PAK Publishing Group
Growing Knowledge for Future

Proceedings Book of ICEFMO, 2013, Malaysia
Handbook on the Economic, Finance and Management Outlooks
ISBN: 978-969-9347-14-6

Information Asymmetry And Lending Equilibrium in Nigeria: A Game-Theoretic Analysis of Bank-Borrower Relationship

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Abstract

The use of game theory to characterise strategic relationships have gained prominence in most fields of economics. However, the application to contractual lending relationships in financial markets has been lacking. In view of the presence of information asymmetry in financial markets, this study is an attempt to characterise the nature of equilibrium that exists in Nigerian financial market, using data from 210 loans made within the last one decade among 18 commercial banks. The study joins in the debate initiated by Sharpe (1990), Fischer (1990) and von-Thadden (2001), and posits that bank-borrower lending relationship has short-run pure strategy equilibrium.

Key words: Information asymmetry, lending equilibrium, pure strategy equilibrium, mixed-strategy equilibrium

JEL Classification Numbers: C70, D82, G14

1. Introduction

Information asymmetry has remained pervasive in most economies of the world despite its propensity to hinder efficient market outcome and/or create market failure. In Nigerian financial market, the occurrence of information asymmetry is considerable in bank-borrower lending relationships because of the dominance of the commercial banks in the credit market activities. In the main, most occurrences are observed to be dominated by the presence of adverse selection and/or moral hazard (see Edelberg, 2004; Ogun and Ofonyelu, 2012; Ofonyelu and Alimi, 2013; and Ogun and Ofonyelu, 2013).

The occurrence of information asymmetry is used to describe a situation where the lender (hereafter referred to as the bank) and the borrower does not possess equal information, or one party has better (and more accurate) information than the other party which affects the successful outcome of the loan. In lending transactions, the occurrence of asymmetry is usually borrower-advantaged[1].

[1] Borrower-advantaged asymmetry arises when the borrower has more or better information than the bank (uninformed party) in term of the quality of the intended investment and the default likelihood (Besanko and Thakor, 1987).

However, evidence of bank-advantaged asymmetry has also been observed to be impactful (see Sharpe, 1990; and von-Thadden, 2001). The source of information asymmetry generally derives from the inability of the bank (borrower) to rightly observed the quality of the borrowers (bank), in terms of the likelihood to switch his incentive after the loan has been availed (on the side of the borrower), or the likelihood to introduce hidden charges and extract rent on the side of the bank. In each of the cases, adverse selection effect result from unobservabilty of quality as well as hidden information[2]. The information advantage each agent possesses affects their behaviour as opportunistic condition is presented. In the main, the most underlying ingredient of information asymmetry is that the skewed information distribution affects the sharing of the gains from the transaction. As a result, more information confers on the advantaged more gain than to the disadvantaged.

The aim of this paper is to analyze the conditions under which optimal equilibrium obtain in a competitive credit market of rational and risk-neutral optimizing agents where firms borrow from banks (as the only source of loan) to finance investment whose success likelihood is probabilistic. The study essentially joins in the debate ignited by Sharpe (1990), Fischer (1990) and von-Thadden (2001). Bank-borrower lending relationship, using a game theoretic framework has long run equilibrium in mixed strategies, but a pure strategy in the short-run. This partially reflects an informational lock-in in the bank-borrower lending relationship which is related to the profit sharing in loan financed investments. The rest of the paper is organized as follows. Section 2 undertakes a brief literature review. Section 3 contains the methodology. Section 4 and 5 presents the results, findings and the conclusion.

2. Literature Review

The pervasiveness of information asymmetry in credit markets became prominent in finance literature following the works of Akerlof (1970), Stiglitz and Weiss (1981); Myers and Majluf (1984); Baltensperger and Devinney (1984); and Crawford (1984). In lending situation, information asymmetry is said to occur when the borrower and lender do not have access to the same information set, or one of them has access to more information than the other party. The most common of the situation is that the borrowers do have more information than the lender about their capability to pay and all other issues surrounding the repayment of the loan. The information is either ignored by the banks or is inaccessible to them (Bebczuk, 2003). Recently, the converse case has been observed to be also possible and occurring (e.g. Ogun and Ofonyelu (2012) and Ofonyelu and Alimi (2013)).

