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ARTICLE

Mind Game in Finance: Game Theory Insights into SME Financing Strategies in Nigeria

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Abstract

Small and medium-sized enterprises (SMEs) play a crucial role in the economy despite their relatively modest scale and often weak governance structures. The challenges faced by SMEs, particularly in terms of financing, have hindered their development and resulted in instances of mis-investment and capital loss. Central to these challenges is the issue of information asymmetry, which creates hurdles for SMEs in securing funds from financial institutions. To address this gap, the application of game theory analysis becomes a necessity. The theories of information asymmetry and pecking order are employed to elucidate the dynamics of adverse selection and moral hazard within the bank-firm relationship. These dynamics contribute to credit rationing scenarios and overall market inefficiency. The study employed game theory to analyze the bank-firm relationship, considering both complete and incomplete information situations. Furthermore, the analysis extends to credit availability for SMEs, with a focus on mitigating defaults and losses through the identification of penalty mechanisms. From the findings, it becomes imperatives that strategies to alleviate SME financing difficulties encompass the mitigation of information asymmetry, establishment of appropriate incentives, collaborative efforts with government agencies and cooperative societies to bolster confidence, reinforcement of small and business enterprise databanks, and the promotion of information sharing among lenders and SMEs.

Keywords: *Game theory, Information asymmetry, SME financing, Bank lending, Nigeria.*
JEL Classification: *C32, G20, G21, G53*

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1. Introduction

On what basis do banks make lending decisions? What do banks evaluate when lending to SMEs? When do banks restrict lending to SMEs? These questions are of paramount importance, especially in the aftermath of the global financial crises that wreaked havoc worldwide, accompanied by economic and social upheavals marked by high inflation, soaring energy costs, and a global pandemic. The role of Micro, Small, and Medium Enterprises (MSMEs) as an engine of economic growth has garnered significant attention since the 1990s, leading to increased policies and programs devoted to ensuring sustainable growth for SMEs, particularly in Sub-Saharan Africa (SSA) (**Adair, 2004**). An

important business phenomenon of the twenty-first century was the inclusion of a large number of small businesses in national economic development programs, making finance available, lowering the costs of raising funds, obtaining required real and up-to-date information, and dealing with complex tax and regulatory systems, among other things (**Cook et al., 2002**).

In addition to the challenge of young and small firms finding it increasingly difficult to compete in markets, another element of the global challenges facing SMEs has been the difficulty of accessing financing for their businesses and obtaining credit from banks due to the triple situations of high inflation, high energy costs, and a continuing global pandemic. The Subprime Crisis (2007–2009) compounded the difficulty of having access to credit, coinciding with a drastic fall in the demand for goods and services and a credit crunch (**OECD, 2009**). This state of affairs, affecting not only industrialized countries but also rendering low-income countries more vulnerable, prompted **Collier (2009)** to state that "While African banks had just started to turn to SMEs, the global financial crisis reversed this trend, and the SMEs were faced with the risk of seeing their access to credit suddenly deteriorate." Several studies have shown that access to credit remains a challenge for the majority of SMEs (**Jasor, 1998**; **Mbaye and Golub, 2002**).

For sustainable development and market competitiveness, the significance and existence of small businesses, including the central role of entrepreneurship in the emergence of Eastern Europe, have been threatened by financial crises in the global economy and credit availability to Asian small businesses, including those in emerging economies such as Nigeria. SMEs are growing significantly in Nigeria, numbering over 14 million, and playing a critical role in sustainable economic growth and development, employment generation, entrepreneurial activity, and innovation. Economists argue that a variety of factors, including the macroeconomic and microeconomic environment, entrepreneurial and business skills, social and economic conditions, and financial and non-financial assistance, influence SME growth (see **Zeneli and Zaho, 2014**).

