Relationship Between Housing Prices and Income in the Republic of Moldova

By

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Abstract

In my thesis I will focus on the important issues of the real estate market in the Republic of Moldova, which comprises about 40% of the country's GDP. This market is quiet important and one of the most difficult to analyze, because of its extreme specificity. I will analyze the relationship between price of real estate and income in Chisinau, Moldova and how it is related to the permanent income hypothesis. I will use the repeated cross sectional data for years 2003 and 2007. The results of the estimation show positive relationship between income and price, slightly higher than expected with the detailed explanation of possible reasons and confirmation of the fitness in permanent income hypothesis. Also, there will be provided suggestions for further research in this field, which is severely underdeveloped in Moldova.

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Introduction

There is a diversity of markets in each country's economy, each one having its own specific issues that can affect all the economy. In market economies one of the most specific markets that we know is a real estate market. Moreover, residential real estate market is one of the biggest segments in the whole real estate market worldwide. For example, according to the paper of Bardhan and Barua (2004) the total stock of housing is worth 100-150% of GDP in the OECD countries. In the USA according to the same source housing stock comprises $12 trln, which is slightly higher than country's GDP value. It has not only economic consequences but also positive externalities and spillover effects that impact the social and political climate of a country. The provision and availability of the residential housing to the population has a direct effect on the quality of life, birth rates and population growth, etc. Buying a residential property implies serious money investment which can be obtained by either long period of savings or by taking a mortgage loan. So properly functioning housing market is essential for solving many social and economic problems.

The Republic of Moldova as a post communist country has very short history of real estate market. Before dissolution of the USSR there was no transparency in this part of economy. It is reasonable to say that the market was not really functioning; mechanisms of the price formation were not driven by supply and demand, but more by the directive from the top. It took about 10 years to form something like real estate market in Moldova, so first, at least partially reliable data, started to appear in the early 2000's. Of course because of that there is no research done so far, that can provide any solid evidence of price formation mechanisms and its relationship to the

income. Taking into account all those factors, I would like to shed some light on this problem with the data available.

There are different definitions of the real estate market (West Encyclopedia of American Law, Farlex Financial Dictionary) but almost all of them agree on the several issues. First, real estate market is a legal term setting the rights over, ownership of and interest on the land, together with the improvements of that land (buildings). Second, the prices of land, the amount land and the legal rights over the land itself can be transmitted among the agents via special market mechanisms. In my piece of research I will leave aside all the legal issues and will focus mainly on the economic part of the definition.

It is also extremely important to stress out that real estate is a very specific good with some unique characteristics which we should always take into account during our analysis. First of all, real estate market involves almost every economic agent during its life cycle – there is a real sector (developers and constructors), user/owner sector (these are real consumers) and facilitators (banks and other financial institutions).

Second, real estate is an immobile, heterogeneous, durable good. It is impossible to disattach a house from the land and sell it as it is impossible to find two absolutely unique objects of real estate. Each object has a set of its characteristics in terms of location, buildings, financing and deterioration (Olsen 1969). According to Olsen because of housing durability the world real estate supply mostly consists of existing stock (98%) and only small part is coming from the newly built stock (2%).

According to the data of The Economist (November 2002) of the total stocks, bonds and real estate market assets of most developed countries valued as much as $115 trillion, the residential and commercial properties are 48 and 14 trillion USD

respectively, which sums up to be around 54% of the whole market. This fact proves that real estate comprises very serious part of the national wealth of all economics. That is why its analysis should be made very thoroughly. With the appearance and fast development of mortgage loans the accessibility of real estate has significantly increased in all countries. Again, according to the same source in the most developed countries almost every family has a mortgage loan, repayment of which may make from 20 to 50% of their income. In case of mortgage the real estate itself is used as collateral and in case of payment stoppages from the borrower the bank can simply foreclose by signing the court action. That action will allow the bank to take back the property and sell it in the open market in order to recover its money.

So in my research I am going to analyze the patterns and caveats of housing market in Moldova in comparison to the euro zone countries and the USA. I will analyze the relationship between housing prices and income and its fitness within the permanent income hypothesis. I will also try to reveal some problems that may appear in the Moldovan housing market due to non economic reasons that may influence the market fundamentals. The thesis is organized as follows. First section focuses on the literature review and the second – on the market description. I describe the data set chosen for the research in the third section. Fourth section covers the establishment of relationship between prices and income based on the data. Fifth section summarizes the results obtained from the established model. Finally, last section concludes and makes suggestions for further research.

Section 1 - Literature Review

Although real estate market has been evolving seriously worldwide during last years, there is still perhaps not enough sophisticated research that was done in the area. The very first working was mostly descriptive consisting mostly of dramatic stories of entrepreneurial success or failure of some well known real estate companies and trade associations. One of the most well-known books of that time was published in 1903 by Richard M. Hurd. He was a very successful mortgage banker in New York, so his book, as an overview of urban development and real estate market of those times, was taken as a basis of the market for almost half of the century. As time passed by, with the development of modern econometrics techniques the approach has changed. For the last 30-40 years academic and policy economists have been conducting quantitative historical research based on the real data and important aspects of real estate fundamentals, transactions, investment and finance, valuation and development. These researchers are actually opening more and more issues in this field and supply the research community with even better deal of further research topics in the upcoming years, especially using the models that can take into account the fact of immobility, heterogeneity and durability of real estate.

So far the analysis of the real estate market has been basically conducted from 3 different perspectives, although connected to each other. First one is a game theoretical approach. One of the recent and impressive papers based on this approach was published in 2007 by Lingling Mu , Junhai Ma. First, they assumed that the market consists of 3 main players – land developer, real estate developer and government and set up a model in order to understand the behavior of each market participant and their influence on the price formation mechanism. After some

derivations they came to a conclusion that cooperation is the optimal strategy of the participants. The moderate tax rate is a very efficient way for government to increase its profits together with the profits of other participants while decreasing housing price level to maintain the pre set level of social stability and happiness. The other paper by Samsura, van der Krabben and van Deemen (2010) uses the same approach to demonstrate the cooperation problem within the project of development of residential location and cost recoveries in the Netherlands. Although this approach contains some limitations it provides better overview strategic interaction in collective decision making within real estate projects. The problems of decision making while zoning, especially in densely populated cities were described by Shahar, Deng and Sulganik (2009). The use of cooperative game theory approach allowed them to establish a model of allocation of land and construction costs in multi store building apartments, which can be used not only by policymakers but also by courts to compute compensations in trials.

