HOUSING BUBBLE AND DETERMINANTS OF HOUSE PRICES: AZERBAIJAN CASE

By Tural Ahmadov

Submitted to Central European University

Department of Economics

In partial fulfillment of the requirements for the degree of Master of Arts

Supervisor: Prof. Attila Rátfai

Budapest, Hungary

2010

Acknowledgement

I am very grateful to my supervisor, Atilla Ratfai for his valuable advices and discussions during our meetings throughout thesis period. I would like to express my gratitude to Salman Huseynov and Elchin Huseynov for their fruithful comments on my thesis work. Moreover, I am thankful to my friends Shams Asadova and Rashad Karimov for their endless support during the academic year.

Abstract

In this thesis I try to find out the existence of bubble period in real house prices in Azerbaijan and house price determinants. I mainly use three approaches: simple affordability and sustainability indicators, asset pricing approach and VECM methodology. Indicators show the period between 2002 and mid-2006 as bubble period in house prices. Asset pricing approach does not reject the existence of a bubble in this period. I construct VECM in order to analyze short-run dynamics of real house prices with fundamentals. In the long-run equilibrium real income and real interest rate are taken as fundamentals. In the short-run only interest rate plays a role in the dynamics of real house prices. House prices adjust to the long-run equilibrium nine percent in a quarter.

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

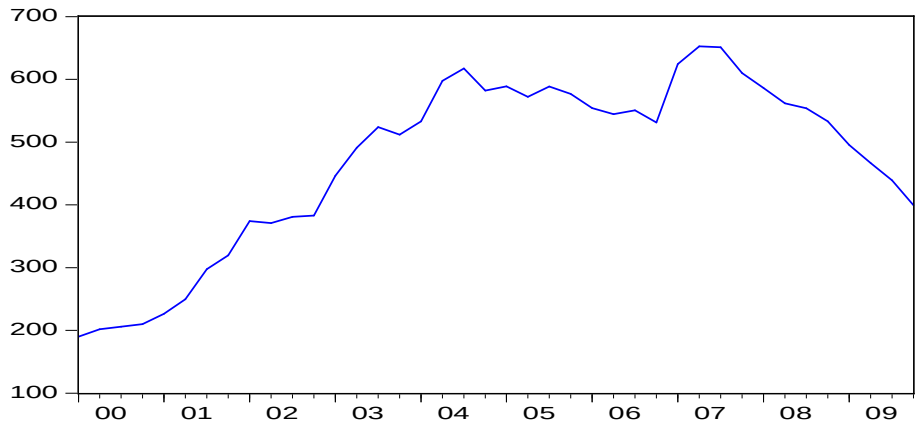
CHAPTER 1: Introduction

"If the reason that the price is high today is only because investors believe that the selling rice is high tomorrow-when "fundamental" factors do not seem to justify such a price- then the bubble exists."

Stiglitz (1990)

Over the last ten years Azerbaijan has achieved rapid economic growth due to the increase in oil prices and the new pipeline projects which led to the increase in the supply of oil to European markets. This rapid boost in growth domestic product contributed a lot to the development of other non-oil sectors. As the capital and biggest city in the country Baku faced with high inflow of people from different parts of the country and even from neighbor countries. As a result of rapid economic growth and vast inflow of people increased demand for housing lead to influential increase in prices.

Figure 1: Real house prices in Baku



It can be concluded that inelastic supply of housing does not meet the increasing demand. The cause for demand increase is not only the demand coming

from inflow of newcomers. New flats offer more comfort and utilities than old flats built in the time of Soviet Union. Increase in the wealth of people makes it affordable for them to switch new flats. Investors seeking for new investment projects find real estate market as a safe harbor in the light of increasing house prices. Decrease in the real interest rates makes it possible for households to take long-term loans in order to finance their purchases. Economic development increases the optimism about future. And a big optimism leads to increasing credits to the private sector, inflation in asset prices, and excessive consumer expenditures. Case and Shiller (2003) states that expectations about the increase in house prices in the future make them temporally increase.

In the period of bubble, households think that if they do not buy today they would not afford it tomorrow. Households know that house prices are too expensive but the idea that they will be compensated with the increasing prices tomorrow makes them confident to see the house as a safe investment. Wealth effect of house prices make households to consume more than they otherwise do. Elevated prices increase capital gains from housing which in return makes household to believe that houses do saving for them and they do not need to save more. This perception leads them to consume more.

This appreciation in prices does not continue forever and when people think that price will no longer increase the bubble explodes. Considering all these effects of overvaluation of prices in the stability of the economy, it is crucial issue to analyze the determinants of house prices in Azerbaijan, detect housing bubble if there is any and find the ways to avoid or minimize the harms of bubble when the house prices bust. The role of real estate market in the recent financial crisis made it more

appealing topic for studies. In Azerbaijan house prices inflated together with expansion of credits. Large portion of credits finances house purchases and different consumer needs. Because of the wealth effect of price increase households borrow more credits to finance their other needs. These credits are collateralized with houses. Housing bubble busts may lead to credit default and decrease in capital and loans collateralized by real estates. This reduces real estate lending.

Decreasing demand for houses makes downward pressure on prices. Further decrease in prices feeds back to bank lending. Therefore, close research of real estate market is of great importance for central banks in order to avoid such financial instability. Another important aspect is the additional unemployment emerging from the burst of bubble. Job losses from construction sector add additional pressure on economic development. Understanding the determinants of housing prices is also important because real estate sector constitutes large portion of households' wealth. Decreasing prices lead to a downward shift in consumption through the wealth effect. Bubble in prices is usually defined as the discrepancy between prices and fundamentals.

In this paper I explain the determinants of house prices in Azerbaijan and then identify the periods of bubble when prices diverge from fundamentals. To my knowledge, the determinants of house prices and identifying bubble periods using econometric methodology were not studied specially for Azerbaijan real estate market. This is the first paper trying to fill this gap. Only one study was done by Stepanyan, Poghosyan and Bibolov (2010) in order to determine house price determinants in several Soviet Union Countries with panel data approach. They use income, foreign inflows and workers' remittances as fundamental factors. According

to their findings, bubbles were not formed in Former Soviet Union (FSU) countries like in some other developed countries. They also state that there is eighty percent deviation between house prices and fundamental value before crisis and twenty percent in the peak point of prices in Azerbaijan. I use different fundamentals that I think more suitable for this country and do Johansen (1995) cointegration method for long-run equilibrium and VECM for short-run dynamics of prices. I choose fundamentals among conventional fundamental determinants addressed frequently in relevant studies. Empirical analysis covers several approaches. First, I try to detect bubble periods with some commonly used affordability and sustainability indicators. Asset pricing approach proposed by Campbell and Shiller (1987) with some restrictions on stationarity of assets their cash-flows is applied. Finally, VECM is used to find long-run equilibrium and short-run dynamics of prices with fundamentals.

The rest of the paper is organized as follows. In the next chapter, I go over the relevant studies relating to my topic. Data description, theoretical background, empirical methodology and preliminary analysis with affordability and sustainability ratios and asset pricing approach are thoroughly explained. In chapter four long-run and short-run dynamics are determined with unit-root, cointegration and error correction models. The last chapter concludes all my findings and provides some explanations to results. In the end of the paper all relevant references are added. In the Appendix section you can find all tables and figures which are mentioned, but not provided inside the main part.

CHAPTER 2: Literature Review

Different models, both in theoretical and empirical methods are presented in explaining the housing price dynamics and determining bubbles in housing prices if there is any. I only consider the ones which are more relevant to what I describe in this work. This topic has been in the main interest of the large number of empirical studies because indeed real estate markets play an essential role in the dynamics of other real markets in the economy.

According to efficient market theory, prices must reflect all the available information in all times. Therefore, according to Fama (1970) bubbles cannot occur. But Shiller (2004) states that house is not only used for capital gains from it but also for shelter reasons and it is real and illiquid asset which could not be sold and bought in a short time period in order to eliminate the overpricing in the market as it is the case in financial markets. Therefore, the disequilibrium may continue in the market for a while. Case and Shiller (2003) support the idea that bubbles occur in the existence of overconfidence in the market. This overconfidence that the prices will surge in the future increases the demand for houses. Considering the inelastic supply of houses, prices jump up starting even today. This kind of rational behavior is based on the idea of buying now and selling in the future, assuming the upward trend in prices. Stiglitz (1990) supports this view and indicates that the bubble in prices occur because people think that prices will be high just because it is high now.