The traditional theory of bank lending behaviour was first spelt out by Hodgman (1961). In his argument, the quality of a depositor's relationship is the primary consideration in determining the availability and pricing of credit to customers. A positive balance of sustained cash flow provides an incentive for banks to extend credit to the borrower. However, Kane and Malkiel (1965), and Wood (1965) argued that not only do deposit quality matters, the impact on the general bank's customers was equally important in the loan pricing. If the refusal of loan to a loyal customer is costly to the bank, the customer then stands at an advantage to be funded. Mainly, banks are concerned about current actions on future behaviour, even while profit incentive is dominant. Viewed from another perspective, Fama (1985), Fischer (1990) and (1990) argued that banks generate inside information as banking relationships evolves.

Rather than take the quality of existing relationship as given, we examine the position that bank take to protect themselves when information is asymmetric. The information asymmetry arises because the two agents are at different sides of the market (one at the supply and the other on the demand side). With the presumption of a simple contractual lending relationship that is ameliorable to a typical problem of trust dilemma, incentives from the lending relationship becomes related to information disclosure and/or availability. In view of the fact that lending relationships are dynamic, and may be affected by economic and internal environment of the banks, we assume that banks would prefer their prices to be low enough and fund all customers if they are committed to reducing risk (by committing high effort) and disclosing all relevant information. With borrowers' heterogeneity, banks

[2] This is used to refer to information which may have been deliberately kept private by the bank for ex-post opportunistic profit maximization.

will seek to maximize information available about their borrowers' type, and be willing to reduce price for their safer borrowers.

Sharpe (1990) observed, solving an implicit contract game, that the resulting equilibrium has a pure strategy. But von Thadden (2001), using similar models as Sharpe obtained mixed strategy equilibrium. Rajan (1992), building on Fischer-Sharpe model also observed a mixed-strategy possibility in a situation which is similar to that of Sharpe (1990). These empirical evidences imply that the explanation of information asymmetry in the credit markets has not been settled. Empirical evidence explaining the presence of information asymmetry in credit markets in Nigeria have been lacking.

The empirical literature is essentially divided into two main strands. One strand focused on the use of contract theory analogies to explain information asymmetry in a bilaterally static or dynamic setting, while the other strand emphasized the role of game theory. In each of the strands, contracts are assumed to be effectively binding and enforceable among other underlying assumptions. The use of game theory is intended to approximate the payoffs to each agent in view of the underlying assumptions.

3. Methodology

Game theory, a branch of mathematics has become an invaluable tool for characterizing strategic relationships between agents with differing or converging incentives. The use of a non-cooperative game theoretic approach is inspired by the strategic nature of bank-lending relationship in Nigeria, whereby the borrowers are more likely to default while the banks are informational rent-seeking[3]. The main problem in solving game theoretic problems is the lack of real life payoffs. In view of this, attempt is made to compute the payoffs of each of the agents based on the prime lending rate at the 2010 (used as the based year), and applied to the actual loans availed and repaid. A lending contract involving a heterogeneous[4] group of borrowers who has private information about their risk types, and banks who has hidden information about charges they make to their borrower (including information rents)[5] is situated in the study. The individual firms are assumed to rely on the banks as the only source of funding.

We set out to characterize a two-stage game, identified by two players (agents): the bank and the borrower. Both players are described by their strategy spaces and payoffs which stipulate the rule of the game. In the first stage, the players (the bank and the borrower) were faced with solving a screening game (see figures 1 of the appendix). The bank is essentially faced with whether to trust or not trust the borrower ability to repay, while the borrower having, fuller information about himself chooses whether to repay or default in the second stage. The acceptance to trust the borrower calls for the second stage of the game. Otherwise, the game ends and no loan or profit is made. The timing of the signalling game in the first stage is illustrated as follows:

1. Nature draws type t_i borrower (B_R) to the bank (B_K) from a set of types $T = \{t_1,..., t_n\}$
2. The borrowers are with the probability distribution $\pi(t_i)$ which is unknown to the bank
3. The bank observes t_i and then interprets the message, m_j from a set of feasible messages $M= \{m_1,...,m_j\}$, derived from the items considered for the loan.
4. The borrower observes the reaction from the bank, m_j (but not t_i) and then chooses an action a_k from a set of feasible actions $A = \{a_1,..., a_k\}$.
5. Payoffs are given by $U_{BR}(t_i, m_j, a_k)$ and $U_{BK}(t_i, m_j, a_k)$.

