Czech University of Life Sciences Prague

Faculty of Economics and Management

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Diploma Thesis

Macroeconomic influences on housing prices in Prague, the Czech Republic

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Marika Schimonová

Economics and Management

Thesis title

Macroe conomic influences on housing prices in Prague, the Czech Republic

Objectives of thesis

The first objective of this thesis is to find out, whether there is some relationship between macroeconomic indicators of the Czech Republic and housing prices of residential properties in Prague. In case that the research will confirm the existence of relationship between macroeconomic indicators of the Czech Republic and housing prices of residential properties in Prague, another objective will be to find out to which extent are the housing prices dependent on macroeconomic indicators. Third objective of this thesis will be to make prognosis of macroeconomic indicators of the Czech republic

Third objective of this thesis will be to make prognosis of macroeconomic indicators of the Czech republic and housing prices of residential properties in Prague.

Methodology

In the first part of this thes is will be described development of housing prices in Prague. The development of housing prices in Prague will be also correlated with macroeconomic indicators, e.g. GDP, unemployment rate, interest rates.

In the second part of this thesis, regression model will be proposed based on the findings from the first part. The regression model should explain the price level of housing prices in Prague in dependence on macroeconomic indicators. After the regression model, estimation of future housing prices in Prague will be made.

The author will use methods of descriptive analysis, statistical analysis of data collected, regression analysis, prognosis.

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The proposed extent of the thesis

60 - 80 pages

Keywords

Housing market in Prague, Housing prices in Prague, residential properties in Prague, real estate market in Prague, real estate price in Prague

Recommended information sources

BERAIA N., NATSVALADZE M.: Medium-term prognosis of residential real estate market price indices in Tbilisi, Georgia, ISBN 978-80-87927-09-0

GOODHART CH., HOFMAN B.: House Prices and the Macroeconomy: Implications for Banking and Price Stability, 2007, Oxford University Press, ISBN 9780199204595

Expected date of thesis defence 2016/17 WS – FEM

The Diploma Thesis Supervisor doc. Ing. Mansoor Maitah, Ph.D. et Ph.D.

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Electronic approval: 25. 2. 2016

prof. Ing. Miroslav Svatoš, CSc. Head of department Electronic approval: 26. 2. 2016

Ing. Martin Pelikán, Ph.D. Dean

Prague on 20. 11. 2016

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Declaration

I declare that I have worked on my diploma thesis titled "Macroeconomic influences on housing prices in Prague, the Czech Republic" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 25 November, 2016

Marika Schimonová

Acknowledgement

I would like to thank doc. Ing Mansoor Maitah, PhD. et PhD for his advice and words of support during my work on this thesis. I really appreciated all his experience, advice and friendly relationship to me and all his students.

I would also like thank to my parents and grandparents, who motivated me to study and supported me during my study years.

Last but not least, I would like to thank all my colleagues at work, whom I met on my way and taught me a lot about life, business and economic analysis in practise. I would like thank especially to experienced investment analyst, my ex-colleague and friend from real estate company CBRE, Zdeněk Polák, for his consultation and advice on methods used in analytical part of this thesis and to my MO dream team in MND a.s. for their trust and energy, when teaching me analysis in energy sector.

Macroeconomic influences on housing prices in Prague, the Czech Republic

Summary

This paper studies the determinants of housing prices in Prague, the Czech Republic. The main question addressed is, which of the supply and/or demand factors (housing prices, price of rents, supply of new housing stock, natural population growth, immigration, material input prices, building plot prices, inflow of foreign direct investment, GDP growth, interest rate on mortgages etc.) are the main determinants of prices of flats in Prague. The collected data of determinants are analyzed using mathematical and statistical methods to assess their influence on housing prices in Prague. The econometric model is estimated using the Ordinary Least Square method, where explained variable are indices of realized prices of flats in Prague and explanatory variables are above mentioned determinants of housing prices in Prague. Data used are time series from period Q1 2008 - Q1 2016. The author concludes, that the macroeconomic determinants of residential property prices in Prague are changes in prices of building plots in Prague, economic activity rate in the Czech republic, average monthly gross wages in Prague, price to rent ratio in the CR, volume of long-term loans lent to households and interest rates of mortgages. Trend analysis shows, that further increase in indices of realized prices of flats in Prague is expected in next 2 quarters.

Keywords: Housing market in Prague, Housing prices in Prague, residential properties in Prague, real estate market in Prague, real estate price in Prague

Makroekonomické vlivy na ceny bydlení v Praze, Česká republika

Souhrn

Tato práce se zabývá determinanty cen rezidenčních nemovitostí v Praze, v České republice. Hlavní otázkou při psaní této práce je zjistit, které nabídkové a/nebo poptávkové faktory (ceny rezidenčních nemovitostí, ceny nájmů, nově dokončená výstavba, přirozený přírustek obyvatelstva, imigrace, ceny materiálních vstupů pro stavby, ceny pozemků, příliv přímých zahraničních investic, růst HDP, úrokové sazby na úvěry domácnostem atd.) jsou hlavními determinanty cen bytů v Praze. Získaná data jsou analyzována a pomocí matematických a statistických metod je ověřen jejich vliv na ceny bydlení v Praze. Ekonometrický model je odhadován pomocí metody nejmenších čtverců, kde závislá proměnná jsou indexy realizovaných cen bytů v Praze a nezávislými proměnnými jsou výše zmíněné determinanty cen bydlení v Praze. Použitá data jsou časové řady v období od Q1 2008 do Q1 2016. Výsledkem modelu je, že makroekonomické determinanty cen rezidenčních nemovitostí v Praze jsou indexy cen stavebních pozemků v Praze, ekonomická aktivita obyvatel ČR, průměrné měsíční hrubé mzdy v Praze, podíl ceny bytu a ceny nájmu v ČR, objem poskynutých dlouhodobých úvěrů domácnostem a úroková míra na dlouhodobé úvěry domácnostem. Studie trendu křivky indexů realizovaných cen bytů v Praze ukázala na strmý nárůst cen v příštích dvou kvartálech.

Klíčová slova: Trh s bydlením v Praze, ceny bydlení v Praze, rezidenční nemovitosti v Praze, realitní trh v Praze, ceny realit v Praze

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1 Introduction

Housing market has revived strongly in the Czech Republic since the Velvet Revolution, but currently (since year 2014) there is one of the biggest pressures on the housing and other real estate prices. The main engines for the price growth is high demand, caused by low interest rates on mortgages, low interest rate on savings and bonds, and high foreign demand.¹ Doubravko and Égert suggest that the run up in the prices in CEE is also consequence of expansion of private sector credit.² One of the factors that cause very low interest rate on savings and bonds is fixed exchange rate. As the CNB pours more money in the economy, the demand for money decreases and the interest rates decrease. In such time, people are seeking for investment, which maximises their profit, or at least preserves the value invested. The real estate is relatively secure investment with relatively high yield, which however decreases nowadays with increasing price.

The determinants of the housing price don't have long tradition of research in the CR. The CNB first started publishing papers on determinants of housing prices in the CEE region and the CR in year 2008, when Doubravko and Égert first presented their research of property price determinants in 19 OECD countries across CEE region using Dynamoc OLS method. Their result showed that, overall, per capita GDP, real interest rates, credit growth, demographic factors and indicators of institutional development of housing markets and housing finance were important determinants of house prices in CEE.

Hlavacek and Komarek then very soon after Doubravko and Égert presented their research on property price determinants in the Czech regions in 2009. Their research was also part of CNB working papers and it was the first analysis of property price determinants focused just on the Czech Republic. They used quarterly panel data and method of aggregate regression. They studied a relatively short time series from 1998 to 2007 and they suggested that the results of the analysis should be interpreted with caution. Their model confirmed a positive effect of net migration, divorce rate, unemployment rate, wage growth, credit growth and land prices on property prices.

One of the aims of this research was to research the property price determinants in Prague, whose property prices and market differs from the rest of the Czech Republic. The author

¹ (TRAXLER, 2016)

² (ÉGERT, 2008)

used available quarterly data for period 2008-2016, analysed each possible determinant in this period and constructed simple regression model of property price determinants in Prague. The result showed, that the macroeconomic determinants of residential property prices in Prague are changes in prices of building plots in Prague, economic activity rate in the Czech republic, average monthly gross wages in Prague, price to rent ratio in the CR, volume of long-term loans lent to households and IR on flats. The author admits that the analysed period is relatively short, so the results should be interpreted with caution, same as in case of Hlavacek and Komarek. There is however conformity between their results and results of this theis. Both works came to conclusion that building plot prices and monthly rent are the determinanants of property prices in Prague.

2 Objectives and Methodology

2.1 Objectives

The objectives of this thesis are to find macroeconomic determinants of the residential real estate price in Prague using regression analysis (ordinary least square method) and to forecast the development of housing prices for the next tw quarters based on study of the trend function. The thesis is focused on Prague's flat market, because of the differences in prices and demand pattern between Prague and other towns or regions in the Czech Republic. As already written in the introduction, the author aims to take up work of Hlavacek and Komarek, who first conducted a study of determinants of property prices in Prague and Czech regions using panel regression and compare their results with the results of this thesis.

2.2 Methodology

The first part of the thesis is dedicated to explanation of main terms in the real estate market and supply and demand.

The second part describes the development of housing market in Prague, ownership structure, state regulation tools, and finally the supply and demand factors influencing housing prices.

In the third part, the author presents her analysis of general determinants of property prices. The data collected and used in the OLS model were chosen based on analysis of general determinants of property prices.

The author used methods of descriptive analysis, statistical analysis of data collected, regression analysis and prognosis.

Data collected were analysed, e.g. mean, median, minimum, maximum, variance, and standard deviation were computed. Then correlation coefficients matrix was computed and data were adjusted accordingly to mitigate relationships with correlation coefficients equal and higher than 0.9. Following correlation matrix, OLS model was computed and the result was statistically tested (T-test, evaluation according to P-value, White's test for heteroscedasticity, LM test for autocorrelation, RESET test, test for normality of residual,

Chow test for structural break at observation 2009:1) to verify, whether there is any autocorrelation, heteroscodasticity or structural break in the data. The software used to compute was MS Excel and gretl. Gretl was used for summary statistics, OLS model and statistical tests MS Excel was used for data collection, preparation of tables and graphs and trend analysis (Linear, Quadratic and Cubic function, and selection of the function according to adjusted R-squared, prognosis according to trend function).

3 Characteristics of the real estate market

3.1 Definitions

3.1.1 Building plot

According to §2 art. 1 b) of construction law, a building plot is a single part of land or group of parts of land, which are circumscribed and intended for further construction of building by zoning or regulation plan³.

3.1.2 Family house

A family house is a relatively small independent building of minimum 1 and maximum 2 floors plus maximum 1 underground floor and 1 loft. A family house is also intended for residential purpose; it has to have more than a half of the area of floor intended for residential purposes. It is usually inhabited by one family of group of inhabitants, which form one household. A family house includes one or more flats (maximum 3 flats according to CSN 73 4301) and has one owner⁴.

3.1.3 Flat

A flat is a group of rooms or a single room, which thanks to its technical arrangements and equipment matches the requirements for permanent residential purposes, and is intended for residential purpose⁵.