According to general acceptance, bubbles occur when prices deviate from their fundamentals. There are two kinds of fundamentals: fundamental value and market fundamentals. Fundamental value of an asset is determined by the present

value formula using three factors such as holding period, discount rate and rents received during the holding period (Stiglitz, 1990). This asset pricing approach is mainly remained in theoretical analysis rather than empirical analysis because of its difficulties in estimating for future. But Black (2006) and Chan (2001) tried to find existence of bubble with this approach using changeable and constant discount rates respectively. Second kind of fundamentals are market fundamentals which determined by supply and demand in the market. There are large number of demand side and supply side factors which have been used by researchers using econometric methodologies in order to compute fundamental value of house prices. Garcia Montalvo and Mas (2000) separates demand side into two concepts: potential demand and effective demand. Potential demand emerges due to social and demographic factors such as migration and household growth. Effective demand arises due to increase in the household disposable income and household wealth. They affect the prices in the long and short run respectively. Supply side is mainly consists of the old house stock because the new completions is a small part of total house stock. But due to the fact that it takes time to respond to high current prices, housing stock can affect the prices only in the medium or long run.

Besides the variety of fundamental factors, different econometric methodologies are also employed in empirical studies. These methodologies range from basic OLS to dynamic VECM methods. Abelson (2005) uses Stock-Watson Dynamic Ordinary Least Squares (DOLS) for long-run and Asymmetric ECM for short-term equation. Inverted demand equation is derived from demand-supply equation with factors such as stock prices, real mortgage interest rate, real household disposable income per capita, unemployment rate, trade-weighted exchange rate and housing stock per capita. Abelson (2005) argues that omitting housing stock from

model is a major error. But he does not include costs of construction as Bourassa and Hendershott (1995) and Bodman and Crosby (2003) do. Omitting this variable could be problem if new houses are the large part of total housing stock. This may be the case in new emerging countries. He finds that in Australia housing prices adjusts to long-run equilibrium in four quarters. Egert and Mihaljek (2007) use panel DOLS methodology for house prices in Central and Eastern Europe countries and nineteen OECD countries. Real income, real interest rate, credits and demographic factors establish robust relationships with house prices. Hui and Yue (2006) employ Granger causality test and impulse response analysis in three main Chinese cities in order to find the existence of bubble. In two cities, according to their findings, the fundamental determinants and house prices do not have a proper relationship. Meen (2002) apply VECM for UK and US with variables such as real house prices, real disposable income, real interest rate and real wealth. Elasticities of real house prices relative to these variables are significant. He concludes that high real house prices are not because of inelastic supply in US but it is the case in UK.

There is no a unique methodology and no specific factors which should be added. But nearly all these studies consider real disposable income, real interest rate and real credits. Additionally rents, CPI and some social and demographic factors could be added. Proper methodology and fundamental factor should be selected according to the data available and country or region under study.

CHAPTER 3: Data Description

I use quarterly data starting from the first quarter of 2000 and ending the fourth quarter of 2009 which is obtained from CBA. I use quarterly observations of nominal income, consumer price index, nominal interest rates, and nominal long-term credits to private sector, nominal house prices, nominal rents and petrol prices of Brent oil for the period under consideration.

The data on CPI is in quarterly basis of which the difference reflecting the inflation between the quarter of this year and the same quarter of the previous year. Until 2005 the inflation rate is around five percent, after 2005 it goes up till the peak point in the third quarter of 2008. After that data there is sharp decline in prices, even deflation is visible. This sharp decline should the result of the crises which affected demand negatively. This index is used to get real variables from nominals such as house prices, income, credits and interest rates.

As a main data of this study, house price is collected from CBA and real estate consulting company, which is defined as the average price of one square meter of flat prices in the primary real estate market in Baku. .

The primary variable of this research, the house price, is defined as the average price of one square meter of flats in the primary real estate market in Baku. The non-availability of the data for the whole country, I assume that these prices reflect the overall prices in the country because Baku plays the locomotive role for the whole economy of a country. Although house prices in levels are different in other cities of the country but assuming that the changes in these prices are the same in all the cities, it is meaningful to consider capital prices as a representative for the whole

country (Abelson and Chung, 2004). House prices take upward direction from the beginning of the period and reach their peak point at the fourth quarter of 2007. From that point prices decline until they reach the equilibrium prices. Over the ten year period real housing prices increased more than three times.

Real interest rate is obtained from nominal interest rate by deflating it with CPI. The interest rates reflect the long term credit rate to the private sector. The path that it takes is the reverse of housing prices do. Nominal income is also deflated by CPI and used as a proxy for the disposable income. Nominal rents are the average rent rate for the seventy square meters flat in Baku. Nominal rent prices are deflated by CPI. Credit data is the total long-term credits to private sector including both in AZN and in major foreign currencies. Over the ten years real credits increased more than ten times. Oil price is taken for Brent type oil showing the price of one barrel crude oil. Oil prices have two large shifts, one upward in the third quarter of 2007 and one downward shift in the fourth quarter of 2008. These two shifts are used in my analysis.

All the used variables are in their log forms. Only interest rate is in the level form. Each variable is expressed in AZN including oil prices which is converted from USD to AZN using quarterly data of exchange rates. Descriptive statistics and Correlation matrix is given in Table 2 and 3 (See Appendix).

Table 1: Variables used

rhp	is the log of real house prices
rcredit	is the log of real long-term credits
rinc	is the log of real income
rinterest	is the real interest rate
oil	is the log of oil prices
rent	is the log of real rent

Theoretical and Empirical Methodology

It is wrong to name every dramatic increase in house prices as bubble. In order to analyze the real existence of a bubble in a market it is necessary to relate house prices with their fundamentals. In the literature these issues are approached from three different angles. Affordability indicators, econometric models and asset pricing approach are these three approaches that I use as a theoretical cornerstone of the paper. Basic indicators such as price-to-income and price-to-rent ratios are widely used in the literature. If the ratio of price-to-income rises above its long-run average then this signals the overvaluation of prices. Average income buyer could not afford house at these prices and as a result reduction in demand will make pressure on house prices. Then, house prices are expected to decrease in the medium-run. But this indicator can be misleading because in the real estate market demand and supply groups are specific portion of a population and their income can be more than average income. The income in the calculation of this ratio is the average income of a population. Another indicator of overvaluation is the price-to-rent ration. It is the equivalent of price-to-dividend ratio in stock market for real estate market. Non-proportional increase in house prices increase the ratio which makes it cheaper to rent rather than buy a new house. Again pressure on demand for houses decreases prices. If there is efficiency in the market then this ratio must be stable in the long-run. But this process of returning back to equilibrium takes time. Therefore, there may bubbles in the short and medium-run.

In the asset-pricing approach, I closely follow Campbell and Shiller (1987) model of present value formula with bubbles.

$$P_t = \theta(1-\beta)\sum_{i=0}^{\infty} \beta^i E_t R_{t+i} + b_t + c \quad (1)$$

where, P_t is house price, R_t is a rent, β is the discount rate, E_t is expectation conditional on information at time t, θ is the coefficient of proportionality, b_t is a random variable for bubble term and c is the constant. This model calculate the price of house by adding present values of all future earnings of owning a house discounted by a discount rate. This does not change whether you own a house or not. If you own then you do not pay the rents that you otherwise pay if you do not own a house. Rational bubble exists when $b_t = \beta E b_{t+1}$. This implies that consumers rationally pay higher price for houses if they expect that the prices will increase in the future. If there is no bubble (b_t=0), then prices and rents are related by the equation (1). If we define spread variable as $S_t \equiv P_t - \theta R_t$ then, from equation (1) it is possible to derive

$$S_t = \theta \sum_{i=1}^{\infty} \beta^i E_t \Delta R_{t+1} + c \quad (2)$$

and

$$S_t = \left(\frac{\beta}{1-\beta}\right) E_t \Delta P_{t+1} + c \quad (3)$$

These two equations relate the differences in prices to differences in prices. If we set $c = 0$, $\theta = \frac{1}{D}$ and $b_t = 0$ it is easy to derive equation (4) from (2).

$$E_t \frac{\Delta P_{t+1}}{P_t} = D - \frac{R_t}{P_t} \quad (4)$$

Campbell and Shiller (1987) call this no arbitrage condition. Expected return from house equals discount rate. The non-stationarity in ΔR_t transforms to S_t via (2) and to ΔP_t via equation (3). If S_t is stationary, then from equation (2) ΔR_t is stationary and ΔP_t is stationary via equation (3). If both rents and house prices are non-stationary but spread is stationary then present value formula requires that the first difference of rents and house prices must be stationary. This is the argument as cointegration between two variables. Therefore, checking the stationarity of spread is the as checking cointegration between rents and house prices. Stationarity of the spread is the present value formula with no bubbles. If we set spread to zero, then price-to-rent ratio is constant which means that stationarity of spread is also stationarity of price-to-rent ratio. The next step is the unit root tests of rents and house prices. Four different scenarios may occur.

