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***Lithuanian loan market evaluation***

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Lund, 2008

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## **Abstract**

We think much of a current consumption is strongly based on various types of loans every person should have an idea about how the loan approval mechanism works. Because everybody wants to know if they have a possibility of getting a loan approval, almost all banks' web pages have a maximum loan calculator, which gives a client a maximum loan amount he/she could borrow at a current date given certain factors (e.g. income, age, place of living, etc.). However this calculator does not give an idea if the loan will be approved or not. We believe that this research will help a client get a better idea whether his/her loan will to be approved or not.

To get a better picture of the bank lending decision process the client could make use of academic research. Unfortunately, empirical research of this type is quite rare. The main reason being that data are usually very difficult to obtain, as it contains personal information and the banks are not normally willing to disclose it

There are other studies that address this issue, Munnell A. H. et al (1996) wrote a paper about mortgage lending in Boston and studied whether belonging to a particular race affected a bank's decision about loan approval. Ross L.S. (1996) analyzed the use of racial differences in loan default to test for mortgage loan discrimination. Stengel M. and Glennon D. (1999) tried to develop a bank specific model to study the mortgage lending discrimination. Black (1978), King (1980), Schafer and Ladd (1980) cited by Munnell et al (1996) have studied the probabilities of getting a mortgage loan if an applicant belonged to a certain minority.

The problem is that these studies are concerned with the US, and they are concentrated on exploring the degree to which race, gender, age, religion or education level affects the possibility to get loan. We believe that these analyses are overly specific and are not relevant for Lithuanian society as the population in the country is mainly the same race and religion.

The objective of this paper is to determine what the main drivers of the decision about the loan approval are in Lithuanian banks. How the Political, Economical, Social and Technological factors, i.e. the general environment of the country affect the decisions of the banks.

# 1. Introduction

In our thesis, we will try to evaluate the Lithuanian loan market. Based on a unique data set we estimate a regression to see what the key drivers for a loan approval are. In order to put our results into context, we will also take a closer look at the Lithuanian economy as a whole.

In a very short time, Lithuania has experienced quite fundamental and intensive economical, political and social reforms. Although some evaluations have been done, it is still unclear what effect these reforms have had on the Lithuanian loan market. Thus, although market evaluations are always valuable, the fact that the Lithuanian market has undergone such drastic changes, make them even more valuable.

However, the methodological aspect of market evaluation is somewhat lacking in economical literature, especially if one would like to take into account not only financial conditions but also macroeconomic factors, which are likely to be relevant given the recent reforms. Thus, in order to obtain more reliable results, the loan market assessment should be accompanied by an analysis of the overall economic situation. In particular, we will analyze political, economical, social and technological (PEST) factors. Some indirect factors that influence the loan market will also be considered.

According to Armstrong (2006) PEST analysis stands for "Political, Economic, Social, and Technological analysis" and describes a framework of macro environmental factors used in environmental scanning. It is a part of the external analysis when doing market research and gives a certain overview of the different macro environmental factors that the company has to take into consideration. It is a useful strategic tool for understanding market growth or decline, business position, potential and direction for operations. It will also help putting our econometrical loan evaluation model into perspective.

In our analysis of the Lithuanian loan market, we will estimate a model for loan approval. In so doing, we will experiment with no less than 12 explanatory variables, including gender, age, place of living, family status, monthly income, application date, loan amount, period, payment method, interest rate, purpose of loan, and percentage value of mortgage. The model will first be discussed theoretically and then estimated empirically using econometrical models.

## **2. Valuation**

Our analysis combines qualitative and quantitative analysis methods. The PEST factor analysis is mainly qualitative, while our evaluation of the Lithuanian loan market is going to be mainly quantitative.

### **2.1 Qualitative analysis**

#### **2.1.1. PEST analysis**

According to Armstrong (2006) PEST analysis is an analysis of an external macro environment that affects all firms. P.E.S.T. is an acronym for the Political, Economical, Social, and Technological factors of the external macro environment. Such external factors are usually beyond the firm's control and sometimes present themselves as threats. For this reason some say that "Pest" is an appropriate term for these factors. Macro environmental factors are country-specific. Country market evaluation should begin with analysis of the present situation. This evaluation should improve solution making and strategic decisions and give us the better insight of how these macro economical factors influence banks decision of loan approval.

Political factors include areas such as tax policy, employment laws, environmental regulations, trade restrictions and tariffs and political stability, while economic factors include economic growth, interest, exchange and inflation rates. Social factors often look at the cultural aspects and include health consciousness, population growth rate, age distribution, career attitudes and emphasis on safety. Finally, technological factors include ecological and environmental aspects and can determine barriers to entry, minimum efficient production level and influence outsourcing decisions. Technological factors look at elements such as research activity, automation, technology incentives and the rate of technological change, see Armstrong (2006).

In what follows, we will discuss each of the factors in detail and identify how they can be expected to affect our model of the Lithuanian loan market.

## Political factors

All the banks in the market are directly influenced by government actions and other political events. This system encompasses spheres such as industrial relation regulating law legislation, product safety standards, and privatized industry price level regulation, prevention of company secret inter settlements, for keeping high price level.

An analysis carried out by the Lithuanian market institute LLRI showed that competition policy in Lithuania is targeted not only to main threats for competition elimination (i.e. reduction of government created restrictions), but also modeling market relation, limiting private property and private agreements (these functions are extra and create unnatural and unnecessary barriers in the market).

Following this analysis, the Lithuanian government decided to execute a public administration reform, the main purposes of which are reducing bureaucracy, elimination of corruption and modernization of public sector. Almost no results were achieved until 2006.<sup>1</sup>

Similarly, the Lithuanian law institute researched business controlling institutions. They calculated 152 institutions with unclear functions. The research showed that all of them performed the same services, but interpreted the service in different ways. There are no legal regulations clearly dividing the duties between these controlling institutions. They are free to perform the inspection of a particular company and slow down its operations at any time, without any preliminary warning. The inspection is usually the tool the competitors use to drive out each other from the market.

