The debtor-attributes information and the probability of performing loans in the microfinance sector

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Abstract
Based on the recent evidence of the high rate of non-performing loans in Indonesia's microfinance sector, there is a need to formulate a mechanism that could control such credit risk. This study attempts to identify the pivotal determinant factors responsible for performing loans. In particular, this research proposes demand-side factors, such as debtor-attributes information, as critical for ensuring installment payments. Using unique data from microfinance in Central Java, it employs logistic regression analysis to prove that debtors’ age and type of collateral significantly affect loan performance. This paper further shows that other variables, such as the payment period and the interest rate, also substantially affect credit risk. These findings have empirical and practical significance. For practical purposes, this research develops the new perspective that debtor-specific information, particularly on their behavioral aspects, requires more in-depth review. This insight may be useful for developing new credit-analyzing tools to alleviate severe non-performing loans. Empirically, this research improves the study of antecedent variables that influence performing loans.

Keywords: Banking; credit risk; financing decisions; non-performing loans; small-medium enterprises (SMEs).

JEL Classification: G21, G23, G29

INTRODUCTION
The data from Bank Indonesia, the Republic of Indonesia's monetary authority, shows that from 2013 to 2017, the rate of non-performing loans (NPLs) in microfinance steadily worsened. Indeed, NPLs increased by 2.5% each year. This situation is exceptionally urgent due to the systemic shocks that will probably occur in the future. Indonesia experienced a severe financial crisis in 1998, and the problem began with the high number of uncontrolled NPLs. Therefore, as a central government institution in the banking industry with direct control, Bank Indonesia should formulate a policy to push down the rate of NPLs.

Based on the Bank Indonesia data from 2013 to 2016, microcredit is declining. This paper argues that the policy of cutting off credit for micro-businesses aims to curtail
the increase of NPLs in the microfinance sector. However, this decision may have other consequences. It creates a barrier to microcredit accessibility. It also limits the micro-business sector’s contribution to the economy as a whole. Thus, Indonesia should consider an alternative policy for reducing the NPL rate while ensuring the accessibility of microcredit. This study argues that a new approach to microcredit scoring could minimize NPL risk. To formulate a sophisticated microcredit scoring system, we need to determine several antecedent variables that affect NPLs.

Many scholars have examined the variables that affect the NPL rate of financial institutions. The variables involved in non-performing loans include bank deposits, total debt, ROA, capital adequacy (Malimi, 2017; Li, 2003; Alexandri & Santos, 2015; Chodnicka-Jaworska & Jaworski, 2017; Irawati, Maksum, Sadalia, & Muda, 2019; Bhattarai, 2016; Chijorga, 2011; Alali & Romero, 2013; Assibey & Asenso, 2015; Vithessonthi, 2016), unemployment rate, inflation, economic growth, export, import, etc. (Vatansever & Hepsen, 2015; Festić, Kavkler, & Repina, 2011; Kauko, 2012; Saba, Kouser, & Azeem, 2012; Messai & Jouini, 2013; Dimitrios & Dimitrios, 2016; Amuakwa-mensah, Marbuah, Ani-asamoah, & Amuakwa-mensah, 2017; Kjosevski & Petkovski, 2017; Betz, Kruger, Kellner, & Rosch, 2017; Waqas, Fatima, Khan, & Arif, 2017).

However, instead of analyzing specific debtor-attributes information, many previous scholars paid more attention to banking-specific information (ROA, total debt, capital adequacy, etc.) and macroeconomic factors (inflation, interest rate, economic growth, etc.). In other words, they placed more weight on the supply-side than the demand-side determinant factors. Nonetheless, according to Arya et al. (2013), the ability and willingness to pay are pivotal for credit payments. The ability to pay is related to how many resources the debtor has to cover the installments. Simultaneously, the willingness to pay is connected to the debtor’s desire to pay each installment, which is usually affected by his or her behavior. In light of studies on behavioral science, such variables could be proxied by debtor-attributes information, such as age, gender, and amount of collateral. The ability and the willingness to pay are related to the demand-side determinant indicators, and they should both be present to assure credit payment.

This study aims to fill the research gap in the understanding of microcredit by shedding light on the relationship between debtor-attributes information and NPLs. It employs unique data from microfinance institutions in Central Java to analyze this relationship, then utilizes a logistic regression model to prove it statistically. The paper is divided into four steps. The first of these elaborates on the original idea of this research. Step 2 offers a literature review and proposes our hypotheses. Step 3 develops the research method to prove the hypothesis. Finally, Step 4 presents the results and discusses their implications.