Scenario 1: P_t is stationary and R_t is stationary

Scenario 2: P_t is stationary and R_t is non-stationary

Scenario 3: P_t is non-stationary and R_t is stationary

Scenario 4: P_t is non-stationary and R_t is non-stationary

First two scenarios are not interesting because they clearly imply that there is no bubble. Third scenario is the case when existence of bubble cannot be rejected if present value model is correct. Forth scenario does not directly imply that there is bubble. Cointegration between rents and prices or the stationarity of prices-to-rent

ratio have to be checked. If price-to-rent ratio is stationary then there is no bubble according to asset pricing approach.

Third approach concentrates on computing fundamental prices of houses and compares them with actual value. Fundamentals divided into two parts, demand (real disposable income, real interest rate, unemployment rate, population, real wealth) and supply (housing stock, construction costs). Real house price changes can be expressed as the fraction of the difference between demand and supply:

$$P_t - P_{t-1} = \alpha(D_t - S_t)$$

where

$$D_t = f(Y, R, DF..etc)_t$$
$$S_t = f(HS, CC..etc)_t$$

Y : is the real disposable income

R : is the real interest rate

DF : are the demographic factors

HS : is the housing stock

CC : is the construction cost

etc : other factors

Following Meen (1990) and Hendry (1984), it is possible to represent house price as an inverted demand equation:

$$P_t = f(Y, R, DF, HS, CC..etc)_t$$

Considering large variety of econometric methodologies that can be used in the determination process of house prices with fundamentals, I concentrate mainly on

VAR models. VAR model captures dynamic relations between variables included in the system. Before including variables, unit roots are checked. If they are all I (1) then, it is possible that some linear combinations of them are I (0). Then, they are called cointegrated. Engle and Granger (1987) suggest VECM instead of VAR if the variables are cointegrated. VAR representation can be represented as VECM as follow:

$$\Delta Y_t = A_0 + \sum_{i=1}^{p-1} \psi_i \Delta Y_{t-i} + \Pi Y_{t-1} + \omega_t$$

where

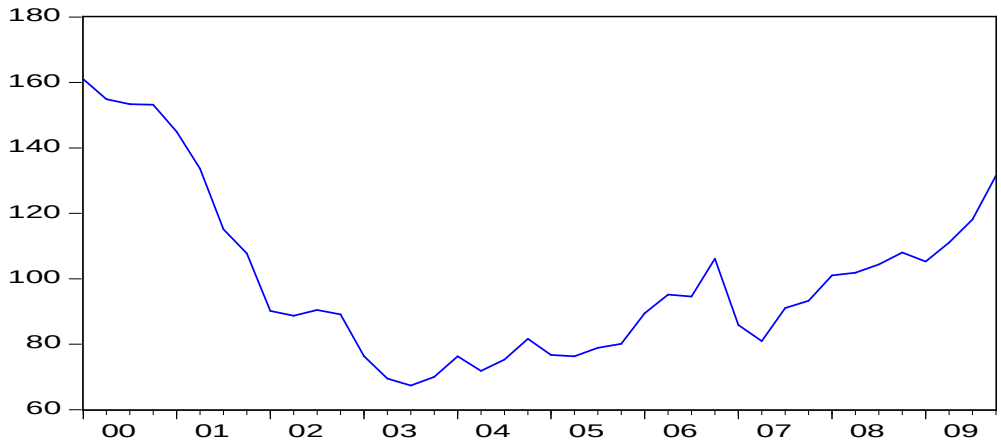
$$\Psi_i = -\sum_{j=i+1}^{p} A_j \qquad \text{and} \qquad \Pi = \alpha\beta' = \sum_{i=1}^{p} A_i - I$$

The term ΠY_{t-1} represents long-run relationship. α is the matrix of loading coefficients which shows the adjustment speed of endogenous variables to the long-run equilibrium. I follow the model proposed by Eddie and Yui (2006). As a first step unit root and cointegration tests are checked for selected fundamentals then long-run relationship is determined by the method proposed by Johansen and Juselius (1990). After determining proper long-run relation between variables, Error correction model for house prices are estimated. ECM shows the short-run dynamics of house prices. Lastly Granger causalities and Impulse response functions are checked.

Preliminary Analysis

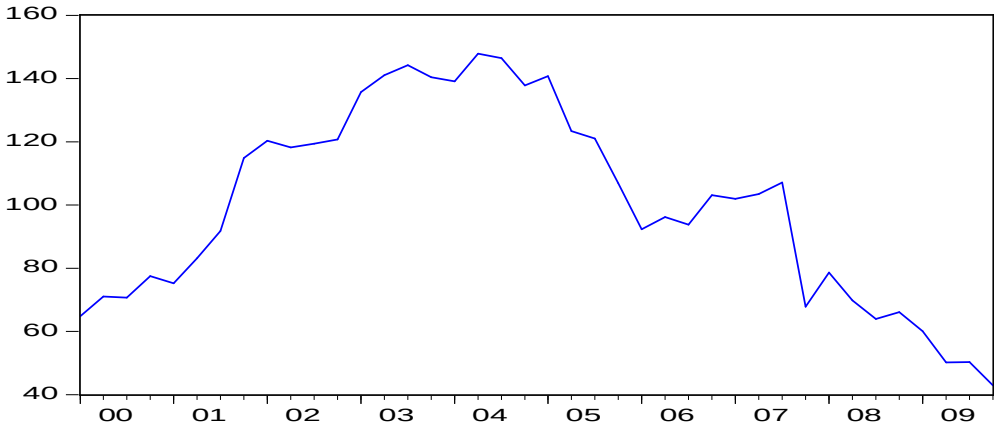
In this section I evaluate price dynamics in Azerbaijan with sustainability and affordability ratios and asset pricing approach proposed by Campbell and Shiller (1987) is discussed. From the Figure 1 it is seen that real house price surges till the third quarter of 2007 where it reaches its peak point then starts declining. From 2000 to 2007 increases approximately 245% then decreases 40% till the end of 2009. Rental return ratio is the inverse of price-to-rent ratio. It is useful to report it because it can be compared with real interest rates. Zemcik (2009) used this ratio in the identification of bubbles in Czech Republic. The ratio is deteriorates from 2000 till 2004 then starts recover (Figure 2).

Figure 2: Rent return



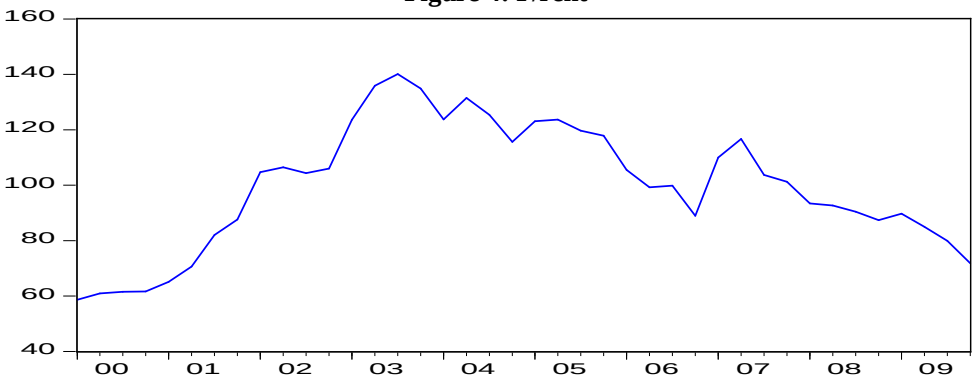
Deterioration is mainly a result of increasing prices faster than rents. After 2004 growth in real house prices is stable till 2007. In 2007 there is positive growth, after which real prices begin to fall down. During the period of nearly no growth in real prices, positive growth in rents makes rent return ratio to recover. The period 2002-2006 can be counted as bubble period in prices according to rent-return ratio. Another ratio is the affordability ratio which is price-to-income (Figure 3).

Figure 3: P/I



This ratio is used by Cadil (2009) in the identification of bubbles. During the period of investigation real income has stable growth. Therefore, all dynamics in the affordability ratio depends on real prices. Between 2002 and mid-2006 the ratio is above the average of ten-year period. This indicates about the existence of bubble in this period. After mid-2006 stable growth of real income pass the no-growth rate of real prices. Prices-to-income ratio drops down to the level which is, even below the 2000-value. In the end of 2009 houses become more affordable than it was in 2000 with the current real incomes. With the price-to-rent ratio I reach the same results that, if there are no other fundamentals that can account for this rapid growth in house price between 2002 and 2006 then existence of bubble can be taken into account (Figure 4).

