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Real Estate Market in Tirana

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Abstract

The Real Estate Market is the most important branch of Albania economy. This Market is complex and influenced by many factors, we can mention the financial, economic, social and demographic factors. In this paper we are studying the Real Estate Market of Tirana, the development and dynamics of the price of real estate as an integral part of the economy. The data used in this paper are derived from the database of the World Bank, the Institute of Statistics, Bank of Albania Reports, as well as information provided individually on the ground and in various sources. The empirical model analyze the relation between residential price and other independent factors, such as population, gross national income, and the total new dwelling area approved from the government each year. This analyze becomes more complicated by the interference of temporary tendencies during different periods. The econometric model is based on multiple linear regressions, and the analysis extended over a period of 12 years from 2005 to 2016. The price of immovable property can be considered as a major indicator of the business cycle. For this reason, the Real Estate Market investigation is an important part of the analysis of the economic situation of a country.The dependent variable for the purpose of this study will be the selling prices of apartment and residential areas in the capital of Albania, Tirana. Through this paper is analyzed the development and dynamics of the price of real estate as an integral part of the Albanian economy. To accomplish this study, is used the Linear Regression Method.

Keyword: Real Estate market, Real Estate price, buble effect, price definition, multiple linear regression method

Introduction

1. Decription of Literature

The purpose of this study is to test the literature and the assumptions derived from the theory on the factors and main varieties that affect the price of real estate. Factors that affected the price of real estate are different, we are studying personal income, demographic factors and construction permits. Personal income has a positive impact in real estate price and increase in the national gross domestic product (GDP) would lead to higher prices of assets. Demographic factors also have a significant impact on determining the price of assets, size of population and domestic migration are relevant factors in the real estate market. Construction permits has an important impact in the trend of real estate price in Albania, during the year politics applied in this field enact the real estate market.

In this paper the concepts on which the theory is based should be translated and defined in measurable units. Particular attention should be present to the reliability and validity of the data collected, as well as the data needs to be stable over time. The validity of data tells us if we have chosen the appropriate variables to test the theory. A valid measurement can be reliable, but a reliable measurement should not necessarily be valid (Bryman, 2008).

The purpose of the regression analysis is to predict variance variables dependent on independent variables, and the regression analysis may also explain the variation responsible for a given outcome and may help to construct predictive models (Field, 2009).

1.1 Personal Income

Based on economic theories, the price of an asset is related to the information available to the factors that affect it. According to Muellbauer and Murphy (2008): if the price is determined by the equilibrium between demand and supply, then prices are provided by the inverse curve of demand from the asset stock and the factors that determine the demand. The price of assets depends on the demand and supply for them, where the offer (asset stock) is given in the short run. So, to determine asset prices, we must pay close attention to the factors that promote demand and asset supply.
Case and Shiller (2003) carried out a study by comparing the price of the property with personal income. Through a mere regression between the proceeds of the asset price, they discovered a positive impact of the property price income. For some sustainable areas, in terms of property prices in the ratio of personal income, the income had an explanatory power of up to 99% of the property price variance. While the most unstable areas, with a more volatile income price ratio per capita, income explained about 50% of variance in asset prices.

Sutton (2002) used an autoregressive vector model in determining the impact of property overruns. The autoregressive vector model (A VAR) is an econometric model used to identify the development and interdependence between time series of different variables. Subsequently, these results were used to calculate how changes in independent variables would lead to changes in dependent variables. In the case of an increase in gross national income, Sutton's study shows that an increase in the national gross domestic product (GDP) would lead to higher and higher prices of assets.

Much of the study deals with the determination of the price of assets in different way. Meen (2002) for example, has used a long-term equilibrium model to identify asset price determinants both in the American market and in the English market. The long-run equilibrium model uses a long-term price-based equation based on determinants that affect the demand and supply of assets. A long-term assessment of the relationship between the asset price and the assumed determinants has been made and the long-term equilibrium is calculated. Also, this study has used a short-term corrected model, which examines the real price variations, long-term model, and the speed at which these deviations are equilibrated. Through this model, Meen showed a similar asset price elasticity for both countries. This means that an increase in real incomes for both countries will lead to an increase in asset prices. The revenue elasticity found for both the US and England were respectively 2.51 and 2.71.