Political climate is one of the important factors that affect the general financial market situation in any country. Political stability affects the growth of private consumption and as a result the growth of per capita GDP in the country. The political climate uncertainty may reduce the private investment and thus lead to lower economic growth<sup>2</sup>. Political stability and the government's attitude to the business environment in the country is significant while making any investment decision and taking the loan among them. Political factors will influence the number of the applicants as less people

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<sup>1</sup> The analysis is available at: [http://www.lrinka.lt/index.php/analitiniai\\_darbai/analize\\_konkurencijos\\_teise\\_ir\\_jos\\_taikymas\\_lietuvoje/3407](http://www.lrinka.lt/index.php/analitiniai_darbai/analize_konkurencijos_teise_ir_jos_taikymas_lietuvoje/3407).

<sup>2</sup> See Alesina et al, 1996, available at: <http://www.springerlink.com/ludwig.lub.lu.se/content/k4p527v71031/?p=76c27c9809814e6f8fba9a67c8f1d58b&pi=48>.

would like to apply for a loan if they feel unsure of their future income. This is so because net income is generally lower during instable times. For example, interest rates are usually higher during such times, and so is the percent mortgaged, as the more unstable and unfavorable the business environment means that financial institutions want more security. The decline in private consumption is a result of a decline in applicant's income. We think lower income per capita will decrease the probability of approval.

## **Economic factors**

In this section we discuss the Lithuanian economy, and analyze how economic factors are likely to influence our loan market model. Usually the economic environment is divided into two parts, the micro and macro environment. Here we concentrate on the macroeconomic environment.

Many believe that the Lithuanian economy is overheated. There are many reasons for this, such as growing inflation, too optimistic economical valuations, rapidly growing leverage, stock and real estate price growth, trading deficit expansion, and labor payment growth has been faster than labor productivity.<sup>3</sup>

The Lithuanian gross national product (GNP) has been growing by roughly 2.8% per year since 2000 according to the Lithuanian statistics department. Analysts believed that the growth would decline in the following years, as they attributed it to the economical cycles. On the contrary the rate kept growing.

Various institutions believe that consumption is the reason for the permanent GNP growth, domestic market expenditure growth and fast growth in export. Furthermore, the labor supply is decreasing and salaries and home income are rapidly increasing.<sup>4</sup>

LLRI have similar GNP growth expectations as the International Monetary Fund. Although they expect a slowdown in 2008, the average economic growth will not slow down during the period 2007 to 2008. Current GNP growth can be explained by the non-introduction of the Euro, interest rate growth, decline in demography, non-slowng emigration and growing competition in Asia, non-decreasing consumption, growing

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<sup>3</sup> See Kuokštis, available at: [http://www.lrinka.lt/index.php/meniu/spaudai/straipsniai\\_ir\\_komentarai/apie\\_perkaitima\\_ir\\_ekonomikos\\_potenciala/4190](http://www.lrinka.lt/index.php/meniu/spaudai/straipsniai_ir_komentarai/apie_perkaitima_ir_ekonomikos_potenciala/4190).

<sup>4</sup> Available at: <http://www.stat.gov.lt/lt/pages/view/?id=2053>.

investment and government expenses, and inside demand and high investment export possibilities.<sup>5</sup>

However, there are many factors that can lower the GNP growth rate in 2008. It could be high emigration, declining demographical situation, labor force decrease, the end of the credit crisis and growing pressure on Lithuanian companies from the East.

Based on GNP forecasts and budget income rate calculations between 2007 and 2008, tax weight is predicted to be 32% of GNP, while in 2006 it was 32.8% (LLRI, 2007. Annual report 2006-2007). We should pay attention to the fact that the relative tax weight is decreasing because it is calculated incorporating GNP that grows faster compared to reduction in weight index.

The tax weight in Lithuania would not decline significantly even though some reforms were made (personal income tax was reduced from 31% to 27%).<sup>6</sup> One of the requirements for taking on a loan is a sufficient amount of official income. If the taxes will remain high, the portion of the informal economy will not decrease. This means that applicants may have enough income to take on a loan but because a significant part of the income may not be official, he or she will not be able to declare it to the bank. This implies that if the informal economy remains large, then net income will not be able to reflect the actual income of the applicant, and this makes our analysis less robust in this respect.

“By definition, the informal economy is understood to be outside the world of regular, stable and protected employment, and of legally regulated enterprises. In the expanded conceptual framework the informal economy is seen as comprised of informal employment (without secure contracts, worker benefits, or social protection) both inside and outside informal enterprises. Simply put, it is economic activity that is neither taxed nor monitored by the government. It is therefore not included in GNP.”<sup>7</sup>

Usually the informal economy is associated with developing countries. The reason for this can be the higher rate of corruption and lower income. People do not want to pay

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<sup>5</sup> Lithuanian Free Market Institute. Available at: [http://www.lrinka.lt/index.php/meniu/spaudai/straipsniai\\_ir\\_komentarai/apie\\_perkaitima\\_ir\\_ekonomikos\\_potenciala/4190](http://www.lrinka.lt/index.php/meniu/spaudai/straipsniai_ir_komentarai/apie_perkaitima_ir_ekonomikos_potenciala/4190)

<sup>6</sup> Available at: <http://www.stat.gov.lt/lt/pages/view/?id=2053>.

<sup>7</sup> See International Labour Organization, 2002. Available at: [http://en.wikipedia.org/wiki/Informal\\_economy#References](http://en.wikipedia.org/wiki/Informal_economy#References).

the taxes that usually tend to be higher than most of the population can afford. But recently Lithuania has also been struggling with a large informal economy. In fact, the relative size of the informal economy has been fluctuating around one fifth in last few years. According to the most recent LLRI market research, the informal economy is expected to decrease to 18.5% of GNP in 2007 and 17.3% of GNP in 2008.