Figure 4: P/rent



The first step in the analysis of the bubbles in asset-pricing approach begins with unit-root tests. Augmented Dickey-Fuller (ADF) tests and Kwiatkowski, Phillips, Schmidt & Shin (KPSS) tests are used in checking the order of integration of real rents, real house prices and price-to-rent ratio. When rents and prices are non-stationary, we have to check the cointegration between them or the stationarity of price-rent-ratio. If all these variables are I (1) then there exists bubble because this contradicts present-value model with no bubble. For Azerbaijan I find that for the period of 2000-2009 all three of these variables are non-stationary and I (1) (Table 6 and 7). Therefore, I find bubble according to asset-pricing approach.

CHAPTER 4: Unit Root and Cointegration Tests

In each time series analysis it is very important to know the order of integration of the series under consideration. Several tools are available for checking this. I use Augmented Dickey-Fuller (ADF) tests and Kwiatkowski, Phillips, Schmidt & Shin (KPSS) tests for checking the order of integration. ADF checks the null hypothesis of unit root against the alternative of stationarity which could include a nonzero mean, a deterministic term and some seasonal dummies. KPSS tests stationarity under null hypothesis against non-stationarity. But these tests have low power if there are structural breaks in the series. Therefore, I also check the series with the unit root test with structural break. This test, proposed by Saikkonen and Lutkepohl (2002) is used when there is contradiction between the result of ADF and KPSS tests.

I use seasonally adjusted data because there is strong seasonality in the series which could include seasonal unit roots. In order to reveal if there is any seasonal unit root or not I apply the test proposed by Hylleberg, Engle, Granger & Yoo (HEGY). In real credits and real income regular and semiannual unit roots exist. In order to get free of these roots the seasonal differencing of the series is required .This procedure is not free lunch. It reduces the degrees of freedom in my small sample. That is why I apply Census X12 in order to make the series seasonally adjusted. But besides to this I use seasonal dummies together with other deterministic terms in each test. The results are tabulated in Table 10, 11 and 12.

The results show that both housing prices and real credits are I(1). There are some contradictions between the results of ADF and KPSS for real interest rate, real

income and oil prices. KPSS and ADF offer I(1) and I(0) respectively for the real income and opposite of it for oil prices and real interest rate. I check these variables with the test for structural breaks with specific structural break date and the test statistics cannot reject unit root even in 1% significance level. So I conclude all series are I(1). Since all variables are integrated of order one, I continue with cointegration.

I use Johansen (2005) test because it is proper test for identifying more than one cointegration equation which is not the case in Engle-Granger (1987). I include centered seasonal dummies together with deterministic terms and if trend is insignificant I exclude it from the cointegration equation. Lagged differences are the ones offered by Schwarz information criteria. Before checking the all variables together, it is better beginning to check cointegration in bivariate systems. This helps to choose the proper order for normalization in estimation stage. If one of the variables include linear trend then trend is included to the test. The results are reported in Table 13. The results show that there are cointegration relations between housing prices and real credit, real income and oil prices. Another cointegration comes out between real interest rate and real credits. There is no direct cointegration between housing prices and real credits which is surprising. These bivariate cointegrations give me hope to believe that there is at least one cointegration between different combinations of these variables together. In multivariate case I look to two different cases. Firstly I look the cointegration relation between house prices, real credits, oil prices and real income. Second choice includes real house prices, real income, and real interest rate. Results are given in Table 14. Results approved my expectation of at least one cointegration and they are in line with bivariate results. For both cases one long run equilibrium, with or without the trend in the cointegration space is found. The trend term inside the cointegration equation is significant.

Empirical Results

Long-run equations

The procedure for finding long-run model begins from VAR model. Proper deterministic terms and lag length are added and trace test statistic shows the right cointegration rank for the given variables. Rank number is considered as a number of long-run relationships.

In this stage I analyze two long-run models and continue with better model in the analysis of short term dynamics. The results for the two cases are tabulated in Table 2.

Table 2: Cointegration Analysis

Vector	Coefficients and std deviations (in parantheses)	
	Equation 1	**Equation 2**
rhp	1.00	1.00
	(-)	(-)
rinc	-4.70	-2.58
	(-1.53)	(-0.33)
rinterest		3.24
		(-0.49)
rcredit	2.20	
	(-0.68)	
oil	-1.15	
	(-0.38)	

In both models all coefficients are significant and many of them have expected signs which coincide with relevant studies in the literature. In the first model real income has positive effect on real house prices. Elasticity of real house prices relative to real income is 4.7. In the long-run, ten percent increase in real income increases housing prices by 47 % which is a large number. This maybe is due to the short data

period, which only captures the period of high inflation in house prices and nominal income. Rapid growth of GDP makes people overconfident about the future. They start to consume a lot and save little. Considering the difference in quality of old flats built in Soviet Union times and new European style flats, households demand increases to new types of flats. Besides to this, investors see the real estate market as a secure investment relative to financial market which they consider volatile to oil shocks. In addition to these factors, house prices could be underpriced before independence of the country and now they try to catch the real price determined by supply and demand to houses. These factors make us believe that this large effect indeed is possible for a while. Meen (2002) finds this number as 2.7. Bessone et al. (2005) find even larger elasticity than mine, nearly 8.3 for Paris. Therefore, this large number is possible and can be a result of a bubble inside the period considered.

The elasticity of real house prices relative to oil prices is 1.15. Increase in oil prices also positively affects the house prices. This may not be the case for oil importers. But for the oil-rich country, oil price increase leads to the increase of GDP. The notion of oil price increase accepted as a future inflow of petrol-dollars in Azerbaijan. Therefore it is as an expected increase in income. Developers of houses receive this as a future increase in demand which eventually reflects itself in the increase of house prices. But the effect may be mixed with income effect. Therefore, in the second model I exclude the oil prices to see the change in the elasticity of house prices relative to real income.

The last variable in the first model is real credits. Annett (2005) finds the elasticity of house prices relative to real credits around 0.2 for some European countries but she agrees that it is not so easy to evaluate the relationship between

credits and house prices. Credits play a role in determining house prices only in some countries. Predictive power of credits on house prices is not so clear. I find coefficient of long-term credits negative. By theory it should be positive. Increase in credits should increase demand for houses which in turn increases prices. One explanation for this negative elasticity could be the following. The price that I use is the weighed average of existing and new house prices. In addition the house stock for Baku consist ninety percent form existing houses. Therefore, households who try to sell their old houses and buy new ones borrow credits, for the difference between prices between old and new ones, from banks. This increases credits but decreases house prices. But omitting it form the model may exclude the effect of financial market on real estate market. Therefore, I include real interest rate into the model which captures the effects of money market.

In the second long-run model I left with real house prices, real income and real interest rate. I omit oil prices because it could highly correlate with real income and income effect could be overestimated. Still, coefficient of income remains positive but has smaller value. This maybe due to the effect of oil prices on house prices from two different sources. First one as I mentioned above, oil prices could play a role of expectations about future and secondly oil prices effect incomes directly. Therefore, this large number can be considered satisfactory in the first model. In the second model all coefficient have expected signs and they are all significant. The elasticity of real house prices relative to income is 2.6. In the literature this number changes between 1.5 and 3. Meen (2002) finds this number as 2.5 for UK. We see that elasticity decreases from 4.7 to 2.6 when I eliminate oil prices from the long-run model. My expectations partly satisfied.

The next variable in the second model is real interest rate. It is one of the main variables with the expected negative sign, used in the literature. I find the coefficient as 3.24. This shows that 0.03 (3%) increase in real interest rate decreases house prices by 10%. Real long-term interest rate can be considered as a price of credits for borrowers. When interest rate increases it becomes more difficult for borrower to return the debt. Therefore, people who want to buy house with mortgage credits, will shift to rent market rather than buying new houses when interest rate increases. Prices shift down when demand decreases. This is the case now in Azerbaijan. Beginning from the third quarter of 2007 till the end of 2009, prices of houses declined 40% in real value. The result for weak exogeneity tests for three variables in the cointegration equation are given in Table 3.

Table 3: Weak exogeneity test

Vector	Test Statistics	Prob
rhp	$\chi^2 = 5.03$	0.024
rinc	$\chi^2 = 4.85$	0.027
rinterest	$\chi^2 = 1.76$	0.183

Results show that weak exogeneity is strongly rejected for income and house prices but not for interest rate. Therefore, I apply zero restriction on the loading coefficient of interest rate in the next section. Weak exogeneity of real interest rate means that it is determined not by the system of these three variables. I continue with this model as a true long-run model. In the next section I try to explain short-run fluctuations in housing prices with fundamentals.