[3] The arises when banks exploit the information advantage they have on their borrowers to charge higher interest rate than obtainable if at ex-post competition with other banks. This also applies to asymmetric charges that are applicable on borrowers, but a =re not specified in the offer letter.
[4] This occurs when H and L refers to the high and the low risks respectively. Mainly, H could be h_1 or h_2, but h_2 turns to be riskier than h_1. Same for L= l_1 or l_2.
[5] In each of the scenario, we assume that agents are more inclined to self retaliation (such as wilful default on the side of the borrowers, and non disbursement of loan on the side of the bank) than seeking litigation. In the extreme case, we suppose that the institutional system for contract enforcement is cumbersome and weak such that litigation as an option is not pursued. Based on the assumptions, each of the agents will renege on strict contract enforcement in the eventual discovery of asymmetry.

The choice faced by the bank is whether to trust the information observed from the borrower and approve (A) the loan or not trust it and disapprove (D). The borrower's strategy on the other hand is whether to default (F) or repay (R) the loan. This illustration is represented in an extensive form as in figure 1 (in the appendix). Playing the game flows from an initial move by nature in the middle of the tree to the terminal nodes at the left or right edge. It does not flow from an initial mode at the top of the tree to the terminal node at the bottom. Risky and safe borrowers have the probability of repayments of Л and 1-Л respectively. Once the bank refuses to trust the borrower, the game ends effectively and payoffs will be zero. Banking essentially is all about taking risks, and as a result banks would want to take some risks by trusting on their borrowers' ability to repay. Otherwise, no lending and profits would be made on the deposits collected. The bank forfeits its payoffs to the borrower when it trusts and the borrower defaults. This outcome banks set out to avoid, and are strictly interested in extending credits to the safe borrowers only. The dilemma essentially derives from the quality of information upon which the decisions are made. Banks want to make loans as much as the borrowers seek to be approved and repay. But it may not be able to control the distribution of its borrower types which could be risky, mixed or non risky (see figures 5.1-3 in the appendix). When the concentration of the high risks is increased, the potential payoffs to the bank become reduced. The Nash equilibrium for both players is (b,b) in the screening game, where each of the b denotes a positive benefits which is becomes defined in the second stage. The quantum of the benefits derivable by each member is dependent on the level of information disclosure, which is decided in the second stage. In the second stage, both agents set out to choose the amount of information disclosure which is related to their profit maximization. Thus, both players are joined by the same strategy set in the second stage, which is in terms of the amount of information to disclose.

The bank is drawn to financing of an investment of which the borrower is the more informed. Bank's interest in the financing of the investment is a function of the borrower's conviction of strict positive returns from the investment. The bank wants to earn as much profit from the investment as much as the borrower's. This essentially is the incentive to want to cheat by the players by undercutting information disclosure. Banks as a result introduce hidden charges for the borrower as a way of undercutting the borrower's profit, while borrowers attempt to hoard unpleasant information in order to secure the loan. Full disclosure of relevant information by borrowers to the bank is known to forestall loan approval in many instances. The level of information disclosure (S) chosen by each player in the second stage is denoted by S_{BK} for the bank and S_{BR} for the borrowers.

For the sake of simplicity, the information disclosure level of each player is limited to the interval (0, 1), and each player is assumed to choose the strategic level independently in stage 2. By implication:

$$0 \leq S_{BK} \leq 1 \text{ and } 0 \leq S_{BR} \leq 1 \qquad (19)$$

Equation (19) implies that both players have a discretionary continuum of information disclosure level-strategies which ranged between 0 and 1. At one extreme, each player can choose to be wholly asymmetric ($S = 0$), and at the other extreme, each can choose to disclose all information required ($S = 0$). In effect, the choice of information disclosure level is the major strategy in stage 2, since the best choice for each player (choice that maximizes individual payoffs) is dependent on the disclosure level chosen by the other player. The rules of the lending game are likewise simple and straightforward. The bank (playing first) decides independently how much to charge for supply the fund (investing) for the investment proposal brought to it by the borrower, and the borrower decides to take up the loan subject to his expected return from the investment while the profitability is probabilistically determined. The closest approximation to reality is that most borrowers would want to earn, at least two-third of the profits. The bank is expected to take the one-third remaining, which is recouped via the interest rate it charged. Ignoring the profitability of the intended investment, the implication of the individual information disclosure on their payoffs functions can be observed.

