

# HOUSING LOAN EVALUATION SYSTEM USING REGRESSION ANALYSIS

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## **ABSTRACT**

Normally, the housing loan companies have to do the same calculations for all of their customers' loan applications. This manual system is troublesome and time consuming. Apart from that, the process of approving a housing loan is done by human using logical reasoning and a few surface calculations. This method does not involve every factor that is related, and some major ones may be overlooked. At the present, the use of factor analysis is widely use in help to lessen burden in making analysis and prediction. Therefore, Housing Loan Evaluation System is developed to suits the need of the loan companies in making analysis generally. This system takes a list of factors related to the loan as inputs. Then, it filters out and sort them according to the importance level. After that, the applied statistics method are use to make an evaluation and from the result, the company can choose to approve or not to approve the loan application.

## **ABSTRAK**

Kebiasaannya, pemberi pinjaman perumahan harus membuat pengiraan berulang untuk setiap permohonan pinjaman yang diterima daripada pelanggan. Sistem cara manual ini membebankan dan mengambil masa yang lama. Selain daripada itu, proses meluluskan permohonan adalah dengan pemikiran logik manusia, dan hanya beberapa pengiraan yang tidak begitu mendalam. Oleh yang demikian, “Housing Loan Evaluation System” ini dibina bagi memenuhi keperluan syarikat atau ejen pinjaman dalam membuat pengiraan yang luas. Sistem ini mengambil senarai faktor yang berkaitan dengan pinjaman sebagai maklumat, membuat tapisan dan mengkategorikannya berdasarkan tahap kepentingan maklumat tersebut. Selepas itu, cara “applied statistics” akan digunakan bagi membuat penilaian dan seterusnya daripada jawapan penilaian tersebut, syarikat boleh pilih untuk meluluskan atau membatalkan boring pinjaman tersebut.

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## LIST OF ACRONYMS

<b>HLES</b>	<b>Housing Loan Evaluation System</b>
<b>IC</b>	<b>Identity Card</b>
<b>EMI</b>	<b>Equated Monthly Installment</b>
<b>SBI</b>	<b>State Bank of India</b>
<b>NBFC</b>	<b>Non-Banking Financial Corporations</b>
<b>CEO</b>	<b>Chief Executive Officer</b>
<b>FNB</b>	<b>First National Bank</b>
<b>VA</b>	<b>Validation Authority</b>
<b>FICO</b>	<b>Fair Isaac Corporation</b>
<b>APR</b>	<b>Annual Percentage Rate</b>
<b>ARM</b>	<b>Adjustable Rate Mortgage</b>
<b>US</b>	<b>United States</b>
<b>HSDSS</b>	<b>Prototype Home Loan Packages Selection Decision Support System Using Financial Model</b>
<b>CRM</b>	<b>Customer Relationship Marketing</b>
<b>eCRM</b>	<b>Electronic Customer Relationship Marketing</b>
<b>CAPEP</b>	<b>Countrywide Automated Property Evaluation System</b>
<b>MFC</b>	<b>Microsoft Foundation Classes</b>
<b>MS</b>	<b>Microsoft</b>
<b>OCX</b>	<b>Object Linking and Embedding Control Extension</b>
<b>MDI</b>	<b>Multi Document Interface</b>
<b>USPAP</b>	<b>Uniform Standards of Professional Appraisal Practice</b>
<b>LTV</b>	<b>Loan to Value</b>
<b><math>R_p^2</math></b>	<b>Coefficient of Determination</b>
<b><math>MSE_p</math></b>	<b>Measn Squared Error</b>
<b><math>C_p</math></b>	<b>Criterion</b>

$F^*$	Coefficient of F test
$F_{in}$	Input of F test
$F_{out}$	Output of F test
$F_{partial}$	Partial F test
ICA	Independent Component Analysis
IDE	Integrated Development Environment
ASP	Action Script Pages
GUI	Graphical User Interface
HTML	Hypertext Modelling Language
PHP	Hypertext Preprocessor
MAC OSX	Macintosh Operating System X
ANSI	American National Standards Institute
ISO	International Organization for Standardization
STL	Standard Template Library
DOS	Disk Operating System
VB.Net	Visual Basic. Net
C#	C Sharp
F#	F Sharp
SQL	Structured Query Language
SPSS	Statistical Package for the Social Sciences
RUP	Rational Unified Process
UML	Unified Modelling Language
UMP	Universiti Malaysia Pahang
CTOS	Credit Tip Off Service
CCRIS	Central Credit Reference Information Malaysia
MRTT	Mortgage Reducing Term Takaful
BLR	Base Leading Rate
PC	Personal Computer
MRTA	Mortgage Reducing Term Assurance
MLTA	Mortgage Level Term Assurance
ANOVA	Analysis of Variance

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

Nowadays, people in Malaysia already have potential of buying new house because it is living needs. A lot of work has to be done by the loan companies in order to determine the eligibility, and possibilities of payment.