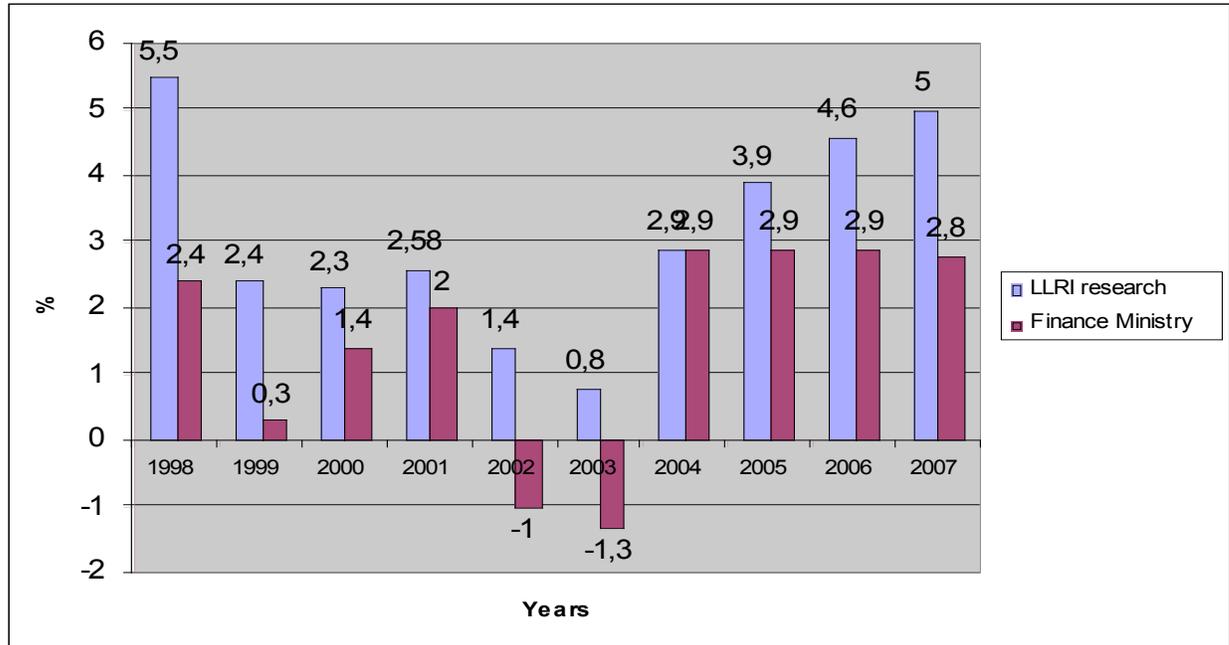
Informal economy reduction is one of the prior tax reform goals raised by the government, but it is obvious that the first attempt, reducing income tax to 27%, was not enough to persuade market members to abandon the illegal way of operating. Personal income tax reduction is not enough to attract more foreign investment or to reduce informal economy significantly (Domarkienė and Miškinis, 2006).

LLRI researched about what the optimal personal income tax from the perspective of the market participants should be in order to eliminate the main part of informal economy. The average answer was 16.8% and the mode of the answers was 15%. Many participants mention that reduction of income tax is not enough. Participants believe that social tax should be modified as well. In 2005, the World Bank reported that more than three fourths of the questioned companies mentioned high tax weight as the main problem for business expansion.

In 2005, the inflation rate was too high to match the Maastricht criteria, which resulted in Lithuania being unable to join the Euro for some period. Market participants do not expect the inflation rate to fall in the near future, but rather they expect it to increase because of the credit crisis (LLRI, 2007. Annual report 2006-2007).

The Maastricht criteria determine which European Union (EU) member states that can enter the third stage of the European Monetary Union (EMU) and adopt the Euro. The four main criteria are based on Article 121(1) of the European Community Treaty.

According to LLRI, prices should grow by 7.3% and they are rising because of increase in energy and public transportation prices, growing budget expenses and salaries, growing consumption and internal demand.



**Picture 1.** Consumer price changes (created by LLR).

Traditional forecasts made by market participants are higher than official country statistics (see Picture 1). The Finance ministry forecasts that price growth in 2008 will be approximately 5%. This rate is much lower than what LLRI research shows. According to the Finance ministry, inflation growth is stronger in consumption goods and service categories with weaker competition. Average inflation is expected to be approximately 12%, as the situation after credit crisis is unstable, and so prices are expected to grow further.

Government decisions and uncertainty about changes in energy prices are the main drivers of this growth. On the other hand, growing competition inside the country slows price level growth. Competition is affected by demand for small export markets. Prices are also reducing because labor productivity is growing.

Growing inflation causes an increase in interest rate, and increase in prices, a decrease in purchasing power and as a result a decrease in consumption and thus the decrease in demand for loans.<sup>8</sup> If the salary of an applicant stays the same while the

<sup>8</sup> See Economist, 2008, available at: <http://proquest.umi.com.ludwig.lub.lu.se/pqdlink?Ver=1&Exp=10-26-2008&REQ=1&Cert=1Xu3PbBnxTzlrF7ZLHL04vTPSFbjpPSRoP0qt7habI9jgm9Yq4qrPKI%2fi9WCStPl&DID=1414974621>

inflation, it (inflation) is affecting the net income as well. Fewer application number and lower income per capita will naturally decrease the probability of loan approval.

### **Social factors**

Unemployment is one of the social factors. We believe its rate will affect our model. The decrease in the unemployment rate in recent past has been the highest in Lithuania compared to other EU countries. According to Euro stat the unemployment rate in Lithuania was 2.3% lower compared to the EU average in 2007.