3.1. The Payoff Functions and Best Responses

The payoffs (V) of each player is expressed as a function of their combined efforts and information disclosure levels (that is, S_{BK} plus S_{BR}), divided by the supposedly profit sharing ratio, minus the private cost of efforts made to ensure the success of the investment. The optimal realization from the loan requires that both players make full information disclosure. However, each agent is also driven by the incentive to maximize private profit, which is possible only by cheating. Expectedly, banks would want to earn as much (if not more than) the borrowers, since they are the source of the fund. But risk taking on the part of the borrower is strictly related to profitability. Borrowers, being the initiator of the investment wants to take the larger gain from the profits made. The profit incentive from the onset is the reason for undertaking the investment, and by extension – seeking the loan. Thus, borrowers would rarely want to share profits equally with the banks in the eventual realization of the loan. On both sides, effort commitment to the successful realization of the loan will be costly. The payoffs to each of the players (V_{BK} and V_{BR}) can be expressed as equations (20) and (21) respectively:

$$V_{BK}(S_{BK}, S_{BR}) = (1/3)[\, S_{BK} + S_{BR} + (S_{BK})(S_{BR})(g)] - (S_{BK})^2 \qquad (20)$$

$$V_{BR}(S_{BK}, S_{BR}) = (2/3)[\, S_{BK} + S_{BR} + (S_{BK})(S_{BR})(g)] - (S_{BR})^2 \qquad (21)$$

Equations (20) and (21) implies that the payoffs of each player is a function of both individual information disclosure levels and that of the other player plus the combined effect of the disclosure, multiplied by the constant g, which is the positive-interaction gain (such as opportunity for future financing, profits, etc)[6], minus the private costs to the player for contributing his or her effort to the successful realization of the loan. Following Guerra-Pujo (2009), we assume for the sake of simplicity that g = [0, 1], and that the cost corresponding to individual's effort level, which is taken to be square of each player's effort information disclosure level. Essentially, agents may try to minimize information disclosure, as the potential gain of information advantage becomes larger. In addition, the cost of providing extra unit of effort to ensure repayment is increasing in the amount of effort already provided. This simplification allows us to preserve a linear payoff function. The multiplicative relationship between the combined efforts at information disclosure, ($(S_{BK})(S_{BR})$) and the interaction gain, g implies that there is a greater gain in cooperating to fully disclose information than otherwise. Fuller information disclosure enhances the bank's ability to apply appropriate interest rate on the loan and sustain the mutually trust between it and the borrowers which is necessary for the eventually repayment of the loan. In effect, fuller information disclosure leads to reductions in perception bias and interest charges, which are both default factors[7].

The best response (BR) of each player represents the payoff maximizing functions. Mainly, each player would be interested in the best possible response of the other within their strategy sets. By converting the analysis to a maximization problem, the first and second order conditions for the payoff functions of the players can be examined. From the general perspective, both players would want to maximize their financial rewards from the investment. Beginning with the bank, the bank's best response - the point at which the bank maximizes their payoffs given the strategy set S_{BR} of the borrower can be obtained by taking the first derivative of the bank's payoff function (dV_{BR}) with respect to S_{BR}. The succeeding expression:

$$dV_{BK}/dS_{BK} = (1/3)[\, 1 + 1(S_{BR})(g)] - 2S_{BK}$$

$$= (1/3)[\, 1 + (S_{BR})(g)] - 2S_{BK} \qquad (22)$$

Since $d^2V_{BK}/d(S_{BK})^2 = 2 < 0$, this implies that the first order condition of the payoff function is the maximum. Having maximized the payoff function, attempt is made to obtain the bank's best response ($BR_{BK} = S'_{BK}$) to the borrower's strategy set S_{BK}. This implies equation (22) is set equals to zero, and substituting S'_{BK} in the place of S_{BK}, and solve.

$$(1/3)[\, 1 + (S_{BR})(g)] - 2S'_{BK} = 0$$

$$(1/3)[\, 1 + (S_{BR})(g)] = 2S'_{BK}$$

$$BR_{BK}(S_{BR}) = (1/6)[\, 1 + (S_{BR})(g)] = S'_{BK} \qquad (23)$$

Equation (23) represents the bank's best response to each possible choice of information disclosure of the borrower. The derivation of the borrower's best response (BR_{BR}) is hinged on the assumption that borrowers are likely to want to earn two-third of the returns from the loan-financed

[6] Even as profit incentives underlie bank lending, future consequences of current behaviour act to leverage lending disequilibrium where they occur. In view of this, bank loans are usually made in view of any realizable future (or long-run) benefit that is derivable.