The second approach is mainly based on the pure macroeconomic modeling. One of the papers written by Goodhart and Hoffman (2008) is mostly based on the interrelations among housing prices, money and credit in the most industrialized countries of the world. They found that there is a link between these variables and macroeconomy, it is especially strong during the last decades and is even more emphasized when the housing prices are booming. Another paper was written by Meen (1996) in order to fill the blanks in interaction between housing and wider economy. He used a macroeconomic model to develop theoretical, empirical and policy conclusions in terms of 10 propositions for the UK. Being very challenging and promising first two approaches lie outside my research interest and will not be further developed in the thesis.

The third approach is much more empirical, it involves the use of rich data sets and advanced econometrics techniques and models. This is the approach I will use in my thesis. There is a variety of different papers which cover both issues of permanent income hypothesis and its upgrades and its consistence with the real estate market and consumption levels in general (for individuals' real estate is first considered to be a consumption good). Of course, I should start with the paper that lies in the basis of the permanent income hypothesis, which is paper by R. Hall (1978). Housing, being a long-term acquiring good (mortgage lasts up to 30 years), as a part of consumption of course falls under the theory. Consumers adjust their current consumption as a fraction according to the estimates of ability to consume in the long run. That fraction being an annuity value of wealth or a permanent income in value should be close to one. After three different tests of the underlying hypothesis, authors of the paper state that basing on the postwar US time series data a modified version of the life-cycle permanent income hypothesis should be applied.

Another influential paper was written in 1985 by Fumio Hayashi. In this paper all the consumption goods were classified in seven groups according to their durability (housing falls in the C_4 group – durables, rents or mortgage payments in C_2) and were tested for about 2000 Japanese households. Under some assumptions of static expectations of the real interest rates, form of utility function and consumption (distributed lag function) several outcomes were caught. First, the durability of C_4 group is not that high as expected, while the durability of C_2 is higher than the predicted one. Second, the results are applicable for 85% of the wage-earner households. It gives information for future research, because C_2 includes mortgage payments which are fixed and cannot be changed between the periods.

Another relationship between housing and the permanent income was established in the paper of Tong Hun Lee (1968). Before the appearance of the paper it was thought that the elasticity of housing price with respect to the current income was approximately close to one. The author exploits the instrumental variable method (use of lagged or future measured income as an instrumental variable). Paper finally shows that by these methods the permanent income elasticity is less than a unity and provides some solid proofs that this result is reliable. Using a time series data for the USA it was shown that the demand for housing stock excluding land was more responsive to changes in the permanent income than to changes in measured income, but still the permanent income elasticity was less than a unity.

Very challenging questions of housing affordability were raised by Joh M Quigley and Steven Raphael (2004). Questions appeared because according to raw data housing is a serious part of the family budget (from 25 to 50% depending on the income) and even small change in the prices and rents (both increased on average by 50% in the US) may have very serious impact on the household well-being. In their model the authors tried to indentify the most important factors that make housing for owners and renters more or less affordable. They concluded that housing is more affordable with the increase of income and less affordable with the increase of inflation, it is less affordable to the very young and very old people, but more affordable to middle aged when their income is the highest through the whole life. Federal taxes and government zoning regulations can seriously decrease the affordability for all age groups. So there is a lot that can be done in order to make the housing more affordable – clearer zoning in order to meet future demand (not the current one), introduction of the „graduated payments" to make housing more affordable to the

young people and improvement of underwriting techniques to correctly assign creditworthiness.

As was mentioned before, the heterogeneity of housing is one of the major problems of neoclassical analysis of the housing market. In their paper Witte, Sumka and Erekson (1979) try to address this particular issue in order to estimate equilibrium prices for housing. They use a simultaneous equations model of bid and offer price, i.e. estimate the nonlinear hedonic price equation in the first stage to apply it in the second. Results obtained in the paper show expected negative coefficient for the bid price and slightly positive to the offer. Also on the demand side consumers with higher status have higher bid, as well as the larger families. Although on the supply side there is still a lot of place for further research.

Again the problem of inflation while financing the mortgage was raised in the paper by J. P. Kearl (1979). The author stresses out that even if inflation is anticipated and correctly implicated in the model of mortgage housing markets, it still leads to the deterioration of the market, increase the real burden of debt and future reallocation of income towards more saving and less consumption. Research has proved that inflation even correctly adjusted is not neutral and distorts the demand for housing plus indirectly investment in housing. Unfortunately in the world of uncertainty full inflation adjustment is not possible, so in any shape of the mortgage it will lead to partial market distortion.

While the average appreciation of the real estate objects may be due to the market fundamentals or market bubbles, not all houses appreciate at the same rate. This question is analyzed in the paper by Bourassa, Haurin, Hoesli and Sun in 2007. They hypothesized that houses may appreciate differently depending on the characteristics of the houses and also on the strength of the housing market itself. Authors made

their investigation basing on the data of the urban areas of the Australian continent. They used a simple hedonic model with extensions that allowed capturing the effect of atypicality and market strength. Conclusions drawn from the data show that there is a path for pricing the rare and unique objects of real estate in the strong market (actually this path contradicts market movements). On the other hand many investors know that investing in unique objects implies much higher risk and more use it for hedging purposes.

Again the idea of relating the housing prices and incomes was risen in the paper of Quan Gan and Robert J. Hill in 2008. Basing on the rich dataset from Sydney, Houston and Texas they showed that there is a strong relationship between income and house prices and changes in the slope of the lines changes with the conditions of the mortgage market. Such a linear relationship may arise from the variant of the permanent income hypothesis. It is also very interesting, that house price distribution is almost independent on the quality of housing stock and depends mostly on the economic factors and demographic.

So was there really a housing bubble or not – that was the question posed in the paper „Bubble, bubble, where is the housing bubble" by Margaret and Gary Smith in the end of 2006. They said that increase in housing prices for roughly 50% during last 5 years still cannot be called a pure bubble, because generally all the factors explaining the rise were indirect and were not justifying the value of the services provided by housing. Even after in-deep analysis they cannot precisely identify if the price increase was due to the rapid increase in fundamentals, or the prices themselves were below fundamentals and just adjusted faster to the real values.