³Source: Ministry for Regional Development CR, Centre for territorial development (Ustav uzemniho rozvoje), <u>http://www.uur.cz/1000-otazek/prehled1.asp</u>, retrieved on 28.8. 2016 ⁴ CSN 73 4301

⁵ CSN 73 4301

3.2 Real estate characteristics

According to the new Czech civil code from year 2014, the real estate is land or any type of building that is constructed on the land. All the land no matter the size and purpose of usage is real estate. Also the part above and under the land is real estate. This is stated, because of constructions that are below the land surface. The real estate may be a building specified for housing, or any other purpose, if they are subject to someone's property. The main attribute of the real estate is immobility, so it is not possible to perform price arbitrages like with other mobile estates.

From the economic view point, the real estate is characterized by following qualities:

- Durability
- Heterogeneity
- High transaction costs
- Long-time delays
- Immobility

3.2.1 Durability

Real estate is durable as it can last for decades or centuries, and the land underneath it is practically indestructible. Majority of supply consists of the existing stock and new development, because the houses last relatively long time and switching of owners is very common.

3.2.2 Heterogeneity

Real estate is not homogeneous product. Each unit is unique in terms of its location, construction, level of depreciation and its financing, which makes pricing complicated, requires additional costs connected to valuation, creates information asymmetry, and restricts substitutability. Economists researching in the field of real estate prices had to take this in to consideration and find ways to deal with this issue.

3.2.3 High transaction costs

Buying and/or moving into a home costs much more than most types of transactions. The costs include real estate agent fees, valuation fee, moving costs, legal fees, cadastre fee, and deed registration fees, tax from purchase of real estate, annual tax on real estate, annual tax from rent (in case of investment real estate), in case of financing from mortgage fees from processing a loan⁶. Transaction costs for the seller in the Czech Republic don't usually overcome 5% (provision of the real estate agency including lawyer and administration fees to the cadastre etc.). The transaction costs for the purchaser is usually around between 5-10% (transfer tax 4%, other costs depend on financing option).⁷

3.2.4 Long-time delays on the market

Finance, design and construction of new housing units are relatively long processes. The suppliers of new houses and flats can't react to current demand as flexibly as in more fluid markets. Because of this time lag, there is great potential for disequilibrium in the short run⁸.

3.2.5 Dual nature

The real estate may be both an investment good and consumption good or both at the same time. Investment good is good that is bought with expectation of future profit, for example high rent or increase in real price. Consumption good means that it serves for using it. It can however be purchased for using it and after selling it with profit or rent it, so it matches both functions. The dual nature is reason not over-investing in real estate and keeping prices as low as the market price on open market is.

3.2.6 Immobility

Real estate is immobile and can't be moved. Because of this, there is no real marketplace and customers have to move to the real estate. Location is one of the features of the

⁶ Source: <u>http://www.home-institute.cz/zaplati-pozor-provize-realitnich-kancelari/</u>, visited 3.9. 2016

⁷ Source: <u>http://archiv.ihned.cz/c1-65490030-kolik-vlastne-stoji-nemovitost</u>, visited 3.9. 2016

⁸ McKenzie, 2006

product, so if customer changes their taste to live in one location, they have to find another real estate in the desired location.

3.3 Subjects in the real estate market

The main subjects on the real estate market are:

- vendors those, who want to sell a real estate
- buyers those who intend to buy a real estate

Buyers or vendors can be (depending on their current intentions), e.g. developers, investors, real estate agencies, consulting agencies, civilians.

3.3.1 Landlord

Landlord is a person or organization that owns and leases land, buildings and apartments to others⁹.

3.3.2 Tenant

Tenant is a person or group that rents and occupies land, a house, an apartment, an office, or the like, from landlord for a period of time; lessee¹⁰.

3.3.3 Owner/user

A person or group that owns their housing, and doesn't rent it to anybody else. <u>Developer</u> - the main player in the field of development of new housing stock in the Czech Republic. Some of the companies are Central Group, Crestyl, Finep, Skanska, Ekospol, YIT, IPB Real (Orco Group), ING Real Estate, Sekyra Group, Geosan Development and others.

⁹ http://www.dictionary.com/browse/landlord

¹⁰ Source: <u>http://www.dictionary.com/browse/tenant</u>, accessed 21.8. 2016

3.3.4 Renovators

Renovators are specialized companies that focus on supplying the refurbished stock. For example they buy old flats in the city centre that don't meet the modern standards, refurbish them to luxury flats and sell them with provision.

3.3.5 Investors

Investors may be banks, investment groups, companies or individuals. They usually invest in projects run by developers.

3.3.6 Real estate agencies

Real estate agencies represent sellers, buyers, landlords or tenants in negotiation with the second party of the deal. Real estate agencies negotiate deals for their clients, who pay them percentage provision from the deal price, when the deal is made. Big real estate agencies in the Czech Republic are e.g. RE/MAX, MM Reality, ERA Reality, Maxima Reality, Svoboda&Williams etc.

All the subjects influence the price of housing with their behaviour, speculations and preferences.

3.4 Demand for housing

The most important determinant of demand for housing is population size and population growth, because the more people are in the economy, the greater their demand for housing is. However, the demand for housing is much more complex issue.

To analyse demand for housing, scientists need to consider also demographic factors such as: family size, the age composition of the family, the number of first and second children, net migration (immigration minus emigration), non-family household formation, and number of double family households, death rates, divorce rates, and marriages¹¹. In housing economics, the main unit for analysis is a household, not the individual as in standard partial equilibrium model, because it is a whole household, which may be an

¹¹ Source: <u>http://edinformatics.com/real_estate/real_estate_economics.htm</u>, visited on 3.9.2016

individual, a couple, a two-generation family or multiple generation family, which demand the housing. Usually one household occupies one unit of housing¹². From the economic viewpoint, scientists need to analyse incomes of individuals and households, prices of housing, prices of loans and mortgages. All these factors are described in more details in following chapters.

3.4.1 Effective demand for housing

To demand for housing is connected to the concept of effective market demand. Effective demand is the demand that is backed up by purchasing power. It refers to the ability of consumers to purchase goods at different prices. It may be also referred to as realized or ex-post demand. We may look at the effective demand by checking the statistics of realized deals in residential real estate market. If the consumers wish to buy housing, but their purchasing power is not high enough or there are supply constraints on the residential real estate market, we may speak about latent or ex-ante demand. The not-yet-realized demand is often referred to as pent-up demand.

3.4.2 Price elasticity of demand for housing

An important characteristic of the demand curve is its sensitivity of quantity demanded to price changes. For this price elasticity of demand is calculated. It is calculated as the ratio of the percent change in quantity demanded over the percentage change in prices. The real estate demand is considered to be price inelastic, because there is not many substitutes for housing.

This concept is important for real estate analysis at both macro and micro level.

At the macro level, it can help estimate the impact of changes in market prices or rents on the demand schedule (the amount of space and/or number of units demanded).

At the micro level, price elasticity of demand shows the investors and developers in which projects to invest and to which not to invest. The developers and investors tend to invest in projects with inelastic demand such as luxury houses in an attractive location, because if

¹² Gonzalez, I.

prices/rents increase, revenues increase as well, as absorption does not decrease enough to eliminate the gains from rent increases.

We can however differ between substitutes for different categories and other features of housing. For example luxury housing has less elastic demand, because there are usually less product substitutes for it. Middle-income housing has more elastic demand compared to luxury housing, because there are plenty of substitutes in this category. Also, the demand schedule for a specific location of housing must be less price elastic than

the demand schedule for the whole metropolitan area since there is less substitutes for the submarket, than in the whole city¹³.

3.4.3 Basic rules of demand for housing

Same as in conventional economic theory, the demand for housing may be defined as the quantity of space or number of units demanded at various prices. Because of this, it is more appropriate to think of demand per meter square or demand for flat with certain disposition, for example two-room flat.

The fundamental law of demand for housing doesn't differ from the conventional one, which shows that a lower amount of space or number of units is demanded at higher prices.

3.5 Supply of housing

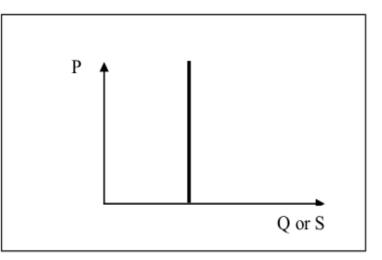
"The term real estate supply refers in general to a schedule that describes the quantity of commercial space or housing units supplied at various prices."

The quantity of new supply is determined by the cost of land, labour, building material and energies, the price of the existing stock of houses, and the technology of production. When dealing with real estate, it is useful to distinguish between 3 broader supply concepts: the long-run aggregate supply, the short-run aggregate supply, and new construction. The most useful concept when it comes to producing period-by-period forecasts of movement of residential real estate stock is new construction. However for the market analysis purposes, cross-market analyses and theoretical studies of long-run behaviour in the real estate market, the most useful concept is long-run aggregate supply.

¹³ Source: <u>http://isites.harvard.edu/fs/docs/icb.topic1143374.files/Rena_Chap%202.pdf</u>, accessed on 21.8. 2016

3.5.1 Long-run aggregate supply

The long-run aggregate supply depicts the relationship between long-run prices or rents and the total number of units or square meters supplied over the long-run.



3.5.2 The short-run aggregate supply

Illustration 1: Short-run aggregate supply of housing stock, source: Basic Real Estate Economics, retrieved from http://isites.harvard.edu/fs/docs/icb.topic1143374.files/Rena_Chap %202.pdf, accessed on 23.9. 2016

The short-run aggregate supply %202.pdf, accessed on 23.9. 2016

shows the market's total stock at a given point in time.

In the short-run, the real estate stock is fixed and the short-run aggregate supply is represented by a vertical line in the price-quantity graph. The fixity of the real estate stock in the short-run is due to the construction lag, that is, the time needed to plan and develop a building. The construction lag is considered to be at least 6-12 months for residential and industrial. Given this construction lag the short-run supply of real estate is insensitive to prices/rent changes or, in economic terms, is completely price inelastic.

3.5.3 New construction

The real estate development process includes the following three basic stages; building permit, start of construction and completion. New construction is the most important supply concept when analysing real estate market, because of the long life of real estate assets. Stock-flow identity, which describes how a market's total real estate stock determined at any given point in time, is used.

The stock flow identity states that the stock at time t, is equal to the stock of the previous period minus the depreciated stock plus completions during period t. The depreciation rate refers to three types of depreciation: physical, functional and economic.

However, economic and functional depreciation of a market's stock is difficult to measure. Physical depreciation refers to the physical aging and deterioration of the building. Functional depreciation refers to the functional obsolescence of an existing building compared to new buildings that provide new services or similar services more efficiently. Economic depreciation refers to economic obsolescence due to external or environmental factors that negatively affect the income-earning capacity of the property. As the stock-flow identity indicates, the marginal change in a market's stock at any period depends on the amount of new construction and depreciation.

4 Analysis of the Czech housing market

We can divide the real estate market into groups based on the purpose of usage of buildings; these are residential real estate market, offices real estate market, industrial and warehouse real estate market, and hotel real estate market. Real estate market and mainly the housing market is very important part of economy. The need of shelter belongs to the human basic needs and investment in housing is one of the biggest investments in most people's life. However, in the developed countries, the purchase of a house or flat doesn't only constitute a solution to guarantee a shelter for them and their children, but it may be a very lucrative investment to appraise their money. The real estates are one of the safest valuable assets of the households. Also investments to the real estate are one of the safest options during period of high inflation¹⁴.

