

Determinants of Home Loan Delinquency: The case of IDLC Finance Limited

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***Abstract:** While analyzing the loan delinquency behavior of home-loan borrowers of a Bangladeshi non bank financial institution, this paper investigated the determinants of home-loan delinquency. The primary contribution of the research delineated in this paper is to demonstrate the importance of borrower specific characteristics in determining the risk of credit loss on housing loan repayment for the lending institutions. It has been documented that the financial aspects of customers have significant influence on timely home-loan repayment risk. Firstly, customers with high loan to value ratio, high fixed obligation to income, higher debt burden ratio and higher installments to income ratio force the borrowers to become delinquent. Secondly, for the lending institutions the behavioral aspects should also be strongly considered, since it is evidenced in developing countries like Bangladesh, that though the customers might have high income or high property value yet they might be delinquent because of lack of their willingness to repay timely.*

***Keywords:** Home loan, delinquency, logit model, financial variables, behavioral variables, robustness, credit risk.*

1.0 Introduction:

Understanding the delinquency behavior of the borrowers has occupied a critical place in lending literature for several reasons. Delinquency is costly to both borrowers and lenders. For borrowers, delinquency costs include penalty fees and a lower credit rating. For lenders, slow loans may be almost as costly as loans that reach default. Effective fund utilization through better and efficient credit management is a necessary condition for short term profitability and long term sustainability for any lending institutions (Khalily and Mayers, 1993; Ho and Yusoff, 2009). This becomes more crucial for specialized non

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bank financial institutions (NBFIs) as they lend the borrowers by borrowing from credit market with high cost of fund. Therefore, identifying the factors that drive delinquency is more important for NBFIs than conventional lending institutions like banks. There have been few studies that incorporated both the financial and behavioral aspects of borrowers in evaluating the credit risk of financial institutions, especially banks (Sullivan, 1987; Kumar 2010). But there have been a vacuum in the literature related to delinquency in general that focused on specialized financial institution like NBFIs.

One of the important sectors, where NBFIs make huge investment is real estate where delinquency behavior of borrower creates a survival challenge for them. Despite its great economic and social potential, housing finance as a sector remains highly underdeveloped and underprivileged in Bangladesh until recent days. There are some studies that focused on the demand for housing (Rahman, 2004), trend of housing finance in Bangladesh (Mina, 1991) and even on the increasing need for institutional credit in housing sector (Huda and Kamal, 1998), but these studies provided us only subjective aspect of this area. Moreover, there are studies that considered specialized financial institution like Bangladesh Shilpa Rin Sangstha (BSRS) to scrutinize the loan repayment performance (LRP) of long-term industrial projects financed (Mohiuddin, Hoque and Islam, 2007). Sharma and Zeller (1996) analyzed the repayment rates of credit groups belonging to three group-based credit programs in Bangladesh: the Association for Social Advancement (ASA), the Bangladesh Rural Advancement Committee (BRAC), and the Rangpur Dinajpur Rural Service (RDRS).

In Bangladesh, unfortunately the housing sector financed by NBFIs, has long been an under studied area. So NBFIs strongly require to identifying and properly addressing the variables that stimulate the delinquency by the borrowers. These provide a strong ground to investigate the determinants of home loan delinquency in Bangladesh. In this study, an attempt has been made to analyze the influence of both the financial and behavioral aspects of delinquent home loan borrowers on the credit risk taking 100 borrowers of IDLC Finance Limited. The analysis provides information that will allow home loan providers to improve assessments during loan sanction procedure and later to implement strategies that improve the default resolution process.

The rest of the paper is divided into the following sections: Section 2.0 is the review of the related literature. Section 3.0 is the research methodology focusing on the variables and hypotheses thereby specifying the model and also on the data with descriptive statistics. The following section 4.0 is the empirical estimation and analysis that concerned with the estimation strategy and robustness of the findings followed by conclusion and policy implication in the section 5.0.