In the LLRI evaluation of 2007 the participants were asked to evaluate the real unemployment rate. According to the results, the unemployment rate is declining. According to LLRI research at the end of 2007, the rate of unemployment is 5.4%.

Holmlund and Calmfors (2000) state that unemployment and economic growth are negatively related in the short-run. The relationship between them in long run is not clear. GDP is a good proxy of the economic growth in country<sup>9</sup> and according to Lithuanian Statistics Department, the private consumption growth has been positively related to GDP growth in the country for past years.

We believe that unemployment will affect the population income as a decrease in unemployment will lead to an increase in average income per capita which we think will increase consumption level and thus raise the demand for the loans. We believe these factors will influence the probability of loan approvals.

### **Technological factors**

Technological factors can drive economic growth in the country, some economists believe that in fact technological factors can even be at the very heart of economic growth process. Technological progress improves the effectiveness of resource allocation. Throughout the world history we had a lot of examples of major technological inventions that boosted the economy, electricity, steam machine, computer etc.<sup>10</sup>

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<sup>9</sup> See Alesina et al, 1996, available at:  
<http://www.springerlink.com/ludwig.lub.lu.se/content/k4p527v71031/?p=76c27c9809814e6f8fba9a67c8fd58b&pi=48>.

<sup>10</sup>See Helpman, 1998, available at:  
[http://books.google.com/books?hl=en&lr=&id=TSSePifW9Y4C&oi=fnd&pg=PA1&dq=technological+factors+and+economic+growth&ots=FyTYv-Aq2u&sig=V7YBy7l8PvjID\\_32rE1VUYMCjec#PPT1,M1](http://books.google.com/books?hl=en&lr=&id=TSSePifW9Y4C&oi=fnd&pg=PA1&dq=technological+factors+and+economic+growth&ots=FyTYv-Aq2u&sig=V7YBy7l8PvjID_32rE1VUYMCjec#PPT1,M1).

We believe that technological factors themselves do not influence loan market directly, but they have impact via economic growth they contribute to. As we mentioned previously the private consumption and economic growth are positively related and we treat private consumption as a proxy for the probability of loan approval.

## **Summary**

This analysis will help us to better understand the results of our estimated loan market model. But since some of these variables are obviously very difficult to measure, we have chosen not to include them in the model. However, we still think that the variables we decided to use will reflect the indirect impact the PEST factors as well.

### **2.1.2. Other important indirect influences**

We think that there are other factors also that will influence our model at a same extent as the PEST factors. In this section we attempt to describe what they are and discuss specifically in what way they will affect our model.

#### **Investment environment**

In this section we explore how the FDI in Lithuania is related to the economic growth in the country. We believe that the economic growth and consumption are closely and positively. According to Lithuanian Statistics department (2007) consumption was the main driver of GDP growth in the country. In this section we attempt to analyze how the FDI contributes to economic growth and private consumption, which we believe is the main driver of the number of loan applications, in Lithuania.

In 2004 the World Bank researched Lithuania's investment climate. They mentioned that the main difficulties for investment are tax weight, the underperformance of business regulation instruments, problems with tax administration and unfair competition, strengthened by informal practice and corruption. Labor force qualification is also a big problem, as highly qualified labor force is migrating and as a result the qualification level of the labor force remaining in Lithuania is degrading.

Foreign direct investment increased by 13% in the first half of 2007, (compared to direct foreign investment level on 01.01.2007) and reached the level of 9.47 billion

Euros. The major part of FDI is devoted to manufacturing (39.1% of all direct foreign investment), financial brokerage (17.4% of all direct foreign investment) transportation and storage and telecommunications companies (12.0% of all direct foreign investment).<sup>11</sup>

Lithuania is ranked as one of the last counties in the EU based on the amount of attracted FDI per capita. FDI per person in Lithuania in first half of 2007 was 2806 euros.<sup>12</sup>

According to UN research, Lithuania is one of the most promising countries for investment. Contrary to these beliefs the mass of investment is not very large compared with other Eastern Europe countries according to statistical information (Domarkienė L., Miškinis G. 2006).

There are lot of studies about the influence FDI has on economic growth in the country. Firm level studies give us the conflicting results. Aitken and Harrison (1999) find no evidence of FDI affecting the economic growth in Venezuela 1979-1989. But Blomstorm (1986) found that the degree of foreign ownership of companies in Mexico is positively related to the economic growth in the country. Macro economic studies however claim that FDI and economic growth are positively related. Borenzstain et al (1998) claim that FDI boosts economic growth in the country with higher-skilled and highly educated labor force. Blomstorm, Lipsey and Zejan (1994) found that education is not important; they say that FDI helps economic growth in wealthier countries. Alfaro et al (2003) suggest that FDI contributes to economic growth in countries with highly developed financial markets.

As we have previously mentioned Lithuania suffers the lack of high skilled and educated workforce. Neither is it a high-income country or has a sufficiently developed financial market. So based on the macroeconomic studies about FDI and economic growth relation we can assume that the degree of FDI in Lithuania is not positively related to the economic growth and thus the level of consumption in the country. Firm level studies do not give as an opportunity to relate the investment environment in Lithuania to the economic growth. i.e. level of consumption.

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<sup>11</sup> See Lithuanian Statistics Department, 2008, available at: <http://www.stat.gov.lt/lt/>

<sup>12</sup> See Lithuanian Statistics Department, 2008 available at: <http://www.stat.gov.lt/lt/>

According to Lithuanian Statistics Department foreign direct investment increased by 19.6% during year 2007, and GDP increased by 6.4%. The reasons for the increase in GDP may have been other than the increase in FDI. We can not conclude that the variables we decided to use in our model will or will not be affected by the investment environment in Lithuania.

### **Exemptions for home loans**

According to Lithuanian law citizens can get back the interest payments for one mortgage loan or one mortgage financial rent (leasing) contract. This exemption is applied only if interest payments were paid to banks, other credit institutions or Finance Ministry approved foreign country funds or state financial institutions.