Section 2 - Real Estate Market in Moldova

Real estate market in Moldova started its serious development in the beginning of year 2000. Before that 6 years of privatization and implementation of different government policies led to the transformation from the command economy to an open market. The development of the market itself also influenced the evolution of the real estate brokers, consultants, appraisal companies and of course construction companies. In the beginning of 2007 right before the drop in the real estate market, its share in the Moldovan GDP was roughly 40% (according to the national statistics) ~1263 million EUR. Probably the first serious boom in the market was in years 2002-2003. According to the Moldavian statistical data, the consumers' purchasing power was extremely high, so the housing appreciation was around 35% by the end of the year according to the evaluation of professional house market players (Logos press 2003/4/24). Some stereotypes of our market were dissolved, like the fact that market is very low in summer and extremely high in the end of autumn. But one issue was and still remains very important for Moldovan real estate market. The biggest part of the demand is produced by remittances, money transfers to the families from their relatives working abroad and is about 50% of the total demand. Although the proportion is decreasing in present, it still remains an influential part of the housing demand. Also, the fast rise in prices is conditional on the macroeconomic and political situation. While political disturbances started to become very small, problems (economic disturbances, lack of trust in the financial system) with holding money in euro/dollar led to the rise in investment in something liquid and reliable – real estate. According to the data of Lara real estate agency, which seems to be much more reliable the average price of $1m^2$ in Chisinau in January 2003 was ranging between 270-330 USD. I should also stress that there is almost no discrepancy between

prices in newly built and used blocks of flats. In the above mentioned range newly built houses are more to the higher limit and used ones to the lower limit.

Those conditions were persisting till year 2007 obviously leading to only one logical outcome – serious price adjustment. But if one applies simple CPI index it turns out that the price of real estate should vary between 450-520 USD for 1 m^2 which was not a real life case. Again according to the data of Lara and NIKA Imobil real estate agencies the prices were varying around 1800 EUR/ m^2, which is about 4 times higher than the officially predicted price. A lot of consultants in the summer of 2007 started to point out the problems that appeared in the real estate market. Among them were very high prices (not comparable to the medium official salaries 2065 MDL~124EUR), and violation of contractual obligations. As we know indeed Financial crisis started in the real estate market and then evolved and got into other industries. It was not the real estate crisis as in the USA, it was the crisis precisely in Moldavian market, when no one wishes to buy property anymore because of skyrocketed prices. Unfortunately official position of the state was far away from precise evaluation of the market. According to the Figure 1 from the National Statistics office the price of real estate in Chisinau was varying between 650-700 EUR/m^2. This discrepancy makes the official data unreliable for further analysis.

Although experts were saying that in those times it was impossible to drop the prices down because low real estate prices will lead to the deficit of high quality real estate and to the deterioration of the market in general. As soon as the money transfers from Moldovan citizens and other wealthy investors are coming to the country there will be no price decrease. On the contrary only high prices may lead to the flow of the capital in the country's economy, to the further maturization of the real estate market,

to the possibilities of substituting old out-of-date buildings with the new modern infrastructure.

So what are the opinions of the professionals in the beginning of 2010? According to the data in 2009 the demand for the real estate property was about 35% of the supply (Lara agency). The additional value to the newly constructed objects was around 448 mln lei (42 mln USD), which is about 65% of the previous year results. Generally, the volume of the new construction fell by 40% in response to the huge oversupply. At the same time the price fell by something like 20% and still seemed to be very high and incapable of stimulating the sales. Although Moldovan real estate market seemed to suffer less than the Russian, Ukrainian or Bulgarian markets. The lack of cheap mortgages in Moldova in comparison to the above mentioned countries didn't allow the prices in Moldova to grow that fast. As was already said mostly the demand was provided by the savings and money transfers. So the real estate market was almost in lose-lose condition. The seller does not want to sell the property with the zero profit, while the buyer is waiting for the further price decrease. Analysts hope that situation will start to improve with the end of the Global Financial Crisis. In the favorable macroeconomic conditions the purchasing power and the level of trust will increase bringing the supply and demand in the close-to-equilibrium condition.

Section 3 - Data Description

In order to conduct an analysis of the real estate market in Chisinau, Moldova, its consistency with the permanent income hypothesis and its change during the boom of the market in early 2000's a repeated cross sectional data was collected. The data was obtained through the private connections from the real estate agency LARA, which is one of the biggest players in the real estate market in Moldova. As was mentioned in the previous section "Real Estate Market in Moldova" of the thesis the government data is not very reliable in almost all variables which are essential for proper analysis because they all tend to be underestimated. Official data was showing 700EUR/m2 while the agencies showed 1800EUR/m2, as well as the official salaries of 2065MDL~124EUR. On the contrary the data obtained from LARA shows the contracts that were signed and the deals that were concluded between buyers and sellers in years 2003 and 2007. Although LARA is not the only real estate company in the Republic of Moldova, it is one of the biggest companies which covers significant part of the contracts with the real estate. So the analysis and results obtained can be considered a good proxy for the reaction and market conditions in Moldova in general. I would also like to mention that the contracts between buyer and seller imply that there is an agreement between these agents regarding the price and other conditions of the deal. So it gives a possibility to state that all the deals presented in the data sample are the market equilibrium deals formed under the conditions of the supply and demand. The collected data sample represents the main information regarding every deal with a real estate which was concluded in years 2003 and 2007. Although the official currency in the Republic of Moldova is Moldavian Lei, the currency used in a sample for „money" variables is euro. It is done first of all because the apartment prices are set in terms of euro in contracts, as well

as mortgage transactions and the income report. It contains the price paid for an apartment, the amount of monthly income, assets owned by the buyer of the apartment, his/her age and tenure (amount of years worked at the current place), the availability of mortgage (dummy) and its amount, year dummy and, finally, the dummy variable which represents the location of the apartment in the city center or any other part of Chisinau.

I will start with the detailed description of the data, because its proper understanding is the key factor to the understanding and interpretation of the model. As was mentioned before housing is a very heterogeneous good with a unique set of characteristics. In order to deal with the issue the sample of apartments was selected in a special way - it reflects only the 2-bedroom apartments with the ~60 m2 living area. The other factors like the quality and the class of materials used for the inner decoration, the kitchen and bathroom facilities and the terraces remain unobserved. But they should not lead to any bias, because it was shown in the paper of Gan&Hill (2008) there is little or no correlation between the price distribution and the quality of housing stock. The prices of these apartments were extracted from 2003 and 2007 so I will provide their descriptive statistics according to the years.

