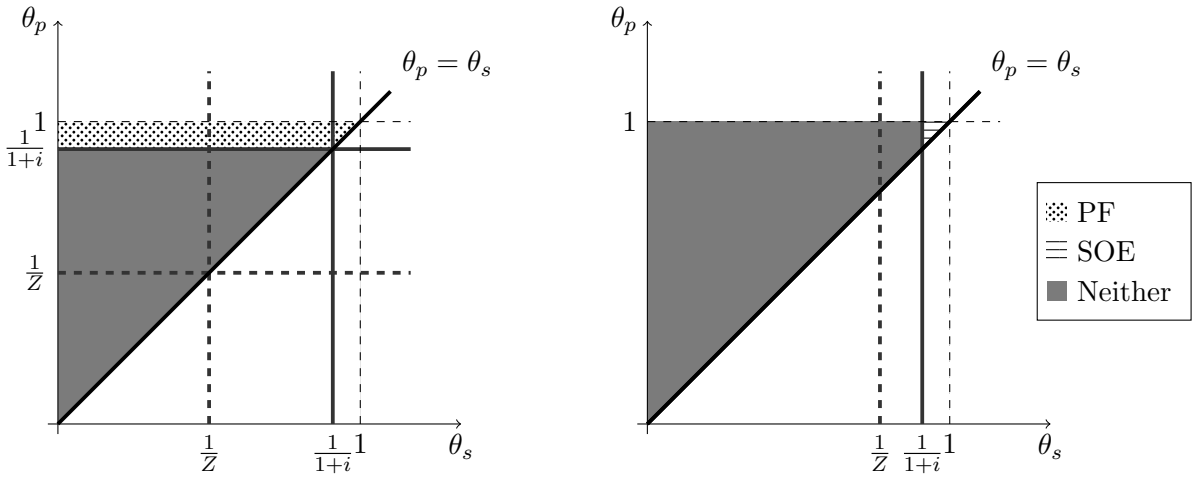


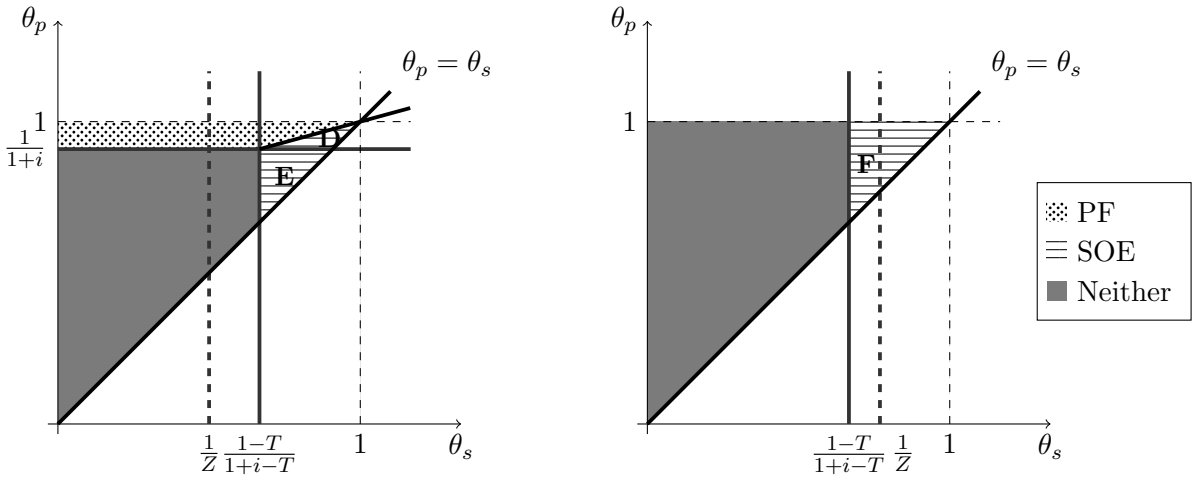
Figure 2: No Bribe and No Bailout



(A) $Z \geq Z_1$

(B) $Z < Z_1$

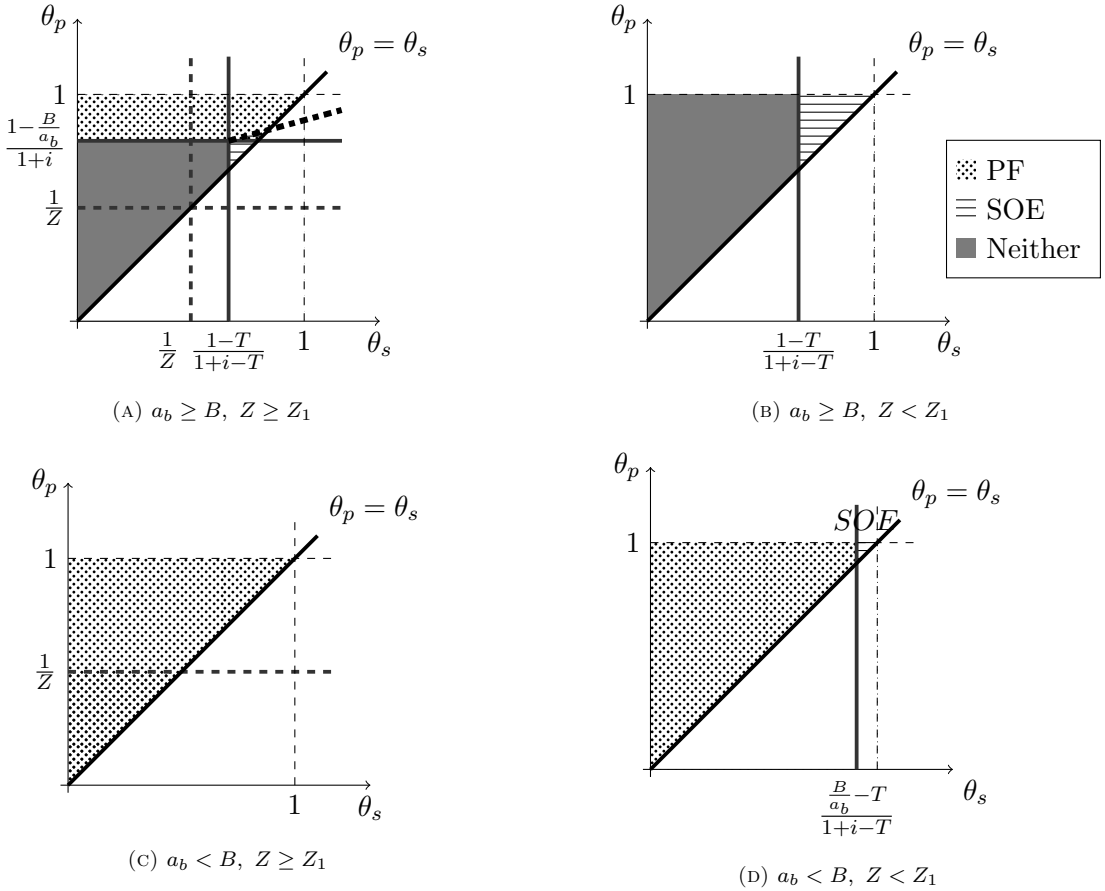
FIGURE 3: NO BRIBE BUT BAILOUT



(A) $Z \geq Z_1$

(B) $Z < Z_1$

FIGURE 4: BRIBE AND BAILOUT