Retrieved payments (these payments include life insurance costs, payments to private pension funds, mortgage loan interest payments, university education costs, and cost for buying new computer with software and/or Internet connection) can not exceed 25% of income exposed to taxation. Payments can be retrieved at the end of fiscal year when citizens have to fill yearly income tax declaration.<sup>13</sup>

In general people are attracted to take on a loan only because of these exemptions. We are not including the exemption variable in our regression as the exemption is not considered by banks while loan approval decision and the main objective of this paper is to give an applicant the better insight of what the financial institutions consider to be important while decision making.

### **Summary**

As with the PEST factors, although not modeled explicitly, we believe the indirect factors discussed here are highly correlated with the variables that we decided to use. In particular, we believe that personal income can be used as a proxy for most of these indirect factors. This discussion will therefore be useful in understanding and interpreting the estimation results.

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<sup>13</sup> See National tax inspection, 2008 available at: [www.vmi.lt](http://www.vmi.lt)

## 2.2. Quantitative analysis

### 2.2.1. Tentative analysis of observations

We were provided with a data set from one of the biggest banks in Lithuania. This bank is a member of Swedish bank group. They prefer to be anonymous. Our baseline loan approval model can be written in the following way:

$$\begin{aligned} \text{Loan approval} = & \alpha + \beta_1 * \text{gender} + \beta_2 * \text{age} + \beta_3 * \text{place of living} + \beta_4 * \text{family content} \\ & + \beta_5 * \text{monthly income} + \beta_6 * \text{loan amount} + \beta_7 * \text{loan period} + \beta_8 * \text{interest rate} + \beta_9 * \text{loan} \\ & \text{purpose} + \beta_{10} * \text{percent mortgaged} + \beta_{11} * \text{application date} + \beta_{12} * \text{payment method} + \\ & \beta_{13} * \text{mortgage existence} \end{aligned}$$

The data was collected from March 13, 2007 to November 1, 2007. The data was provided by the bank manager working with golden client segment. The bank customers are randomly split between managers, so our evaluation can be generalized for the upper middle class of the Lithuanian population.

The data set consists of 43 observed loan applications. The explanatory variables we include are gender, age, place of living, family content, monthly income, application date, loan amount, loan period, payment method, interest rate, purpose of loan, mortgage existence and percentage of loan covered with mortgage. Loan approval will serve as our dependant variable.

The majority of loan applicants are men from the ages of 22 to 53. Most women apply for loan only if they are single. When a family decides to take on a mortgage loan, the income of all family members is considered, but the actual applicant is usually a man as we can see from the data set. The reason for this could be social and psychological factors dominant in society.

The age of the applicants varies from 22 to 53. Because the retirement age in Lithuania is 65, people who take on loans have to pay it back by that time. Usually when a bank considers the approval of a loan it calculates if an applicant will be able to cover his/her payments with his/her net income till retirement, as the average income after retirement tends to be very low.

Less than 10% of applicants live in suburbs or smaller cities. Banks consider the place of living to be important as the expenses vary depending on which city the applicant lives. The capital, Vilnius, is considered to have the highest living costs. The other two largest cities Kaunas and Klaipeda are considered to have lower costs of living and all of the other cities are considered to have the lowest costs of living. As our data consists mainly of the applicants from Kaunas and its suburbs, for our calculations later on we will only use the cost of living for Kaunas and all the other smaller cities (for applicants who are living in suburbs of Kaunas).

Family content is important when calculating total family expenses. The set of costs are different for adults and kids. While taking on a mortgage loan banks base their calculations on the sum of income of all family members.

In order to reduce the number of variables and to get more precise picture, we decided to introduce a net income variable. The bank which provided us with the data set has a calculator on its web page. The calculator gives the maximum amount of the loan an applicant can get from the bank given certain factors. The factors considered are the monthly income of the applicant, family content and the place of living. After entering these inputs into the calculator, a measure of net income is returned, and this measure is then used to decide the maximum loan amount that the applicant can get. Therefore, because of its importance in the loan decision process, we have decided to use net income as one of our explanatory variables. Another advantage with using this variable instead of monthly income, family content and the place of living is that it saves degrees of freedom.

Application date may have an effect on loan interest rates if there is any external force affecting the economy of that time. The Credit crisis during the summer 2007 can be a good example of this. Our data includes this period. On the other hand we would expect application date and interest rate to be highly correlated and as the data is not time series we will exclude this variable from further calculations.

The loan payments were calculated based on the annuity method for all applicants in our data set. Loan payments are calculated by banks after they approve the loan, and are therefore not considered in decision about whether to approve the loan or not.

Moreover all applicants chose the same loan payment method so there is no variation in this variable. We have therefore decided not to include this variable in our regression.

Gender is probably not a very relevant variable for our purposes, because men and women are equal and have the same rights in Lithuania. We decided not to include the gender variable in the regression. Men generally have higher income than women do in Lithuania and, as we can see from our data set, women apply for a loan if they are single or single mothers and never if there is a man in the family. As a result the majority of applicants are men and this naturally will result in more loans applied by men to be approved than by women.

Interest rates differ for consumption and mortgage loans. For a mortgage loan the rate fluctuates depending on the chosen interbank borrowing rate (EURIBOR, LIBOR and VILIBOR). Banks add their profit margin of 0.7% to 2% to these borrowing rates. Consumption loan interest rates are fixed for the whole loan period.

Our data set consists of mortgage and consumption loans. We believe that the purpose of loan will be significant so we introduce a dummy variable equal to one for mortgage loan and zero for consumption loan.

According to the Lithuanian law, a mortgage loan must be partly covered by the cost of the applicant's property, usually more than 70% of loan value, while consumption loans do not require any mortgage. In the calculations, we will include the percentage of the value of the mortgage, as it clearly reflects the mortgage existence.