Table 1 - Price descriptive statistics according to years (in euro)

	Price in 2007	Price in 2003
Mean	72779	36329
St. Dev	19233.73	16369.67
# of observations	90	90

From the Table 1 one can draw several conclusions – there was a significant price increase in the real estate sector and there was an increase in volatility of the market segment during these 4 years. It is obvious that the price doubled in 4 years which means an average increase of ~19% yearly.

It is also important to draw the attention on the fact of the apartment localization in the city. Although geographically Chisinau is a compact city, still the central region is the most valuable one and just by data scanning it is possible to observe significant difference in price levels for centrally located apartments and all other districts. More precise description is given in the Table 2.

Table 2 Price descriptive statistics according to apartment location (in euro)

	Price in central location	Price on the periphery
Mean	67349	42040
St. Dev	20970.52	23343.73
# of observations	89	91

The other important aspect is the income of each buyer of the apartment. It was shown in many papers before that, household's income is one of the most important characteristics which influence the decision of buying/not buying the apartment. The details about the income distribution is given in Table 3

Table 3 Income distribution of the apartment's buyers (in euro)

	Income in 2007	Income in 2003
Mean	2774.44	1225.07
St. Dev	2221.63	511.62
# of observations	90	90

As is obvious out of the descriptive statistics the income distribution in 2007 has a wide range, actually, there is a very huge difference between the income of those who bought the prestigious apartments in the center of the city and those who bought apartments in other districts. As soon as one takes under control the factor of apartment location the descriptive statistics becomes much more precise (Table 4).

Table 4 Income distribution of the apartment's buyers after control for the location (in euro)

	Income in 2007 (central)	Income in 2007 (non-central)	Income in 2003 (central)	Income in 2003 (non-central)
Mean	3965.2	1583.68	1337.7	1117.34
St. Dev	2598.73	574.33	614.72	363.78
# of observation	45	45	44	46

Out of this data one can draw a logical conclusion that higher income of the apartment buyer automatically increases his/her probability to buy an apartment in the most prestigious district - city center. The highest income volatility in the first group still persists, ranging from 1523 EUR/month (the lowest) up to 12962 EUR/month (the highest). The correlation test shows significant level of correlation

(0.3701) between the fact of buying centrally located apartment and the income level for the whole sample, which is shown in the Table 5

Table 5 Correlation between price and central location of the apartment

	INCOME	CITYCENTRE
INCOME	1.000000	0.370182
CITYCENTRE	0.370182	1.000000

It is well-known that in modern world significant part of apartments is bought using the mortgage. Because of the low level of development of credit activity in Moldova together with the high interest rates only 61 apartments out of the 180 deals in the sample were bought using the mortgage. Out of the data it is also possible to figure out that bank was providing financing of roughly 50% of the price paid for an apartment in both 2003 and 2007. It was kind of a co-payment incentive for the buyer, in order to prevent him from defaulting. Mortgage terms and monthly payments were not taken into account because of several reasons. First, mortgage for purchase of the apartment was used only in 1/3 of the cases, second – all the terms of mortgage, interest rates and payment schedule were set individually, so it does not allow combining them in any way and showing the existing pattern due to the sample limitations.

Assets own by the apartment buyer can also be a proxy for the wealth level. In my case by assets we understand the amount of material wealth besides the apartment, that is owned by the customer. Mostly assets here consist of the cars, deposit accounts in the banks, jewelries, expensive equipment. I have to stress that in my sample this are not the assets of the buyer's family, but the assets of the buyer only, so assets written in the family member's name are not considered, even if they were purchased before by the apartment buyer. More details can be found in Table 6

Table 6 Assets owned by Buyer of the apartment by years (in euro)

	Assets in 2007	Assets in 2003
Mean	75345.02	7926.67
St. Dev	115741.01	11552.96
# of observations	90	90

As it is obvious from the Table 6, the standard deviation of the assets is higher than their mean in both 2003 and 2007. Most probably that high deviation comes from the legal issue of assets' registration (focus on buyer's ownership only).

Several more characteristics that can influence the decision of purchasing a specific apartment are age and tenure (the number of years worked at the same place). Details regarding the age and tenure can be found on Figure 2 and Figure 3 respectively.

As it is seen in the age distribution – the average age of apartment buyer is roughly 47 years, which is compatible to the Life Cycle hypothesis. Especially for Moldova people tend to buy real estate when their income is on the highest possible level, so that they can afford buying relatively expensive apartment and can have relatively long period of life for enjoyment (by using the apartment).

Average work tenure of buyers in the sample is 7,31 years, but it is more moved to the lower years. So people who have just got a new highly paid job and now can afford buying a new real estate comprise relatively big part of the sample, which is again compatible with Life Cycle hypothesis, because they expect their future income to grow, so that they can afford buying a piece of real estate now.

Section 4 - Model Specification

As was mentioned in the introduction my main objective is to analyze the relationship between the real estate prices and income in the real estate market in Chisinau, Moldova using a simple econometric model. In series of papers the general idea was regressing the housing prices in different cities in different years on a set of variables, with income being the major variable of interest. We expect to obtain a positive coefficient on the income variable between 0 and 1. Also, as many real estate objects are purchased using the mortgages, this variable is also included in the final model. The availability of mortgages may push the price of the real estate up just because people with low salaries can afford buy relatively expensive piece of housing using the credit system for this purpose.

Besides these variables in the model were included the variables regarding the age and the tenure. According to the life cycle hypothesis they should indicate that middle aged people with stable income will be more willing to pay the relatively higher price for the apartment than younger people, who have just started their career. Taking into account the fact that life is not endless, it is logical to introduce the quadratic function for the age in order to understand what is the exact age when people are not willing to buy expensive apartment just because they will not have enough time for the enjoyment from buying after that.

In the descriptive statistics it has also been shown that there was a serious price adjustment during 4 years from 2003 to 2007. So of course the dummy variable that catches this relationship is included to the model.