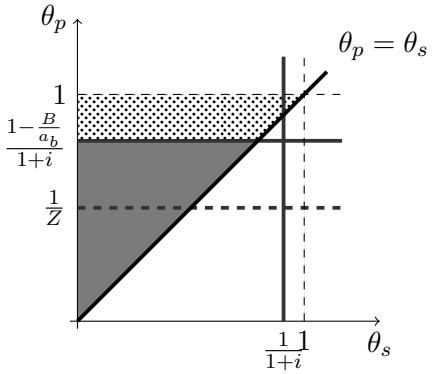
(A) $a_b \geq B,\ Z \geq Z_1$

(B) $a_b \geq B,\ Z < Z_1$

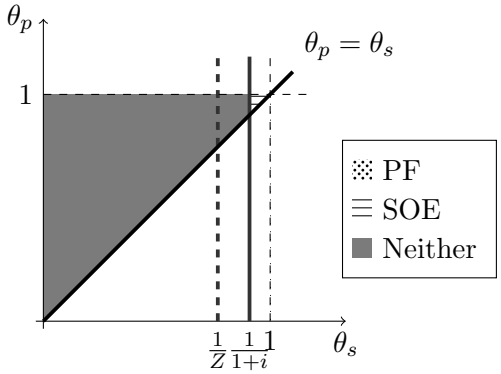
(C) $a_b < B,\ Z \geq Z_1$

(D) $a_b < B,\ Z < Z_1$

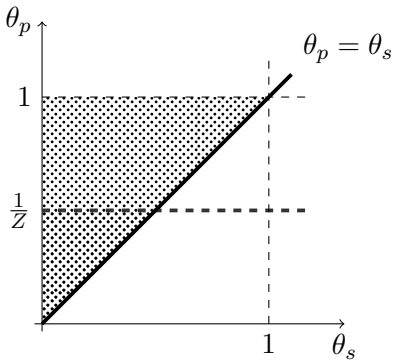
FIGURE 5: BRIBE BUT NO BAILOUT