Error Correction Model

In this section short-run dynamics of real house prices are investigated with VECM. I check whether there is partial adjustment to long-run equilibrium and which variables effect short-run dynamics of real house prices. Significance of the coefficients of lagged variables and the coefficient of cointegration equation is checked. Loaded coefficients show the adjustment speed of endogenous variables to the long-run equilibrium. I use cointegration equation with real house price, real interest rate and real income. I include one lag of endogenous variables, seasonal dummies. In addition, trend and constant are included inside the cointegration space. I omit the lagged endogenous variables' coefficients by imposing zero restrictions on their coefficients which appear insignificant. In order to get model for house prices, I normalize the coefficient of house prices to one in cointegration equation. I report only real house price model in Table 4.

Table 4: Short-run equation

$$\Delta rhp_t = -0.092(EC)_{t-1} + 0.56\Delta rhp_{t-1} - 0.347\Delta r\,\text{int}\,erest_{t-1}$$

(0.034) (0.105) (0.173)

I get minus sign in error correction term which proves that there is adjustment process in short-run to the long-run. Each quarter real house prices adjusts 9% to the long-run relationship between income, interest rate and house prices. The only lagged values of real house prices and real interest rate are significant in the short-run. In the short-run real effect does not affect real house prices. Before continuing to Granger

causality analysis I check for autocorrelation, normality and conditional heteroskedasticity of residuals. Results are tabulated in Table 5 and residual autocorrelation and partial autocorrelations are plotted in Figure 5 and I find no concern to worry.

Table 5: Diagnostic Statistics for the House Price Model

Portmanteau test	$\chi^2 = 134.92[0.558]$
LM test	$\chi^2 = 61.43[0.052]$
ARCH-LM test	$\chi^2 = 13.80[0.61]$
VARCH-LM test	$\chi^2 = 189.90[0.29]$
Normality test	$\chi^2 = 1.07[0.58]$

Granger-Causality Analysis

I do Granger Causality tests between house prices, income and interest rates. Firstly, causalities are explored between pairs in VAR(4) model. Then, VECM model of house prices, interest rate and income is used to capture the causality between house prices and two fundamentals together. Results are given in Tables 15 and 16. I detect Granger causality only between house prices and interest rates. No Granger causality is found between income and prices which means that housing prices in Baku boost much faster than real income. But in 10% significance level there exist causality from house prices to income. This could be due to capital gains from the boost of house prices. Existence of Granger causality between interest rates and house price is expected. As I explained before higher interest rates leads to less demand in real estate market which consequently decreases prices. Opposite causality from prices to interest rates can be explained as an appreciation of the houses as collateral

gives banks opportunity to enlarge credit lines with lower interest rates. In VECM null hypothesis with no Granger causalities are rejected in both directions.

Generalized Impulse Response Analysis

With the help of Impulse response functions it is possible to show the effect of one standard deviation shock to one of the innovations on the values of interest rate, house prices and income in VECM. It gives opportunity to trace the two-way dynamic relations between variables. I use generalized impulses (orthogonalized innovations) in order to make responses invariant to the ordering. Accumulated responses are depicted in Figure 6. The standard deviation of house price itself leads to positive increase in the next eight quarters. Accumulated response of house prices to the standard deviation of house price itself is very sensitive and is around 40% for one year. Negative response to income is less sensitive and is around 5% for one year. This result is in line with Granger-causality analysis. Non-parallel increases in income and house prices can give a justification for this negative response. Response to real interest rate shocks is sensitive, leading 20% decrease in one year. I find that house prices relate strangely with market fundamentals, especially with real income.

CHAPTER 5: Conclusion and Discussion

The main objective of this paper is to find the period of bubble if there is any and determinants of house prices with long-run equilibrium and short-run dynamics in the Republic of Azerbaijan. The main interest is to analyze the relation between real house prices and fundamentals. Bubble exists if prices cannot be explained with fundamentals. Fundamentals could be demand side or supply side. I mainly concentrate on demand side factors because despite the fact that in a period of ten years there is huge boom of construction of houses but this new completions make only ten percent of whole housing stock in Baku. Non-availability of other supply side data makes it difficult to analyze supply and demand side together. Consistent with economic theory, in the demand side I consider real income, real interest rate for credits, real long-term credits and oil prices. Oil prices are used because of its role in Azerbaijan's economic growth and development. Oil prices are seen as main indicator of future growth and capital inflow. Three different approaches are applied: basic affordability and sustainability indicators, asset pricing approach and VECM. The analysis of basic indicator reveals the possibility of bubble between 2002 and mid-2006. In this period real income cannot explain the appreciation of real house prices. After mid-2006, price-to-income ratio decreases as a result of increasing incomes. Therefore, in the beginning of the period real prices inflates very fast and other fundamentals could not catch the speed of house prices. This period can be a period of speculative bubble. But it is fact that demand for houses is not necessarily come from average income class. Therefore, in future research households can be divided into groups according to their income level and each group is analyzed separately. Price-to-rent ratio suggests the same period as bubble in real house prices. From the

beginning of 2000 prices increases much faster than rents but from 2004 large growth rates in real rents catches and even passes growth rates in prices. This may be a result of increase in incomes and increase in prices of houses. People who can not afford to but house in the prevailing prices chooses renting as a substitute good. High demand for renting increases rents. Another explanation is the increase in incomes. Owners of houses think that renters can afford to pay higher rents because their incomes increase as the overall development in the country is in the process. To deepen the analysis I continue with the asset pricing approach. Present value formula for assets can be used in order to price real prices. Rents are seen as future cash flows from house whether you own a house or not. Therefore, rents play a fundamental role in house pricing. PVF without bubble states that prices and rents must be in the same order of integration and if they are integrated of order one then they must be cointegrated. Both real prices and rents appear to be I(1) and not cointegrated. Their stochastic terms are not eliminated. Therefore, in the long-run they deviate from each other. This again supports the idea for the existence of speculative demand and housing price bubble.

Lastly, I use Johansen cointegration method and error correction model to find the long-run and short-run adjustments of real house prices. Firstly, I try to find long-run relationship between real house prices, real credits, oil prices and real income. I find both elasticities of real house prices relative to real incomes and oil prices to be significant have expected signs. But coefficient of credits has significant but negative sign which is not as expected. There can be several explanations for this. Firstly, from the graphs of real credits and real house prices it is evident that prices go up and down but credits only has upward direction. There is always demand for houses. Some demand groups buy houses not depending on the prices and others buy when

prices are low. Therefore, credits increase till there is no huge decline in prices. Because, this time it extremely affects debts' values which makes it impossible for households to return debt. As a result banks face with default risk and collateral risk decreases supply of credits by strong regulations. It is not possible to evaluate the effect of decrease in prices on credits because it happens in last two years following the current crisis. The effect may take time to show itself. Secondly, in Azerbaijan loans mainly taken to buy new houses not old ones because developers have contracts with lenders to make it easy to sell. Households selling their old houses in order to buy new ones increase supply of houses available in the market. Prices can be negatively related to credits because of these reasons. But I omit this variable and add real interest rates despite the fact that Annett (2005) states that real credit is important determinant of long-run trends. Dynamics in real interest rate can explain more the effects of financial market on real estate market. It is also one of the main variables used in the analysis of real house prices in the literature. I left with three variables real income, real interest rate and house prices. Long-run elasticity of prices relative to income is 2.6 which is nearly the same value for US found by Meen (2002). In the long-run real income affects real house prices positively. Real interest rate has a negative effect on housing prices. High interest rates make it expensive to take loan. I find elasticity as 3.24 which is reasonable number. It can be count as average elastic if we compare this value with -9.42 for Netherlands and -1.3 for US. I continue with this long-run equation and try to find the determinants of prices in the short-run. VECM with three variables, one lag, trend and constant in the cointegration space and one cointegration equation is set up. I use general-to-specific omitting method using AIC criteria in order to get rid of insignificant coefficients. I find that real house prices converge to long-run equilibrium 9% in each quarter. Half-way life is five quarters,

more than one year. In the short-run only own and real interest rate lag differences are significant. Both are very influential in the short-run. Next I do Granger causality tests between real house prices and fundamentals. I find that there exists Granger causality between interests and prices in both direction and only from prices to incomes in one direction. Real house prices have wealth effect which in turn increases incomes. Higher interest rates lead to less demand in real estate market which consequently decreases prices. Appreciation of the houses as collateral gives banks opportunity to enlarge credit lines with lower interest rates.