The model equation looks like:

$$PRICE_{i,t} = \alpha_0 + \alpha_1 * NUM2007_i + \alpha_2 * M\_AMOUNT_{i,t} + \alpha_3 * INCOME_{i,t} + \alpha_4 * ASSETS_{i,t} + \alpha_5 * AGE_{i,t} + \alpha_6 * TENURE_{i,t} + \alpha_7 * CITYCENTRE_t \quad (1)$$

Where the variables are

PRICE	Price of the apartment in EUR
NUM2007	Dummy for the year, 1 for year 2007 and 0 for year 2003
M_AMOUNT	Amount of mortgage provided for apartment purchase in EUR
INCOME	Amount of monthly income in EUR
ASSETS	Amount of assets besides the apartment owned by the individual in EUR
AGE	Age of the apartment buyer in years
TENURE	Time worked on the last place of employment in years
CITYCENTRE	Dummy for the apartment location in within the city limits, 1 is for central location, 0 - otherwise
i	Index for individuals
t	Index of time

I would also like to point out the fact that in Chisinau, Moldova, unlike in majority of European cities there is a tendency of moving to the center of the city. So just the

location of the apartment holding everything else constant should bid the prices up. So if having the apartment in the city center is prestigious, then we expect to have a serious correlation between the income and assets of the buyer and the probability that he would choose the apartment which is centrally located. Including the dummy of apartment location then can lead to the multicollinearity problem and to the imprecise results of the model. To show that there is really a serious relationship between the above mentioned variables a probit model will be presented.

$$P(CITYCENTRE=1|\beta_1*ASSETS + \beta_2*AGE + \beta_3*INCOME + \beta_4*M\_AMOUNT +$$

$$\beta_5*TENURE + \beta_6*NUM2007) \qquad \textbf{(2)}$$

Where all included variables were described in the equation (1).

If the hypothesis of strong correlation after probit estimation persists, then the location dummy may be dropped from the final model.

I have mentioned earlier in the introductory part, that housing is a very heterogeneous good. Because not all the characteristics of the each piece of real estate were observed, there will be a problem of heterogeneity in the standard errors, if the usual standard errors are used during the estimation. In order to take care of the mentioned issue the White Heteroskedasticity standard errors are used.

Section 5 - Estimation Results

The regression results are presented in the Table 7, where the model corresponds to the one described in the previous chapter.

Table 7 General Model results (dependent variable is PRICE)

Variable	Coefficient	Standard error
NUM2007	36780.41**	2198.73
M_AMOUNT	0.106	0.137191
INCOME	0.520	0.691372
ASSETS	-0.025**	0.009151
AGE	-406.923	256.0822
TENURE	282.071	168.4568
CITYCENTRE	25109.59**	1724.919
C	39988.21**	11643.62
R-squared	0.8694	
Included observations	180	

** 99% significance level, * 95% significance level

As one can see from the Table 7, there are four variables that are highly significant – constant, assets owned, year and location dummies. Unfortunately both variables of interest (INCOME and M_AMOUNT) are not significant in this specification on any significance interval. Although if we apply an F-test on joint significance of these variables, then they seemed to be marginally significant with the F-test=3.2871. So the test doesn't allow us to drop the variables INCOME and M_AMOUNT out of the model, due to their importance, although there is something to be done in the

specification. The coefficients for other significant variables are the ones that were expected, with the only exception of coefficient on ASSETS which is -0.025. It has never been described in the other papers and generally contradicts common sense, that more assets one has, less expensive apartment one is buying. Most part of the papers expect to get a positive coefficient, showing that if one is wealthy enough, then he/she will buy a real estate unit which corresponds to the general level of wealth. I will describe the above mentioned coefficient in details later.

As was mentioned in the previous section I expect to have a positive correlation between income and the availability of mortgage and the decision of buying in apartment which is located in the city center. In the data description chapter it was shown that a simple correlation between level of income and the center dummy variable is 0.37, which is quiet significant. So in order to understand which factors are crucial for the apartment buyer, when he chooses the apartment location, the probit estimation was made. The results can be found in Table 8.

Table 8 - Probit estimation results (dependent variable - CITYCENTRE)

Variable	Coefficient	Standard Error
NUM2007	-2.426**	0.377066
M_AMOUNT	10^{-5}**	0
INCOME	0.002**	0.000387
ASSETS	10^{-6}	0
AGE	-0.067**	0.013034
TENURE	-0.004	0.023300
Pseudo R-squared	0.594444	
Included observations	180	

** 99% significance level, * 95% significance level

It is well known from the theory that the probit coefficients themselves do not provide a lot of information, so to show the change of probability of buying a centrally located apartment, one should go back to calculus and apply the following general formula:

$$\Phi(\beta_1 * NUM2007 + \beta_3 * INCOME + \beta_5 * AGE) - \Phi(\beta_1 * NUM2007 + \beta_3 * INCOME + \beta_5 * AGE)$$

Where we can use the different values for income or age to capture the influence of income or age change on probability respectively. Also, I mentioned that the probit estimation was done for the whole sample of variables, respectively treating the possible change of probabilities between two years 2003 and 2007. So the above mentioned formula will be applied for two different time periods, inserting 1 in case of year 2007 (NUM2007=1) and 0 in case of year 2003 (NUM2007=0). I am going to start with the modeling of the following situation – what is the probability change in 2007 for a 50 year old average person having a 1000EUR difference in income. It turns out that 1000EUR income increase in 2007 increases the probability of buying the apartment in the center of the city by 0.2108. Redoing the same calculation for the 2003 shows even more serious impact, a 50 year old average person making 1000EUR more is 0.7274 more likely to choose the apartment in city center. Taking into account the average salary rate in the sample in two different years one can draw a conclusion that it has a very serious impact on the people's decision.

Age being also very significant variable in the probit estimation provides the following result. Let's compare the person with the same amount of income in 2007 but with the 10 year age difference. The influence on the decision here is very slight, a 10 year younger person is only 0.0012 more likely to buy the apartment in the city center. Again redoing the same calculation for the year 2003 some other result is

obtained – a 10 year older person is 0.1081 more likely to choose the apartment out of the city center. Both these results are logical and can be easily explained. First, older person prefer more quiet life in a peaceful neighborhood, so one tends to invest his/her money in the apartment which is located in the green and quiet zone which is usually outside of the central location, where persists business life 24 hours a day. This probability gets smaller in 2007 because the city grows and transportation problems (that are not considered in the model) may significantly influence one's decision.

To sum the things up, there is strong relationship between several variables in the general model, which definitely leads to a multicollinearity problem and imprecise estimators. In order to correct this specification problem the CITYCENTRE dummy variable will be excluded from the model and the new results will be presented. After dropping the dummy for a central location I expect to get significant INCOME and M_AMOUNT variables. The results of the estimation are presented in Table 9.