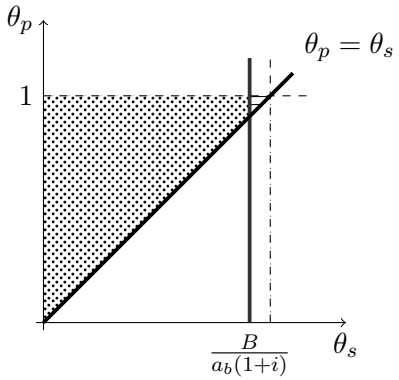
(A) $a_b \geq B,\ Z \geq Z_1$



(B) $a_b \geq B,\ Z < Z_1$

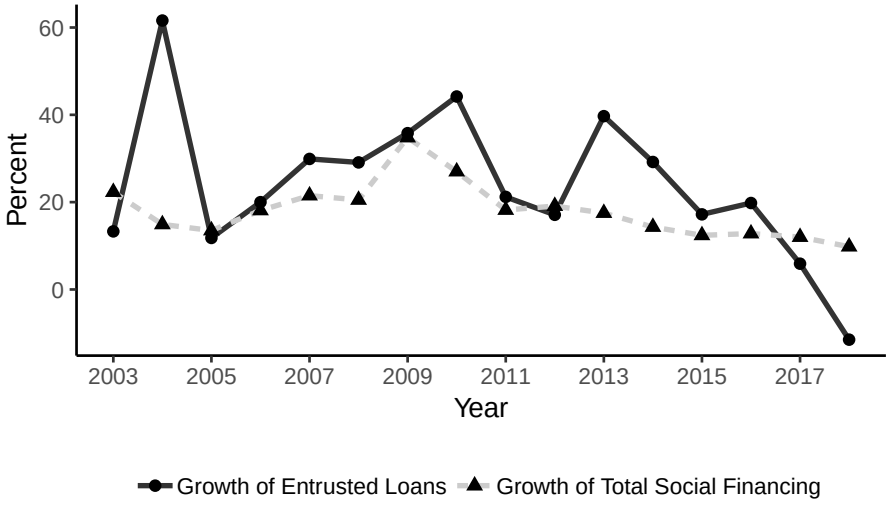


(C) $a_b < B,\ Z \geq Z_1$



(D) $a_b < B,\ Z < Z_1$

Figure 6: Growth Rate of Entrusted Loans



Source: The People's Bank of China.