Loan approval is our dependent variable. We made it a dummy variable equal to one in the case of approval and zero otherwise.

We expect net income to have a positive effect on the possibility of getting a loan, as the higher the income of a client the higher the probability that the loan he or she has applied for will be approved. By contrast, the loan amount is expected to have a negative effect, as the financial institutions would want to have a higher level of security for larger loans even though they can get higher profit from the interest payments.

The percent mortgaged is expected to be positively related to the approval decision, as a certain percentage of a mortgage loan needs to be backed up by a real estate. In that case, the larger the real estate value in relation to applied loan amount, the higher the probability of the approval. Loan-to-value is the amount a client is borrowing against the

current value of the real estate. The higher this value, the higher the risk to the lender. The higher the risk the higher the interest rate.

We believe that the period is important as well. The longer it is the larger total payment for interest will be even though the monthly payments of the longer period loans are normally lower than that of a shorter period. From a client perspective, it tends to be important to tailor the monthly payments to his/her budget. We expect the period variable to be positively related to the approval decision.

We would expect the purpose of loan to be significant also. Normally financial institutions do not issue large consumption loans as they are not secured with any real estate, while mortgage loans tend to be backed up with a certain property. The mortgage loan approval procedure is more complex so it is easier to issue a consumption loan, and because it does not have to be secured with a property the demand for consumption loans will tend to be higher.

The rate of interest is probably not too important in the loan decision process. Financial institutions do not rely heavily on an interest rate when deciding about whether to approve a loan or not. Normally banks are not in charge of the interest rate, and they cannot influence it as there are stronger macro economical factors shaping the interest rate trend. As from a client perspective the interest rate is not something they can choose or alter when they decide to apply for a certain loan. Interest rates are set in a different manner for mortgage and consumption loans, as it usually tends to be fixed for consumption loans and fluctuates during the loan payment period for mortgage loans. The rate for a mortgage loan is normally reviewed once in every six months the reason for this is that the interbank borrowing rate fluctuates daily and financial institutions try to adjust the resulted change in the interbank rate, though they tend to review it not too often as after interest rate adjustment all the payments must be recalculated for the client and this is time consuming and costly. The interest rate of a mortgage loan is constructed by adding a bank mark up percentage to the chosen interbank borrowing rate. Usually all the loan issuing financial institutions tend to set roughly the same interest rate for the same types of loans.

Age is expected to be important in the loan decision process. The main reason for this is that banks want to be secured that loan will be paid back before an applicant

retires. As we mentioned above personal income after retirement in Lithuania tends to be low. So banks issue loans which can be paid back by the time an applicant is 65 (official retirement age in Lithuania).

### 2.2.2. Estimation

In the following section we will attempt to identify the most suitable type of regression and find the correct model. As mentioned earlier set of explanatory variables include age, net income, loan amount, period, interest rate, loan purpose, percent mortgaged. After running different types of regressions we will compare the results and choose the best model that fits the data best. After selecting the model, we will discuss the outcome of the regression, and compare it to our expectations.

#### ***Estimation results***

We will start with simple ordinary least squares (OLS) regression just to get a general idea of how our estimated model looks like. We decided to log the loan amount and the net income variables to be able to account for extreme observations as well.

#### **Regression 1 (OLS)**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<b>C</b>	2,189	0,938	2,333	0,026
<b>AGE</b>	0,000	0,007	-0,029	0,977
<b>DUMMY_PURPOSE</b>	-0,364	0,594	-0,612	0,544
<b>INTEREST_RATE</b>	-4,463	5,031	-0,887	0,381
<b>LOG(LOAN_AMOUNT)</b>	-0,201	0,074	-2,702	0,011
<b>MORTGAGE_PERCENTAGE</b>	0,692	0,661	1,048	0,302
<b>LOG(NET_INCOME)</b>	0,130	0,075	1,738	0,091
<b>PERIOD</b>	0,001	0,009	0,110	0,913
<b>R-squared</b>	0,223			

As we can see the regression results are not very promising. According to Brooks 2006, the p-value, also known as the marginal significance value, is the tool that tells if the dependant variables are significant. P-value of less than 0.10 means that the variables are significant at 10% significance level. As we can see mostly our P-values are more than 0.10, which means that none of them are significant at 10 % significance level.

R-square is the tool which measures to how well the regression model fits the data. In other words, R-square tells us how well the right-hand side variables explain the variation in the dependent variable. Our R-square is only 22.3%, which is suggestive of a relatively poor regression.

Because of the poor fit of our OLS regression, we decided to go for a binary response regression. This choice was motivated by the fact that our dependent variable is binary. Using this information is expected to improve upon the fit of the model

According to Long (1997), binary response models are widely applied in the social sciences. The linear probability model (LPM) is simply OLS applied to a regression with a binary dependent variable. In other words, Regression 1 is a LPM

Our dependent variable can only be observed in two cases, either the loan is approved, or it is not. In reality, some of the loan applications might have been closer or the approval than others. For example, one application might have been very close to approval, while another had almost no chance at all. The outcome of LPM model would have been zero in both cases.