The pioneering studies of the relationship between individual attributes and corporate performance investigated how the socio-demographic characteristics of managers and CEOs affect their decisions. For example, Facio, Marchica, and Mura (2016) examined how CEOs’ gender affects corporate risk-taking behavior. They found that female CEOs tend to make less risky investment decisions than male CEOs. This result supports the previous research, which found that gender is a determinant factor in how individuals choose their level of risk (Khan & Vieito, 2013). Risk-taking behavior is one of the several variables that affect debtors’ willingness to pay. Arya, Eckel, and Wichman (2013) argued that people who are more prone to taking risks tend to have a higher probability of defaulting on their debts. Bachan (2014), in his study of student loans in the United Kingdom, noted that female students are less likely than their male counterparts to apply for credit. In other words, the ease with which people take out a loan is used as a proxy for higher risk-taking behavior. This evidence is in line with Yordanova and Alexandrova-Boshnakova (2011), who found that females tend to exhibit lower risk-taking behavior in business decision making. Risk-taking is positively correlated with a
higher use of credit because more borrowing entails a larger number of installment payments per period. This will cause the burden of spending to become heavier. According to psychological theory, the lower risk-taking behavior of women is due to their lower sense of autonomy, self-confidence, and optimism (Marinelli, Mazzoli, & Palmucci, 2016). On the contrary, women tend to give better professional advice and make decisions more wisely than men.

The other individual attribute that affects decision-making is the dimension of age. While it has not been discussed extensively in the finance literature, it is examined in behavioral management studies. For example, Schubert (1988) analyzed how age is related to leadership style and found that more senior leaders tend to use more passive methods than younger leaders. Younger leaders tend to embrace the latest, most innovative practices because they have a higher risk tolerance than senior leaders. Ouimet and Zarutskie (2014) found that young workers dominated in young firms. They made highly creative contributions in high-tech industries and then pushed businesses to create more growth. On the other hand, they argued that young companies have a higher probability of failure, possibly due to the behavior of their young, risk-taking workers. Based on this research, we can conclude that younger people are more creative, innovative, and risk-taking, while older people are more cautious. In the literature on non-performing loans, two factors prompt people to pay their debts: their ability to pay and their willingness to pay. Based on the previous research, people who have higher risk-taking behavior tend to have a higher probability of defaulting on their debt payments (Arya et al., 2013).

Debtor-attributes information also includes the amount of collateral for the loan. Capponi and colleagues (2020) argued that collateral is an important factor affecting credit risk. Brigo, Morini, and Pallavicini (2013) asserted that collateral is a critical requirement for prompt installment payments. Collateral reflects the symmetry of risk between lenders and debtors, that is, lenders require high collateral when facing a high credit risk (Brigo, Liu, Pallavicini, & Sloth, 2014; Gregory, 2012, 2015; Saunders & Allen, 2010). Manove, Padilla, and Pagano (2001), however, observed that high collateral requirements increase the probability of defaulting. Two theoretical suppositions underpin this interpretation. First, being willing to offer a high amount of collateral to lenders implies an imminent risk of bankruptcy, as debtors urgently need more funds to operate their companies. Second, lenders impose high collateral requirements when they are unable to prove their credit analysis accurately. Thus, lenders require it as compensation for carrying a higher credit risk.

However, this study does not entirely agree with the statements above. This research argues that high collateral requirements stem from asymmetric information between debtors and lenders. They represent the second way to increase debtors’ moral obligation to repay their debt. These requirements also minimize the lenders’ adverse selection bias when making loan decisions. Many previous studies also noted that high collateral requirements positively affect the probability of loans being repaid. In Indonesian society, the land or home deed is viewed as the best form of collateral.

**METHODS**

The research uses individual debtors’ data from a sample of microfinance transactions collected by an independent non-formal organization in Klaten. The sample size was 175 debtors. The data consisted of the loan status (LS) as a proxy of credit default, debtors’ age (DA), debtors’ gender (DG), and debtors’ collateral information (DCI). The loan status reflects whether the debt is in default. This research categorized the loan status into dummy variables: 1 for performing loans and 0 for non-performing loans. The debtors’ collateral information is categorized into two types. The first is a guarantee in the
form of a land or home certificate. The second is any other kind of collateral. This variable was categorized into dummy variables: 1 for a land/home certificate and 0 for other collateral types.