The price level is generally influenced by parameters such as region, locality (town, suburb, and village), type of real estate, and type of ownership and mainly by the availability and effectiveness of financing the real estate; the interest rate on mortgages offered by banks is thus an important aspect. The real estate market should also respect the qualitative differences between new and old housing and many more other factors, such as type of housing (family house, residence, block of flats), infrastructure in the locality, amenities, parking and social structure of the population, which is problem mainly during times of housing bubbles, when the demand is higher than supply and purchasers are willing to buy flats for prices that exceed a reasonable price level of a dwelling in such standard¹⁵.

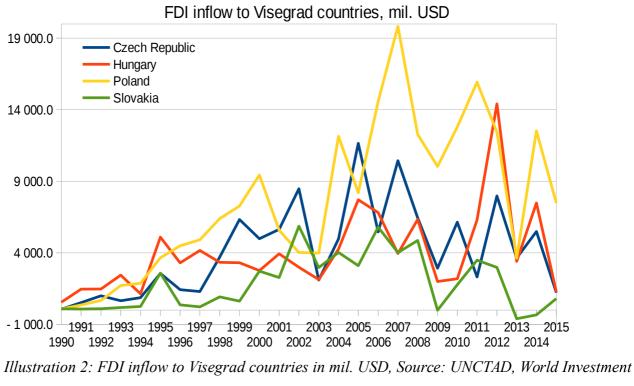
4.1 Historic development of the Czech real estate market after 1989

Since 1990's particularly Prague went through a big boom on the housing and housing rental market since the real estate market started liberalisation after 1989. The development standards have been nearing those of other Western European countries and friendlier legislative environment, increase in quality and supply of professional real estate products

¹⁴ (KAPLAN, J., 2002)

¹⁵ Source: <u>http://isites.harvard.edu/fs/docs/icb.topic1143374.files/Rena_Chap%202.pdf</u>, accessed on 1.9.2016

and services made the Czech Republic and particularly Prague very interesting for the



Report 2016, own-compilation

foreign buyers and property investors.

The Czech Republic has been one of the leading countries in terms of foreign direct investment in the CEE region since the 1990's¹⁶. The political stability, location and relative flexibility, industrial base and know-how of labour force and business environment brought huge volume of investment to the CR.¹⁷ We may see on the figure FDI inflow to Visegrad countries above, that the Czech Republic was the regional leader of receiving investments from 1998 to 2003, when huge companies were privatised, and from 2004 (EU accession) to 2010 (when the recession was terminating). Since 2011 Hungary and Poland are the biggest FDI recipients in region, since the CR is one of the most developed countries in CEE and its market is small and easily saturated, so the yields on the investments are not as high as in other countries in Visegrad group. However the graph

¹⁶ http://www.erstecorporatebanking.cz/en/investment/cr-is-leader-in-real-estate-investments-in-cee-cbre

¹⁷ (KPMG Česká republika, s.r.o.)

confirms, that in times of recession, investors decide to invest rather to the CR, which is economically and politically more stable than the other countries in this region. After the Velvet Revolution, major political and economic changes happened. The privatisation caused a big boom in the real estate sector. Planning of new construction of houses reverted back to the individual municipalities, but the market remained highly regulated by the state¹⁸. Prague immediately became the economic island profiting from inflow of foreign investment and tourism. Demand for flats in Prague became so high, that prices were higher in Prague compared to other towns. On the other hand, in the rest of the Czech Republic demand was not so high and the flats are not scarce, therefore prices are accessible. The difference in prices may be seen from the graph of indices of realized prices of second-hand flats, which shows curves from Prague, CR excluding Prague and CR in total. We may observe from the graph, that the indices in Prague are the highest. (The graph comparing indices of realized prices of flats in Prague and the rest of the CR was only available for second-hand flats, for new flats data were available only for Prague).

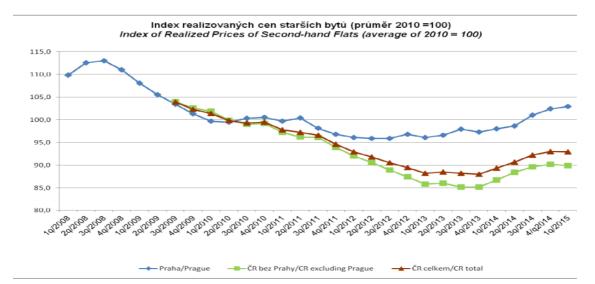
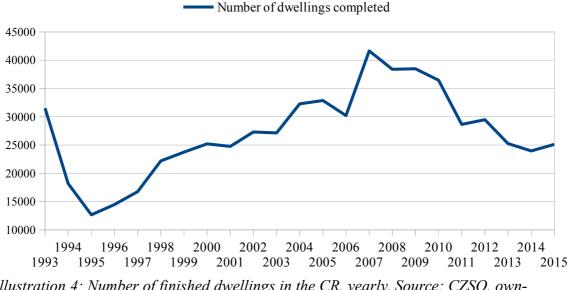


Illustration 3: Index of realized prices of second-hand flats (AVG = 2010), Source: CZSO

¹⁸ Czech-real-estate.com, accessed on 2.9.2016

According to Czech real estate server Czech-Real-Estate.com, Czech buyers aiming to build a house in the village prefer buying old houses or ruins falling to pieces with existing documentation in Cadastre, connected to the town or village network sewage, electricity, water services and road.

The demand for flats rose mainly in 1992-1993, but supply did not change much since the Revolution. Prices increased in the end of 1993, when the economy encountered big inflow of western companies operating in Prague. After the share bubble burst, the investments to real estate became alternative for investment to shares. Real estate investment became popular also between households due to more affordable prices of mortgages. A lot of investment funds also poured speculative capital to the Czech real estate.



Number of finished dwellings in the CR, yearly

Illustration 4: Number of finished dwellings in the CR, yearly, Source: CZSO, owncompilation

The difference in price of new housing and second-hand housing disappeared in the years of biggest boom, in years 2006-2008. This development of prices was not right and logical, but the demand was so high, that the buyers didn't respect the logic of pricing. In 2009 the demand decreased, the price decreased by 12%¹⁹ the real estate market started to be more

¹⁹ http://www.globalpropertyguide.com/Europe/Czech-Republic/Price-History, acessed on 2.9.2016

balanced and the logic in pricing of new and second-hand housing started to be respected again. Before the crisis, Czech economy was in very good condition thanks to the real estate boom. The GDP was increasing on average by 4.3% yearly in years 2000-2008, and there was very optimistic outlook to the future, but in 2009 building and construction

Czech economic performance

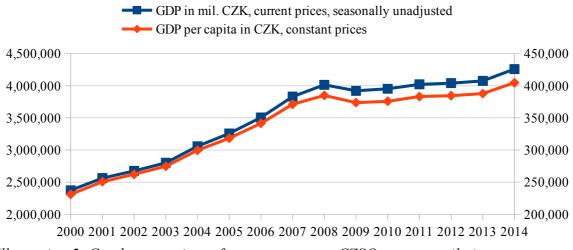


Illustration 5: Czech economic performance, source: CZSO, own compilation

industry declined and new construction decreased by 14% y-o-y. The average yearly increase in GDP from 2009 to 2014 was just 0.009% noting that the GDP growth changed by negative 4.8% from 2008 to 2009²⁰.

Housing policy also went through long development since the Velvet revolution. Before the revolution, there were only three types of ownership: state, cooperative and family house. The most important impact on real estate market in the Czech Republic had financial crisis in the years 2009-2011 and the economic and real estate market boom that changed the conditions and ownership structure in the last years. The real estate boom also changed the price levels of housing and price differences between new and second-hand housing. The real market value of some types of real estates has increased multiple times²¹ since the Velvet revolution. The current yields in 2015 reached 6.6% for prime industrial buildings and ca. 5.6% for offices and retail buildings. Residential buildings usually have lower yields, because of the tension on the housing market that decreases the yields. The current

²⁰ Source: CZSO

²¹ <u>http://www.globalpropertyguide.com/Europe/Czech-Republic/Price-History</u>, accessed on 2.9.2016

yields on housing real estates in 2015 were ca. 3.6%²². According to Global Property Guide, the house price index in Prague increased 63% only from 1998 to 2003, but after accession the EU in 2004, the prices of some luxury apartments rose by 91%.

4.2 Ownership structure

The current ownership structure of the Czech residential real estate market is following: **Cooperatives** – they account for ca. 9.4% of total residential housing. Their role is thus inconsiderable, but new construction in this sector stagnates.

Rental housing sector – also accounts for ca. 22.4%. This sector is very complicated; a lot of flats are in neglected state due to long time of regulation of rents. The relationships between tenants and occupier are subject of frequent court actions.

Public housing sector – accounts for ca. 4.5% and was influenced by similar issues as the rental sector. Today there are two possibilities, how to rent a council flat. Firstly, applicants may take part in auction of available flats and the best offer wins. Secondly, applicants that meet conditions may apply for social housing in municipality of their permanent residence²³.

Private ownership sector – accounts for ca. 56% of total residential housing and its share still increases due to construction of new family houses and flat houses, but also due to continuing privatisation. Maturing mortgages market in the CR has also its share on increasing number of dwellings in private ownership.

²² http://www.globalpropertyguide.com/Europe/Czech-Republic/Rental-Yields

²³ MMR. 2015. Bydleni v ČR v číslech. *Ministry for Regional Development CR*.

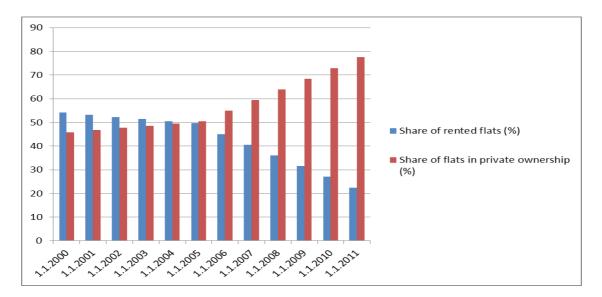


Illustration 6: Ownership structure of flats in the CR between 2000 and 2011, source: statistical database of CNB, ARAD1, author's compilation

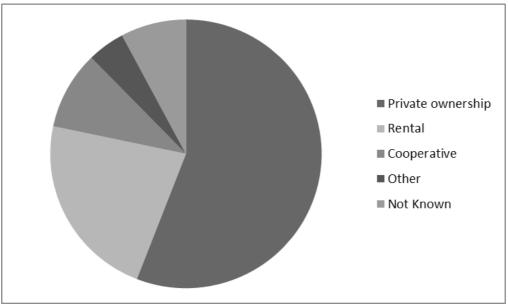


Illustration 7: Structure of usage of flats in the CR, souce: Ministry of Regional Development, author's compilation

4.3 State regulation tools

The state interferes to the real estate market by emission of new law and edition of current laws. The state regulates the amounts of tax on real estates, tax on transfer of real estates, value added tax. The state collects the taxes stated above and regulates the real estate market. Below are mentioned some examples of laws that state uses to regulate real estate market.