Other studies identify the income of individuals disposing of assets as a significant factor in a comparable manner. Abelson, Joyeux, Milunovich and Chung (2005) analyzed the Australian property market through a long-term model. They came to the conclusion that, among other variables, the real disposable income of the owners determines the real price of the assets. The revenue elasticity for real estate prices in the Australian case is 1.7, slightly lower than the Meen (2002) study for the American and English market mentioned above, but revenue again has a significant effect on the price real estate.

This is because the demand for asset prices is partly dependent on the amount of money individuals are in the expense of spending. When the average real disposable income of households increases, a higher percentage of owners can afford a higher percentage of total available assets in the market. So, the average income of individuals will increase, this would lead to an increase in wealth demand. This implies that real incomes have a positive influence on wealth demand. Therefore, real income is an essential element in determining the price of assets. There are also scholars who criticize the findings of the aforementioned studies about real incomes and dispute some of the conclusions. Shiller (2006) used data from different countries and defined a long-term equilibrium model to see if, among other factors, revenue fluctuations were integrated with asset price fluctuations. The study concluded that although earnings and other underlying factors may affect the price of assets, there is

little evidence that assumes that it is possible to predict the level of asset prices from its determinants' levels.

Tsatsaronis and Zhu (2004) conducted an analysis using data from 17 industrialized countries in an autoregressive vector model. According to this study, income changes have little influence on the explanation of price changes in assets. They concluded that the contribution of individuals' income to the explanation of the total price variation of assets is less than 10%. However, the connection they found is important, they came to the conclusion that household income is not a major factor in determining long-term real estate prices.

1.2 Demographic Factors

Demographic factors also have a significant impact on determining the price of assets. Mankiw and Weil (1989) published a link between the number of births and a significant rise in asset prices in the years to come. They predicted a constant price trend of assets based on future growth projections and population age. Significant increase in the price of assets is attributed to the boom of children born when they reach adulthood. Mankiw and Weil (1989) have found an important link between population demographics as we can mention the size or age and price of the assets. Poterba (1991) applied the method used by Mankiw and Weil (1989) in the Canadian market and came to the conclusion that the link between demographic factors and asset price becomes irrelevant over the time series used. Levin, Montagnoli and Wright (2009) studied the impact of demographic factors in determining UK housing prices. Their study was focused on changing the price of assets, population, age and incomes between Scotland and England. Through these differences they found a constant link between asset prices and demographic factors. Specifically, they found that the growth rate of the ages of 20-29 who buy for the first time an asset and the age group 30-44 have a significant link to the rate of asset price growth. They also came to the conclusion that the size of the population is an important determinant of the price of assets.

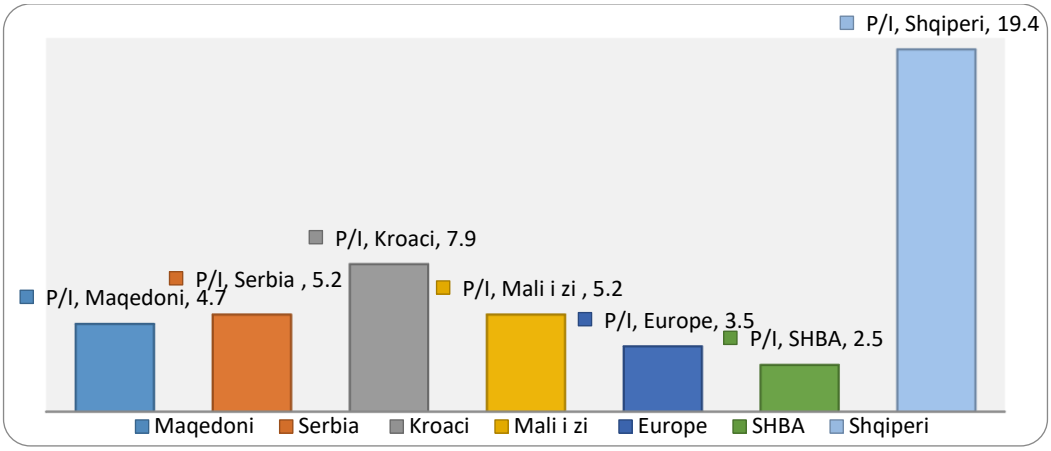
Domestic migration has a significant impact on the price of real estate, and even in some cases it determines the development of a city or a certain area. An increase in demand would automatically impact the price increase. It has often been argued that demographic changes have a significant influence on determining the price of wealth, but the magnitude of these effects is difficult to model. So, the demographic factors are widely studied, but their influence on the price of wealth remains unclear.