This study examines the relationship between debtor-attributes information and the rate of performing loans. It employs the likelihood of achieving credit as the dependent variable. Debtors’ age, gender, and collateral type are considered debtor-attributes information. Therefore, they are used as independent variables in this study. In addition, this research includes the loan size, payment period, and interest rate as control variables because it uses dummy values for both the dependent and independent variables. Therefore, it employs logistic regression analysis to analyze and estimate the data. The equation below explains how logistic regression works.

\[ P_l = F(Z_i) = (\beta_0 + \beta_1, X_i) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(\beta_0 + \beta_1, X_i)}} \]

Thus the probability of the loan status will be default or not is,

\[ P_l = \frac{1}{1 + e^{-Z_i}} \]

if we multiply the right side of the probability with \( e^{Z_i} \), it will produce the equation.

\[ P_l = \frac{e^{Z_i}}{1 + e^{Z_i}} \]

\[ 1 - P_l = 1 - \left( \frac{1}{1 + e^{Z_i}} \right) = \frac{1}{1 + e^{Z_i}} \]

Therefore, we can calculate the ratio of the credit default and the performing credit.

\[ \frac{P_l}{1 - P_l} = \left( \frac{1}{1 + e^{Z_i}} \right) \left( \frac{1 + e^{Z_i}}{1} \right) = e^{Z_i} \]

We can transform the equation above into logarithm natural (Basheer & Ibrahim)

\[ \ln \left( \frac{P_l}{1 - P_l} \right) = Z_i \ln e = Z_i \]

\[ \ln \left( \frac{P_l}{1 - P_l} \right) = Z_i = [ \beta_0 + \beta_1, DA_i + \beta_2, D(DG_i) + \beta_3, D(DCI_i) + \beta_4, PP_i + \beta_5, INT_i + \beta_6, SIZE_i + e_i ] \]

Where,

- \( DA_i \) = the age of the debtor i
- \( D(DG_i) \) = the debtors’ gender. 1 for man, 0 for women
- \( D(DCI_i) \) = the debtors’ collateral information. 1 for land/home certificate, 0 for the others
- \( PP_i \) = the payment period
- \( INT_i \) = the interest rate of the debtors’ loans
- \( SIZE_i \) = the debtors’ total loans

**RESULTS AND DISCUSSION**

**Results**

This research used data from 175 debtors to non-formal microfinance organizations in Central Java. Table 1 illustrates the sample used in this study and provides the basic statistics of the debtor-attributes information, such as gender, collateral type, basic, age, payment period, interest rate, and loan size.
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Table 1
Descriptive Statistics of the Variables

|                  | Size of Loans (IDR) | Interest Rate (P/A) | Payment Period (monthly) | Age |
|------------------|---------------------|---------------------|--------------------------|-----|
|                  | Mean                | Std. Dev            | Mean                     | Std. Dev |
| Gender           | Male                | 28,634,259          | 34,741,341               | 15.38 | 2.95 |
|                  | Female              | 23,590,909          | 29,230,636               | 15.20 | 2.86 |
|                  | Home/Land Certificate | 38,587,838         | 45,358,795               | 15.17 | 3.04 |
| Collateral       | Not Home/Land Certificate | 17,940,000     | 13,257,984               | 15.44 | 2.81 |

Source: Data Analysis

Figures 1 and 2 summarize these statistics. Figure 1 insists on comparing the loan size between male and female debtors. In contrast, Figure 2 presents the interest rate for loans based on gender and the presence of a home/land certificate as collateral.

**Figure 1**
The Size of Loans
Sources: Data processes (2020)

**Figure 2**
The Interest Rate
Sources: Data processes (2020)
According to Table 1 and Figure 2, loans that are assured by a house or land certificate tend to be larger and have a lower interest rate than others. These findings implicitly prove the theoretical foundation of this study: lenders require a home or land certificate as collateral to minimize credit risk. Larger loans implied a higher possibility of default, and lenders asked for high-quality collateral to mitigate the risk. Lower interest rates indicated that lenders felt safe extending more credit after receiving a secure type of collateral. However, a deeper analysis of Figure 2, which compares the interest rate between genders (male and female) and collateral types (presence/absence of a home/land certificate), shows that these variables have a very limited effect on the interest rate. This means that gender and collateral information do not influence lenders in determining the level of interest charged. Instead of being affected by demand-side factors, the interest rate is more likely to be responsive to supply-side factors, such as banking-specific financial performance and macroeconomic indicators. Moreover, such supply-side factors probably influence the size of loans. This paper presents a statistical analysis of the data in Table 2.