FIGURE 7: Re-lending Case

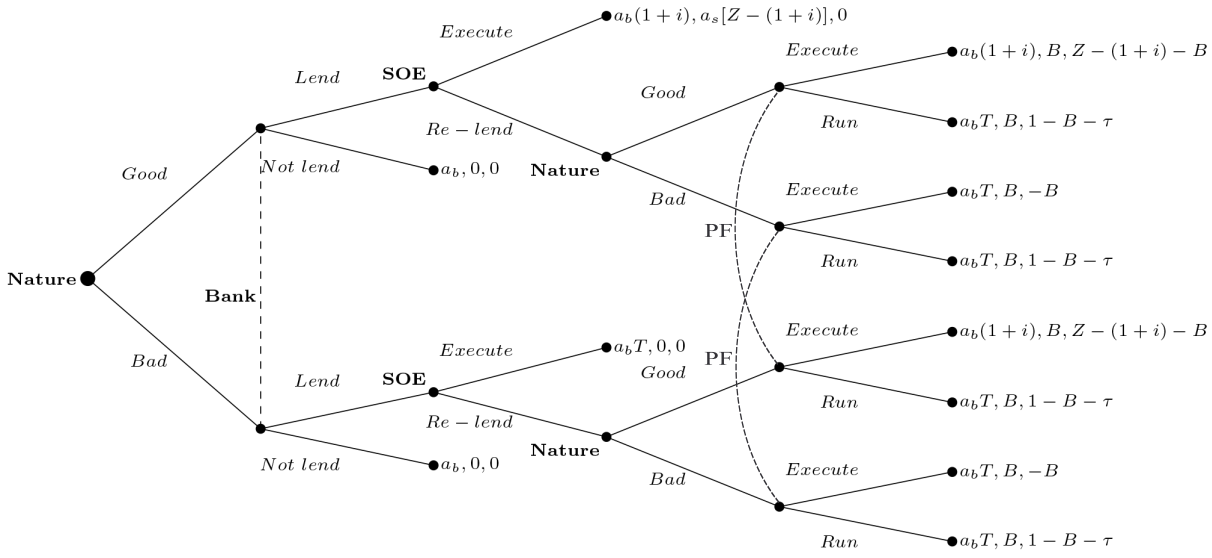
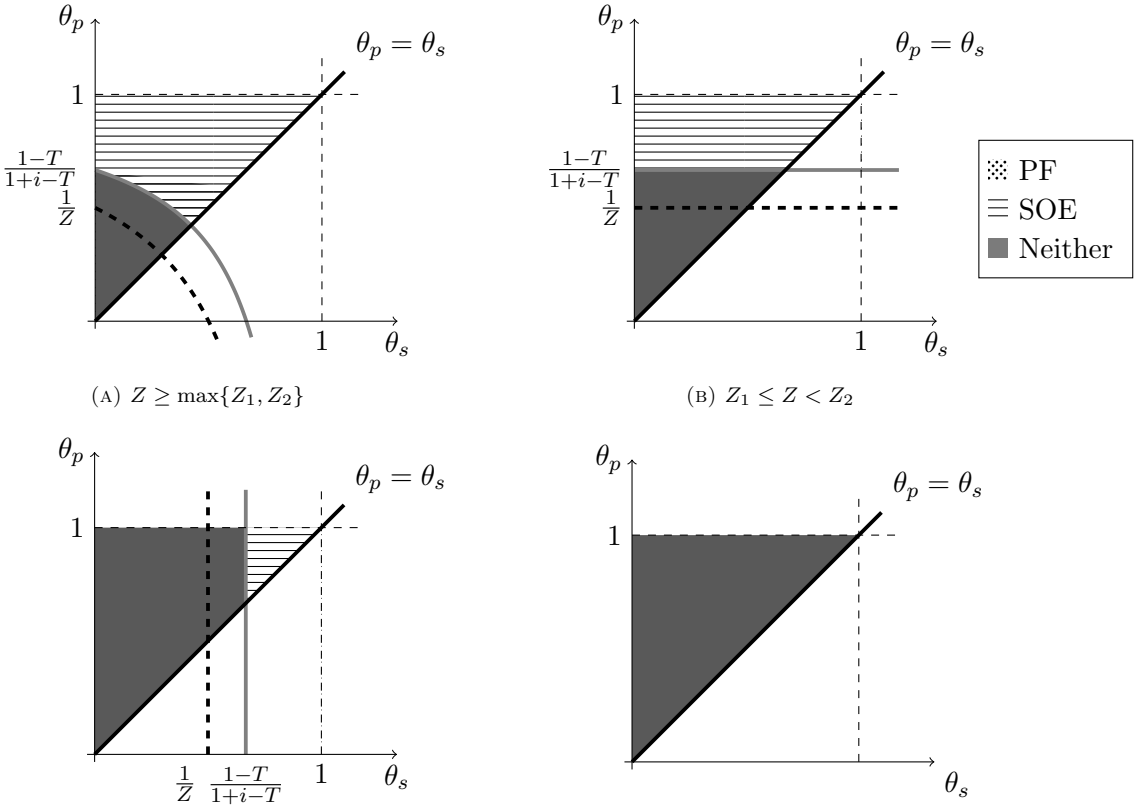