Policy makers and academicians have underscored the importance and relevance of finance to SMEs, as well as the significance of SMEs to the sustainable growth and development of every economy. Yet, the question remains: why are banks not lending to SMEs despite the unprecedented attention given to SMEs and the considerable achievements they have made in the development of the Nigerian economy? SMEs are regarded as crucial for economic growth, poverty alleviation, and wealth creation worldwide, as well as the promotion of more pluralistic and vibrant societies. This is because, apart from increasing per capita income and output, SMEs also create employment opportunities, enhance national economic balance through industrial dispersal, and generally promote effective resource utilization, which is considered critical for economic development and growth. **Joseph et al. (2021)** stated that approximately 96 percent of Nigerian businesses are SMEs compared to 53 percent in the U.S. and 65 percent in Europe. SMEs represent about 90 percent of the manufacturing/industrial sector in terms of the number of enterprises. They contribute approximately 48 percent of GDP compared to 62 percent in South Africa and 50 percent in the U.S. or Europe (**Joseph et al., 2021**). **PwC (2020)**, quoting data from the National Bureau of Statistics (NBS), estimated the total number of SMEs in Nigeria to be about 37.07 million, accounting for about 50 percent of industrial jobs and 84 percent of the total.

Several efforts have been made by both fiscal authorities (government) and monetary authorities (Central Bank of Nigeria) to increase SMEs' access to finance. Some of the initiatives include the launching of Small and Medium Enterprises Equity Investment Scheme (SMEEIS) – aimed at jumpstarting SMEEIS as vehicles for rapid industrialization, FGN Special Intervention Fund for MSMEs, Small and Medium Enterprises Restructuring and Refinancing Facility (SMERRF). Others include Small and Medium Enterprise Credit Guarantee Scheme (SMECGS), Micro, Small and Medium Enterprises Development Fund (MSMEDF), Agribusiness/Small and Medium Enterprises Investment Scheme (AGSMEIS), among others, which aim to drive SMEs' access to soft credit and increase their contribution to the nation's output.

Notwithstanding these intervention initiatives, which include the provision of guarantee funds and subsidizing bank loans to expand SMEs' capacity, the majority of SMEs' funding is still obtained from personal savings (family and friends) and cooperative societies (**Babatunde, 2017**). Financial institutions account for less than 5% of start-up financing for SMEs. Due to the sector's perceived high risk, the current bank lending rates in the country, between 25 percent and 30 percent, are considered a death pill for small and medium-sized firms. PwC MSME Survey (2020) revealed that about 50% of SMEs considered the cost of borrowing too high, and about 22% considered lack of finance as the most pressing problem facing the sector. According to PwC (2020), SMEs accounted for 84% of total employment, 49% of GDP, 7.7% of exports, and about 99% of the number of businesses in Nigeria. Yet, the sector is unable to access bank credit in the volume and type it requires. SMEs play very important roles in developing economies, and assisting them is a task that ranks high in the priorities of most national governments.

Despite the acknowledged prominence of SMEs in nation development and the efforts made by fiscal and monetary authorities to increase SMEs' access to formal financial financing, SMEs still struggle to access credit in the formal financial market. The reason why formal financial service providers are reluctant to finance SMEs is the crux of this research. Specifically, the study aims to identify the issues constraining SMEs' access to credit from the formal financial market, particularly the role of information asymmetry in the relationship between SMEs and formal financial service providers like banks.

The rest of the paper is organized into three sections. Section 2 provides a brief review of literature on SMEs financing in the global game theory framework, Section 3 provides a methodological framework illustrating how both SMEs and financial institutions play in the SME lending framework, and Section four provides conclusions and recommendations.

2. Review of Literature

There is a shared view among policymakers, regulators, and academics that Small and Medium Enterprises (SMEs) serve as the engine of economic growth and development (**Zeneli and Zaho, 2014**; **Taiwo et al., 2016**; **Joseph et al., 2021**). It is widely acknowledged that SMEs play a strategic role in fostering positive employment generation, entrepreneurial activity, and innovation. However, SME entrepreneurs contend that elements such as credit rationing, low loan size, and high-interest rates persistently characterize the bank-firm relationship. This is attributed to the sector's perceived poor creditworthiness, the prevalence of low-net-asset firms, and the inclination of banks to favor high-net-asset firms over low-net-asset SMEs (**Berkowitz and White, 2004**). Credit rationing among small firms is classified based on borrowers' wealth, loan size, and interest rates (**Gropp, Scholz, and White, 1997**).