[7] The perception of the borrowers about the sincerity and fairness of the bank matters for repayment. Where borrowers are generally biased, and as a result see loans as personal share from the national bounty ('cake' as popularly referred to), default incidence tends to be high.

investment than the bank. Following similar mathematical operations, the borrower's best response function, BR_{BR} to the bank's strategy can be specified as:

$$BR_{BR}(S_{BK}) = (1/3)[1 + (S_{BK})(g)] = S'_{BR} \qquad (24)$$

The resulting equilibrium in information disclosure depends essentially on the value of the interaction gain, g. In essence, the greater the information disclosed, the greater is the gain to each of the players. Since the gains are not individually excludable, there is the incentive by each of the players to privately maximize own payoff function over the social function by not disclosing much. For the agents, strategies are the level of information to disclose to each other, bearing in mind that full information disclosure reduces their information rent. Mainly, since borrowers maximizes a larger payoff than the bank in the eventually realization of the loan, banks are expected to disclose more. Attempt is made in the further to observe the implication of varying the information disclosure of each of the players, while holding the strategies of the other constant.

The normal forms[8] representation of the bank-borrower lending game are depicted in figure 6.13. The normal-form representation of a game specifies: (1) the players in the game, (2) the strategies available to each player, and (3) the payoff received by each player for each combination of strategies chosen by the player (Gibbons, 1992). We let S_i denote the strategy space and u_i denote the payoffs for each player in the game. In effect, the strategy space comprises all the strategies of the players, where *i* refer to the bank (BR) and borrower (BR). That is, $s_i \in S_i$, $\forall$ $S = (s_{BK}, s_{BR})$. The game is denoted as $G = \{S_1, ..., S_n; u_1, ..., u_n\}$. Both players in principle choose their actions independently without full knowledge of the others' choice. We assumed that default is total. Thus, this exclude the probability that a borrower default partially, probably resulting after some initial repayment had been made. Where such was the case, the focus becomes on the actual amount that was unpaid, and not on the principal. Table 6.13 characterize the payoffs of the bank-borrowers lending relationship. λ, α, and Y refers to the value of the collateral pledged, the monetary value of the information gain (or rent), and the borrower's wealth. If the collateral pledged was essentially fixed and illiquid, recovery of the loan via its disposal becomes cumbersome.

Table-6.13. Bank-Borrower Relationship (where collateral value is realizable)

		Borrowers	
		Full disclosure(FD)	Partial Disclosure (PD)
Banks	Full Disclosure (FD)	7288, 14576	-7288+λ, 21864
	Partial Disclosure (PD)	7288+α, 14756-α	**λ+α, -λ+α**

Source: Computed

If we assume further that the role of collateral requirement is essentially to enforce compliance[9], but not sufficiently for recouping loss, such that λ=0, and information rent only confers the possessor the opportunity to make extra half of the payoff if both had fully disclosed information. In such situation the role of the borrower's wealth becomes nil. This in essence implies that α will attract ₦3644 for the bank and ₦7288 for the borrower. The emerging outcome shows that the cost of non-cooperative disclosure will be higher for the borrower than the bank compared to when collateral was easily realizable. The weight attached to the collateral by the borrower essentially determines how much he will want to make partial disclosure. For this reason, banks ensure that valid collateral are pledged to secure loans. The ensuing outcome is represented in the figure below.

[8] A game in its strategic form is also referred to as its normal form. It is essentially a compact way of representing a game in which players simultaneously choose their strategies. The resulting payoffs are presented in a table with a cell for each strategy combination.

[9] Though many of the loans are realizable in the long run, banks are interested in the short term repayment period. Since bank loans are essentially short term, we focus on the short term payoffs of the bank, since such defaulting loans would have been classified as risk assets, or bad debts when they extend over 6 months. In the long run, $\lambda \neq 0$.