2. Ratio Price/Income

This report is one of the most important indicators of residential apartment market analysis, for the reason that we can not judge the level of housing prices without first comparing the apartment's average price with GDP per capita, or with the wage level, which would help us determine the real value of residential apartments.

Increasing income raises consumption, so people will also increase their consumption of homes, and increasing their demand for housing will also raise the prices. So housing prices are very much related to the income per capita of the population.

Graph 1. Ratio price/income per capita of the population



Source: IMF

Referring to the graph, this ratio in Albania is very high (it has a value of 19.4), compared not only with European countries (the price / income ratio is 3.5) and US (the price / income ratio is 2.5), but also compared with other countries of the region. This is not due to the level of housing prices in Albania, which today is much lower than in other countries, including those of the region, but because Albania is the country with the lowest GDP per capita compared with the countries of the region.

An apartment of surface of 68 square meters in the city of Tirana (prices are the highest in Albania here) costs an average of 76 thousand Euro, while in Prague it costs 169,048 Euro, in Berlin 108,392 Euro, in Warsaw 179,000 Euro, in Budapest 87,720 in Vienna 147,220 and in Rome it costs 266,900 Euro.

The level of housing prices in Albania and other Eastern European countries is considerably low, however, that does not mean it is easier for an investor in these countries to provide funds for buying a residential apartment, rather, given the very low income conditions, this investment becomes quite difficult.

3. Demographic Developments Occurring in Albania

The complete process and urbanization structure in Albania between 1945 and 1990 was characteristic of combining two factors: concentration and centralization. The key to success in initiating Albania's policies was the development of rural areas and the limitation of urbanization in these areas. The main features of these policies were: a) 1/3 population distribution in urban areas and 2/3 in rural areas; b) the increase of the urban population during 1945-1960, during which time 7% of the population lived in Tirana.

After the 1990s, due to migratory movements, there has been a change in the structure of the Albanian population: the population living in villages decreased from 64% of the country's total population in 1990 to 58% in 2000 and in 2018 it was estimated that 53.4 % of Albania's population lived in cities.

Demographic data have a determining effect on the real estate market price at local level, which match the differences in the housing demand in various geographic areas.

In particular, the density and population age structure play an important role in determining the price dynamics in the real estate markets at local level. According to the Institute of Statistics INSTAT, the population of Albania in 2016 was 2,886,026. Tirana is the area with a population of 811,649 – the highest in the country – making it the largest urban area in Albania. On average, 20300 people migrate annually to urban areas. According to INSTAT data, in 2001, 22.9% of the total population lived in Tirana and Durres in 2006, the population of both areas reached the 25.5%, and in 2017 the population living in both areas reached the 28%.

By contrast, in the northern and southern areas there happened a decrease in the percentage of the population (INSTAT). Demographic changes and demographic movements of the rural population towards urban areas, especially Tirana, Vlora, Durrës, Shkodra, have caused housing prices to be higher in these cities. The very young age of our country's population (29.7 years) is another element confirming that housing demand will continue to be high. The most important population group related to the development of housing real estate, is that between 25 and 40 years old. This economically active age group represents the largest demand for residence; in 2005 this age group was made of 601 thousand inhabitants, while in 2017 it was made of 674 thousand inhabitants. To determine the impact of this age group change on the demand for housing estates, we need to know its prospective trend. If in the US, people continue to buy their first home at the age of 25, here they are doing it at about the age of 35.

4. Impact of Construction Permits in Real Estate Market

Construction permits has an important impact in the trend of real estate price in Albania.

The declining annual trend of new constructions alerted a slowdown in the demand for real estates, which led to a slight drop in prices. This is also reflected in the real estate price index, which by 2007 has constantly gone upward, while throughout this year, such index, as seen from the graph, has the tendency of declining, thus expressing the eventual crisis of the Albanian real estate market and economy.

Furthermore, this stagnation of the real estate market was caused by the lack of construction permits. It is estimated that throughout 2007 the number of construction permits has reached its minimum over the last 20 years. Never before has the number of construction permits been so low (466 construction permits were issued this year or about 68% less than in 2006). The lack of construction permits in some way paralyzed the construction sector as well as the housing sales market. The drop in the demand for apartments and a fall in the housing prices affected the value of collaterals required by banks, which are engaged in providing mortgage loans and lending to the construction sector.