According to the Central Bank of Nigeria, SMEs are key to the development of any economy due to their potential for employment generation, improvement of local technology, output diversification, development of indigenous entrepreneurship, and forward integration with large-scale industries. However, in Nigeria, the SMEs sub-sector has experienced significant underperformance, undermining its contribution to economic growth and development. The key challenges affecting SMEs in the country can be categorized into four main issues: an unfriendly business environment, poor funding, low managerial skills, and lack of access to modern technology, with a pronounced emphasis on the scarcity of finance (**FSS 2020 SME Sector Report, 2007**).

Olawale and Garwe (2010) identify the lack of finance as a key factor constraining the growth of micro, small, and medium enterprises (MSMEs) in sub-Saharan Africa (SSA). This aligns with the work of **Beck and Demirguc-Kunt (2006)**, who assert that the right type of finance helps alleviate MSMEs' growth constraints and increases their access to external finance, thereby leveling the playing field between firms of different sizes.

Globally, commercial banks, being the primary source of SME financing, have often hesitated to lend to SMEs due to perceived risks and uncertainties. In Nigeria, the fragile economic environment and the absence of requisite infrastructure have made SME businesses costly and inefficient, exacerbating their credit competitiveness. Small businesses heavily rely on financial access for their survival, growth, and expansion. However, studies reveal that small businesses face difficulties in accessing bank loans because banks encounter information asymmetry and higher credit risk and information costs when extending loans to small businesses (see **Carbo-Valverde, Rodriguez-Fernandez, and Udell, 2016**; **Duygan-Bump, Levkov, and Montoriol-Garriga, 2015**).

Danielli, Giunta, and Cipollini (2013) examined credit historical data from banks along with financial statement data of selected SMEs. Assessing the creditworthiness of 188 Italian SME companies based on profitability conditions, solvency and liquidity conditions, and credit relationship quality, they found that the loss of profitability and low usage of short-term lines of credit are better indicators of the likelihood of default. They observed that loss of competitiveness could have increased debt ratios faster than sales margin, leading to credit default.

Berkowitz and White (2004) analyzed 1750 non-corporate firms and 2800 corporate firms for different exemption levels on the probability of credit rationing on different firm characteristics. They showed that higher personal bankruptcy exemptions are associated with increased credit rationing and higher interest rates, especially for non-corporate firms. This applies to the level of firms' net assets and delinquent personal or business obligations.

In a study of credit rationing as a determinant of SMEs' creditworthiness in South Africa, **Hoque, Sultana, and Thalil (2016)** outlined reasons why microfinance banks do not give loans or ration credit to SMEs, including risky businesses, lack of sound financial statements, sector biases or sectors with low-profit returns, lack of proper collateral, poor repayment history, and a lack of personal guarantor. **De la Torre (2008)** found that the opaqueness and informality of business, the absence of financial

statements, collateral, and information asymmetry are major determinants of credit rationing to SMEs. Microfinance lending institutions identified a lack of trust in SME owners, the risk of funds diversion, and information asymmetry as barriers to SME financing.

2.1. Theoretical Review of SME Financing

There is a rich body of theoretical literature addressing the credit access of small and medium-sized enterprises (SMEs). This study delves into two theoretical facets of corporate finance that contribute to credit rationing: information asymmetry and the pecking order theory. The challenges faced by enterprises in obtaining credit are frequently linked to issues of information asymmetry, where hidden information prompts banks to approach lending to small and medium-scale businesses with suspicion or extreme caution. The lack of transparency in internal management, performance, and reliability information held solely by enterprises can be a reason for banks to ration credit.

Credit rationing arises when enterprises with profitable investment projects struggle to secure financing. In practical terms, this situation occurs when the demand for credit surpasses the supply, and banks are unwilling to raise interest rates to achieve market equilibrium. Theoretically, credit rationing can be triggered by asymmetric information, the existence of statutory usury rates, unfavorable fees for corporate failure, and insufficient competition among banking institutions.