2.0 Literature review:

The most commonly mentioned causes of delinquency of home loan in the literature are: borrowers personal characteristics, unemployment, marital status, credit history, age, trigger events (like divorce, loss of a job, accident or sudden death), purpose of purchase, income of the borrower, payment to income ratio, credit score, loan tenure, location, easing of lending norms, lending standards, negative equity, loan to value ratio (LTV), contemporary economic condition, default cost, default as a rational decision, decision to relocate, wealth maximization etc.

There are relatively few studies on home loan delinquency both in developed and developing countries like Bangladesh. Early studies of mortgage delinquency include Herzog and Earley (1970), Von Furstenberg (1974), Morton (1975) and Campbell and Dietrich (1983), that examined the relationship between delinquency and various loan and borrower characteristics. Herzog and Earley (1970) found that LTV and the presence of junior financing have a positive effect; income stability, measured by type of occupation, has a negative effect whereas the term of the loan and payment-to-income ratio are found to have no affect on delinquency. Von Furstenberg (1974) has documented a consistent nonlinear relationship between default incidence and the age of the mortgage. Morton (1975) showed that variables capturing home equity and a borrower's ability to pay are less systematically related to delinquency. Campbell and Dietrich (1983) considered possible borrower action at each point in time and found that borrowers are assumed to select the action that yields the highest utility. The authors found that household income, interest rates, LTV and unemployment rates are more influential in explaining home loan delinquency.

Another approach to analyzing home loan delinquency considers the impact of income and expense shocks on borrowers' decisions to delay mortgage payments. Webb (1982) examines potential delinquency using increases in mortgage payment-to-income ratio over time as a proxy and found that households headed by persons in occupations with high income variability are more likely to become delinquent. Also, mortgages with a high degree of variability in payments are more likely to become delinquent.

Gardner and Mills (1989) recognized that delinquent borrowers do not necessarily end up in default, employing a logit regression model to estimate the probability of default for currently delinquent loans. Kau and Keenan (1998) treated default as a rational decision and provided the entire distribution of defaults' severity that are both disperse and skewed. The severity distribution shifts more than in proportion to the rise in the loan to value (LTV) ratio.

Several studies found that the loan-to-value (LTV) ratio is a key variable in explaining the probability of home loan default (Ingram and Frazier (1982), Campbell and Dietrich (1983), Vandell and Thibodeau (1985), Mills and Lubuele (1994), Deng et al. (1995)).

Lee (2002) has identified the ‘purpose of purchasing real estate property’ is one of the key determinants of delinquency and thereby default risk. If the borrowers purchase new houses for the purpose of personal investment instead of owner-occupied housing, then they will transfer part of their risk to the financial institutions by paying smaller down payments and decreasing their initial equity commitment as much as possible. Therefore, when the market price of collateral falls sharply or economic performance becomes much worse, the property frequently will be abandoned by the owners thereby limiting their loss.

Getter (2003) complemented these finding by using the 1998 Survey of Consumer Finances to show that borrowers use other non-housing financial assets to help make payments during unexpected periods of financial stress. Consistent with prior findings, Chinloy (1995) found that in the United Kingdom during the period 1983 through 1992, LTV and income were the primary covariates associated with delinquency. Other studies by Baku and Smith (1998), Calem and Wachter (1999), Ambrose and Capone (2000), have also found that credit scores, contemporaneous economic conditions, and the incentive structure of the lender all can impact delinquency.

Vandell (1978) and Campbell and Dietrich (1983) found a positive relationship while other studies found a negative relationship (Springer and Waller, 1993; and Cunningham and Capone, 1990) with regards to borrower related characteristics where they considered the payment-to-income ratio is a popular ability-to-pay measure. Other studies focus on the wealth of the individuals and household income (Canner et al., 1991; and Berkovec et al., 1996), age (Capozza et al., 1997), and the number of years of job tenure (Cunningham and Capone, 1990).

Böheim and Taylor found that age was important: old heads were less likely to experience housing finance problems. Households with higher income and at least two members earning in a households were also less likely to face housing finance problems. Orla and Tudela (2005) found that persistence in mortgage payment problems was greater among households in which the head was 35 years old or over than it was among households headed by younger individuals. That is, younger households are more capable of getting out of problems than those aged 35 or over.