Table 9 – Final Model results (dependent variable is PRICE)

Variable	Coefficient	Standard error
NUM2007	30432.79**	2809.059
M_AMOUNT	0.411**	0.147380
INCOME	2.567**	0.794371
ASSETS	-0.027	0.016644
AGE	-227.449	299.5123
TENURE	122.949	204.2067
C	38006.88**	13565.01
R-squared	0.6894	
Included observations	180	

** 99% significance level, * 95% significance level

In the presented model, both variables of interest (INCOME and M_AMOUNT) are already significant. This model has a bit lower explanatory power then the general one, presented earlier. In the final model R-squared is 0.6894, which is relatively high, especially taking in consideration the amount of observations in the sample.

I would like to stop on each coefficient in details. I start with the coefficient of the variable of interest – income. It is absolutely logical that with the increase in income one would like to pay a higher price for the unit of real estate. So we expect to have a positive coefficient for this variable. As was said before in the thesis, according permanent market hypothesis and variety of papers the coefficient on INCOME should be between 0 and 1. In fact for the US this coefficient was 0,54, for EU countries – around 0.65. For the sample used in my estimation the coefficient on INCOME is 2,567 (positive) and is statistically significant on the 99% significance interval. In words it means, that 1 euro increase in the level of income leads to willingness of a buyer to spend 2,567 euro more for an apartment (60 sq.m 2 bedroom apartment). The result is not the one that was expected to be, but there can be several explanations for that.

First of all the problem may lie in the data sample, that was collected for the research. Low number of observations may not allow capturing the full effect of income on price. The other explanation is that there has been a serious price adjustment during the analyzed period in Moldavian real estate market, which was described in the sections above. It is highly likely that the increase in price is led not only by the fundamentals. Because of the lack of the research and information, that was collected in the early 90-s it is not even possible to understand where are the fundamentals. It may be highly likely that, these were fundamentals that were below their long-term trend and the whole price adjustment was lead by the adjustment of

fundamentals. On the other hand the fundamentals for the real estate market could be on the long-term trend and then the whole price increase is basically led by the speculations on the market.

It is practically impossible to determine those who were buying the apartment as a place for living and those who were just investing money in it, in order to sell the object in the future as the price increases. Most probably real estate market as almost all type of markets is semi-strong form efficiency (according to the efficient market hypothesis). Then it is very obvious to imply, that if one expects the real estate price increase in future, it raises the price today by exactly that expected amount. Of course here not all agents are homogeneous, so it is almost impossible to assign the exact amount of price increase, but for sure their future expectations regarding price increase are similar.

According to the information of many analysts of real estate, which was provided earlier, there is a bubble in the market, so the coefficient on INCOME variable exactly shows this phenomenon.

The second variable of interest is the mortgage amounts. As was already said earlier mortgage availability can provide lower income buyers with the possibility of buying an apartment. In that case there would be lower demand with the same level of supply and as a consequence lower market price. So, the expected coefficient on the variable M_AMOUNT is positive and also fluctuating between 0 and 1. In the final model the coefficient is 0.411 and is statistically significant at the 99% confidence interval. It is actually as is predicted by the theoretical models and by the other papers – 1 euro increase in the provided mortgage leads to the price push up of 0.411 euro. As was already mentioned in the data description part of the thesis banks

provide financing to the buyers in the amount of roughly 50% from the total price of the apartment. It provides a very efficient mechanism, according to which the buyer will not default because in default case he loses the apartment and as a consequence 50% of his own money that has been already invested. It is also expected that there is a negative correlation between the income and the fact that a mortgage is used for buying an apartment for the Moldavian real estate market. As it is shown in the Table 10 it is exactly the case – correlation is -0.266470.

Table 10 Correlation between the mortgage amount and the income

	M_AMOUNT	INCOME
M_AMOUNT	1.000000	-0.266470
INCOME	-0.266470	1.000000

It was also mentioned, that conditions on each and every mortgage lie outside the research, but obviously they also may influence the correlation coefficient through the term and interest rate payments.

Rather interesting result was obtained for ASSETS variable. It is expected to have a positive relationship between the amount of assets held by the real estate buyer and the price of a real estate object itself. Especially for Moldova in theory this relationship should be very strong and positive. Due to the national attitude Moldovan citizens prefer to maintain the chosen level of well being, so those who are wealthier (have more assets) are more tempted to invest in more high class apartment. But in the final model the coefficient on the variable ASSETS is -0.027 is not statistically significant. It turns out that according to the model there is no significant relationship between the level of wealth (assets held) and the price ready to be paid for the apartment. There can be several reasons for that. First - as was explained earlier

assets in my model represent only the amount of other valuables that are owned by the buyer itself. So even if his family owns some valuables, that were bought using his income, it is not taken into consideration in the model. So there can be a situation of a buyer making decent income each month and at the same time having very low assets in his personal possession. Second due to the sample limitations more precise result just cannot be obtained, so most probably with the larger sample it is possible to get significant result, especially taking into account the fact, that the correlation between the income and assets is rather mild (0.387982).

The last statistically significant variable in the model is year 2007 dummy. It was mentioned several times in the thesis, that there has been a serious price adjustment in the early 2000's, so there is no way to ignore this fact. The coefficient on the variable is expected to be positive. Just from the data description the difference in the mean prices in 2003 and 2007 was 36450 euro (36329 and 72779 respectively). Taking into account other facts the model provides the coefficient 30432.79 and it is statistically significant on the 99% significance interval, which means that on average the increase in apartment price is 30432.79 euro in 4 years. Of course it is very high increase and again it can be a proof of speculations and not real increase due to the macroeconomic fundamentals.

Some variables like AGE and TENURE in the final model specification are not statistically significant both independently and jointly (F-test=0.3184). Although their exclusion from the model specification led to the significant decrease in the explanatory power. Actually even being not statistically significant both variables produce the predicted coefficients. So we have a positive relationship between the prices ready to be paid for the apartment and the tenure (the amount of years worked) because people who are getting stable income and having permanent job

place feel more secured and are willing to put more money in the apartment purchase. At the same time we see the negative relationship between the prices and the age of the buyer. As was mentioned earlier it also makes sense, especially taking into account the Life Cycle Hypothesis statement regarding buying more expensive apartment and having enough years of life for the enjoyment from the fact of the purchase.