According to **Stiglitz and Weiss (1981)**, in the presence of information asymmetry, funders may choose to either withhold funding or ration it. The authors outline two scenarios for credit rationing: the first occurs when one of two identical groups of loan applicants is approved, and the other is not, while the second arises when identifiable groups in the population cannot obtain credit or can only do so at a much higher price. The authors emphasize that, regardless of the interest rate agreed upon by the applying enterprises, credit will be denied if the expected profitability, as perceived by lending banks, is low.

Adair and Hamad (2004) present a similar argument, stating that banks are disinclined to grant relatively small loans to SMEs or very small enterprises due to the lack of profitability and high transaction costs involved. SMEs, deemed the highest risk of default on loan repayment, may be excluded from the credit market, referred to by **Stiglitz and Weiss (1981)** as being "redlined." In the credit-rationing model, the risks of "redlined" enterprises are not easily identifiable by banks, potentially leading to an overestimation of default likelihood and subsequent exclusion from the credit market. Consequently, the most opaque or non-transparent SMEs are likely to be excluded from credit access.

Credit rationing also occurs when banks recognize economies of scale related to fixed transaction costs, such as information gathering and loan appraisal and monitoring. These costs can be higher if SMEs lack transparency (**Berger and Udell, 2006**), and if the financial information they provide is not of high quality, SMEs' credit access is restricted (**Cull et al., 2006**). **Pandula (2011)** contends that credit rationing by banks and financial institutions results from adverse selection, moral hazard, and issues related to contract observance. Information asymmetry is more pronounced among small enterprises than their larger counterparts (**Tucker et al., 2003**). When an enterprise is "opaque" (lacking reliable financial information), credit institutions hesitate to approve loan applications. Similarly, **Giannetti et al. (2011)** argue that when an enterprise is granted a loan, this reveals favorable information about the loan to other lenders. **Murro et al. (2019)** suggest that if enterprises increase their level of opacity, asymmetric information problems can be mitigated, positively impacting credit availability.

Theoretical solutions to difficulties related to asymmetric information involve enterprises pledging collateral or offering assets (financial or real estate) that lenders can seize in case of non-repayment. **Giannetti et al. (2011)** argue that enterprises placing a lien on their assets to obtain bank loans are more likely to succeed, and in the event of default on loan repayment, creditors will have the right to seize inputs and other assets. These findings align with **Xu's (2018)** hypothesis that better legislation allowing for collateral security facilitates businesses in obtaining bank loans. **Beck et al. (2018)** found that fixed assets had a positive and significant effect on access to bank loans. However, the role of guarantees in alleviating problems related to anti-selection and moral hazard has been disputed by **Stiglitz and Weiss (1981)**, who show that these problems are positively related to guarantees.

In summary, SMEs grapple with problems related to information asymmetries, such as adverse selection and moral hazard. Adverse selection occurs when there is a lack of symmetric information before a deal between a buyer and a seller, while moral hazard involves the risk that one party has not entered into the contract in good faith or has provided false details about its assets, liabilities, or credit capacity.

3. Games Theory and SME Financing

In financing activities, a prevalent issue is the information asymmetry between SMEs and investors. SMEs possess comprehensive information about their current operations, profitability, and the ongoing viability of the firm. Conversely, banks lack such detailed and contextual information, making

it challenging for them to form opinions about the sustainability and health of the firm's operations, resulting in incomplete information (**Gao, 2011**). This study delves into the financing challenges faced by SMEs from two perspectives: the dynamic game of complete information and the dynamic game of incomplete information. Building on these perspectives, the study aims to pinpoint the primary reasons why banks exhibit reluctance in lending to SMEs and provide recommendations to address the current challenges.

3.1 A Dynamic Game of Complete Information

The Game's Basic Assumptions

- The players are banks and small and medium enterprises. Both banks and SMEs are rational entities, with their pursuits focused on maximizing their own interests.
- In the event of enterprises defaulting on a loan, an efficient judicial system would safeguard the lender's normal interests, and the investigation cost of the bank would be low, counted as zero.
- Both sides of the players conduct a dynamic game, meaning that one party may act based on the other party's action.
- The players have complete information about their potential benefits in each state during the game.