4.3.1 Housing benefits by state

Housing benefit is recognized for persons or families with low income. It is aimed to cover a part of housing expenses including rent, energies, water, waste and heat. The Ministry of Work and Social Affairs also states "normative expenses for housing", which are taken as average expenses for housing according to size of municipality and members of household. The amount of housing benefit is calculated as difference between normative housing expenses and income multiplied by coefficient 0.3 (or 0.35 in Prague).

4.3.2 State support of building savings

State support of building savings was very important factor for the real estate market, because it belongs to one of the most popular financial products in the Czech Republic since year 1993, when it was introduced by the Law of building saving and state support of building saving n° 96/1993. This product was popular, because it was secure investment offered just by the building saving banks with special approval. The interests and the state support fee were quite high and even though the interest and state support fee is not so high nowadays, people prefer it because of the simplicity and security. However the conditions changed and now people using the building saving can't subtract the interests from tax base. There is also discussion, whether there should be restriction on usage of saved amount or not. Some say that people should prove, whether they used the saved money and state support for the purpose of building, some are against. Since year 2013, there is list of items that can be financed by the building savings.

4.3.3 Construction law

Construction law regulates the town and country planning and construction order. Construction order sets, which buildings, land changes and construction works will need to ask for concession.

4.3.4 Law on unilateral rent increase

The state tries to regulate the relationships between the owner and renter, because the housing is considered as important assumption of economic stability of each household. State tries to regulate prices and prevent from increasing the rent above the market price, increasing the rent price due to short-term fluctuations and from fluctuations due to low elasticity of supply.

The regulation of state may be a subject of discussion, because it was not always effective. For example in 1993 a law that regulated the price roof of rents was introduced and in 1995 the law was changed. As a result of this change, there were created two groups of housing; one part of housing belonged to the group with regulated prices of rents and one with market price rent. This was a huge issue, because the question of deregulation was decided based on the date of signature on rent agreement. In housings with deregulated rents were living both low and high income households, and so the regulated rents were not just for those who couldn't afford housing for market price. Also regulation of rent prices decreased the market price of rents, so it was enormously ineffective step. Another consequence of regulation of rent prices was slow-down of renovation of houses, because the owners of houses with regulated rents claimed to have little money for renovations. It is possible to increase the rent price now, but the agreement of both parties is needed according to the Civil Code.

The increasing of rent is regulated by new Civil Code as of year 2014, paragraphs 2249 and 2250. The owner can increase the rent if the current rent is below the level of rents in comparable housing in the same locality. The owner can also increase the rent, if he or she has done significant changes to the flat or flat house, which ameliorate living conditions there and save expenses for the energies paid by the renters.

4.3.5 Support of mortgages

Another manner of state support of the real estate market is state support of mortgages. The aim of this strategy is to help young people younger than 36 years caring of child younger than 6 six years to afford their own shelter. The state pays support fee for the paid interest on mortgages. The support has form of interest subsidy and is counted as EU reference interest rate + 1%. The mortgage is processed only on maximum 50% of investment costs. Another condition to be met is that the recipents of mortgages finance maximum 90% of the investment amount from external sources and have at least 10% of the total price financed by their own sources. The maximum time of support is 10 years. However, the subsidy applies only for those types of mortgages that don't exceed 800.000 CZK for flats and 1.500.000 CZK for houses. The law which regulates it is 249/2002 Sb.13.²⁴

Another important strategy of state support of people paying for their own houses or flats is the opportunity to subtract the interest paid on mortgage from the tax base, maximum sum that may be subtracted from the tax base is 300.000 CZK per year.

The attitude of government towards the support of accessible housing is influenced by the situation of construction industry, which is huge sector of the Czech economy, and employs more than 370 thous. people²⁵.

²⁴ Source: <u>http://finance.idnes.cz/pujcky-pro-mlade-na-bydleni-dd6-/viteze.aspx?</u> c=A160323_102421_viteze_kho, accessed on 2.9.2016

²⁵ (Odborový svaz stavba ČR, Svaz podnikatelů ve stavebnictví ČR, 2012)

4.4 Determinants of housing prices

One classification of determinants of housing prices that is used is endogenous and exogenous determinants. More traditional is however classification of the fundamental factors determining housing prices which can be divided into supply and demand factors and will be further used in this thesis. The endogenous and exogenous classification however includes some other interesting determinants that are worth mentioning. Endogenous determinants are the price factors and exogenous determinants are for example prices of houses and flats, prices of rents, interest rates on loans. The exogenous determinants of the demand for housing can be divided into the following categories²⁶: market size, income/wealth, prices of substitutes, actual vs expected price. They are the same important as the price, because they can have key influence on the effective demand, thus it is very important for analysts to have quality forecasts of exogenous determinants of housing demand to assess the future outlook on housing market and identify investment opportunities.

Market size factors that affect the demand for housing is number of households, which indicates how many housing units are needed to satisfy the demand on the housing market. The effect of market size on demand for housing is positive, that means that prices being constant and market size bigger, quantity demanded will be higher in terms of either square footage or number of units.

Income or wealth affects directly the demand for residential real estate. The effect of income or wealth on housing demand is also positive; prices being constant and incomes of households increasing, more households will demand new house or flat, so increases in real income are in theory associated with increases in the number of housing units. However, many housing economists use permanent income rather than annual income, because of the high cost of purchasing real estate.

In case of demand for purchase of housing, the substitute of it is renting a flat or house. It can however be also a class or standard of housing.

²⁶ Source: <u>http://isites.harvard.edu/fs/docs/icb.topic1143374.files/Rena_Chap%202.pdf</u>, visited 3.9.2016

If the price of flat rents increases and prices of houses and flats stay on the same level, increase in apartment rents will be likely to boost demand for housing. This is something what happened nowadays in the CR. As prices of rents are more expensive, more families find home-ownership more attractive.

In case of substitute standard, families renting a luxury flat in the centre of Prague may be forced to seek for middle-class flat in the centre of Prague if the rents of luxury flats get more expensive. The demand schedule for middle-class flats will subsequently shift to the right to reflect the greater amount of meters square demanded.

Expectations of higher prices or rents in the future may result in increases in the number of housing units demanded. Similarly, growth expectations on the part of firms may also induce shifts in the demand for commercial real estate.²⁷

The actual price is the price, that is now and the expected price is the price that subjects on the housing market expect to be in future. Very often, we need this concept to explain the the situation on the housing market, that doesn't seem to be explicable by conventional supply and demand model, but the explanation of behaviour of the subjects on the housing market can be explained by the price changes they expect in the near future.

For example in the times of increasing prices and increasing demand, one would conclude that the law of demand is being violated. However, the decision of buyers to purchase a flat may be accelerated by the rising prices. If the buyer wants to purchase a flat in for example one year and the prices are rising with no probability of declining in one year, many buyers will be discouraged by the expensive price, but many others will accelerate their intention to buy before the price levels are higher than expected and so the demand will rise. Also, if we look at a market in which housing prices rise, because of increasing immigration of households in the area, the price for housing will increase. Some subjects on the housing market could speculate or behave myopically in the early stage of the rising demand and extrapolate the recent market developments and price movements into the future. Thus, assuming reasonably behaving households, expected increase in demand for housing may be result of increase prices of houses and flats, which is opposite of the effect actual price increases would have. The effect higher prices expectations represents, a shift,

²⁷ Source: <u>http://isites.harvard.edu/fs/docs/icb.topic1143374.files/Rena_Chap%202.pdf</u>, p. 35, visited 3.9.2016

not movement along, of the demand curve. Expected price changes are also exogenous determinants of demand.

4.4.1 Supply factors

According to Hlavacek and Komarek, supply on the housing market is mainly driven by the financial efficiency of the construction industry and is regarded as non-elastic in the short run. They also divide the housing market into two segments. The first segment is existing housing stock with inelastic supply and prices already fixed. The second segment is new housing construction stock, where the margins between prices of inputs and the current market price determine the amount of new construction.

The supply factors include the cost factors, such as land prices, average apartment acquisition amounts and building construction costs. An increase in the costs of a new flat should, at a given level of demand, lead to an increase in the value of existing stock of flats. The relationship between housing supply and its influence on housing prices is, that higher amount of housing supply should lead, ceteris paribus, to lower upward pressure on flat prices. Supply factors influence the housing prices with a long lag, because of the long period, that it takes to plan, receive a building permit and construct a new project.

4.4.1.1 Prices of flats, houses, building plots prices of rents

Prices and rents of housing are the endogenous determinants of housing demand, especially important is the ratio of price or rent expenditure to household income. When prices of rents become too expensive relative to household's income, households will demand more flats or houses ceteris paribus, and vice-versa.

On the graph below, we may see the change in affordability of flats in Prague, which illustrates that the most affordable were flat prices in 2011-2012 and since then the flat prices increased in comparison to nominal wages. The graph shows, that during the recession, buyers didn't buy so many flats as before it and the prices went down. In 2014 however the economic situation stabilised and the interest rates decreased. A lot of households started to look for and buy more flats in further periods.

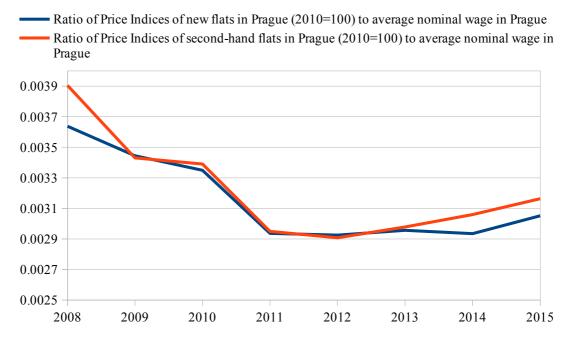


Illustration 8: Ratios of price indices to average nominal wages in Prague, source: CZSO, own compilation

The line graph below demonstrates the development of indices of realized prices of new flats in Prague from the second quarter of 1998 until the second quarter of 2016. Overall the trend is downward since 2008, but since the second quarter of 2015, the indices of realized prices of new flats in Prague have tendency to go upwards again. This trend was hugely caused by decreasing interest rates of mortgages (which will be described more in next chapters), which dropped at that time to below 2.5%.

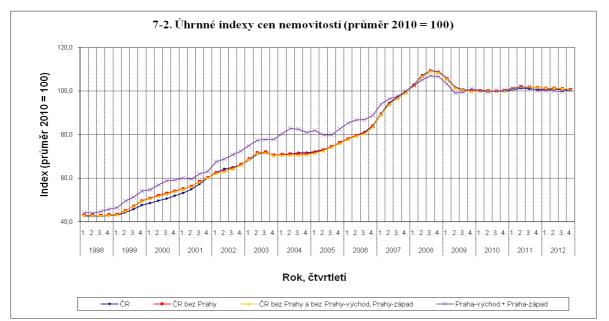


Illustration 9: Price indices of real estate in the Czech Republic, average of year 2010 = 100, source of graph: CZSO

In the graph of Price indices of real estates, we may see, that the curve illustrating price indices of family houses, apartments and multidwelling buildings is less volatile than the curve illustrating price indices of solely family houses and flats indicating that the prices of family houses and flats are more vulnerable to economic situation changes and other influences on the market. Also the market of multidwelling buildings is not as liquid as the other sectors of real estate market, which may play an important role in terms of the volatility.