Based on the above literature that focused on home loan delinquency, we identified our variables and formulated hypothesis to find out the determinants that influence the

delinquency behavior of the borrowers, focusing on 100 customers from IDLC Finance Limited.

3.0 Hypotheses:

In researching the determinants of home loan delinquency of IDLC, some variables have been identified that have influence on the probability of delinquency by the borrowers. While evaluating the credit standing and profile of a particular customer, IDLC home loan credit team also focuses on these variables.

Table 1: Determinants of delinquency--Variables definition, Code and Expected signs of influence

Variables	Code	Description of variables	Hypothesis	Expected sign
Delinquency	<i>DELIQ</i>	Delinquent Loan, 1 if customers are late on their payments as scheduled; 0 otherwise		(Dependent variable)
X ₁	<i>Age</i>	Age of head of household at the time of loan (as indicated in the data base)	The more young a customer, the less chance that he will become delinquent	(-/+)
X ₂	<i>MatS</i>	Marital status, 1 if household head is divorced or separated; 0 otherwise	If married the chance of being delinquent is high	(+)
X ₃	<i>NoDep</i>	Number of children under 18	The more the number of children higher the chance of being delinquent	(+)
X ₄	<i>LnIn</i>	Household income, Log of household income	Higher the income lower is the tendency to be delinquent	(-)
X ₅	<i>Prof</i>	Profession, 1 if businessman otherwise 0	Businesspersons tend to be delinquent more than executives	(-/+)
X ₆	<i>LnPropVal</i>	Log of Property value	Higher the property value lower is the tendency to be delinquent	(-)
X ₇	<i>DBR</i>	Debt Burden Ratio	Customers with high debt burden ratio tend to be delinquent	(+)
X ₈	<i>IIR</i>	Installment to Income Ratio	Customers with high installment to income ratio tend to be delinquent	(+)
X ₉	<i>FOIR</i>	Fixed Obligation to Income Ratio	Customers with high fixed obligation to income ratio tend to be delinquent	(+)
X ₁₀	<i>LTV</i>	Loan to Value Ratio	Customers with high loan to value ratio tend to be delinquent	(+)

3.2 Model specification:

In this research, the dependent variable delinquent customer equals 1 if the house-loan is not repaid on schedule i.e, customers who are late on their payments and 0 if otherwise. The model is expected to yield the predicted probability of delinquency in housing loan repayment. An empirical examination of the influence of income variables, credit history variables and demographic variables will facilitate in determining the credit risk or delinquency possibility.

At first a descriptive statistics has been given to interpret the characteristics of the sample. As the dependent variable in this study is dichotomous in nature, so a logit model is applied to determine the probability of delinquency (Lawrence and Arshidi, 1995). Though, econometrically, it can be modeled through linear probability model applying the Ordinary Least Square (OLS) technique but since the error term in this technique suffers from heteroskedasticity, this should be avoided. Moreover, as the dependent variable is dichotomous, the conditional probability may fall outside the permitted range or logical limits (0, 1) in OLS. The other logic for using logit model is that it assumes a logistic function rather than normal distribution for its cumulative density function like probit model. In the empirical study the Logit model shows the contribution of each variable on the probability of a borrower to default. Ten variables have been included in the model to explain the probability.

DELIQ = f [Age(X_1), Marital status(X_2), Number of children(X_3), Log of household income(X_4), Profession(X_5), Log of Property value(X_6), Debt Burden Ratio(X_7), Installment to Income Ratio(X_8), Fixed Obligation to Income Ratio(X_9), Loan to Value Ratio(X_{10})]

Here dependent variable is Delinquency where *DELIQ* =1 if the borrower delays on repayment and otherwise 0.

3.3 Data:

Primary data regarding the delinquent home loan customers of IDLC Finance Limited have been collected from the real estate customer service and collection departments of IDLC. In researching on this topic, the stratified sampling method has been followed. The dependent variable of the study is the delinquency of the home loan. The customers have been categorized into two stratum based on their repayment performance for the period of 2009. The complete list of the delinquent borrowers and regular customers has been collected from whose loan contracts are ongoing and two samples from the two stratum

have been randomly selected as showed in Table-2. The study is based on a sample size of eighty customers from the regular customers, i.e., non-delinquent customer category and a sample size of twenty customers classified as delinquent customer category.