In addition to the lack of price increase, constructors faced another quite unknown phenomenon that was the failure to sell apartments, which has perhaps been one of the main reasons for this situation in the housing market, although there has also been a certain interim saturation of the demand for housing ownership or a preparation for the breaking of the bubble recently observed in the housing market in Albania.However, Albania's construction industry has been quite slow in reacting to the global financial crisis, which originated in the US real estate market, for the reason that construction activity is based on orders given several months ago, or in some cases even years ago.

The entire Albania will return to the construction site. Almost all of the circles result in a significant increase in data release permits in the third quarter of this year, whereas in the capital, growth has started in the first quarter of the 2017s.

The number of building permits issued in the country during 2017 has increased considerably, with the record keeping of Tirana, warning of a new wave of construction in the medium term. According to data published by INSTAT, in 2017, 819 construction permits were issued throughout the country, with an increase of 88.3% or 384 more permits. The largest concentration of permits has been in the capital. According to INSTAT, in the year 2017, in total, 231 permits were issued in Tirana, with an increase of 118% compared to last year, or 125 more permits. The building has also been the area of construction permits given in the capital. In 2016, a total of 106 construction permits were issued in Tirana for an area of 209.3 thousand square meters, while in 2017 the number of permits amounted to 231 for a total area of 522 thousand square meters. So, for the surface, the growth was 2.5 times. The planned area for construction in Tirana is as much as 60% of the total for all of Albania.

After Tirana, the construction license is headed by Fier, with 133 permits granted for the whole year and Durres with 105 permits. Cities where there is no interest in construction are Kukes and Dibra, where the number of permits granted was minimal. The area for new buildings in Albania increases by 128.5% According to INSTAT's official announcement, in the fourth quarter 2017, a total of 211 construction permits were approved for new buildings, out of 147 approved permits in the fourth quarter 2016, marking an increase of 43.5%. Referring to 2017, a total of 819 construction permits were approved for new buildings, out of 455 permits approved in 2016, marking an increase of 80%. The area of building permits approved for new buildings, in the fourth quarter 2017, is approximately 197,130 m^2, out of about 183,319 m^2 approved in the fourth quarter 2016. This indicator, in the fourth quarter 2017, compared to the same quarter of a year before, it increased by 7.5%. During 2017, the area of building permits approved for new buildings is about 868,534 m2, from about 380,141 m2 approved in 2016, marking an increase of 128.5%. All over the country there is a high orientation of cheap liquidity in the construction sector where the most sensitive is in the main cities, especially in Tirana, Fier, Vlora, Durres. Experts have warned that this offer being created with apartments is higher than demand and the market may risk bubbling, as dwellings risk being left unchecked.

5. Econometric Analysis: Bubble effect

In the first section of this study, we have analyzed the theoretical impact of different factor on residential price. In this section we will analyze the empirical connection between residential price and other independent factors, such as population, gross national income and the total new dwelling area approved from the government each year.

The econometric model is based on multiple linear regressions, and the analysis extended over a period of 12 years from 2005 to 2016. In order to increase the number of periods, the data are expressed on quarterly bases, by totaling 48 observations.

The dependent variable for the purpose of this study will be the selling prices of apartment and residential areas in the capital of Albania, Tirana. Meanwhile the independent variables included in the model are the Population of Tirana ("POT"), Gross National Income per Capita ("GNI/C"), and the total area of new Construction Permits Approved ("CPA") from the government each year in Tirana, which represent the area added each year in Tirana residential sector. GNI/C is the most reliable variable to expresses the economic potential of a country because reflects the average income of a country's citizens. The increase of Tirana population in these 15 years was one of the main factors affecting the growth of the new constructions and the development of real estate sector. Meanwhile the new dwelling area approved from the government each year is the best metric to measure the increase of real estate sector and to determine the future supply in the real estate market.

Table 1. Data Used in the econometric model

Year	Average Residential Price ($)	Construction Permits Approved (sqm)	Gross National Income per Capita ($)	Population of Tirana
2005	826	1.278.000	2763	667.405
2006	1.040	678.000	3093	683.927
2007	1.161	342.000	3703	700.163
2008	1.335	953.000	4393	715.328
2009	1.306	470.000	4049	731.004
2010	1.174	774.000	4053	747.169
2011	1.245	745.000	4425	763.561
2012	1.045	320.000	4216	780.905
2013	954	495.000	4424	798.263
2014	963	666.000	4521	816.222
2015	877	4.000	3916	834.151
2016	1.091	141.000	4130	842.981

Source: INSTAT, World Bank, Authors Analysis

The information regarding the GNI/C is based on World Bank database and is expressed in US dollar currency; meanwhile the other independent variables are based on data provided from Albanian Institute of Statistic.