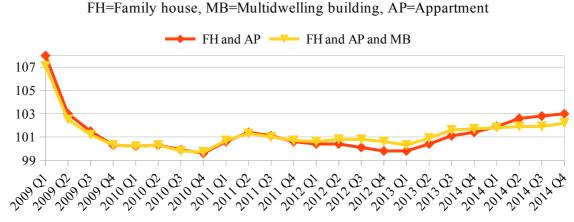


Illustration 10: Price indices of residential real esates, source, CZSO, own compilation

In terms of prices of building plots, the fastest increases in prices have had the standalone building plots that are not part of complex buildings. Their prices have increased by 40% since 2010. Another interesting curve is the one of Prague, which shows that during the time of recession, prices of building plots in Prague decreased much more than others confirming that the market in Prague is the island in the Czech Republic and is highly influenced by the foreign capital inflow. Otherwise the development of prices was very similar to those of flats, family houses and multidwelling buildings.

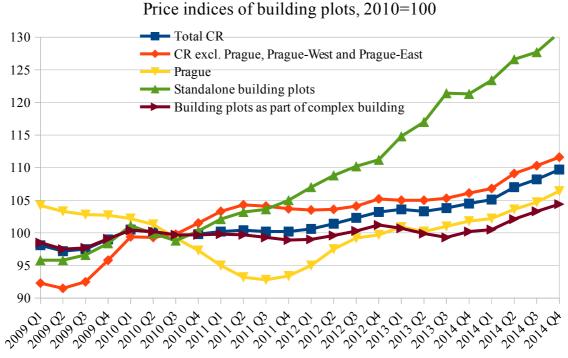


Illustration 11: Price indices of building plots, average of year 2010 = 100, source: CZSO, own compilation

4.4.1.2 Supply of housing

According to McKenzie and Betts, the supply of housing at any future time will consist of currently available housing units minus destructed housing units minus housing units converted to other uses (hotels, office units, commercial units, industrial units) plus new supplied stock plus other units converted to residential use.

To build new housing units, four economic elements; land, labour, capital and entrepreneurial skills are needed. Changes in availability of these elements result in changes in the price of new supply. This issue was already described in the chapter Housing construction prices. However the new supply of housing is more and more restricted by government or municipality. For example on the graph below, we may see that there are more newly finished flats in family houses that in multi-dwelling units, which may be also a result of municipality restrictions to developers intending to build new houses of flats. The new supply of all types of monitored categories of housing is declining in the Czech Republic, even though Czech Republic has one of the lowest average footage per inhabitant; just around 35 sqm/person according to Praguemonitor.cz.²⁸ With prognosis of decline of birth rate, but longer life prospect of population and net immigration, there may soon be shortage of housing units.

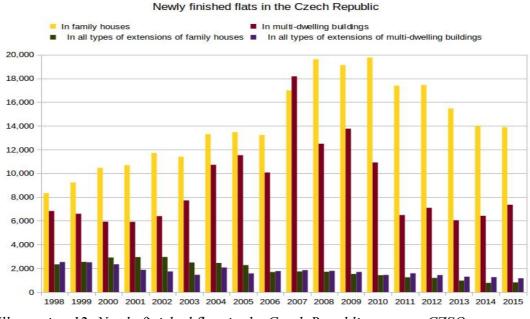


Illustration 12: Newly finished flats in the Czech Republic, source: CZSO, own compilation

4.4.1.3 Housing construction prices

The Czech Statistical Office publishes various detailed statistics of construction prices indices in the Czech Republic. However, the data are not separated into administrative units, or CR and Prague; neither are they separated into single types of residential real estates, so the data for flats or family houses only cannot be obtained.²⁹ Data are divided into categories according to nomenclature: Residential buildings, Non-residential non-productive buildings, Non-residential productive buildings, Civil engineering works, hydraulic structures. There also data for more detailed nomenclatures, e.g. CZ-CPA and CZ-CC.

²⁸Source: <u>http://praguemonitor.com/2016/03/09/hn-floor-space-person-rise-czech-flats</u>, accessed on 2.10.2016

²⁹ (Konces spol. s.r.o., Oceňování nemovistostí, prodej software a dat, statistika, 2016)

There are 3 main indices worth to mention in this work; Price indices of Constructions by Kinds of Constructions, Indices of Material inputs of Construction output by Kinds of Constructions and Indices of Construction costs of Construction output.

Price indices of Constructions by Kinds of Constructions are price indices of the finished buildings and construction valued on the cost basis and are represented by the price in sector C in the diagram construction prices index.

Indices of Construction costs of Construction output is the price of material inputs, labour and profit margins of the building company represented as the output price in sector B in the diagram construction cost index.

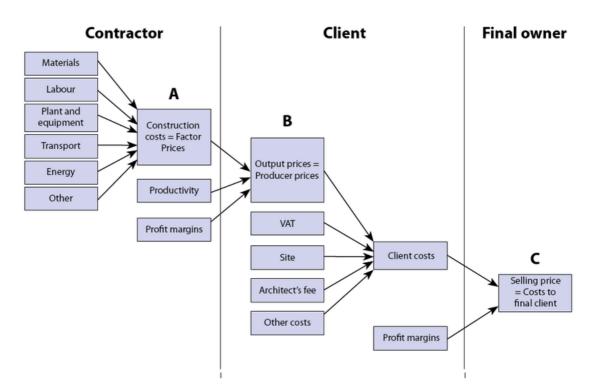


Illustration 13: Diagram construction cost index, Source of the diagram construction cost index: http://ec.europa.eu/eurostat/statistics, accessed on 20.8.2016

Indices of Material inputs of Construction output by Kinds of Constructions include direct material inputs (building materials and indirect material inputs (machinery, equipment, energies etc.), which constitute inconsiderable part of costs. Material inputs of construction

may create between 25 and 75% of all cost of the construction. They are indirectly influenced by the indices of transport, wages and social and health insurance fees³⁰. In the graph illustrating price indices of construction costs in the Czech Republic, it may be seen, that the price indices of material inputs were the most volatile and they changed the least due to competition pressure on the factor markets in the chosen period 2010 Q1-2015 Q4. On the other hand price indices of construction output. The prices of construction output however have not been so volatile and have had the highest growth since 2005. On the curve illustrating price indices of cost of finished constructions we may see, that these prices are the least volatile, but they reflect the most of these cost price indices the overall economic situation and the mood in the real estate market.

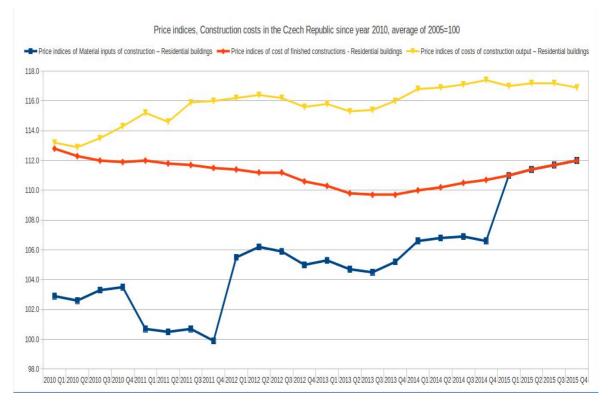
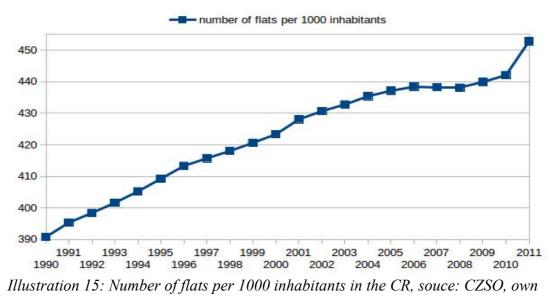


Illustration 14: Price indices, Construction costs in the Czech Republic since year 2010, average of year 2005 = 100, Source of data CZSO, own compilation

³⁰ CZSO metadata of Price indices of Constructions by Kinds of Constructions, Indices of Material inputs of Construction output by Kinds of Constructions and Indices of Construction costs of Construction output

4.4.1.4 Number of flats per 1000 inhabitants, average footage per capita

These indicators show the density of housing supply in a state or city. The Czech Republic has nowadays ca. 455 flats per 1000 inhabitants, which might seem to be sufficient stock. If we compare for example the average floor area per capita in the CR and other European states, we see that the CR is below the average with its ca. 35 sqm/person and also the average size of dwellings is 18 sqm below the average of EU27.



compilation

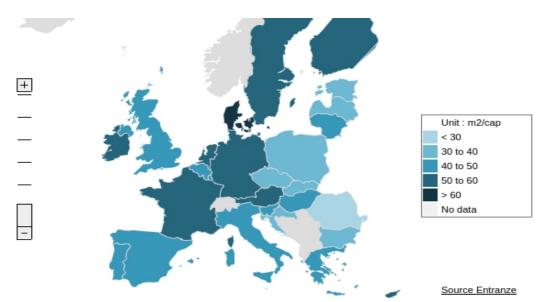


Illustration 16: Average footage per capita, source of the image: <u>www.entranze.enerdata.eu</u>, accessed on 21.8. 2016

According of the Eurostat data, in the whole CR 29% of dwellings accommodate single households, 29% of dwellings accommodate households with 2 members and 38% of dwellings accommodate households of 3-5 members, the rest are households of 6 and more members. In Prague the percents are 36, 30.5, 31, 2.5 respectively. The proportions are close to the EU average excluding Croatia, Lithuania and Finland³¹.

³¹Source of the data: Eurostat, retrived from: <u>http://ec.europa.eu/eurostat/statistics-</u>

explained/images/a/a2/Distribution_of_occupants_per_dwelling%2C_national_averages_and_capital_cities %2C_by_NUTS_level_3_region%2C_2011_%28%C2%B9%29_%28%25_of_all_dwellings%29_PF15.png, accessed on 1.10.2016

4.4.2 Demand factors

4.4.2.1 Population

According to McKenzie and Betts, the most important influence on housing demand is population. The population is the main determinant of housing demand as major community growth must be followed by growth in number of housing units. However they claim that the total number is not the main factor, rather we should look at the demography. Demography is breakdown of the composition of population according to age, sex, occupation, income level and other socioeconomic variables, which together describe the population, and they can tell us more about its housing needs. According to Hlavacek and Komarek, the age structure of the population, can be reflected in the economic activity rate of the population. McKenzie and Betts illustrate the differences in population composition of different neighbourhoods by following example, when young people leave their houses. At 18, some of young people leave their houses, but until 30 years almost all of them seek for their own shelter. Therefore two neighbourhoods with different population of people between 18 and 30 years will have different housing needs. Also they wrote that neighbourhood which contains mostly older, retired people living in flats and not having any young children, will have lower demand for another housing unit. On the other hand, a neighbourhood having a lot of middle-aged and middle-income families will have higher demand for new housing units as they potentially have more children leaving home soon. Population trends are also relatively easy to follow in research and forecasts - simply add the time period to the age of population, add birth rates, subtract death rates and add migration.