Summing up all my findings I conclude that bubble cannot be rejected between the years 2002 and mid-2006 with the fundamentals that I use. In this period fundamentals could not explain sudden inflation of house prices. But in the following years fundamentals close the gap. I expect in the following two years prices will continue to fall as real interest rates are rising and demand is decreasing because of incomes do not have high growth which they had before the crises. Small sample and non-availability of proper data for some supply and demand side fundamentals make it difficult to explain the cause of the appreciated prices which I conclude as bubble between 2002 and mid-2006. For the future research I suggest to include construction costs, inflow of population to Baku as fundamentals. Also, models can be constructed separately for new and existing houses. I think they are affected by different fundamentals. In addition, other econometric models can be checked such as DOLS.

APPENDIX

Table 6: Summary Statistics

Variables	Mean	Std.deviation	Maximum	Minimum	# of observations
rhp	469.744	139.940	649.711	187.536	40
rinc	1,924.891	821.560	3,554.165	1,058.264	40
rent	301.639	67.002	407.558	209.498	40
rinterest	0.090	0.069	0.201	-0.052	40
oil	44.962	21.487	107.318	17.945	40
rcredit	1,662.499	1,386.766	4,765.838	445.218	40

Table 7: Correlation Matrix

	RHP	RINC	RENTS	RINTEREST	OIL	RCREDIT
RHP	1.00	0.51	0.75	-0.76	0.66	0.39
RINC	0.51	1.00	0.87	-0.40	0.78	0.96
RENT	0.75	0.87	1.00	-0.69	0.87	0.82
RINTEREST	-0.76	-0.40	-0.69	1.00	-0.76	-0.32
OIL	0.66	0.78	0.87	-0.76	1.00	0.70
RCREDIT	0.39	0.96	0.82	-0.32	0.70	1.00

Table 8: Unit root test: ADF

Variables	# of lags	Determinitic terms	T-stat	5% significance	P-value
rhp	0	constant and trend	0.617	-3.52	0.999
d(rhp)	0	constant	-3.85	-2.94	0.005
rent	0	constant and trend	-1.45	-3.52	0.828
d(rent)	0	constant	-6.69	-2.94	0.000
P/R	0	constant	-1.56	-2.93	0.492
d(P/R)	0	none	-4.93	-1.94	0.000

Table 9: Unit root test: KPSS

Variables	# of lags	Determinitic terms	T-stat	5% significance
rhp	5	constant and trend	0.197	0.146
d(rhp)	6	constant and trend	0.101	0.146
rent	5	constant	0.704	0.463
d(rent)	4	constant	0.181	0.463
P/R	5	constant and trend	0.187	0.146
d(P/R)	5	constant and trend	0.074	0.146

Note: Lags shows the bandwidth using Newey-West Bartlett kernel

Table 10: Unit root test: ADF

Variables	# of lags	Determinitic terms	T-stat	5% significance
rhp	1	constant and trend	-0.27	-3.52
d(rhp)	0	constant	-2.76	-2.94
rcredit	0	constant and trend	-1.54	-3.52
d(rcredit)	0	constant	-4.68	-2.94
rinc	0	constant and trend	-4.15	-3.52
d(rinc)	0	constant	-10.73	-2.94
rinterest	1	constant	-2.61	-2.94
d(rinterest)	0	none	-4.5	-1.94
oil	0	constant	-2.63	-3.52
d(oil)	0	constant	-6.52	-2.94
rent	4	constant and trend	-0.68	-3.54
d(rent)	3	constant	-4.05	2.94

Table 11: Unit root test: KPSS

Variables	# of lags	Determinitic terms	T-stat	5% significance
rhp	5	constant and trend	0.2	0.146
d(rhp)	5	constant and trend	0.07	0.146
rcredit	5	constant and trend	0.17	0.146
d(rcredit)	4	constant and trend	0.1	0.146
rinc	4	constant and trend	0.18	0.146
d(rinc)	3	constant and trend	0.05	0.146
rinterest	4	constant	0.43	0.46
oil	3	constant and trend	0.124	0.146
rent	5	constant	0.713	0.463
d(rent)	3	constant	0.184	0.463

Table 12: Unit root test: (Saikkonen & Lutkepohl (2002))

Variables	# of lags	Determinitic terms	T-stat	5% significance
oil	7	trend and shift dummy in 2008 Q4	-1.86	-3.03
rinterest	0	trend and shift dummy in 2009 Q1	-1.9	-2.88
rinc	3	trend and shift dummy in 2007 Q4	-1.67	-3.03

Table 13: Johansen (1995) Cointegration Test (Trace Test)

Variables	Deterministic terms	# of lagged differences	Ho:r=ro	Test statistic	5% critical value
rhp,rcredit	c,orth tr,sd	1	ro=0	12.13	15.49
	c,orth tr,sd	1	ro=1	1.5	3.84
	c,tr,sd	1	ro=0	13.95	25.87
	c,tr,sd	1	ro=1	3.19	12.51
rhp,rinc	c,orth tr,sd	2	ro=0	16.21	15.49
	c,orth tr,sd	2	ro=1	3.45	3.84
	c,tr,sd	2	ro=0	20.36	25.87
	c,tr,sd	2	ro=1	7.6	12.51
rhp,oil	c,orth tr,sd	2	ro=0	21.28	15.49
	c,orth tr,sd	2	ro=1	8.99	3.84
	c,tr,sd	2	ro=0	25.34	25.87
	c,tr,sd	2	ro=1	11.8	12.51
rhp,rinterest	c,orth tr,sd	2	ro=0	21.14	15.49
	c,orth tr,sd	2	ro=1	8.33	3.84
	c,tr,sd	2	ro=0	22.26	25.87
	c,tr,sd	2	ro=1	8.45	12.51
rcredit,rinc	c,orth tr,sd	1	ro=0	11.51	15.49
	c,orth tr,sd	1	ro=1	1.26	3.84
	c,tr,sd	1	ro=0	21.88	25.87
	c,tr,sd	1	ro=1	6.3	12.51
rcredit,rinterest	c,orth tr,sd	3	ro=0	15.4	15.49
	c,orth tr,sd	3	ro=1	0.24	0.84
	c,tr,sd	3	ro=0	27.16	25.87
	c,tr,sd	3	ro=1	11.77	12.51
rcredit,oil	c,orth tr,sd	1	ro=0	11.6	15.49
	c,orth tr,sd	1	ro=1	0.45	3.84
	c,tr,sd	1	ro=0	18.51	25.87
	c,tr,sd	1	ro=1	6.38	12.51
rinc,rinterest	c,orth tr,sd	3	ro=0	9.64	15.49
	c,orth tr,sd	3	ro=1	0.8	3.84

	c,tr,sd	3	ro=0	15.85	25.87
	c,tr,sd	3	ro=1	6.8	12.51
rinc,oil	c,orth tr,sd	2	ro=0	9.91	15.49
	c,orth tr,sd	2	ro=1	0.01	3.84
	c,tr,sd	2	ro=0	19.03	25.87
	c,tr,sd	2	ro=1	8.77	12.51
rinterest,oil	c,orth tr,sd	2	ro=0	13.07	15.49
	c,orth tr,sd	2	ro=1	2.7	3.84
	c,tr,sd	2	ro=0	24.59	25.87
	c,tr,sd	2	ro=1	4.06	12.51

Table 14: Johansen (1995) Cointegration Test (Trace Test)

Variables	Deterministic terms	# of lagged differences	Ho:r=ro	Test statistic	5% critical value	P-value
rhp,rcredit,rinc,oil	c,orth tr,sd	1	ro=0	51.47	47.85	0.01
	c,orth tr,sd	1	ro=1	29.53	29.79	0.054
	c,orth tr,sd	1	ro=2	13.43	15.49	0.09
	c,tr,sd	1	ro=0	66.23	63.87	0.031
	c,tr,sd	1	ro=1	36.98	42.91	0.17
rhp,rinc,rinterest	c,orth tr,sd	2	ro=0	27.13	29.79	0.09
	c,orth tr,sd	2	ro=1	11.48	15.49	0.18
	c,tr,sd	2	ro=0	47.36	42.91	0.016
	c,tr,sd	2	ro=1	20.54	25.87	0.19

Table 15: Granger Causality tests

Causality Hypothesis	Test value	P-value
rhp-->rinterest	2.72	0.05
rinterest-->rhp	5.95	0.0014
rhp-->rinc	2.34	0.08
rinc-->rhp	1.3	0.29
Note: tests based on VAR(4) model		
Ho:no Granger causality		