Table 2: Screening process of the sample

300 borrowers selected on a random basis and then categorized into two stratum based on their repayment performance	
Excluded from the sample are:	
Those who have partially taken loan amount during the period of study	72
Those who failed to repay full amount of pre-disbursed interest	23
Those who have a business transaction of less than three years	55
Those who have made a early-settlement or reschedule the loan	50
Total number of customers selected for study	100

Following this screening process, any classified or non-classified loan customers or home loan borrowers would qualify for inclusion in the sample. Our data shows that, 80 percent of the samples were regular borrowers and 20 percent were delinquent customers.

3.4 Descriptive Statistics:

The descriptive analysis has actually provided a summarized picture of the data of the independent variables both for the delinquent and regular customer categories. Descriptive statistics are presented in Table-3.

Table 3: Descriptive Statistics of Delinquent and Regular Customers

Variables	Regular Customers (N=80)		Delinquent Customers (N=20)	
	Mean	Standard Deviation	Mean	Standard Deviation
Age	48.89	5.93	47.83	6.15
Income Level	85381.62	77047.09	73937.50	42844.26
Debt Burden Ratio (DBR)	0.3500	0.1416	0.5610	0.1076
Installment to Income (IIR)	0.2966	0.1432	0.4985	0.1722
Fixed Obligation to Income (FOIR)	0.7078	0.1574	0.8730	0.1113
Loan to Value (LTV)	0.3891	0.1512	0.6485	0.0592
Log of Property Value	15.39	0.0467	13.75	0.0332

The table shows that the average age of the regular borrowers centers around 49 years (approx) while that of delinquent borrowers is 48 years (approx), indicating that young borrowers are more aggressive towards risk and are more likely to default earlier than the matured ones. The income levels of regular borrowers are higher than that of delinquent borrowers, implying that borrowers with more regular income tend to become less delinquent. Similarly, the debt burden ratio (DBR) and installment to income ratio (IIR) logically supports the argument that lower DBR and IIR helps the borrowers to repay the loan as scheduled. The average of loan to value (LTV) shows that LTV is lower for regular borrowers than that of delinquent ones. And similar justified result is found in case of log of property value that the average value of property is higher for regular borrowers.

4.0 Empirical Estimation and Analysis:

4.1 Estimation Strategy and Test of Robustness:

Logistic regression is a simple and appropriate technique for estimating the log of the odds of default as a linear function of loan application attributes. A logistic model has the flexibility of incorporating both the qualitative and quantitative factors and is more efficient than the linear regression probability model.

Burrows (1997) used a logistic regression to model the likelihood of households being in arrears of three months or more. The results suggested that households were more likely to be in arrears if they had a 100% mortgage, were employed part-time or unemployed or unable to work, worked in the private sector (relative to the public sector).

Lawrence and Arshidi (1995) used the logit model using a series of borrower and bank variable to analyze the management of problem loans and to determine the resolution choice. Logit model was also used by Campbell and Dietrich (1983) to show that the age of the mortgage, the LTV ratio, interest rates and unemployment rates significantly explain mortgage prepayment, delinquencies and defaults. Logit, probit and discriminant analysis are the most commonly used research methodology to examine factors for different level of default risk. Jackson and Kaserman (1980) used multivariate regression and probit analysis to measure default risk. Charitou, Neophytou and Charalambous (2004) found that the logit method is superior to other methods in predicting defaults. The popularity of logit method is mainly due to the fact that no assumptions are imposed on variables, with the exception of missing values and multi collinearity among variables. Contrary to this, non-parametric methods can deal with missing values and multicollinearity (or correlations) among variables, but often are computationally demanding.