FIGURE 8: RE-LENDING



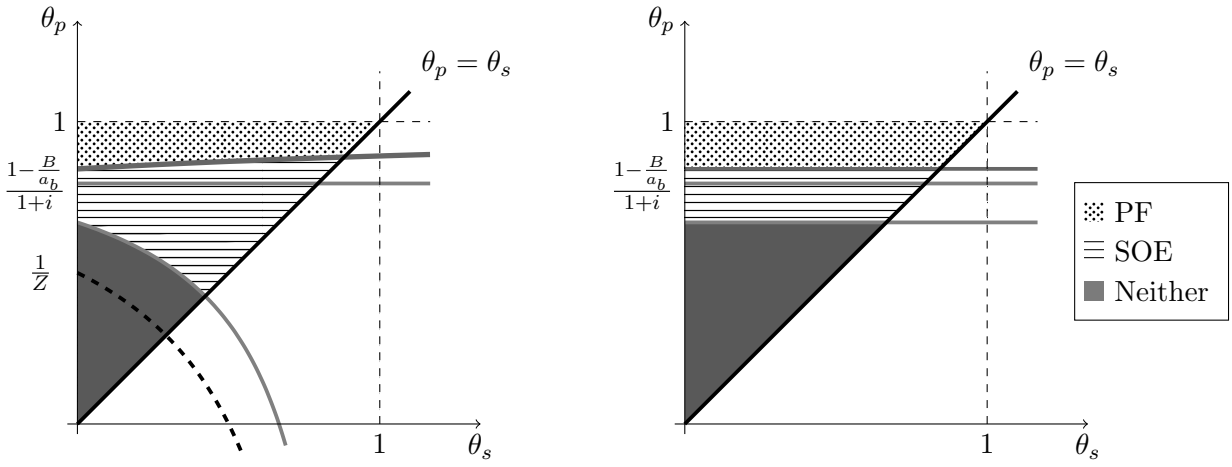
(A) $Z \geq \max\{Z_1, Z_2\}$

(B) $Z_1 \leq Z < Z_2$

(C) $Z_2 \leq Z < Z_1$

(D) $Z < \min\{Z_1, Z_2\}$

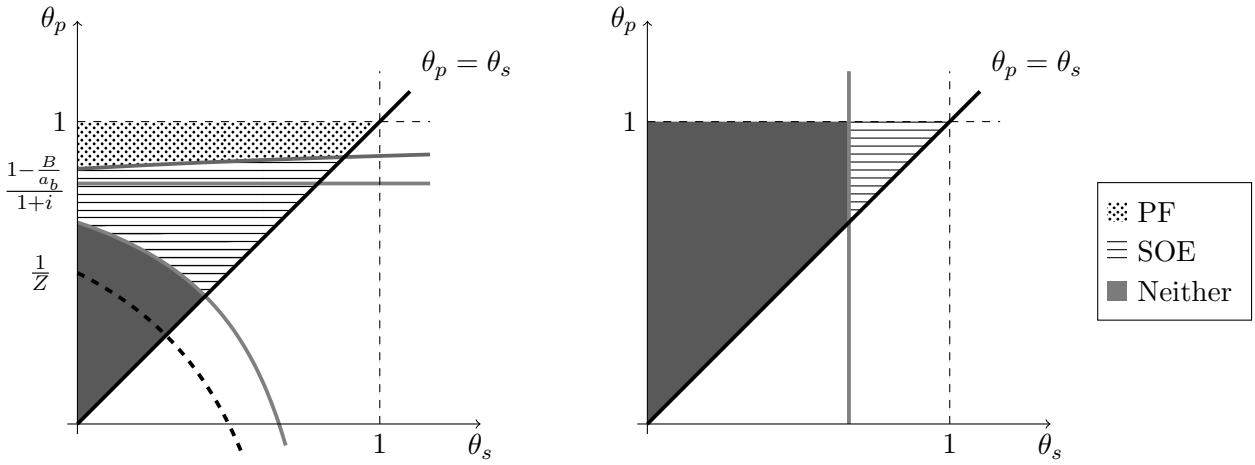
FIGURE 9: RE-LENDING CASE: $a_b \geq B,\ Z_1 \leq Z_2$



(A) $Z \geq Z_2$