In order to also be able to take account of how close an application was to approval, we have to introduce the notion of a latent, or unobserved, variable. In contrast to our dependent variable, the latent variable is a continuous variable that generates the observed loan approvals. We can think of this variable as measuring for example the creditworthiness of the applicant. If the value of the latent variable is small then the loan will not be approved and so the value zero is observed, while if the value is large then the loan will be approved and so the value one is observed. The latent variable is assumed to be linearly related to the explanatory variables in the following way:

$$\text{Latent variable} = \alpha + \beta_1 \text{age} + \beta_2 \text{net income} + \beta_3 \text{loan amount} + \beta_4 \text{period} + \beta_5 \text{interest rate} + \beta_6 \text{loan purpose} + \beta_7 \text{percent mortgaged} + \text{error}$$

The relationship between the latent variable and loan approval can be described as follows:

$$\text{Loan approval} = 1 \text{ if } \text{Latent variable} > \text{breakpoint}$$

*Loan approval = 0 if Latent variable  $\leq$  breakpoint*

Since the latent variable is not observed we cannot use OLS to estimate the above model. Fortunately, estimation is still possible using maximum likelihood (ML), which in contrast to OLS requires an assumption about the distribution of the errors. If the errors are assumed to be normally distributed with mean zero and variance equal to one, then we have the probit model, while if the errors are assumed to be logistically distributed with mean zero and variance  $\pi^2/3$ , then we have the logit.<sup>14</sup>

Academics agree that the choice between the logit and probit models are mainly dependant on the convenience and the convention as the results are highly similar.<sup>15</sup> Our decision for using a particular model will therefore be based on the McFadden R-squared, which is an analog to the conventional R-squared of the linear regression model.<sup>16</sup> In particular, as we see from Regressions 2 and 3, since the McFadden R-squared seem to be slightly higher for the probit model, we decided to drop the logit model.

**Regression 2 (Logit)**

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(LOAN_AMOUNT)	-1,050	7,260	-1,447	0,148
MORTGAGE_PERCENTAGE	3,899	3,003	1,298	0,194
LOG(NET_INCOME)	7,776	5,392	1,442	0,149
C	4,972	3,652	1,361	0,173
PERIOD	0,273	0,335	0,813	0,416
DUMMY_PURPOSE	-1,412	1,485	-0,951	0,342
INTEREST_RATE	2,146	7,318	0,293	0,769
AGE	-0,023	0,097	-0,236	0,814
McFadden R-squared	0,503			

**Regression 3 (Probit)**

<sup>14</sup> See Long J. S., 1997, p. 34-83

<sup>15</sup> See Long J. S., 1997, p. 34-83

<sup>16</sup> See Brooks C. 2006

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(LOAN_AMOUNT)	-5,880	4,247	-1,385	0,166
MORTGAGE_PERCENTAGE	2,179	1,738	1,254	0,210
LOG(NET_INCOME)	4,396	3,119	1,409	0,159
C	2,758	2,178	1,266	0,205
PERIOD	0,150	0,184	0,814	0,416
DUMMY_PURPOSE	-7,801	8,497	-0,918	0,359
INTEREST_RATE	1,201	4,544	0,264	0,792
AGE	-0,014	0,059	-0,236	0,814
McFadden R-squared	0,505			

We also see that, although the R-squared has increased by almost 100% when compared to Regression 1, all the variables included in the regression are insignificant. But this can be due to Heteroskedasticity, which means that the error terms do not have the same variance as assumed in the probit model. In order to account for this, we apply the Huber/White Robust standard errors. The results are reported in Regression 4 below.

#### Regression 4

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(LOAN_AMOUNT)	-5,880	3,261	-1,803	0,071
MORTGAGE_PERCENTAGE	2,179	1,281	1,702	0,089
LOG(NET_INCOME)	4,396	2,312	1,901	0,057
C	2,758	1,755	1,571	0,116
PERIOD	0,150	0,101	1,482	0,138
DUMMY_PURPOSE	-7,801	5,750	-1,357	0,175
INTEREST_RATE	1,201	3,149	0,381	0,703
AGE	-0,014	0,038	-0,363	0,717
McFadden R-squared	0,505			

As we can see the results look much more promising with some variables being significant at the 10% level. However, there are still insignificant variables that seem to have no explanatory power at all. The results obtained after removing these variables one by one are reported in Regression 5

#### Regression 5: Reduced probit regression

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(LOAN_AMOUNT)	-4,105	1,871	-2,195	0,028
MORTGAGE_PERCENTAGE	8,132	4,171	1,950	0,051
LOG(NET_INCOME)	3,048	1,261	2,417	0,016
C	1,976	1,140	1,733	0,083
PERIOD	0,110	0,067	1,654	0,098
McFadden R-squared	0,471			

It is seen that if we choose to look at the 10% level, then we end up with four significant variables, the loan amount, the mortgage percentage, the net income and the loan period. This finding appears to be reasonable, at least to the extent that it coincides with our expectations.

### ***Discussion of the results***

As we used the binary response model to estimate the regression the coefficients of the outcome can not be used to measure a magnitude of how a unit change in an independent variable affects the dependent one. The unit change in a variable depends on the values of all variables in the model so it is not equal to its (variable's) coefficient. We can only talk about the significance level and the sign of the coefficients.<sup>17</sup> In order to figure out to what extent our independent variables are affecting our loan approval dependent variable we will calculate the so-called marginal effects.

“Parameter estimates from discrete choice models, such as probit and logit must be transformed to yield estimates of the marginal effects – that is, the change in predicted probability associated with changes in the explanatory variables. The marginal effects are nonlinear functions of the parameter estimates and the levels of the explanatory variables, so they cannot generally be inferred directly from the parameter estimates.”<sup>18</sup>

We calculated marginal effects. They are vectors so we decided to use mean values as a representative measure.

	ME period	ME loan amount	ME mortgage percentage	ME net income
Mean	0,029	-1,097	2,173	0,814

<sup>17</sup> See Long J. S, 1997, p. 5-6

<sup>18</sup>See Anderson, S. and Newell, R. G. 2003, available at: [http://elin.lub.lu.se.ludwig.lub.lu.se/cgi-bin/linker/link/lub/elsevier/01651765\\_2003\\_81\\_3\\_321-326/S0165-1765\(03\)00212-X](http://elin.lub.lu.se.ludwig.lub.lu.se/cgi-bin/linker/link/lub/elsevier/01651765_2003_81_3_321-326/S0165-1765(03)00212-X).

Now we can talk about the results of our model.