Migration is the only variable that cannot be forecasted with high reliability as it can change quickly, for example due to natural catastrophe, unexpected refugee crisis etc. In the graph illustrating population by age groups in thousands of inhabitants, we may see that the total of children aged 0-14 years in the CR declined approx. 28% since year 1989. In 1989 2,253,000 children aged 0-14 years lived in the CR, while in 2015 there were 629,000 less.

The population in economically productive age had more stable development since year 1989. In 1989, there were 6,817,000 inhabitants aged 15-64 years and their total was

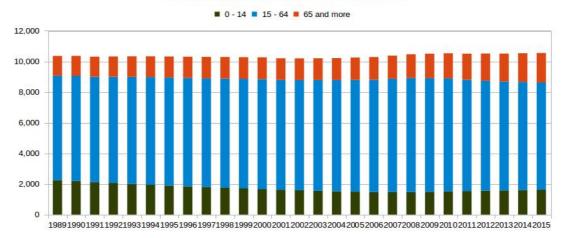
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slowly increasing until year 2008, when the total peaked on 7,431,000. In year 2009, the total started to slowly decrease and now we have almost 7,000,000 people in economically productive age. We can see also in table 2 showing the number and composition of households in 2006-2015, that the proportion of working persons and dependent children in a household has slightly declined in the mentioned period, while the proportion of non-working pensioners has risen.

The oldest age group is the one that continues to grow in total population. Since 1989 the total population aged 65 years and more has grown by ca. 50%, from 1,292,000 to 1,932,000. Very interesting is to look at the yearly increments of this age group; between 1989 and 2004, the average increment was 9.5 thous. inhabitants and the yearly increments in this period did not jump over 16 thous., while after year the average yearly increments are 45.3 thous. and the lowest yearly increment was in year 2005 (22,000). In year 2011 the yearly increments peaked on 66,000, but since then it did not drop under 52,000. The Czech Ministry of Labour and Social Affairs is aware of this increase and claims, that the total number of this age group is expected to double by year 2050 compared to the current state.³² This is a big challenge for the Czech economy and there is a big question mark, what impact this will have on the housing demand.

With youngest generation declining and eldest generation rising, there will probably be stable demand for new housing in near future. The senior population should live longer, they will not abandon their houses for the younger generation and these will demand new housing. According to the CNB data, almost 80% of flats were in private ownership and 20% rented, this means that the proportion of housing in private ownership is relatively high and for the effective demand will be important also buyers seeking to buy a flat as an investment, for example to conserve money for future pension.

³²Souce: <u>http://www.mpsv.cz/cs/2856</u>, accessed on 3.10.2016



Population by age groups, thousands of inhabitants

Illustration 17: Population by age groups in thousands of inhabitants, measured on Dec-31, source: CZSO, own compilation

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Households	2,893	2,884	2,839	2,820	2,840	2,839	2,811	2,840	2,830	2,823
Per household averages:										
Members	2.30	2.30	2.29	2.27	2.26	2.26	2.26	2.26	2.23	2.22
working persons	1.04	1.04	1.03	1.02	1.01	0.99	1.01	1.01	1.00	1.00
dependent children	0.59	0.58	0.58	0.57	0.57	0.58	0.57	0.57	0.55	0.54
non-working pensioners	0.51	0.52	0.52	0.52	0.52	0.53	0.53	0.54	0.53	0.54
other members	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.14	0.15	0.14

Table 1: Number and composition of households in thous. 2006-2015, source: CZSO

4.4.2.1.1 Marriage rate

The marriage rate can act in positive direction to the demand, as a wedding often establishes a completely new household. In the figure illustrating the statistics of marriages, we may see that the marriage rate had the fastest decline since year 1990 to 1994 and since then the trend was relatively stable. In 2007 the total of marriages peaked at 57,157. We may see some correlation between the marriages and economic situation since the start of the millennium. The graph also shows that the average rate of bride increased by almost 2 years since 2005 and the average age of groom increased by 1.5 year. The average age of groom and bride should soon peak as for forming of household there is not enough space after 32 years of age. To conclude, this determinant is losing its impact to

influence the housing demand, as the marriage trend is on decline and more and more couples prefer to live in a household and establish family without being married first.

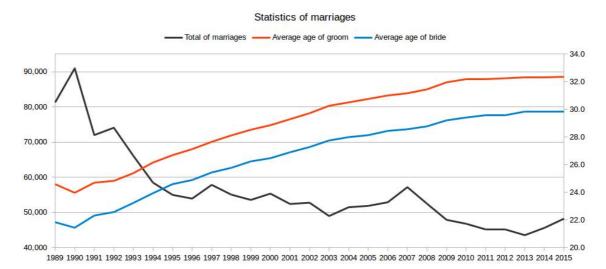
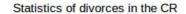


Illustration 18: Marriage rate in the Czech republic, 1989-2015, source CZSO, own compilation

4.4.2.1.2 Divorce rate

Divorce rate causes the housing demand to increase with no growth of population. In highdivorce states, the divorces are major factor of housing demand. Property price growth should also be fostered by a higher divorce rate, as most divorces turn one household into two, thus giving rise to the need for a new dwelling. In the Czech Republic, the divorce rate has declined by almost 69% since 1989 and the length of marriage has reached 13 years in 2015. This means that people nowadays are aware of the economic impact of marriage and divorce for them; they postpone the marriage until quite high age, but live together in marriage longer than before.

However, we have here no information about how long the divorce process takes now and then and how many families decide to live separately before the divorce, so we cannot make any conclusions based on this statistics.



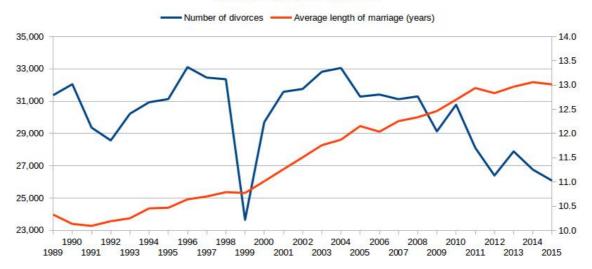


Illustration 19: Statistics of divorces, source: CZSO, own compilation

4.4.2.1.3 Total population growth

Total population growth is sum of natural population growth and net migration. Natural population growth is the difference between newly born and dead. Net migration is the result of emigration (people moving out) and immigration (people moving to the CR). In the graph showing the Total population growth in the CR, we may see that between years 1989 and 1993 total population in the CR was growing thanks to both natural

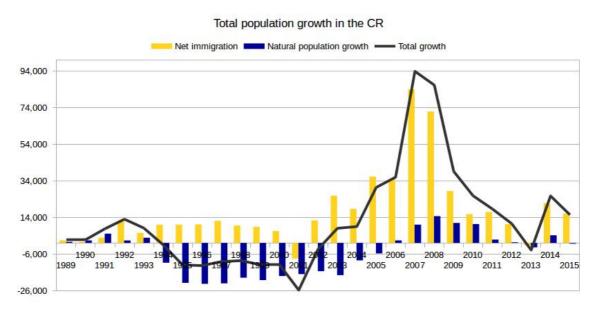


Illustration 20: Total population growth in the CR, source: CZSO, own compilation

population growth and net immigration being positive. However between 1994 and 2002, total population growth was in negative numbers due to negative natural growth. The Czech population started to grow again in 2002 mainly thanks to higher immigration, which peaked in 2007. Also in this period was baby boom of the strong generation born in the 1970's, which is the generation postponing establishment of family until their 30-ish. Since the start of the millennium, we are also witnesses of increasing emigration from the Czech Republic. These trends together mean that if the trend of negative natural growth will continue, the demand for housing for young people is decreasing and the demand of foreigners will increase. This will not only change the number of new flats built, but also the pattern of new supply.

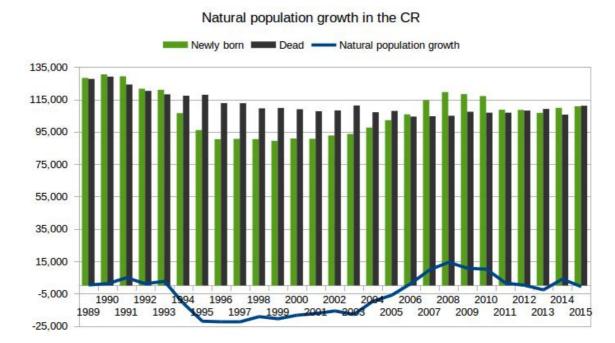


Illustration 21: Natural population growth in the CR, source: CZSO, own-compilation

Net immigration to the CR

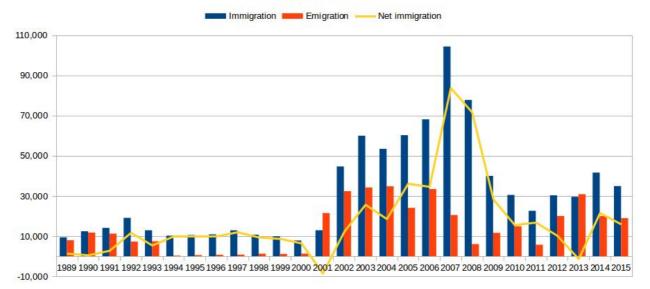


Illustration 22: Net immigration to the CR, source: CZSO, own compilation

4.4.2.2 Household income or monthly wage

According to McKenzie and Betts, the second major determinant of housing demand is income. The people having enough money to cover costs of housing create an effective demand for housing. However, not only the nominal income is responsible for changes in housing demand. The economists need to look at that part of the income that is available for paying housing costs. That say, if the nominal income increases and other costs like food and clothes increase, the income growth will not have any effect on housing demand. Income levels don't only affect total housing demand, but also its composition. Higher income groups usually demand more luxury flats and houses in more posh quartiers than the lower income groups. Sometimes also people of lower income groups must share flats or houses with their parents or flatmates.

Below is attached table by Czech Statistical Office that shows the gross/net income and expenditures of household and maps the structure of the expenditures. We can see that the housing costs between years 2006 and 2015 constituted the same proportion of the consumption expenditures of households.