So in our analysis we preferred the logit model where we are actually predicting the probability of a housing loan delinquency based on ten financial and non financial (qualitative borrower characteristics) factors for data of 100 borrowers (20 percent delinquent and 80 percent regular). But when we applied the logit analysis, we got seven variables to be better and that is why we considered seven variables in the final model.

$$DELIQ = \beta_0 + \beta_1 LTV + \beta_2 DBR + \beta_3 Prof + \beta_4 NoDep + \beta_5 Age + \beta_6 LnIn + \beta_7 FOIR + \mu_i \dots \dots \dots \text{Model 1}$$

For testing the robustness of our model we have changed the variables in Model-2 and Model-3, which also helped to test the stability of our findings. We could have test stability of findings through variation of sample size but we preferred changes in variables method since our data size is limited. We incorporated IIR in the Model 2 instead of DBR.

$$DELIQ = \beta_0 + \beta_1 LTV + \beta_2 IIR + \beta_3 Prof + \beta_4 NoDep + \beta_5 Age + \beta_6 LnIn + \beta_7 FOIR + \mu_i \dots \dots \dots \text{Model 2}$$

In the Model 3, we took log of property value instead of log of income.

$$DELIQ = \beta_0 + \beta_1 LTV + \beta_2 DBR + \beta_3 Prof + \beta_4 NoDep + \beta_5 Age + \beta_6 LnPropVal + \beta_7 FOIR + \mu_i \dots \dots \dots \text{Model 3}$$

4.2 Results and Findings:

The outcome of the test (Table 4) is consistent with the expectation that clients with a given set of attributes have higher probability to be delinquent. The Wald chi-square for all the three models having values of 33.90, 34.78 and 53.21, with p-values of 0.00001, depicts that our models as a whole fits significantly better. The resulting signs of the coefficients for most of the explanatory variables are consistent with expectation. We changed the core variables in three models and found that results are consistent in each model which strongly supports that our findings are stable and robust.

The positive coefficient of *LTV* is statistically significant at 1 percent level for all the three models and implies that customers with high loan to value ratio tends to be delinquent more and accepts our hypothesis. Similarly, *FOIR* produced the positive coefficients, statistically significant at various significance levels, correctly justifies that the customers with high fixed obligation to income are highly pressurized to be delinquent. The *DBR* with positive coefficient is statistically significant at 5 percent, logically defends the fact that higher debt burden ratio higher is the chance of being in the delinquent loan category. Similarly when we replaced the *DBR* with *IIR* in Model-2, it gave the expected positive sign with statistically significant at 5 percent, supported the fact that customers with lower or fewer installments to income ratio tends to be in the regular loan group. So, all these financial aspects of borrowers strongly determine the tendency of delinquency by home loan borrowers (Dunn and Kim (1999)).

Table-4: Logistic regression of dichotomous variable Delinquent loan

Explanatory Variables	Model 1	Model 2	Model 3
<i>LTV</i> (Loan to Value)	0.2514 (3.17) [0.001]*	0.3041 (4.19) [0.000]*	0.2987 (3.35) [0.0005]*
<i>Age</i> (Age of the borrower)	-0.2632 (-1.38) [0.0845]***	-0.332 (-1.46) [0.0725]***	-0.2595 (-1.38) [0.0845]***
<i>DBR</i> (Debt Burden Ratio)	0.1159 (1.77) [0.039]**		0.0996 (1.67) [0.047]**
<i>Prof</i> (Profession)	-1.608 (-1.47) [0.0705]***	-1.563 (-1.37) [0.0845]***	-2.171 (-2.19) [0.014]**
<i>NoDep</i> (Number Of dependents)	-1.248 (-1.65) [0.0495]**	-1.128 (-1.67) [0.0475]**	-1.361 (-1.88) [0.030]**
<i>LnIn</i> (Log of Income)	0.7362 (0.51) [0.305]	1.652 (1.14) [0.126]	
<i>FOIR</i> (Fixed Obligation to Income)	0.0784 (1.49) [0.0685]***	0.0902 (1.91) [0.028]**	0.113 (1.63) [0.051]***
<i>IIR</i> (Installment to Income)		0.0600 (1.97) [0.0245]**	
<i>LnPropVal</i> (Log of Property Value)			1.712 (0.99) [0.1625]
CONSTANT	-20.697 (-1.06) [0.288]	-28.907 (-1.29) [0.0985]	-41.895 (-1.23) [0.1085]
Number of Observations	96	96	96
Log pseudolikelihood	-10.093	-11.182	-9.238
Wald Chi ²	33.90	34.78	53.21
Prob>Chi ²	0.0000	0.0000	0.0000
Pseudo R ²	0.7666	0.7415	0.7864