Table-6.14. Bank-Borrower Relationship (where collateral is nil)

		Borrower	
		Full disclosure(FD)	Partial Disclosure (PD)
Bank	Full Disclosure (FD)	7288, 14576	0, 21864
	Partial Disclosure (PD)	10932, 7288	3644, 7288

Source: Computed

Based on Table 6.14, the borrowers' payoffs are rarely affected when bank becomes asymmetric. Thus, borrowers receive same payoffs whenever the part decides to extract hidden charges. But when banks decides to be symmetric (by fully disclosing all charges applicable), borrowers would be strictly better-off by cheating. Banks however would never want to permit such situation, and as a result would be more inclined to cheat. This is the reason why bank lendings are characterized by hidden charges.

3.2. One-Shot or Repeated Interactions

The one-shot analysis of the game derives from the fact that every loans availed is meant to serve a particular. As a result, the considerations of most loans are usually made with respect to the current conditions rather than for future gain. Essentially, small loans fall into the category of short and one-shot games. The outcomes of the game would be different when the game is repeated from the one-shot case. Usually, when players interact over time, threats and promises concerning future behaviour becomes relevant in affecting current incentives. Nigerians loans are essentially short term oriented. As a result, such loans can be considered as being principally one-shot relation than repeated. With opportunity for rolling over, and funding larger investments, loan interaction could be analyzed as a repeated relationship such that present action derives from the past, while the present also affects the future payoffs. In the following subsection, a one-shot interaction between the two parties is explored, and followed by a repeated analysis.

3.3. Solution to the Game

Two approaches are common for finding solution to normal form game representations: (1) the Dominant Strategy Approach (DSA) and the Nash Equilibrium Approach (NEA). In principle, banks are assumed as the first player (since they choose the amount of interest rate to charge and whether to attach hidden charges or not outside the offer letter). Using the DSA, PD strictly dominates FD. As a result, banks will not want to play FD at all. Since the borrower is indifferent by the payoffs whenever banks partially disclose information, the dominant strategy equilibrium (DSE) becomes (PD, FD) = (10932, 7288). The banks and the borrowers earns ₦10,932,000 and ₦7,288,000 respectively out of a total loan of over ₦210 million naira (see table B-1 in the appendix). Based on the NEA, a two-equilibrium outcome emerges: (PD, FD) and (PD, PD). However, (PD, FD) is strictly preferred to (PD, PD). The implication of the above is that the dominant Nash equilibrium coincides with the Nash equilibrium (DSE=NE). The result from the game analysis essentially shows that the banks have strict positive incentive to be asymmetric. Hence, there is a positive incentive to increase information asymmetry on the part of the banks. As an industry, there is a higher general social benefit on the part of the bank to make full information disclosure. For instance, in each of the situations, the aggregate returns to the industry equalled ₦21,864,000, compared to when it chooses to make partial disclosure (which gives payoffs of ₦18,220,000 and ₦10,932,000 respectively).

3.4. Pure or Mixed Strategy Equilibrium

Following the solution to the games in section 6.7.1, it is not certain for how often the borrower would want to fully disclose information, since his is indifferent whenever the pay chooses the be asymmetric by partially disclosing information. It would have been expected that banks would consider the social benefit of (FD, FD) to the industry and design its lending contract to ensure repayment. But because it is a non cooperative game, such equilibrium rarely exists. The pure strategy Nash equilibrium (PSNE) of (PD, FD) is sustainable as far as it is a one-shot relationship. The non sustainability of the equilibrium becomes important in repeated games where there is possibility of retaliation. Since bank lending is essentially short-run, the bank's equilibrium strategy is to offer partial information on every loans made while the borrower is better-off by also making partial information disclose. The penalty on the part of the bank for sustaining the Nash equilibrium is occasionally default. This is common in cases where the payoffs deviate strongly from the expected returns.

4. Conclusion

The main problem in solving game theoretic problems is the lack of real life payoffs. In view of this, we attempt to compute the payoffs of each of the agents based on the prime lending rate at the 2010. The resulting equilibrium in information disclosure depends essentially on the value of the interaction gain, g. The result from the game analysis shows that banks have strict positive incentive to be asymmetric – earning more from partial information disclosure than when information was fully disclosed. At the equilibrium, the banks and the borrowers earned ₦10,932,000 and ₦7,288,000 respectively. The game only has a pure strategy equilibrium in one-shot relationships. While the possibility of mixed strategy is likely, the grim-trigger effect of retaliation makes its occurrence unlikely.