The information regarding the residential selling prices are based on market research conducted by the authors of the study, considering information published by real estate agencies operating in Albania and other public data. The information is expressed in US dollar currency.

The study has been extended over a period of 12 years from 2005 to 2016, because we have a lack of data related to the real estate price in the country since before the 1990s there was no real estate market at all. Even in the early 1990's, where a real estate market began in Albania, most of the transactions were carried out in informality and therefore we do not have reliable information to expose the study to a greater extent.

Multiple Linear Regression

To build up the statistical model, we have used the statistical program EViews 6.0, and the output of the data analysis is the following equation.

Residential Price = 2397.463- 0.000657 * C***PA*** + 0.3741 * ***GNI*** + 0.00359 * ***POT***

Test 1: Econometric Analysis

Dependent Variable: P

Method: Least Squares
Sample: 2005Q1 2016Q4
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2397.463	252.6825	9.488046	0.0000
CPA	-0.000657	0.000199	-3.295529	0.0019
GNI/C	0.374114	0.033105	11.30076	0.0000
POT	0.003597	0.000398	9.047447	0.0000

R-squared	0.749672	Mean dependent var	1072.128
Adjusted R-squared	0.732604	S.D. dependent var	164.0605
S.E. of regression	84.83624	Akaike info criterion	11.79898
Sum squared resid	316676.2	Schwarz criterion	11.95491
Log likelihood	-279.1755	Hannan-Quinn criter.	11.85791
F-statistic	43.92311	Durbin-Watson stat	0.205492
Prob(F-statistic)	0.000000		

In the statistical model generated, the ***R^2 Adjusted*** coefficient which is a better indicator than ***R^2,*** indicate a percentage of 73.26 % which mean that 73.26 % of depended variable i.e. the residential price is defined by the independent variables included in the model, and the rest is the remaining term which includes other factors not considered in the model.

By analyzing the coefficients β1, β2 and β3 signs, we will see that independent variables have a positive impact on the property price, except the CPA which has a negative impact. By referring to the values associated, we will have this analysis.

- If the CPA variable will change with one unit and the other variables will remain unchanged, the dependent variable will change by - 0.000657 units.
- If the GNI/C variable will change with a unit by keeping the other variables unchanged, the dependent variable will change with 0.3741 units.
- If the POT variable will change with a unit by keeping the other variables unchanged, the dependent variable will change with 0.00359 units

Fisher's Test is used to determine the general significance of the model. Based on the data generate from the model, the F-statistic indicates a value of 43.9 which is way higher than the Critical F with freedom degree [3;48] and significant level of α = 0.05, which in our case has a value of 2.79. Based on this result, we have the right to reject the null hypothesis and accept that the model we have built is important.

To determine the importance of each independent variable, we have used the Student's t-test. The value of the t-test for the variable POT is 9.04, for the GNI/C 11.3 and for the CPA -3.29, which are higher/lower than the critical t with freedom degree [48-3] and significant level of α = 0.05, which in our case result at a value of +/- 2.011.

Considering this result, we have right to reject the null hypothesis and accept that independent variables are important.

In addition, if we want that the model that we have built to be accurate it should complement the hypotheses of the Ordinary Least Squares method (OLS), i.e. the β coefficients are BLUE (Consistency, Unbiased and Efficient).

Homoscedasticity Test

To test whether or not heteroscedasticity is present in our model we will use the ARCH test.

The ARCH test is an autoregressive procedure over the residual squares over time:

Hypothesis

H_0: $\varphi_{1=}\ \varphi_2 \ldots\ldots = \varphi_\rho = 0$ ***Homoscedasticity***

H_a: At least ≠0 : ***heteroscedasticity***

The results obtained by the ***Testi ARCH*** confirm that the test value $n*R^2 =$ 28.16 is lower than the critical value $\chi^2_{47} =$ 67.5, concluding that our model does not suffer from heteroscedasticity.

Testing the normality distribution of remaining (residue) term.