There are many housing loan companies which provide different type of loans with different type of factors. The use of applied statistics analysis system is widely known nowadays as it helps to lessen human burden with its effectiveness in making analysis and prediction using all those factors using Applied Statistics techniques, the regression and correlation fits the best technique to do forecast.

Most of the time, a housing loan company (bank) will have to face a lot of applications for a loan, and each of this applications needs to be reviewed thoroughly before approved process. Factors have to be taken into consideration, calculated and come out with a prediction whether the customer are afford to pay recurrently for the loan they chose.

The HOUSING LOAN EVALUATION SYSTEM USING REGRESSION ANALYSIS is developed to help the loaner on predicting their customer's eligibility in payment and making decision. Thus, this system can maximize the profits for the company through avoiding losses in the future.

## **1.2 Problem Statement**

Normally, different housing loan companies (banks) have different criterias/factors they need. These factors bear different weightages and some of them may not even affect the customers' ability to pay at all.

Besides that, the housing loan companies have to do the same calculations for all of their customers' loan applications. This manual system is unreliable and time consuming.

Apart from that, the process of approving a housing loan is done by human using logical reasoning and a few surface calculations. This method does not involve every factor that is related, and some major ones may be overlooked. The result obtained from this way is not accurate to make close predictions about the ability of the customers in making payments in the future.

## **1.3 Project Objective**

In order to develop the Housing Loan Evaluation System using Regression Analysis, the overall objectives of this system are:

- i. To identify the general and important factors for predict customer's detail.
- ii. To develop the prototype of Housing Loan Evaluation System using Regression Analysis.
- iii. To proposed an evaluation approval for house loan.

## **1.4 Project Scope**

The project scopes that have been identified are divided into three types which are user module, data and system environment. There are two types of users in this system which are house loan agent(banks). The requirement are taken from three housing loan providers (banks) which are Maybank, Bank Islam, and CIMB Bank and data gather from questionnaire surveyed from government officials which include administration staff, support staff, and professional staff. The system covers the calculation of the loan only. This system use stand alone application concept and will be developed using NetBean IDE 6.9.1 for the interfaces and Java for the programming languages.

## **1.5 Thesis Organization**

This thesis is divided into 6 chapters and each chapter is devoted to discuss different issue in the project. Chapter 1 will discuss on introduction to the system. The problem statement, objective and scope will be identified. Chapter 2 will discuss about all the research and literature review that related to the project. Chapter 3 will discuss the approach and framework for the project. It explains about the method that is implemented while designing the system. Justification about hardware and software that used to develop the system will also be discussed. Chapter 4 will document all processes that involve in the development of this project, generally, this chapter explains about the designed project development. Chapter 5 will explain about the analysis come from result and as well the system testing. And lastly chapter 6 emphasize on the conclusion for overall application.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Nowadays, the application of new house loan has been become common in the normal daily life for the Malaysian public. However, a lot of buyers just only apply house loan without any consideration of the factor at the surroundings. This causes the majority of house loan not fully unpaid. Therefore, required an evaluation that can evaluate whether buyer can make the full payment or not. The topics that related to the evaluation of the house loan are house loan meanings in detail, the evaluation tools methods and issue related with interest of the house loan.

From the means of house loan, House Loan is the fund that buyer has to borrow (usually from bank or other financial institution) to purchase a property, generally secured by a registered mortgage to the bank over the property being purchased. A home loan required to pledge home as the lender's security for repayment of loan. The lender agrees to hold the title or deed to the property until have paid back the loan plus interest [1]. In this statement, house loan is a pre-condition for a house buyer to a house, property or mortgage. It is important either apply house loan or not because house loan involves many years payment. If not consider well, can happens that can't able to pay the loan.

Refer to the "statistical method", according to Wikipedia, Regression Analysis is a statistical method or technique for modeling and analyzing several



variables, when focus is on the relationship between a dependent variable and one or more independent variables. Regression analysis used to estimates the conditional expectation of the dependant variable given the independent variables - that is, the average value of the dependant variable when the independent variables are held fixed. Regression analysis is widely used for prediction and forecasting, where its use have substantial overlap with the field of machine learning. Regression analysis is also used to understand which among the independent variables are related to dependant variable, and to explore the forms of these relationships [2]. This statement shows that in the statistical method, one of tool that can measure the factor which can related to house loan is regression analysis. This method can helps the loan agent to evaluate the buyer whether capable to apply the house loan or not in the long term condition by using the mathematical notation.