The net income variable turned out to be the most significant in the loan approval process. We believe this result is fairly reasonable and it coincides with our expectations. As this variable has marginal effect of 0.81 we can say that its increase by a unit will increase the probability of getting a loan approval by 0.81%.

The log loan amount variable is as well a significant variable. It is negative as expected. This implies that if a client is taking on a higher loan he/she has a lower probability of getting a loan approval. The marginal effect of loan amount variable is -1.097. This suggests that increasing the loan amount by a unit will result in the decrease of approval probability by almost 1.10%. We think that the reason for this can be that issuing a bigger loan is riskier for a financial institution and requirements to be fulfilled in order to get approval are stricter than those for smaller ones. Even though the income from the interest payments will be higher for a bigger loan this result suggests that banks tend to be rather risk averse and would prefer smaller but guaranteed profit. Moreover clients who are willing to take higher loans usually attempt to negotiate better loan conditions and it is not profitable for the bank.

As we have already mentioned above a certain percentage of the loan needs to be secured with the real estate for mortgage loans regardless of the client income. Our mortgage variable is significant as expected. The marginal effect of it is equal to 2.173 and proves that the higher percentage of the loan is covered with mortgage the higher is the probability to get an approval. Loan approval has the largest sensitivity to variation in mortgage percentage variable as the change coefficient is more than 2%. Normally the banks in Lithuania want to secure 70% - 90% of the mortgage loan issued with the real estate.

The period variable is also significant as we expected. As mentioned above normally the longer the loan period is the lower the monthly payments are, but at the end the client ends up paying more interest than for a shorter period loan. The period of a mortgage loan can be up to 40 years, while the consumption loan period is maximum 5 years. This result may suggest that banks prefer issuing mortgage loans to consumption

loans because in case of some crisis (for example prominent Credit Crisis 2007) renegotiation of the latter one is more difficult.

We ended up having three non significant variables: age, interest rate and the purpose of the loan.

We expected the purpose of the loan to be significant. This result suggests that the type of the loan does not influence the decision making process and the financial institutions do not differ between the consumption loans and the mortgage loans while the approval decision. They tend to be more interested in other factors such as the sufficient income and real estate. Moreover we think that purpose of loan can be reflected in other variables such as mortgage percentage or/and period as these variables shift significantly for different loans.

The interest rate variable came out to be not significant as we expected. This suggests that banks do not consider it an important factor while decision making. The reason for that might be that as mentioned above they can alter interest rates only slightly themselves.

The age variable turned out to be non significant on the opposite to our expectations. This result suggests that the age of an applicant is of no importance while decision making. The reason for that could be that the period of loan reflects the age of an applicant, so they are correlated. As we have previously mentioned the banks are concerned with the age of an applicant since the average income after retirement in Lithuania is rather low. So they try to tailor the period of a loan to each applicant's age in order to be guaranteed that the loan will fully be covered till the applicant retires.

### **3. Conclusions and solutions**

Finally we would like to generalize all of our research results and give conclusions which may lead to some kind of solutions or/and suggestions.

In the first place, as we mentioned at the very beginning of our paper we focused mainly on particular specifics of a loan market and ability to adapt results for individuals applying for loans. In this paper we analyzed what are the key factors that influence the loan approval process in Lithuanian banks.

We stated certain expectations about the factors that in our opinion were relevant while a loan approval decision making process and tested our hypothesis of them being important in the process.

During our research we attempted to combine qualitative and quantitative methods, as we believed that a combination of these two methods would give a reliable and trustworthy result of a research. For qualitative insight we performed PEST factor analysis and analyzed other macroeconomic variables which are not included in PEST factors but, in our opinion, could have indirect, nevertheless significant effect on our variables. For quantitative analysis we run an econometrical regression.

Performing a qualitative valuation of the Lithuanian economy, allowed us to intuitively find important and unimportant variables and evaluate and analyze the current situation in the country. This valuation also provided us with opportunity to relate the main subject of our research to the processes in the country. After performing PEST factor analysis we decided not to include them in our regression and used PEST factors as good proxies for our initial variables.

Later on, for quantitative analysis we performed several econometrical regressions and tried to choose the best model. Based on provided data we tried to estimate a regression to see what the key drivers for a loan approval in Lithuania are and if they coincided with our expectations. Our initial idea was to see which of the variables from our data set consisting of 43 observed loan applications (gender, age, place of living (city or suburb), family content (number of adults and kids), monthly income, application date, loan amount, period, payment method, interest rate, purpose of loan (consumption or mortgage loan), and percentage value of mortgage) are important for our dependent variable – loan approval.

After performing several regressions we decided to go with binary response model as our dependent variable had only two outcomes – zero in case of no loan approval and one in case of approval of the loan.

The estimation output helped us to eliminate non-significant variables and to talk about their influence type (negative or positive). On the other hand we were not able to talk about the magnitude of the impact of each variable as regression betas were not informative due to our model being the binary response model. So in order to figure out

to what extent our explanatory variables were affecting our loan approval variable we had to calculate so-called marginal effects.

From the marginal effects we conclude that the most effect on the approval has the unit change in the percent mortgaged variable. The unit change in this variable increases/decreases the probability of a loan approval more than 2%. The second important factor is the amount of the loan. The unit increase in amount results almost in 1.10% decrease of the probability of approval. Net income of an applicant though being the most significant variable in the regression affects the approval by 0.80%. And finally period, being the least significant variable in the regression has the smallest effect on the approval, only 0.03% for a unit change in period variable.

The outcome of our regression mostly coincided with our expectations. We are satisfied with the results and believe that they are reasonable.

We think that the main drawbacks of our research are little variation in the data in the first place and a few observations in the second place. Nevertheless we attempted to reach the best result possible with the available data.

To sum up we would like to say that our expectations are fulfilled as it is clearer what the main drivers of approving or denying a loan are and how do they drive the decision. As this was our main goal we believe this topic is analyzed properly and answers to main questions are found.

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