The Process of Game Development

1. First, the study assumes that a credit market with complete information is the ideal state. If borrowers were in debt default, an efficient judicial system would solve the problem quickly. Meanwhile, the investigation cost of the bank is low and assumed to be zero.

The payoff matrix of the bank and enterprise is as follows (see Figure 1):

i. If the bank did not lend to the SME, then both sides' payoff would be zero (0,0).

ii. If the bank decided to lend to the SME, and the firm paid the loan on time, then the situation would be a win-win cooperation. The payoff is (5, 3), as the bank gets its capital and interest.

iii. If the bank decided to lend to the SME, and the firm paid the loan late, then the situation would still be win-win cooperation if we assume no punishment for late repayment. The payoff is (4, 3), as the bank gets its capital and interest.

iv. If the bank provided a loan to the SME, and the enterprise refused to return the loan principal and interest, the bank would lose its capital and interest, while the SME would benefit from its opportunistic behavior. The payoff is (-2, 5).

v. If we solve this by backward induction, we see that the equilibrium is (0, 0) payoff, where the bank refuses to give a loan because it foresees opportunistic behavior by the SME.

Such a situation is common when the relationship between the lender and borrowers is a one-time occurrence, and neither the bank nor the borrower has the opportunity to play again based on what the other players played earlier. In real life, such a situation is often mitigated in several ways, including the bank's adoption of various incentives to encourage borrowers to repay loans and the government providing the right institutions that will permit the prosecution of opportunistic behavior by any of the players. Top among the strategies adopted by banks to ensure SMEs repay their loans is the demand for collateral, which can be auctioned if SMEs default on loans. However, since most SMEs lack assets used as collateral, banks cannot obtain sufficient income through the auction of mortgaged property (**Chen & Tang, 2001**). Therefore, the only solution is to resort to the judicial system. However, the judicial system in Nigeria is inefficient, ineffective, and takes a long time to deliver justice. The inefficient judicial system is likely to make the bank unable to recover its principal, interests, and the cost of the judiciary if the bank resorts to recovery through the law courts.

The second assumption: If we assume that the cost of prosecuting and confiscating SMEs' assets in the event of default is zero or minimal, while it costs the SME more if the bank decides to prosecute the SME during default, the SME would be deterred from opportunistic behavior and would always want to pay back the loan. This modifies the pay-off in the extensive form game, as shown in Figure 2.

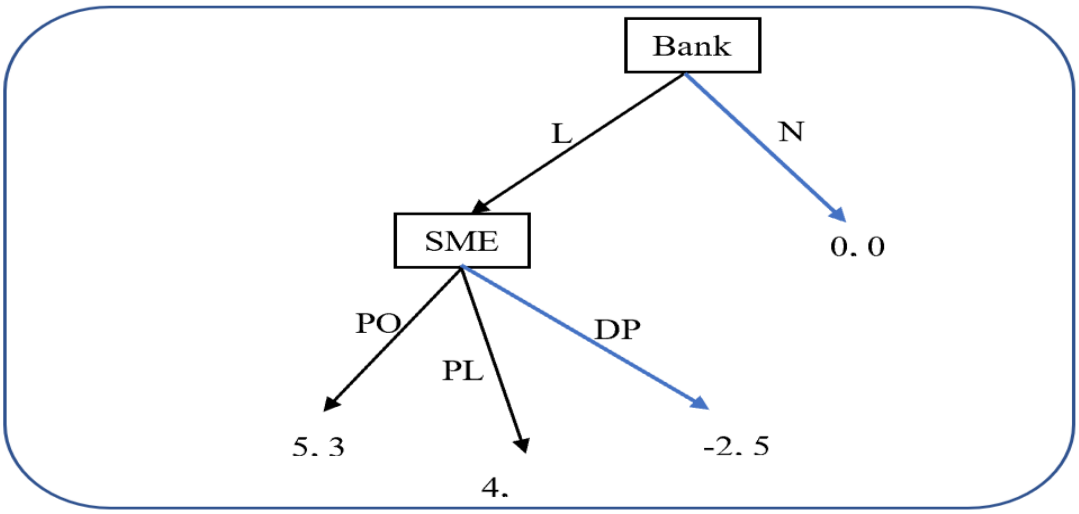

Figure 1: Extensive form representation of the basic form of the game

In Figure 2, assuming that the SME will be charged a late payment cost of 'cl' and a non-repayment cost of 'cd'.