*** significant @10percent, ** significant @5 percent, * significant @1 percent

Log of Income used in Model 1 & Model 2 and log of property value used in Model-3, does not provided the expected sign, though statistically not significant and does not comply with our hypothesis. But it supported the findings of Lawrence and Arshidi (1995), that borrower with high profile tends to default more despite their credibility. So, the character of a borrower in repaying the loan is more difficult to assess but extremely important for lending institutions (Koch and McDonald (2000)). In this paper we took the proposition that businesspersons generally have less stable income as businesses are by nature risky, but our analysis did not support that as it gave negative coefficients which are statistically significant at 10 percent in Model 1 and 2 & at 5 percent in Model 3. This can be argued that as the businessmen take high risk it is obvious to earn high return too.

Though our hypothesis regarding the age of the borrower was that the young the borrower, the less the chance of being delinquent, but our analysis showed that it has a negative coefficient (statistically significant at 10 percent) which contradicts the established literature. This might be because of socio-economic and cultural differences between developed and developing country like Bangladesh. More over it can be argued that in Bangladesh the lending institutions usually does not have any arrangement, like developed countries, which enable them to auto-credit the loan installment from the salary of the borrowers. So it can be said that young borrowers are more aggressive towards risk and are more likely to default earlier than the matured ones.

5.0 Conclusion and Policy Implications:

In this study, the primary objective was to analyze the influence of both the financial and behavioral aspects of delinquent home loan borrowers on the credit risk. Using 100 housing loan accounts (for the period of 2009) data from a renowned NBFIs of Bangladesh; we investigated the crucial factors that drive the borrowers to be delinquent. The primary contribution of the research delineated in this paper is to demonstrate the importance of borrower specific characteristics in determining the risk of credit loss on housing loan repayment for the lending institutions. It has been documented that the financial aspects of customers have significant influence on timely home-loan repayment risk. Firstly, customers with high loan to value ratio, high fixed obligation to income, higher debt burden ratio and higher installments to income ratio force the borrowers to become delinquent. Secondly, for the lending institutions the behavioral aspects should also be strongly considered, since it is evidenced in developing countries like Bangladesh, that though the customers might have high income or high property value yet they might be delinquent because of lack of their willingness to repay timely.

The findings of this study are consistent with the literature and most the variables used in three different models collaborates with the earlier studies done in different countries by

other researches. In Bangladesh, the study on delinquency of home loan borrowers is first of its kind to the best of authors' knowledge and thus it directly and strongly contributes in the home loan delinquency literature in general and in specific for developing countries like Bangladesh.

An active system of housing finance provides real economic benefits and positively influences savings, investment, and household wealth. It provides opportunities for low/middle income house-holds to own their real assets. Unfortunately in Bangladesh, house-finance remains underdeveloped until recent days. Though the House Building Finance Corporation (HBFC) has been the traditional dominant player in housing finance sector, now many domestic and international commercial banks and a few new specialized institutions have entered into the market, and have significant potentials for growth. With increase in competition, predicting future loan delinquency is extremely important for house-finance providers to minimize the operating cost in short run and to ensure sustainability in the long run.

This study analyzed the loan delinquency behavior of limited number of samples of a Bangladeshi non bank financial institution. Although the findings are consistent with the earlier findings, nevertheless validity of these finding may be strengthen with large samples drawn from all or sampled NBFIs. Moreover, limited samples have restricted us to use instrumental variables as some of the explanatory variables may suffer from the problem of endogeneity. This issue was never addressed in earlier studies. Therefore, there is a scope for future study.

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