Table 2
Results of Logistic Regression Analysis

| Probability of Performing Loans |  |
|---------------------------------|---|
| Constant                        | 4.12 (1.32) |
| Debtors’ Age (DA)               | 0.80 (2.17)*** |
| Debtors’ Gender (DG)            | -0.02 (-0.11) |
| Debtors’ Collateral Information (DCI) | 0.44 (1.91)*** |
| Payment Period (PP)             | -1.09 (-2.55)*** |
| Interest Rate (INT)             | -8.15 (-1.91)*** |
| Size of Loans (SIZE)            | -0.10 (-0.60) |
| Chi-Square                      | 20.55 (0.000) |
| McFadden R-Square               | 0.10 |

*** A significant level is 5%.
Source: Data analysis (2020)

Discussion
Based on the results, the logistic model used in this research is robust, as shown by the value of the Chi-square (0.002 < 0.05). This analysis confirms hypotheses 2 and 3. They are proven by the probability values of debtors’ age and debtors’ collateral type, which are under 0.05. However, the results indicate that the probability value of debtors’ gender is above 0.05, which disproves the first hypothesis. Beyond these research hypotheses, the analysis found that payment periods and interest rates significantly affect loan performance. According to Table 2, the z-values of debtors’ age and debtors’ collateral are 2.18 and 1.90, respectively. This means that older debtors are as much as 2.18 times less likely to default, whereas securing a loan with a home or land certificate will raise performance as much as 1.90 times. This research also found that the two other explanatory variables significantly affect performing loans, with z-statistics of -2.25 for
the payment period and -1.90 for the interest rate. That is, the longer the payment period and the higher the interest rate, the more likely the debtor will be unable to pay.

According to the analysis, debtors’ gender is not significantly related to loan performance. This means that females and males have an equal probability of having performing loans. In other words, this study insists that performing loans are not related to gender, but rather, are influenced by specific attributes associated with it, such as age. This result is not in line with some previous research that found gender to be a determinant factor in loan performance, possibly due to this study’s distinct sociocultural research sample. Many previous studies were conducted in Western countries where people make decisions independently, including those about their finances. The culture is slightly different in our research setting, Central Java, Indonesia, where people have limited freedom in decision making (Anderson, Reynolds, & Gugerty, 2017; Agarwal & Mazumder, 2013; Kenkel, 1961; Lackman & Lanasa, 1993; Osanya, Adam, Otieno, Nyikal, & Jaleta, 2020; Permana, Aziz, & Siong, 2015), particularly when seeking loans. For instance, the wife has always asked her husband’s opinion when making financial decisions, and the choice to take out a loan in Central Java has always been made with both parties’ approval. Thus, it is quite difficult to assess loan performance based on individual gender, especially since most people in our research sample are married. Therefore, it is plausible that our study found that gender does not affect loan performance. This is in line with Setargie (2013), who determined that gender was not the primary factor in performing loans. The author argued that instead of considering how individual gender affects credit performance, we should investigate how the effective control mechanism determines loan quality. Campbell, Loumioti, and Wittenberg-Moerman (2019) asserted that gender-associated discrepancies in loan performance were not dependent on gender itself, but were likely derived from related soft information such as individual psychology.

This study discovered that debtors’ age positively affects loan performance, with older debtors tending to have a higher probability of meeting their payment installments ($p < 0.05, z > 1.96$). This is congruent with many previous studies that found a significant relationship between debtors’ age and loan performance (Gonzalez & Loureiro, 2014; Özdemir & Boran, 2004). For instance, Gonzalez and Loureiro (2014) argued that loan success is substantially affected by debtors’ age. They noted that older debtors suffered less from heuristics and biases in decision making. Therefore, they faced lower credit risk because they did not seek to aggressively enhance their capital.

Older debtors have a more mature way of thinking than younger debtors. They are usually more cautious with their money and use their funds to finance their businesses. This leads to lower credit risk due to less reactive financial decision-making. Raharja et al. (2017) provided empirical evidence of how over-reactive decision-making severely harms financial performance. The results suggest that debtors’ age is a practical consideration in credit performance, which may be particularly useful when formulating a credit scoring mechanism. In such a tool, debtors’ age should be entered in the system as a primary credit approval variable.

Debtors who give their land or home certificate as collateral tend to have a higher probability of repaying their loans (see Table 2). This is statistically significant ($p < 0.05, z > 1.96$). These findings are similar to those of previous studies that also observed the critical role of collateral in alleviating the risk of defaulting (Chen & Kao, 2011; Coco, 2000; Cossin & Hricko, 2003; Adebisi & Matthew, 2015; Heider & Hoerova, 2009; Hull & White, 2014; Jiménez & Saurina, 2004; Karumba & Wafula, 2012; Steijvers & Voordeckers, 2009).
Most people value their land and home as primary assets. Indeed, they would be reluctant to lose them and would therefore strive to maintain these investments. In an experimental study to prove this claim, Mandala et al. (2012) showed that loans with a more valuable source of collateral (i.e., home, land, car) are more likely to perform better than loans with less valuable collateral. Lenders should consider requiring valuable collateral (i.e., a land or home certificate) for loans with a higher credit-risk score to encourage debtors to pay.