The payoff matrix of the bank and enterprise is as follows:

i. If the bank did not provide a loan to SME, then both sides' payoff would be zero. The revenue would be (0,0).

ii. If the bank provided a loan to SME and the enterprise paid the loan back on time, then the situation would be win-win cooperation. The payoff is (5, 3).

iii. If the bank provided a loan to SME and the SME paid back the loan late, the payoff is (4, 3+cl), where the bank gets 4, and the SME gets 3 plus the late repayment cost. Notice that the late repayment cost is mostly negative, i.e., cl < 0, meaning that the higher the late repayment cost, the lower the SME pay-off when they pay back late. For instance, if the late repayment cost (cl) is 2, then SME pay-off would be (3-2 = 1).

iv. If the bank provided capital for SME and SME refused to repay the loan, the new pay-off would be (-2+pl, 5+cd), where 'pl' represents the income the bank generates from the auction of SME collateral or benefit from its prosecution of the SME and is always positive (i.e., pl > 0), whereas 'cd' is the cost of default paid by the SME in the form of forfeiting its asset or collateral used to borrow the fund and is always negative (i.e., cd < 0). For instance, if cd = 6 and pl = 2, we could see that when the SME refuses to repay the loan, the pay-off would become (0, -1) as in panel B of Figure 2.

In this scenario, solving backward induction yields an equilibrium payoff of (5, 3), representing a win-win situation for both players. However, due to inefficiencies in Nigeria's judicial system, banks often incur high recovery costs (for hiring lawyers and other recovery expenses) and, in reality, recoup very little. This discourages banks from lending to SMEs despite their societal role. Even if the bank obtains a favorable judgment, enforcing it in the absence of tangible collateral is challenging. Furthermore, SMEs may appeal, causing further delays. As a result, the primary objective of collecting loaned amounts cannot be achieved when banks pursue recovery through the current judicial system.

The expected return of the bank's persistent demands on the SME for debt payment is less than debt recovery cost in this case. Consequently, the bank tends not to pursue the matter, making its threat less credible. Therefore, when the SME knows the bank's rational choice and obvious dilemma in the face of negative externalities, its best option is to become recalcitrant and refuse to pay the amount owed.

To avoid losses, banks choose not to trust SMEs and retain the principal when they know the company would refuse to repay the debts. The best choice for banks is not to lend to SMEs, leading to the so-called "credit crunch" when banks expect to lose their principal if they agree to lend. In this circumstance, the Nash equilibrium of the dynamic game between the bank and the SME becomes (0, 0) as in Figure 1. At this point, to guarantee its principal's safety, the bank would rather lend to large corporates, with less credit risks, tangible collateral, and proven management, instead of SMEs (**Lu, 2005**). This is why SME loans account for a relatively small proportion of the total bank loan portfolio.