Table 16: Granger Causality tests

Causality Hypothesis	Test value	P-value
rhp-->rinterest, rinc	2.57	0.04
rinterest, rinc-->rhp	2.72	0.04
Note: tests based on VAR(4) model		
Ho:no Granger causality		

Figure 5: Autocorrelation and partial autocorrelation

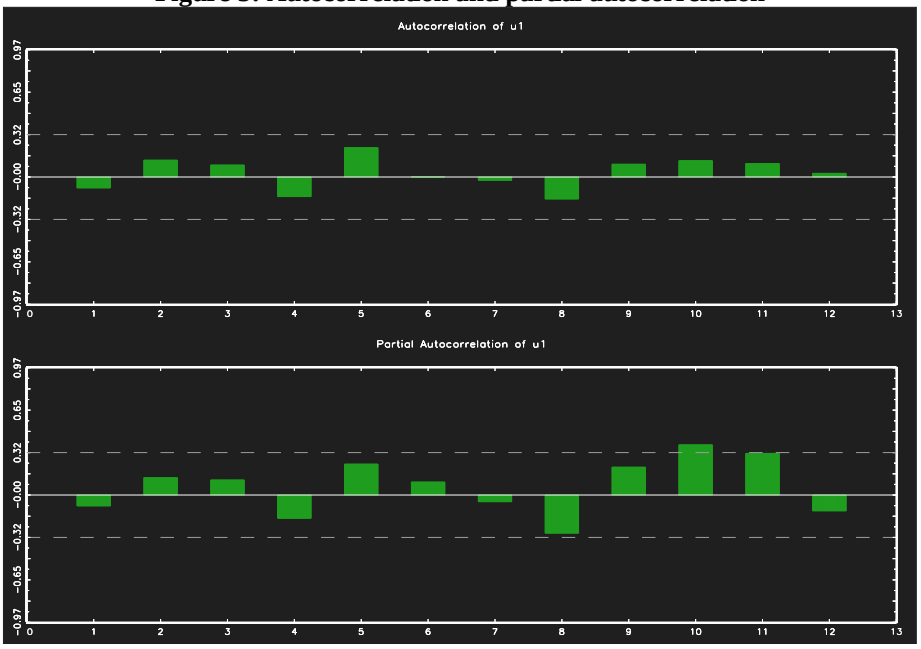


Figure 6: Impulse Responses of Real House Prices

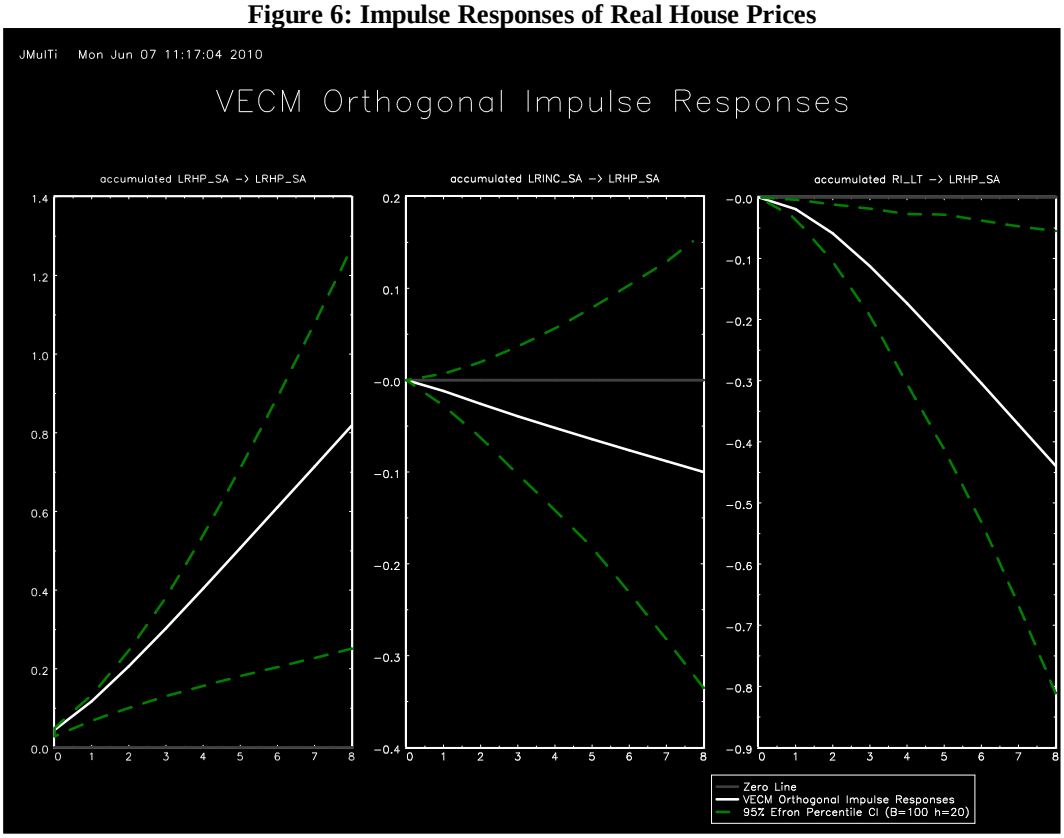


Figure 7: Impulse Responses of Real Income

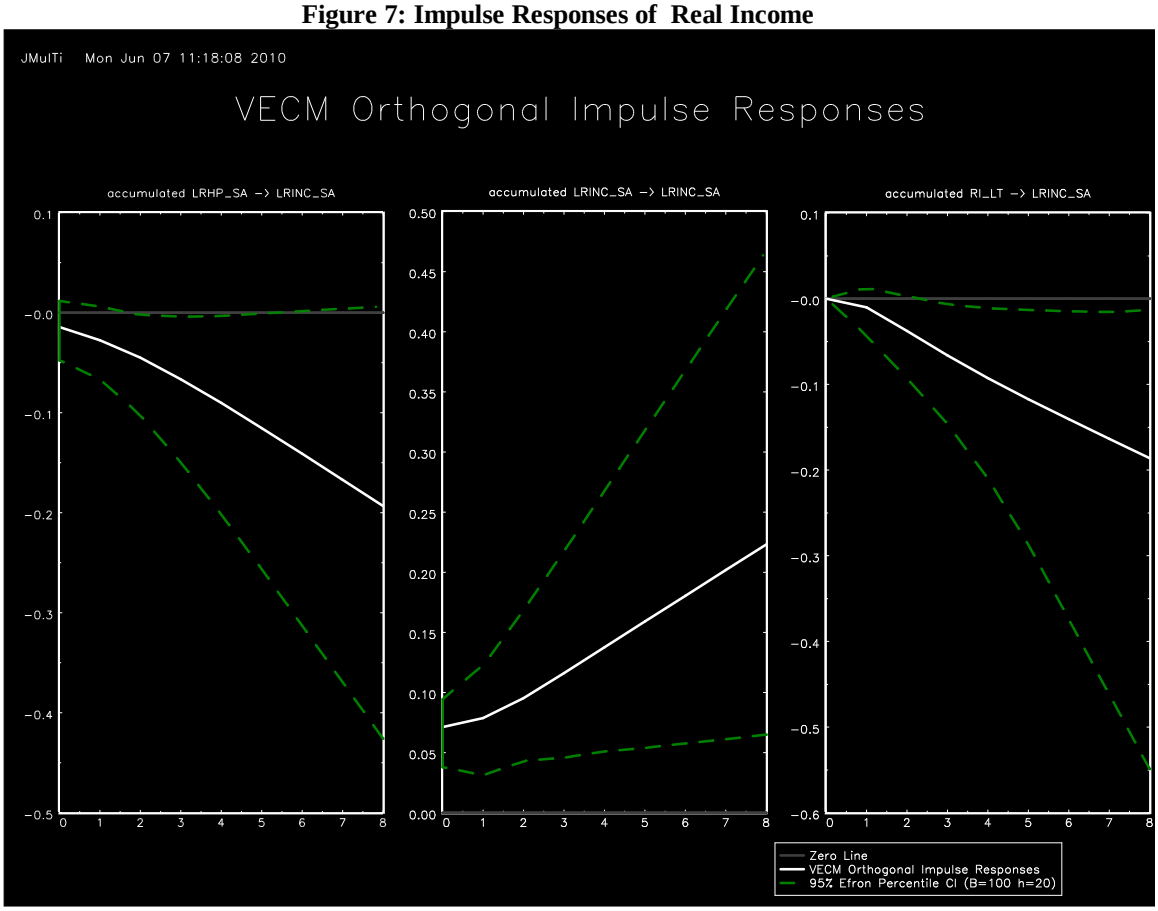
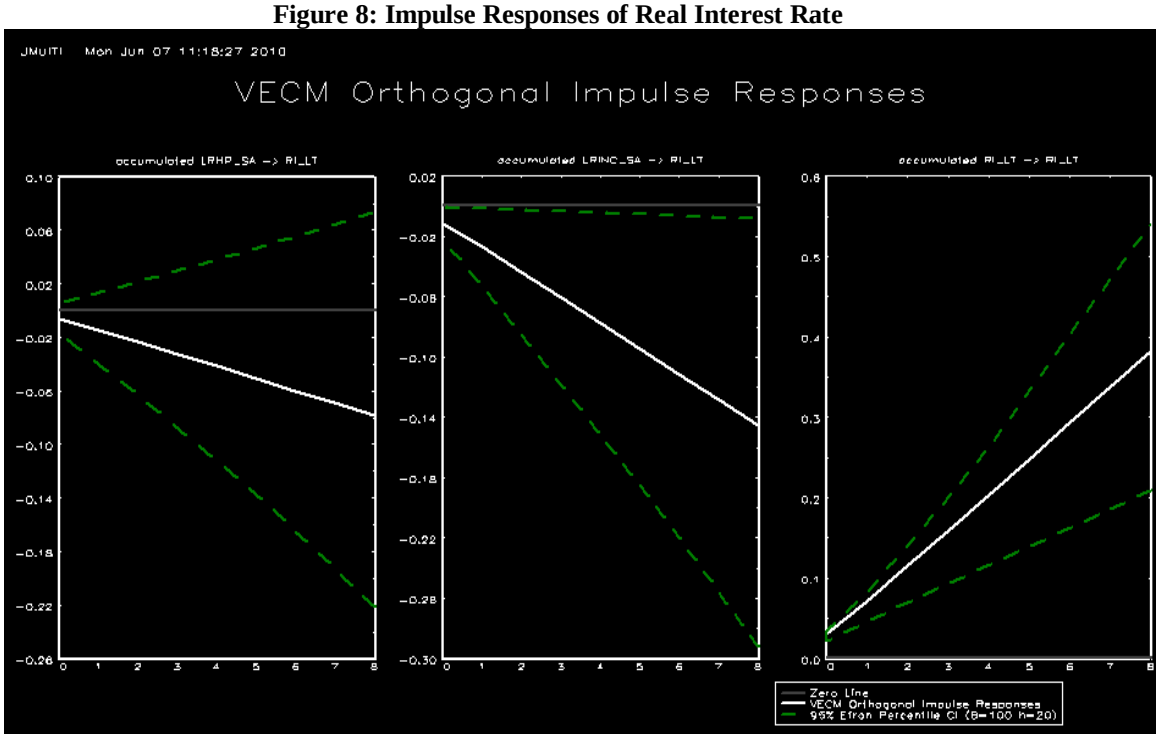