(B) $Z_1 \leq Z < Z_2$

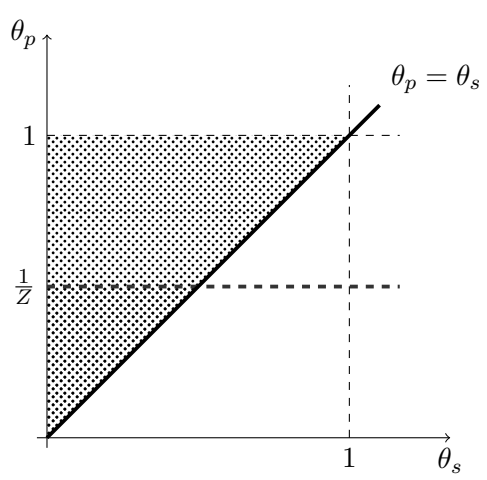
FIGURE 10: RE-LENDING CASE: $a_b \geq B,\ Z_1 > Z_2$



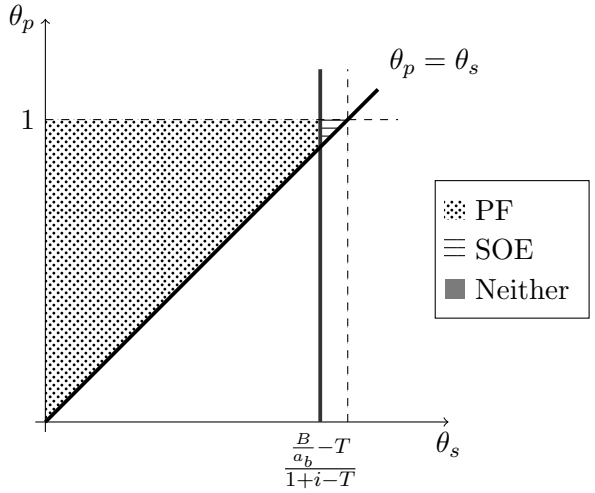
(A) $Z \geq Z_1$

(B) $Z_2 \leq Z < Z_1$

FIGURE 11: RE-LENDING CASE: $a_b < B,\ Z_1 > Z_2$



(A) $Z \geq Z_1$



(B) $Z_2 \leq Z < Z_1$