Refer to “Interest rate” by Kimberty Amadeo, it states that interest rate is the percentage changed or paid, for the rise of money. It is changed when the money is being borrowed, and paid when it is being loaned [3]. This statement shows that when apply the house loan, the interest rate will vary with the total amount of house loan in different type of time period to paid. This means that if house loan paid in much more longer year, the interests will increase as well and vice versa. In conclusion, evaluate the house loan is very important and should be observed to maintain its level in the economy areas. The house loan should evaluate so that the economy in country Malaysia can be improved. This can make Malaysia be the world class competency-based country in the global world.

The system will getting the input from user which is the buyer especially the factor regardless the major or minor. The system will calculate the expected result from the input got and display the result to user whether the house loan approved or not from the evaluation by the system.

For more detail, this system has three phases. Firstly, is the phase input / getting information. In this phase, the user needs to key-in the basic information data such as Full Name, IC No, Address, etc. Besides that, the user need to key-in the data related to house loan such as loan amount factor related and etc.

Secondly, is the phase processing. In this phrase, the system will gather all the information required to start calculate and make analysis for the factor regarding to the loan.

Lastly, which are phase output/ display evaluation. At the last phase, system will display the result from calculation of the factor and evaluate the user capable to pay house loan or not.

Inside the processing phrase, which have the calculation of the regression analysis. This calculation is using statistical tool which is linear regression equation in the applied statistical method. This method describes the linear relationship involving more than two variables. By using this method, can getting the relationship between two or more variables and describing such relationship with an equation that can be used for predicting value of a variable given to the value of the other variable. At last, can evaluate from result in scale form which from 0 to 1.

At the conclusion, the system can evaluate the agent whether buyer capable to paid for house loan or not by referring the scale result.

## **2.2 Thesis Domain**

### **2.2.1 House Loan Article**

According to articles of the house loan, once decide to avail a home loan, the next thing that storms brain is choosing between fixed and floating rate of interest.

Usually, when news media splashes reports on banks increasing home loan interest rates in India and their impact on Equated Monthly Installment (EMI), it better to opt for fixed home loan rate. In fact, banker may also advise to go for the same.

Now ideally as it should be, assumed that once select fixed rate plan for the rate of interest will remain unchanged over the entire tenure of the repayment period irrespective of any subsequent increase in the same. But actually this is not the case.

Here we demystify the nature of fixed interest rate housing loan transaction so that could make an informed decision over the matter.

- All the banks include the reset clause on fixed interest rate in home purchase loan agreement papers. So if had taken the loan @ 10.5 per cent for 15 years it does not mean that the same rate will be applicable all across the period.
- India's largest public sector bank State Bank of India (SBI) has introduced a clause as per which it has right to revise the fixed rate home loan after two years. Similarly, Canara Bank and Corporation Bank also have similar provisions to revise the rates after 5-years of disbursing the loan.
- Private sector banks and Non-Banking Financial Corporations (NBFCs) are also following the same policies and the rates too are revised from time to time.

Table at **Appendix A** illustrates the comparison between the interest rates from various Housing Finance Companies and banks.

- As is apparent from the table, one can get the best fixed loans deals for a period of 0-20 years from the “Bank of India”, expect of course, when the loan period is between 6-10years, where Punjab National Bank would let you have the best deal as far as the percentage of interest is concerned [4].

According to Harsh Roongta on 4 Jan 2010, the statement about A common question that is asked these days by home loan borrowers is – “*Should I prepay my home loan?*” The trigger for this question normally arises because the loan consumer has some windfall cash inflows (like an annual bonus or sale of some shares etc). Typically get conflicting advises on whether to prepay the home loan or invest the sum in some other financial instruments. The most common is that home loan interest is tax deductible and hence it is a cheap loan and may be better off investing that money somewhere else to get a better return rather than repaying the home loan.

These complicated post tax calculations make sense for only a few high-end savvy consumers who in any case have access to expertise to solve this dilemma. (<http://www.apnaloan.com/loan-advice-india/prepay-loan-calculator.html>).

For other consumers as a rule, it is always advisable to pre-pay any loan, including home loan, if have spare cash. The only exception to this would be (1) if the borrower has taken fixed rate home loan in 2003 at around 7-8%. or (2) the borrower has very little cash to spare for emergencies (normally should be around 4-6 months expenses).

A common misunderstanding that sometimes trips a prepayment decision is the fact that the principal amount outstanding has not fallen substantially, even after making EMI payments for 3 to 4 years. For example in most 20 year loans only around 10% of the loan would have been repaid at the end of 3 years. This is because the borrower is paying back a higher proportion of interest in the initial EMIs. The interest component could be anywhere near 80% in the initial months. Interest component comes down and principal component increases as a proportion of the EMI as the loan tenure matures.