Figure 8: Impulse Responses of Real Interest Rate



REFERENCES

Abelson, P., R. Joyeux, G. Milunovich, and D. Chung (2005): "Explaining House Prices in Australia: 1970–2003" *Economic Record*, Vol. 81, pp. S96–S103.

Annett, A. (2005), "Euro area policies: Selected issues", *IMF Country Report*, No. 05/266.

Bodman, P.M. and Crosby, M. (2003), "How Far to Fall? Bubbles in Major City House", *Prices in Australia, Working Paper*, Melbourne Business School.

Bourassa, S. and P. Hendershott (1995), "Australian Capital City Real House Prices,

1979-1993", *Australian Economic Review*, Vol. 111, pp. 16-26.

Black, A., P. Fraser and M. Hoesli (2006), "House Prices, Fundamentals and Bubbles", *Journal of Business Finance and Accounting*.

Bessone, A. J., B. Heitz and J. Boissinot (2005), "Marché immobilier: voit-on une bulle?"

Campbell, John Y., and Robert J. Shiller (1987): "Cointegration and Tests of Present Value Models," *Journal of Political Economy*, October 1987.

Case, K. E. and Shiller, R.J. (2003): "Is There a Bubble in the Housing Market?" *Brookings Papers on Economic Activity*, 299–342.

Chan, H. L., S. K. Lee and K. Y. Woo (2001), "Detecting Rational Bubbles in the Residential Housing Markets of Hong Kong", *Economic Modelling*, Vol. 18, pp. 61-73.

Eddie C. M. Hui and Shen Yue (2006): "Housing Price Bubbles in Hong Kong, Beijing

and Shanghai: A Comparative Study"

Egert, B. and D. Mihaljek (2007): "Determinants of House Prices in Central and Eastern Europe", *Working Paper No. 236,* Bank for International Settlements

Engle R. and C. Granger (1987): "Cointegration and Error Correction Representation, Estimation and Testing", *Econometrica*, 55, 251–276.

Fama, Eugene (1970): "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance, No. 25*

Hamilton, J. D. (1994): "Time Series Analysis", *Princeton University Press,* Princeton,

New Jersey.

Hofmann, D. (2005): "Kingdom of the Netherlands-Netherlands: Selected Issues", *IMF*

Country Report, No. 05/225, Washington, DC.

Hylleberg, S., Engle, R. F., Granger, C. W. J. and Yoo, B. S. (1990): "Seasonal integration and cointegration", *Journal of Econometrics* **44**, pp. 215–238.

Johansen, S. (1995): "Likelihood-Based Inference in Cointegrated Vector Autoregressive Models (NewYork: *Oxford University Press*).

Johansen, S. and Juselius, K. (1990): "Maximum likelihood estimation and inference on cointegration: With application to the demand for money", *Oxford Bulletin of Economics and Statistics*, 52(2), 169–210.

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P. and Shin, Y. (1992): "Testing the null of stationarity against the alternative of a unit root: How sure are we that the economic

time series have a unit root?" *Journal of Econometrics* **54**, pp.159–178.

Lutkepohl, H. *(1991)*: "Introduction to Multiple Time Series Analysis", *Springer-Verlag, Berlin.*

Lutkepohl, H. and Poskitt, D. S. (1991): "Estimating Orthogonal Impulse Responses via Vector Autoregressive Models, *Econometric Theory* **7,** pp. 487–496.

Lutkepohl, H. (1993): "Testing for Causation Between Two Variables in Higher Dimensional VAR Models" in H. Schneeweiss and K. F. Zimmermann (eds.), *Studies in Applied Econometrics*, Physica-Verlag, Heidelberg, pp. 75–91.

Lutkepohl, H. (2001): "Vector Autoregressions" in B. H. Baltagi (ed.), *A Companion to*

Theoretical Econometrics, Blackwell, Oxford, pp. 678–699.

Meen, G. (2002), "The Time-Series Behaviour of House Prices: A Transatlantic Divide", *Journal of Housing Economics,* No. 11.

Meen, G. (1990): "The Removal of Mortgage Constraints and The Implications for Econometric Modelling of UK House Prices", *Oxford Bulletin of Economic and Statistics*, No. 32, pp. 1-23

Mikhed Vyacheslav (2009): "Testing for Bubbles in Housing Markets: A Panel Data Approach" *Journal of Real Estate Finance and Economics 38,* pp. 366-386.

Saikkonen, P. and Lutkepohl, H. (2000): "Asymptotic Inference on Nonlinear Functions of The Coefficients of Infinite Order Cointegrated VAR Processes" in W. A. Barnett, D. F. Hendry, S. Hylleberg, T. Terasvirta, D. Tjostheim and A. Wurtz (eds.), *Nonlinear Econometric Modeling in Time Series Analysis*, Cambridge University Press,

Cambridge, pp. 165–201.

Saikkonen, P. and Lutkepohl, H. (2000): "Testing for The Cointegrating Rank of a VAR Process with an Intercept, *Econometric Theory* **16**: 373–406.

Saikkonen, P. and Lutkepohl, H. (2000): "Testing For the Cointegrating Rank of a VAR Process with structural shifts", *Journal of Business & Economic Statistics* **18**, pp. 451–464.

Shiller, Robert (2004): "From Efficient Markets to Behavioral Finance," *Journal of Economic Perspectives*, 17 (1), pp. 83-104

Stiglitz, J. E. (1990): "Symposium on Bubbles", *Journal of Economic Perspectives*, 1990, pp. 13-18.

Stepanyan V., Tigran Poghosyan, and Aidyn Bibilov (2010): "House Price Determinants in Selected Countries of the Former Soviet Union", *IMF Working Paper/10/104*

Stock, James and Mark Watson (1993): "A Simple Estimator of Cointegrating Vectors in Higher-Order Integrated Systems," *Econometrica*, v. 61, pp. 783–820.