To test if the remaining (residue) term has normal distribution, we will use the ***Test Jarque - Berra***, which tests in the whole if the distribution is normal or not.

Hypothesis

H_0 : Normality (good prediction parameters)

H_a : Lack of normality (the parameters are not good for prediction*)*

From the test results we see that the value of the coefficient Jarque-Bera = 1.34 is smaller than the critical value of $\chi^2_{(3)}$ whose value is 7.815 with the coefficient of significance α = 0.05. So, we are within the acceptance zone of the zero hypothesis, which means that the remaining (residue) term have normal distribution,

Testing the autocorrelation

If in a regressive pattern the remnants are correlated with themselves in the past then this model suffers from autocorrelation. To test the first order autocorrelation, we will use statistics Durbin – Watson.

Hypothesis

H_o: lack of autocorrelation

H_a: Autocorrelation *(the parameters are not credible for projections)*

To prove that a model does not suffer from the autocorrelation, the coefficient DW must be equal or circa 2. In our case the value of DW = 0.20, which means that our model suffers from a significant positive autocorrelation.

In this situation to correct the presence of autocorrelation we will apply two techniques.

Through the first technique, the presence of autocorrelation will be eliminated by using the first level differentiation.

In addition, by applying the second technique, we will include in the equation an autoregressive term AR (1).

Analyzing the equation obtained by the modifications applied we will see that the DW coefficient has reached a value of 1.78 that is close to 2, which mean that we have eliminating the presence of autocorrelation in our model.

Testing the multicollinearity

Testing multicollinearity means testing whether there are strong correlated between descriptive or independent variables. In such cases action must be taken to eliminate such links in order to obtain a better model.

To identify links between variables, we build the matrix of correlations.

Table 2. Correlation Matrix

	P	CPA	GNI/C	POT
P	1,00	(0,65)	0,70	0,85
CPA	(0,65)	1,00	(0,43)	(0,68)
GNI/C	0,70	(0,43)	1,00	0,74
POT	0,85	(0,68)	0,74	1,00

Source: Authors Analysis

By analyzing the correlation matrix, we can conclude that the independent variables are not correlated with each other and the model does not suffer from multicollinearity, except the variables GNI/C and POT which have a positive correlation coefficient of 0.74, which is justified by the theory because an increase in the number of population would bring an increase of GNI.

In addition, in order to understand the correlation of residential price with other independent variables, we will analyze each variable.

- Firstly, the residential price and the CPA have a negative correlation of c. -0.65, which is justified because an increase in construction permits would increase the stock of real estate and an increase in the stock would inevitably lead to a reduction in the selling price.

- In addition, the residential price has a positive correlation with the GNI/C of circa 0.7. Theoretical, an increase of GNI/C, which represents the average income of a country's citizens, would increase the demand for real estate and therefore the selling prices.
- The same we can conclude also regarding the positive correlation between the residential prices and the population, which an increase of population in a specific area would increase the demand for real estate and therefore the selling prices.

In conclusion, the model meets all the hypotheses of the OLS method and thus it is a model specified correctly and the coefficients α and β are consistent, unbiased and efficient (BLUE).

Study Limitations.

Although the linear regression model that we have outlined above fulfills the conditions for being a good model as well as fulfilling the hypotheses of the OLS method, again it has its limitations.

First, as we abovementioned, the residential price variable is an average of the prices of Tirana. The real estate selling price in Tirana fluctuate from one zone to another, were the price in central area of the city range from 2,000 to 2,500 USD/m^2, meanwhile in the city outskirts it range from 500 to 900 USD/m^2. It would be more interesting if we were to create two econometric models, one for central area and one for outskirts to soften variance between observations.

Secondly, although most of the data is referred to the World Bank database, which increases the credibility of the study, the remaining are based on public information and does not refer to an official database.

Lastly, in order to prove that a model is conducted in the right way, the main finding should be in line with other studies conducted by other researchers. Unfortunately, in Albania we have absence of studies regarding the dynamics of real estate prices and the real estate sector in general.

Conclusions

The price of real estate has increased rapidly during last years in Albania. Real Estate market is influenced by many factors, the most important is income of the population. According to empirical analysis the residential price has a positive correlation with personal income of about 0.7, because a growth of personal income, would increase the demand for real estate and therefore the selling prices of real estate.