Conclusion

In this thesis I have studied the real estate market in Republic of Moldova, basing my research on the representative sample from Chisinau, Moldova. The main issue has been the analysis of the relationship between the price level of real estate in Chisinau and the income level and its fitness within the permanent income hypothesis. To conduct the necessary research the repeated cross sectional data from the biggest real estate broker was collected for years 2003 and 2007. Official data from the national statistics was proven to be unreliable due to its undervalue in comparison to the data of real estate agencies, which represents the functioning market and price level, formed under the conditions of supply and demand.

In the final model specification I have found out that in the Moldavian real estate market there is a positive relationship between the income and the apartment price level as was predicted by previous papers in the other US and European cities. Although there was somewhat higher coefficient than it was described in the previous research, due to several factors, the most important being the impossibility to understand if the price adjustment was lead by the market fundamentals exclusively or there was only a price bubble due to the speculation activity. I have also shown that availability of mortgage leads to the price adjustments and it is very important especially for the lower income buyers, who can afford buying more expensive apartment.

One more important finding of the research was the confirmation, that Moldovans have a tendency of moving in the city center especially in the case of wealthy people. It is an opposite situation for the US and European cities.

Although the study provides the reader with guidelines regarding the situation in the real estate market in the Republic of Moldova, there are still questions left, which provide a good place for further research in this particular field. First of all, the analysis could have been much better with the availability of richer dataset, especially concerning the detailed apartment characteristics and personal buyer's characteristics. Second, it is still not clear the position of the fundamentals with respect to their long run trend. Price adjustments that took place in the last years could have been explained much better knowing the evolution of the pattern of the real estate market fundamentals in Moldova. Even taking into account the fact of relatively weak official data, the research in this field could be very useful. Finally, the relationship of wealth (assets) and price should be analyzed more thoroughly, taking into account controversial results of estimation. Most probably the richer data set will and slight change in the model specification will provide more precise and significant result, showing a positive relationship between these two variables.

References

Ashok Deo Bardhan & Samir K. Barua (2004) "Real Estate Industry: Creating Value through Public-Private Partnership"

The Gale Group (Copyright 2008) "West's Encyclopedia of American Law", edition 2.

Farlex (2009) "Farlex Financial Dictionary"

David L. Scott (2003) "Wall Street Words: An A to Z Guide to Investment Terms for Today's Investor" copyright by Houghton Mifflin Company

Olsen, E.O. (1969) "A competitive theory of the housing market", American Economic Review, Vol. 59, pp. 612-622.

The Economist, data extraction from November 2002 **www.economist.com**

Lingling Mu , Junhai Ma (2007) „Game Theory Analysis of Price Decision in Real Estate Industry", China, *International Journal of Nonlinear Science* Vol.3, No.2, pp.155-160

D. Ary A. Samsura, Erwin van der Krabben and A.M.A. van Deemen (April 2010) „A game theory approach to the analysis of land and property development processes" *Land Use Policy*, Volume 27, Issue 2, Pages 564-578

Danny Ben-Shaha, Yongheng Deng and Eyal Sulganik (March 2009) „Property appraisal in high-rises: A cooperative game theory approach" *Journal of Housing Economics*, Volume 18, Issue 1, pp 25-33

Charles Goodhart and Boris Hoffman (2008) „House prices, money, credit and the macroeconomy" *European Central Bank*

Geoffrey Meen (1996) „Ten Propositions in UK Housing Macroeconomics: An Overview of the 1980s and Early 1990's" *Urban Stud.*; Volume 33: pp 425-444

Robert E. Hall, (1978) „Stochastic Implications of Life Cycle – Permanent Income Hypothesis: Theory and Evidence", *Journal of Political Economy*, Vol 86, No 6.

Fumio Hayashi (1985) „The Permanent income hypothesis and consumption durability", *Quarterly Journal of Economics*, Vol. 100, No. 4, pp. 1083-1113

Tong Hun Lee (1968) „Housing and Permanent Income – Tests based on the Three-Year reinterview survey", *Review of Economics and Statistics*, Vol. 50, No. 4, pp. 480-490

John M Quigley and Steven Raphael (2004) „Is housing unaffordable? Why isn't it more affordable?", *Journal of Economic Perspectives*, Vol. 18, No. 1, pp. 191-214

Ann D. Witte, Howard J. Sumka, Homer Erekson (1979) „An Estimate of a Structural Hedonic Price Model of the Housing Market: An Application of Rosen's Theory of Implicit Markets" *Econometrica*, Vol. 47, No. 5, pp. 1151-1173

J. R. Kearl (1979) „Inflation, Mortgage, and Housing" *The Journal of Political Economy*, Vol. 87, No. 5, Part 1, pp. 1115-1138

Steven C. Bourassa, Donal R. Haurin, Jessica L. Haurin, Martin Hoesli and Jian Sun (2007) „House Price Changes and Idiosyncratic Risk: The Impact of Property Characteristics", No 07-03, *Ohio State University*, Economics dept

Quan Gan and Robert J. Hill (2008) „A New Perspective on the relationship between house prices and income" *School of Economics discussion paper* 2008/13, Sydney

Margaret Hwang Smith and Gary Smith, (2006) „Bubble, Bubble, Where's the Housing Bubble?" *Brookings Papers on Economic Activity*, Vol. 2006, No. 1 , pp. 1-50

Tatyana Glazova (2003.01.23) „Real estate market is rising" *Logos Press weekly*, #2 (498)

http://logos.press.md/Weekly/Main.asp?IssueNum=498&IssueDate=24.01.2003&YearNum=2&Theme=6&Topic=9954

National Bureau of Statistics, population income charts

http://www.statistica.md/pageview.php?l=ru&idc=338&id=2354

Nika Mobil real estate agency http://www.nikaimobil.md/kvartiry_md.shtml

Lara Real Estate agency http://www.lara.md

Appendix

Figure 1

Edinet – 1sq m = 350 EUR
        1bedroom=14-16000 EUR
        2bedroom=19-21000 EUR
        3bedroom=22-24000 EUR