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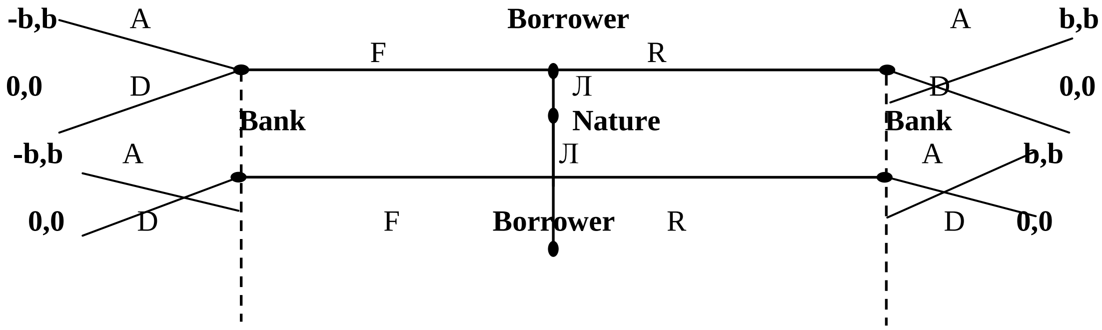
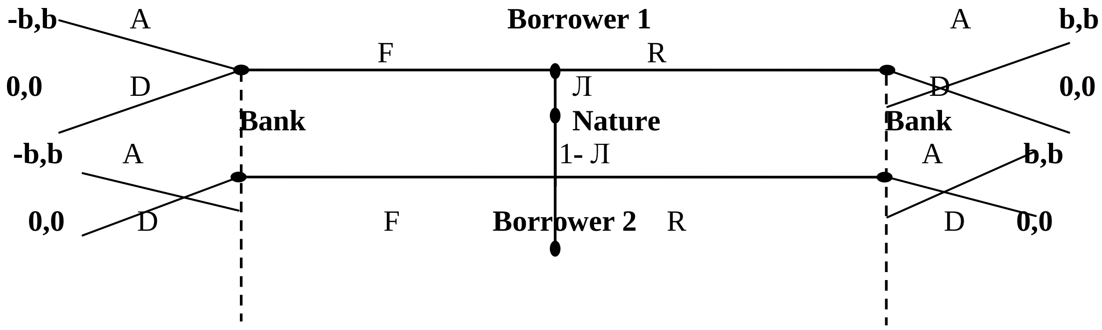
Appendix

Figure-1. Extensive Form Representation of Bank-Borrower Signalling Game



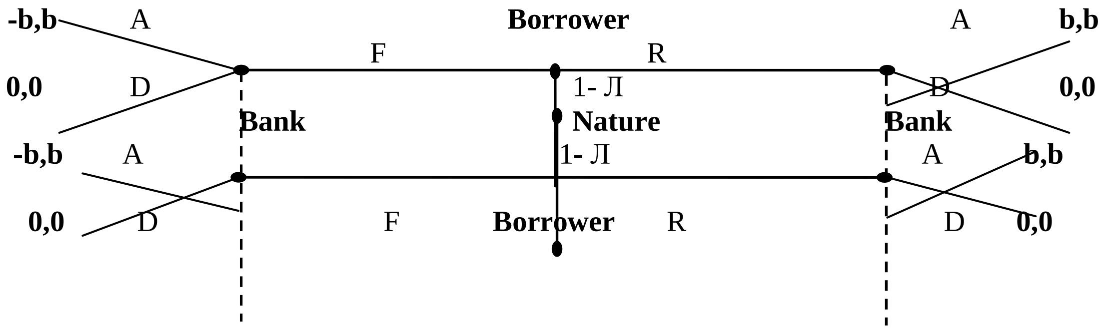
Source: Author's Characterization

Figure-2. Extensive Form Representation of Bank-Borrower Signalling Game



Source: Author's Characterization

Figure-3. Extensive Form Representation of Bank-Borrower Signalling Game



Source: Author's Characterization