It has often been argued that demographic factor has a significant influence on determining the price of wealth, they are widely studied, but their influence on the price of real estate remains unclear. In the real estate market in Tirana, residential price and the demographic factor are strongly related, we can conclude that this

correlation is positive 0,85, which an increase of population in a specific area would increase the demand for real estate and therefore the selling prices.

The residential price and the construction permits have a negative correlation -0.65, which is justified because an increase in construction permits would increase the stock of real estate, and an increase in the stock would inevitably lead to a reduction in the selling price.

Bubble effect on real estate is a new occurrence in Albania. Currently, the real estate market in Albania is in a bubble stage because the prices and stock of assets are very elevated. The real estate market in Albania is very complex. This complexity can be caused by many factors such as informality, the government's lack of regulatory capacity, and uncontrolled population migration to the capital and the coastal cities as Tirana, Durres and Vlora.

Has a conclusion, the empirical results indicates that c. 73% of depended variable is defined by the independent variables included in the model, meaning that the residential price in Tirana during the last 12 years, was highly affected by the increase of the population, which has direct impact the demand for real estate, the increment in the household income as well as government policies that have been implemented in the real estate sector.

Appendix

1. Heteroskedasticity Test: ARCH

Heteroskedasticity Test: ARCH

F-statistic	67.30420	Prob. F(1,45)	0.0000
Obs*R-squared	28.16722	Prob. Chi-Square(1)	0.0000

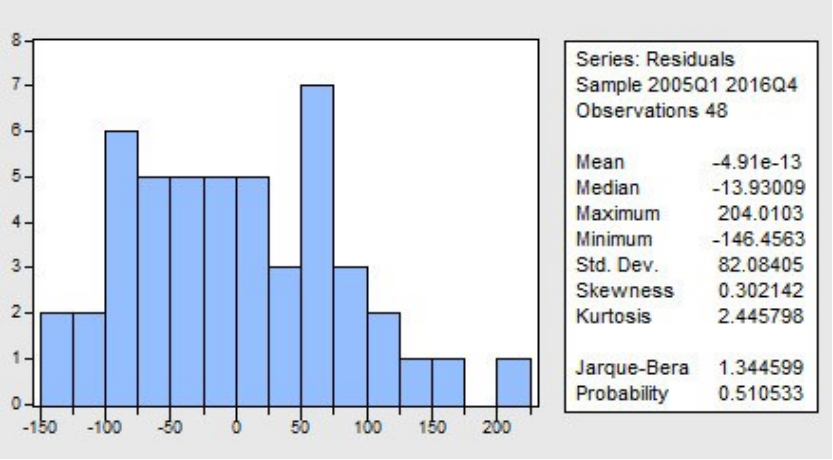
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample (adjusted): 2005Q2 2016Q4
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	650.4172	1045.344	0.622204	0.5369
RESID^2(-1)	1.011633	0.123311	8.203914	0.0000

R-squared	0.599303	Mean dependent var	6570.753
Adjusted R-squared	0.590398	S.D. dependent var	8101.294
S.E. of regression	5184.839	Akaike info criterion	19.98649
Sum squared resid	1.21E+09	Schwarz criterion	20.06522
Log likelihood	-467.6824	Hannan-Quinn criter.	20.01611

F-statistic	67.30420	Durbin-Watson stat	1.329481
Prob(F-statistic)	0.000000		

2. Histogram, Normality Test



3. The new equation to correct the presence of autocorrelation

Dependent Variable: D(P)
Method: Least Squares
Sample (adjusted): 2005Q3 2016Q4
Included observations: 46 after adjustments
Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	52.64939	26.52403	1.984970	0.0539
D(CPA)	1.22E-05	3.12E-05	3.390328	0.0083
D(GNI)	0.201299	0.036924	5.451697	0.0000
D(POP)	-0.012416	0.005857	-2.120043	0.0401
AR(1)	0.846119	0.086776	9.750587	0.0000

R-squared	0.873528	Mean dependent var	7.291713
Adjusted R-squared	0.861189	S.D. dependent var	34.60926
S.E. of regression	12.89449	Akaike info criterion	8.053800
Sum squared resid	6816.986	Schwarz criterion	8.252565
Log likelihood	-180.2374	Hannan-Quinn criter.	8.128258
F-statistic	70.79546	Durbin-Watson stat	1.783718
Prob(F-statistic)	0.000000		

Inverted AR Roots	.85

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