As mentioned earlier, this study found that higher interest rates are negatively associated with loan performance. This is statistically proved by a p-value below 5% (p < 0.05) and a z-value above 1.96 (z-value > z-statistic). The higher the interest rate charged, the higher the probability will be that debtors will default. It is widely accepted that lenders charge higher interest rates to offset higher credit risks when channeling loans. Therefore, finding a significantly negative correlation between high-interest rates and loan performance is not surprising. The result is in line with those of previous scholars, who also noted the negative effect of high rates of interest on credit performance (Altavilla, Boucinha, & Peydró, 2018; Collins & Wanjau, 2011; Cadena & Schoar, 2011; Chen, Cheng, & Wu, 2013; Fabozzi, Mann, & Choudhry, 2003; Liao, Li, & Wang, 2014; Van Deventer, Imai, & Mesler, 2013; Vickery, 2008).

As Table 2 shows, this study statistically proved that longer payment periods have a significantly negative relationship to loan performance, with a p-value below 5% (p < 0.05) and a z-value above 1.96 (z-value > z-statistic). This means that the longer the loan period is, the higher the risk of defaulting. The following equation for loan instalment payments illustrates this finding:

$$VoL_M = LIP$$

Based on the equation, the loan value at the maturity date ($VoL_M$) equals the sum of loan installment payment ($LIP$).

$$LIP = \left[\frac{L}{n}\right] \times (1 + i)^n$$

$LIP$ is the result of dividing the loan ($L$) by the payment period ($n$) multiplied by 1 plus the interest rate ($i$), then multiplied by the payment period ($n$). If the payment period ($n$) increases, the loan value at the maturity date ($VoL_M$) also rises.

If the amount of the loan is large and the loan period is long, the more money the debtor will be required to pay the lender before it matures. These conditions increase the debtor’s risk of being in default. Therefore, the evidence regarding the significant negative relationship between the payment period and performing loans is logical. This result aligns with previous studies that found that more extended payment periods increase the credit risk (Wang, Zhao, & Peng, 2018; Karan, Ulucan, & Kaya, 2013; Wilson, Summers, & Hope, 2000). For instance, Mandala, et al. (2012). Moreover, simulations found that along with the amount of collateral, the payment period plays a critical role in loan performance. Loans with a payment period of less than 34 months had a greater likelihood of repayment than those with more extended schedules.
CONCLUSION

This study examines the relationship between demand-side factors, such as individual debtors’ attributes, and the probability of successfully repaying loans. This information is essential to microfinance development. Many previous studies have neglected to pay attention to the role of behavioral attributes in credit default. Some earlier scholars overemphasized supply-side credit performance factors, such as banking-specific financial performance and macroeconomic indicators, and largely ignored demand-side aspects. Employing unique data from a micro-lending organization in Klaten, Central Java, this study uses a logistic regression model to analyze the effects of demand-side variables on loan performance.

The results show that debtors’ age and collateral information significantly influence non-performing loans in the non-formal microfinance sector. Collateral information is related to the type of collateral debtors use to guarantee their credit. This study found that securing a loan with the deed to a home or land decreases credit risk. This result supports Karumba and Wafula (2012), who implied that the higher value of this form of collateral would indirectly increase the debtor’s moral obligation to pay each installment. Therefore, employing this type of collateral as a prerequisite for extending credit will increase the probability of repayment.

Moreover, the study revealed that debtors’ age significantly affects loan performance. It found that older debtors are more likely to be responsible borrowers, while younger debtors are more prone to default on paying their installments. Moreover, this research found no significant effect of the debtors’ gender on non-performing loans.

This study offers practical solutions to lenders on decreasing credit risk while improving the probability of loan repayment. They should also consider other explanatory variables such as the payment period and interest rate. Indeed, our results show that longer payment periods and higher interest rates have a significantly adverse effect on debtors’ ability to cover their loans.

In the future, scholars should investigate other aspects of debtors’ behavior in making credit decisions. As we previously noted, the success of repayment is related not only to debtors’ ability to pay, which is influenced by the attributes discussed in this study, but to their willingness to pay. Future research on debtors’ behavior should concentrate on this aspect of debt repayment. More research is also needed to help lenders formulate credit-analyzing tools to facilitate sustainable microfinancing.

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