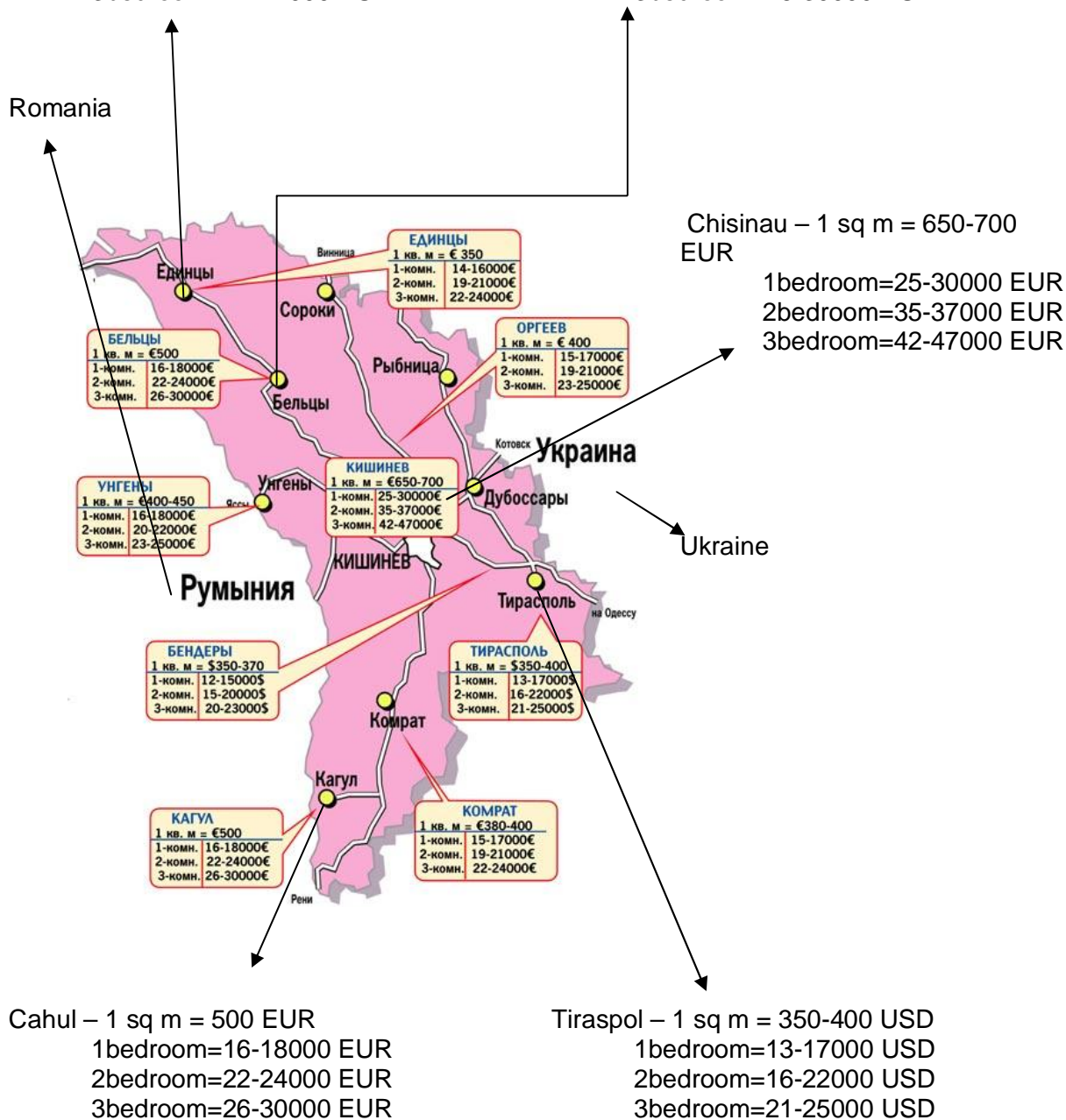Balti – 1 sq m = 500 EUR
        1bedroom=16-18000 EUR
        2bedroom=22-24000 EUR
        3bedroom=26-30000 EUR

Romania

Chisinau – 1 sq m = 650-700 EUR
        1bedroom=25-30000 EUR
        2bedroom=35-37000 EUR
        3bedroom=42-47000 EUR

Ukraine

Cahul – 1 sq m = 500 EUR
        1bedroom=16-18000 EUR
        2bedroom=22-24000 EUR
        3bedroom=26-30000 EUR

Tiraspol – 1 sq m = 350-400 USD
        1bedroom=13-17000 USD
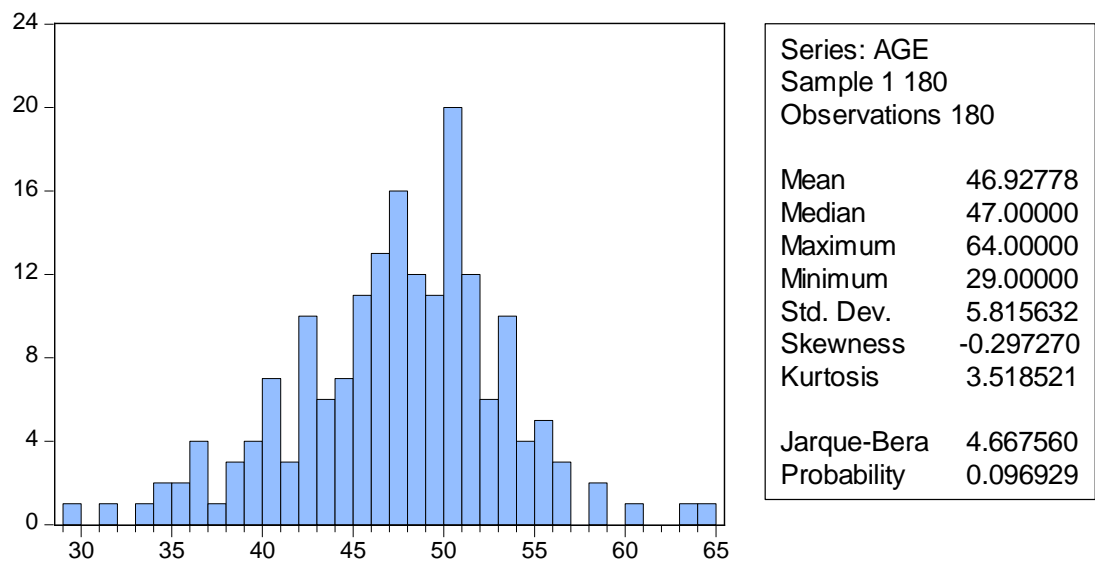   2bedroom=16-22000 USD
        3bedroom=21-25000 USD

Figure 2 Age distribution

Figure 3 Tenure distribution