This often leads to a common mistake of assuming that it is better not to prepay, say, after half way through the loan tenure, because the interest component is low now. But the fact is that the interest outgo as a percentage (which is what the interest rate is) on outstanding principal is the same whether it is after the 24th month or after the 120th month. As interest rate on home loans is calculated using reducing balance method, the interest rate is always calculated on the remaining outstanding principal. As the remaining outstanding principal will be lower after 120 months compared to after 24 months, the interest amount which needs to be apportioned across the remaining tenure would also be lower, resulting in lower interest component. But the interest rate on the remaining principle would be the same at both the time period.

So the decision to repay one's home loan should not be driven by the stage of your loan tenure but by prevailing interest rate and availability of cash [5].

This statement is showing that first mind set of the home borrowers is that ability to prepay the home loan. This is because of the tax and loan interest rate is harder to prepay back compare to invest the money at other usage. According to this statement, can prove that the home loan plus the interest is a big amount that making home borrowers not confident or not capable to pay.

### **2.2.2 Housing : Best recovery bets**

The average home price is forecast to plummet over the next two years. But these 7 cities are predicted to post gains.

#### **San Francisco**

Median home price: \$675,000

Value lost since 2006: 25.7%

Forecast gain by 2011\*: 4.8%

The San Francisco metro area has seen its home values drop by a quarter, and the city still has some pain to work through. The city's median home price is expected fall another 8.3% by June 2010.

After that, however, the market there may come roaring back: Fiserv predicts a 14.3% gain between June 2010 and June 2011. Averaged out, that means a 4.8% gain over the next two years.

One reason for the sharp comeback is that much of the area's excess inventory will have been sold. It's already dropped by nearly in half over the past year.

The recovery will be delayed, though, as the area -- particularly Oakland and the East Bay -- works through its foreclosure problems. During the first six months of 2009, one of every 52 homes had at least one foreclosure filing.

The good news, according to Mark Fleming, chief economist for First American Core Logic, is that core city neighborhoods don't have nearly as many foreclosures as those out on the fringe. The steady demand in those communities will serve as a base as other neighborhoods rebuild.

By Les Christie, CNNMoney.com staff writer [6]. This statement showing that home having the big and high impact to the market or economy whether the country can improve or not.

### **2.2.3 FNB HOME LOAN NEWS**

The dramatic rise in the value of residential property in recent times is changing the face of South Africa's housing market.

Values have in some instances gone up three-fold in just two years. "Phenomenal growth in property value has boosted residential development in the country," says First National Bank (FNB) Housing Finance CEO, Marius Marais.

According to Marais, even if the rapid rise in property prices eases, there are other growth markets. "The positive sentiment towards property is also extending into properties that were overlooked in the past – principally houses in townships," he explains.

"For the first time township properties have become assets to their owners and a healthy sales environment is emerging. It is an arena in which FNB will expand its role of providing finance and helping to reduce the housing backlog."

Marais continues: "With the residential housing market being highly finance-dependant, creating more flexible lending conditions in all areas is a key issue that will notably increase accessibility to housing."

Despite the government's significant achievement in the delivery of over 1.6 million houses in the 10 years since 1994, there is still a sizeable housing backlog in the country.

As part of on-going efforts to address the problem, on 31 March 2005, the Minister of Housing and the country's four major banks signed a Memorandum of Understanding in which all parties committed to creating functioning housing markets in previously under-served areas, and to making home loan finance available and accessible to low-income customers. This agreement emanates from the Financial Sector Charter signed in 2003.

## **2.2.4 Requirement to Qualify for a Home Loan**

Mortgage lenders have become much stricter in their requirements to qualify for a home loan. The days of buying a house with nothing down and a drive-by appraisal have ended, and prospective buyers can expect their financial lives to be scrutinized. Home shoppers can save a lot of time by doing their own research and collecting the paperwork they need to qualify for a home loan, be approved by a lender and achieve their goal of home ownership.

To qualify for a home loan, borrowers must show they have enough income to make the payments and cover their other expenses and as well need to prove current income with recent paycheck stubs, and often provide information about past jobs as well. If self-employed, need to show a track record of earnings, demonstrated through past years' tax returns and the books from your business.

Lenders look for evidence that have the down payment cash in hand, such as a bank or brokerage statement. The specific down payment percentage varies by lender and loan program. Ginnie Mae, a government loan guarantor, notes that a conventional loan may entail 20 percent down. If can qualify for a VA loan, may not have to put anything down. This causes that need additional money to cover closing costs, unless you're able to roll those expenses into the loan amount.

FICO credit score means a lot when apply for a home loan, because higher FICO scores earn lower interest and better loan terms. A good FICO score reflects both a clean credit history and a manageable debt load.

If total obligations, including proposed mortgage, exceed 36 percent of gross monthly income, mortgage originators won't lend, so pay credit card balances off, or at least down, before apply for a home loan.