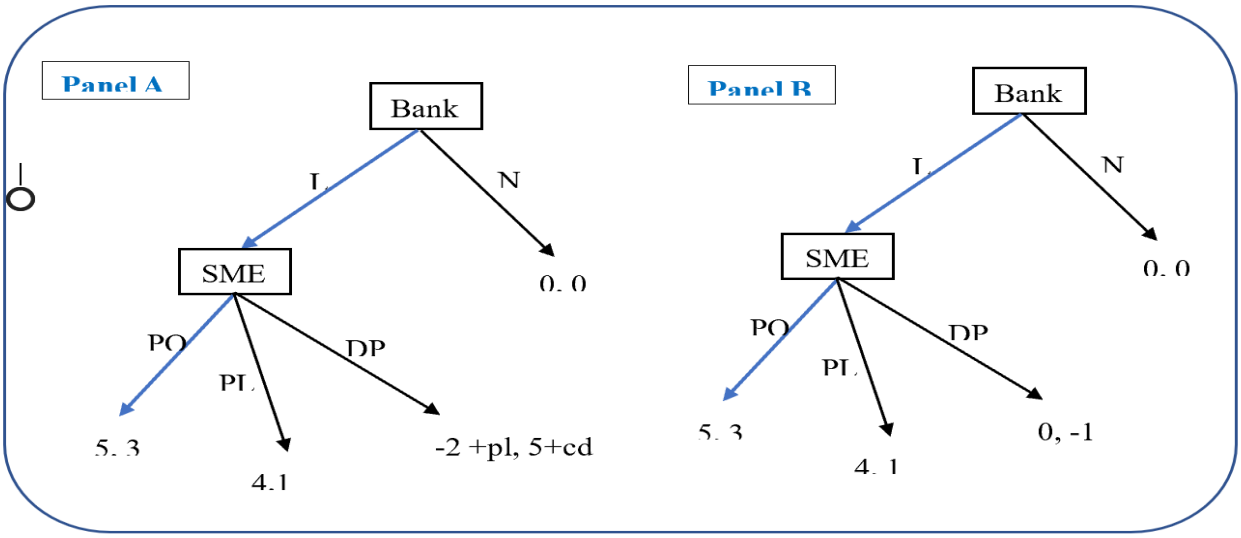

Figure 2: Modified version of the Extensive form game

Equilibrium Analysis:

Inferring from the above analysis, the bank will not recover its total principal if it lends to the SME when the SME chooses not to pay back. This is the basis of credit rationing, low loan size, high-interest rates, and explains why SMEs cannot gain enough credit to fund their own development. The dearth of a standard financial system and trusted transactions journaling in SMEs makes banks face extremely high costs of searching for business information about SMEs. The small size of most SMEs financing accounts for a fraction of banks' total income, and thus, lending to SMEs is not attractive from both the risk and profitability perspectives. The bank's cost-income ratio - costs include the cost of searching for information and the amortized cost of non-performing loans (NPLs) of SMEs - from SMEs is much higher than the one from large enterprises. Therefore, bank credit funds flow to large enterprises eventually.

To reverse this trend, SMEs should institute a standard financial reporting structure, enlist on credit bureaus to track their credit history to overcome information asymmetry, while the government should guarantee an effective and efficient judicial system to increase the negative incentive of breaking contracts.

4. Conclusion and Recommendations

The study provides insights into the information asymmetry between banks and small enterprises in Nigeria. Game theory analysis supports the idea that, in the light of complete information, banks will opt for a mixed strategy, meaning they make decisions with a certain probability randomly under the circumstances of lacking confidence in SMEs, which depicts market inefficiency. This explains why, except when the government development bank intervenes, the total loans to SMEs will continue to account for a small proportion of total loans in commercial banks and other financial institutions. The study also identifies some reasons why SMEs face challenges in accessing funding from the conventional banking system, including information asymmetry, moral hazards, a poor institutional framework to enforce credit agreements, lack of collaterals or valuable assets, and managerial capabilities, among others.

From the analysis of game theory and SME financing above, the following recommendations are made:

i. SMEs should, in collaboration with SMEDAN, jointly institute an SME databank where up-to-date operational activities of all SMEs would be resident.

ii. SMEs can institute a cooperative loan guarantee mechanism where the loan of an operator would be guaranteed by other operators, holding them liable until the loan is fully paid.

iii. Banks should work with government agencies and cooperative societies to ensure the personal information of the owners of SMEs and business information is verifiable when giving out loans to reduce the cost of default and information costs for SMEs.

iv. SMEs should pool resources together to build a central database that will enhance data integrity and equip operators with minimal financial education that will assist when applying for loans.

v. To correct the inefficiency in the judiciary, there should be special courts to adjudicate on Bank/SME disputes.

vi. SMEs should endeavor to provide correct and complete information to the bank whenever they are accessing credit or when such is demanded. In the long run,

this practice will be more beneficial to SMEs as banks can afford to lend to bigger companies instead of lending to SMEs.

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