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
GROSS MO	NEY INCOME, YEARLY TOTAL (CZK)	134,569	144,743	156,598	160,675	164,047	163,235	170,332	169,276	174,809	177,235
NET MONEY	(INCOME, TOTAL	116,549	125,817	137,497	142,402	145,437	145,081	152,125	150,488	154,992	157,609
GROSS MO	NEY EXPENDITURE, YEARLY TOTAL (CZK)	125,605	139,134	143,055	146,895	148,629	150,369	152,581	152,067	154,969	154,164
NET MONEY	EXPENDITURE, TOTAL	107,585	120,208	123,955	128,622	130,019	132,215	134,374	133,279	135,153	134,538
by purpose:											
A. Consumpt	ion expenditure	97,342	104,017	112,256	115,309	116,244	117,882	118,819	120,827	122,049	122,467
B. Non-consu	Imption expenditure	10,243	16,191	11,698	13,313	13,774	14,333	15,555	12,452	13,103	12,071
Structure (9	%):										
CONSUMPT	ION EXPENDITURE	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
01	Food and non-alcoholic beverages	20.1	20.1	20.1	19.3	19.3	19.1	20.0	20.2	20.3	20.0
02	Alcoholic beverages, tobacco	2.9	2.9	2.7	2.8	2.8	2.9	2.8	2.8	2.9	2.9
03	Clothing and footwear	5.4	5.4	5.2	5.0	5.0	4.8	4.7	4.7	4.9	5.0
04	Housing, water, electricity, gas and other fuels	20.7	19.9	19.9	21.4	21.7	22.3	22.1	22.2	21.5	21.1
05	Furnishings, household equipment etc.	6.9	7.1	6.8	6.7	6.2	6.2	5.8	5.5	5.7	6.0
06	Health	2.0	2.3	2.7	2.7	2.7	2.7	2.8	2.6	2.6	2.6
07	Transport	10.9	10.8	11.1	10.5	10.7	10.9	10.7	11.0	10.5	10.5
08	Communication	4.8	4.7	4.7	4.6	4.6	4.5	4.4	4.3	4.2	4.2
09	Recreation and culture	10.2	10.5	10.5	10.3	10.2	9.8	9.5	9.3	9.5	9.4
10	Education	0.5	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.6
11	Restaurants and hotels	5.0	5.2	5.2	5.2	5.0	5.1	5.3	5.2	5.3	5.6
12	Miscellaneous goods and services	10.4	10.8	10.6	10.9	11.1	11.0	11.2	11.6	12.0	12.1

Table 2: Households' incomes and expenditures in CR between years 2006-2015, source: CZSO

4.4.2.3 Rents of flats

Demand for property can also be affected by market rents, growth of which tends to lead to rising apartment prices. This factor reflects substitution between renting and home ownership, as rising rents motivate households to buy a flat of their own. The level of rents also affects investment in housing for speculative reasons, as growth in rents ceteris paribus increases the returns on such investment and leads to rising demand for apartments. Data for rents of flats in the Czech Republic and/or Prague were not found. In the regression analysis was used price to rent ratio in the CR from database of OECD instead.

4.4.2.4 Loans

The major factors of property price growth have recently also included the development of the financial market. This is being reflected primarily in growth in housing loans and is reducing the liquidity constraints on households when acquiring their own housing and should therefore be pushing property prices upwards.

In the graph below, we may see the quarterly increments of new mortgages and bank loans of households for housing purposes. The graph shows, that from year 2006 to 2008 the average quarterly increments were very high – in the end of year 2007 the quarterly increment was more than 2 times higher than the pre-crisis average. The high value of mortgages lent to households that were not able to pay the monthly repayments was one of

the causes of the global economic crisis. Since then the quarterly increments decreased to a new average 12,691 mil. CZK. The total bank loans for housing purposes are shown in the graph below. We may see that during that in the period before the global economic crises, there was boom on the residential real estate market and the increments in the volume of mortgages averaged at 23,601 mil CZK per quarter.

The households decelerated taking new loans and mortgages for new dwellings in Q1 2009, when there started the recession and many people lost their job. As a result, since Q1 2009 the increments of new loans and mortgages for dwellings averaged on just 12,691 mil. CZK. In Q1 2009 the indices of realized prices of new flats in Prague started to fall as well as the interest rates on mortgages as the economic situation the CR worsened and the demand to purchase new dwellings decreased. The interest rates are used as tool to stimulate demand for housing and bank loans, but in period of low economic growth this tactics did not do the job. The index of realized prices of new flats in Prague dropped to its minimum in Q2 2013. At that time, there was very low demand for mortgages and loans for purchases of dwellings. In the time of economic recession, the real estate market is very dependent on the level of interest rates, so as a consequence, the interest rates were further decreased and the decreasing trend continued until Q3 2016. On graph showing increments of volume of mortgages quarterly, it may be seen that since Q2 2015 the increments were quite high above the post-crisis average and for the first time since the crisis they touched the border of 20,000 mil CZK.

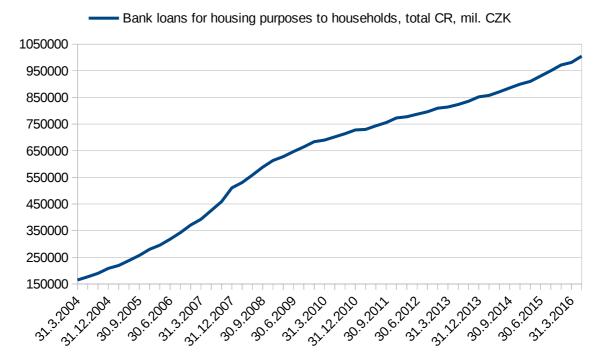


Illustration 23: Total bank loans lent to households for housing purposes, mil. CZK, source: CNB, own compilation

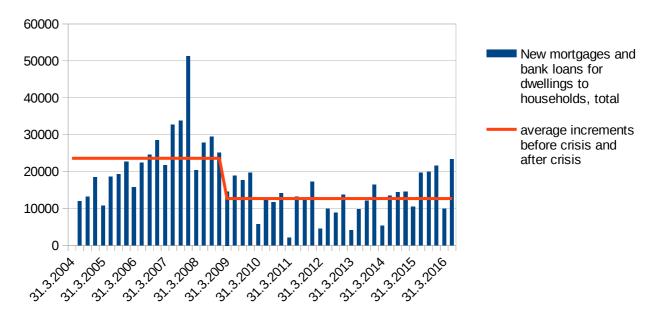


Illustration 24: New mortgages and bank loans for housing, mil. CZK, source: ARAD database of CNB, own compilation

4.4.2.5 Interest rates of mortgages

The price of housing is in majority of cases in the Czech Republic very closely related to the price and availability of credit, as the majority of households finance their dwellings from mortgages. The banks usually lend between 60 and 95% of the market price. In case of covering up to 100% of the market price, banks demand from the borrower additional real estate as security, signing life insurance contract with the bank etc. The mortgage is usually paid within period from 5 to 30 years. The borrower has possibility to repay the mortgage in advance, but usually there are certain conditions which are needed to be met, so that the bank doesn't charge additional fees. The best period for advance repayment is the termination of fixation period. Fixation period is time for which the bank mustn't change the level of interest rate to the borrower. Fixation period can last 1, 3, 5, 10 or 15 years. The borrowers have to count also on payment other charges connected to getting a loan, such as charge for bank account and charge for loan processing³³.

The mortgage interest rate increase causes the loan financing of property purchases less attractive and increases households' repayments of existing loans, thus the higher the interest rate is, the lower the demand ceteris paribus.

As discussed earlier in chapter Loans, In the Czech Republic the interest rates in 2015 and 2016 have dropped below 2.5%. The drop of the interest rates is apparent from the graph below that shows the level of interest rates from year 2004 to 2016 quarterly. The Czech republic came through economic recession in years 2012-2013 and in consequence to the recession the Czech National Bank decided to take action and boost the economy and Czech export by regulation of CZK:EUR exchange rate. The regulation is based on keeping stable exchange rate around 27 CZK per 1 EUR and as a result the CNB emits more money to the circulation. The demand for money thus drops with the interest rate. The Czech recession is however connected also to the recession that is in the EU and with with the CR trades most.

³³Source: <u>http://www.portalobydleni.cz/zpravy/400-nemovitosti-jakym-zpusobem-financovat-koupi/</u>, accessed on 10.09.2016

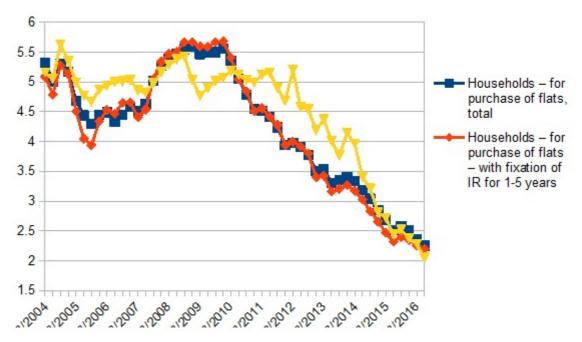


Illustration 25, Interest rates on households' loans, source: CNB, own compilation

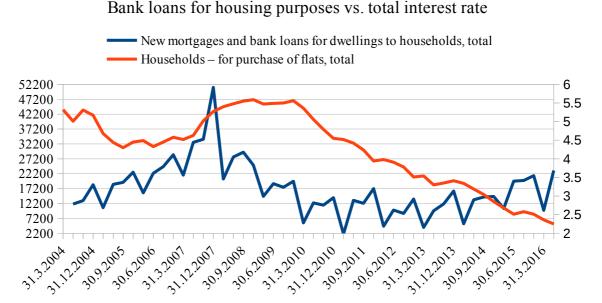


Illustration 26: Bank loans for housing purposes vs. total interest rate for housing purposes

4.4.2.6 Demand from abroad - FDI/GDP

Demand from abroad can affect demand for housing quite strongly. As a proxy for this demand was used the ratio of FDI to GDP (graph below), as the proportion of FDI to GDP shows us how important for the economy the FDI is. The graph shows that the biggest

proportion of FDI to GDP was during the years of privatisation in the period 1994-2002, another big wave of inflow of FDI was when the CR entered the EU, since then the inflow of foreign capital is on relatively low level and big opportunities for foreign investors that would change the numbers are not expected. For the future, we can only expect stagnation of FDI inflow and slightly downward trend.

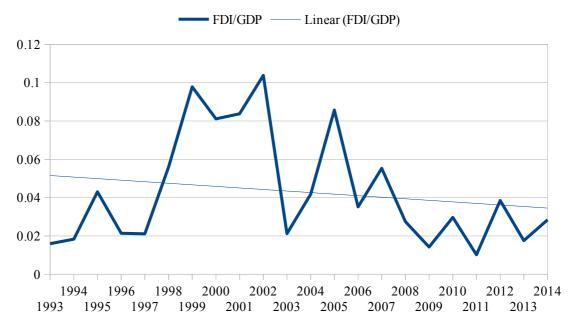
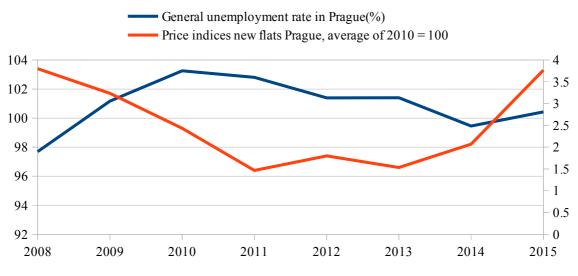


Illustration 27: FDI to GDP, source of data: CZSO and CNB, data in nominal prices in mil. CZK, own compilation

4.4.2.7 Unemployment rate

The employment rate of the population is one of the biggest factors of demand for housing as only people having prospect of stable employment are ready to ask for loan and pay the monthly repayments. The opposite relationship is best shown on graph named General unemployment rate in Prague vs. price indices of realized prices of flats in Prague. However data for the price indices were only available from year 2008, so longer period could not have been shown. There is only one moment in this graph when the relationship doesn't seem to be perfectly opposite and it is in 2015. Possible cause of this may be that the stock of existing and new flats didn't suffice anymore to meet the demand for housing and so the prices were increasing independently on the unemployment rate.



General unemployment rate in Prague vs. price indices of realized price of flats in Prague

Illustration 28: General unemployment rate in Prague vs. price indices of realized prices of flats in Prague, source of data: CZSO, own compilation

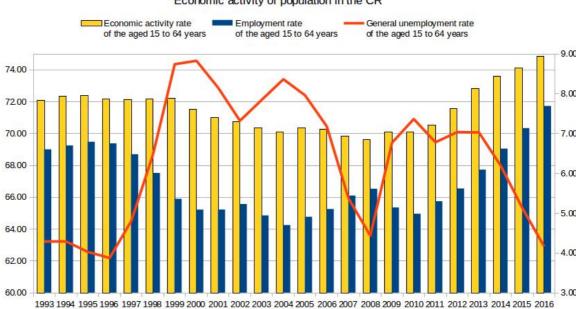
4.4.2.8 Economic activity rate

Economic activity rate is very close to the unemployment rate, just the relationship between this variable and housing is positive. On the table below showing Economic activity rate, we may see that the proportion of economically active people in the population is increasing since the revolution, but the proportion of economically active in the whole population is slightly decreasing and currently stands at 59.4% - the highest since year 2004.

The second illustration in this chapter is focused on the economic activity rate of population between 15-64 years. Here we may see that the economic activity as well as the employment rate in this age group is increasing mainly since year 2010. Their unemployment rate is currently stands slightly above 4%. This population is very important in this research, because the most potential buyers of flats belong here.

Population older 15 years (thous.)	Economically active workforce (thous.)	Of Employed (thous)	that Unemployed (thous)	Economically inactive workforce (thous.)	Rate of economic activity (%)	Employment rate (%)	General unemployment rate (%)
1993 8 292,7	5 093,6	4 873,5	220,0	3 199,1	61,4	58,8	4,3
1994 8 354,6	5 147,9	4 926,8	221,2	3 206,7	61,6	59,0	4,3
1995 8 406,4	5 170,6	4 962,6	208,1	3 235,8	61,5	59,0	4,0
1996 8 447,5	5 173,5	4 972,0	201,5	3 274,1	61,2	58,9	3,9
1997 8 487,0	5 184,8	4 936,5	248,3	3 302,2	61,1	58,2	4,8
1998 8 523,2	5 201,5	4 865,7	335,7	3 321,8	61,0	57,1	6,5
1999 8 555,3	5 218,2	4 764,1	454,1	3 337,1	61,0	55,7	8,7
2000 8 586,4	5 186,1	4 731,6	454,5	3 400,3	60,4	55,1	8,8
2001 8 577,4	5 146,0	4 727,7	418,3	3 431,4	60,0	55,1	8,1
2002 8 599,1	5 139,1	4 764,9	374,1	3 460,1	59,8	55,4	7,3
2003 8 636,9	5 132,3	4 733,2	399,1	3 504,6	59,4	54,8	7,8
2004 8 673,3	5 132,5	4 706,6	425,9	3 540,8	59,2	54,3	8,3
2005 8 716,0	5 174,2	4 764,0	410,2	3 541,8	59,4	54,7	7,9
2006 8 773,4	5 199,4	4 828,1	371,3	3 574,0	59,3	55,0	7,1
2007 8 845,0	5 198,3	4 922,0	276,3	3 646,7	58,8	55,6	5,3
2008 8 943,8	5 232,3	5 002,5	229,8	3 711,4	58,5	55,9	4,4
2009 9 009,3	5 286,5	4 934,3	352,2	3 722,9	58,7	54,8	6,7
2010 9 015,4	5 268,9	4 885,2	383,7	3 746,5	58,4	54,2	7,3
2011 8 964,7	5 223,0	4 872,4	350,6	3 741,7	58,3	54,4	6,7
2012 8 964,6	5 256,9	4 890,1	366,9	3 707,6	58,6	54,5	7,0
2013 8 951,5	5 306,0	4 937,1	368,9	3 645,4	59,3	55,2	7,0
2014 8 932,6	5 297,9	4 974,3	323,6	3 634,7	59,3	55,7	6,1
2015 8 935,7	5 309,9	5 041,9	268,0	3 625,7	59,4	56,4	5,0
— 11				~ ~		~	

Table 3: Economic activity rate in the CR, source: VDB.CZSO.cz, own compilation



Economic activity of population in the CR

Illustration 29: Economic activity of population 15-64 years old and general unemployment rate of the aged 15-64 years, source: CZSO, own compilation

4.4.2.9 Building savings

Building savings is type of saving that aims to gather finance for purchase of housing or its reconstruction, or purchase of new equipment. The building savings are very popular, because it is very secure product with guaranteed interest rate. Building savings are usually offered by specialized banking houses. The saver, who is a physical person, citizen of the CR or citizen of the EU with residence permit and birth certificate number in the CR, may get state support and in the end of saving period and meeting additional conditions, saver can also get loan on building savings. Building savings thus connects purpose saving and purpose loan, which is characterized by low and fixed interest rate for the whole repayment period³⁴.

4.4.2.10 VAT on real estates

VAT belongs to the most complex taxes. The tax-payers are physical as well legal bodies that has yearly turnover higher than 1 mil. CZK. The tax rate is subject of changes, but in long-term, there is main aim of lowering the basic VAT rate and unification into one tax rate. Increase of VAT rate causes increase of total price of real estates and decreases the demand. In 2009 was the last increase of VAT rate and at the same time was introduced possibility of group registration for payment of VAT for group of persons with the seat of business in the Czech Republic. The group had to be connected on the basis of persons or shared capital. Another VAT exception is "social housing" and for those applies the decreased VAT rate. Social housing is flat with area of max. 120 m² and houses with area of max 350 m², infantile institutes and accommodation centres for employees of state defence service.

4.4.2.11 Taxes on residential real estates

Tax on transfer of real estate is paid just once the property of real estates is transferred. The tax base is the appraised price and tax rate is equal to 3%.

<u>Property tax</u> in the Czech Republic is paid in advance and it is calculated based on the area of ground in square meters in the case of flats. This number is multiplied by coefficient 1,2. The basic tax rate for properties is 2 CZK/m2 of area, on which the flat takes place. It is

³⁴Source: <u>http://www.portalobydleni.cz/zpravy/400-nemovitosti-jakym-zpusobem-financovat-koupi/</u>, accessed on 10.09.2016

then multiplied by another coefficient depending on size of the municipality in interval < 1; 4,5 >, where the highest value is valid just for Prague 5.

5 Regression analysis

5.1 Main data collected and discussion

The data for the regression analysis were collected from official websites of the Czech Statistical Office, the Czech National Bank, Ministry of Regional Development of the CR, and OECD. Their time frame of the final model is from 1998 to 2015 yearly. Unfortunately, longer period could not be analysed as the prices of flats and rents were only available from year 1998, although other variables data were available from 1993 or even longer. Rent price indices were only available from the whole CR, not for Prague. The author collected various data, which did not fit to the model, because of high correlation between variables, nonlinear relationship between the variables, and finally, all the determinants discussed in the previous chapter could not be fitted in the equation due to requirements for degrees of freedom. The list of these variables is enclosed as the appendix.

Acronym (unit) Base period Data name units Source Indices of realized prices of new flats Prague price index Average of 2010=100 CZSO IFR Indices of building plots in Prague IBP Same time of last year = 100CZSO price index **Indices of Material inputs of Construction output by** price index IMICO Same time of last year = 100CZSO Kinds of Constructions Nomenclature **Completed apartments in Prague** CNB absolute number CA **Marriages Prague** CZSO absolute number M **Divorces Prague** OECD absolute number D Natural population growth in Prague NPG CZSO persons NM CZSO **Net migration Prague** persons General unemployment rate in Prague % U CZSO % Economic activity rate in the CR ΕA CZSO Q-o-q changes CZSO Unemployed persons/vacancy Prague U/V persons GW Average monthly gross wage in Prague CZK CZSO Price of flat to rent of flat ratio in the CR ratio PR OECD mil. CZK LTL CNB Volume of long-term loans to households _ % IR CNB IR on mortgages Net FDI inflow to the CR bil.CZK FDI CNB

The following data set formed the best fit for the estimated model:

5.2 Declaration of variables

The econometric model consisted of 6 independent variables listed in the table below.

Variable type	Notation	Data name	units
Dependent	yt	Indices of realized prices of new flats Prague	price index
	x 1	Indices of building plots in Prague	price index
	x2	Indices of Material inputs of Construction output by Kinds of Constructions Nomenclature	price index
	x3	Completed apartments in Prague	absolute number
	x4	Marriages Prague	absolute number
	x5	Divorces Prague	absolute number
	x6	Natural population growth in Prague	persons
Independent	x7	Net immigration Prague	persons
muepenuent	x8 x9 x10	General unemployment rate in Prague	%
		Economic activity rate in the CR	%
		Unemployed persons/vacancy Prague	persons
	x11	Average monthly gross wage in Prague	CZK
	x12	Price of flat to rent of flat ratio in the CR	ratio
	x13	Volume of long-term loans to households	mil. CZK
	x14	IR on mortgages	%
	x15	Net FDI inflow to the CR	bil.CZK

These variables were chosen based on the analysis of determinants of housing prices in previous chapter. The model is also influenced by the work of Michal Hlaváček and Luboš Komárek, who also researched the determinants of property prices in the CR and Prague using aggregate regression analysis.

5.3 Hypotheses

The hypotheses on the expected effects are summarised in the table below.

Explained variable (units)	Expected effect of explanatory variable to the explained variable	Explanatory variable (units)
Indices of realized prices of new flats Prague	+	Indices of building plots in Prague
Indices of realized prices of new flats Prague	+	Indices of Material inputs of Construction output by Kinds of Constructions Nomenclature
Indices of realized prices of new flats Prague	-	Completed apartments in Prague
Indices of realized prices of new flats Prague	+	Marriages Prague
Indices of realized prices of new flats Prague	+	Divorces Prague
Indices of realized prices of new flats Prague	+	Natural population growth in Prague (persons)
Indices of realized prices of new flats Prague	+	Net migration Prague (persons)
Indices of realized prices of new flats Prague	+	General unemployment rate in Prague (%)
Indices of realized prices of new flats Prague	+	Economic activity rate in the CR (%)
Indices of realized prices of new flats Prague	-	Unemployed persons/vacancy Prague (persons)
Indices of realized prices of new flats Prague	+	Average monthly gross wage in Prague (CZK)
Indices of realized prices of new flats Prague	+	Price of flat to rent of flat ratio in the CR
Indices of realized prices of new flats Prague	+	Volume of long-term loans to households (mil.CZK)
Indices of realized prices of new flats Prague	-	IR on mortgages (%)
Indices of realized prices of new flats Prague	+	Net FDI inflow to the CR (bil.CZK)

5.4 Formulation of model and time-series analysis

The prices of flats in Prague are influenced by indices of building plots in Prague, indices of material inputs of construction output, completed apartments in Prague, marriages and divorces in Prague, net immigration to Prague, economic activity rate in the CR, volume of long-term loans to households lent by banks and net FDI inflow to the CR.

If the building plots in Prague are more expensive, the price of new flats will increase and prices of second-hand flats will also increase.

If the prices of material inputs of construction output are more expensive, prices of flats in Prague will increase.

If the supply of completed flats in Prague increases, demand for flats will decrease and so the price of flats in Prague will decrease. If there are more marriages in Prague, the demand for flats will increase and the price of flats in Prague will increase.

If there are more divorces in Prague, the demand for flats will increase and the price of flats in Prague will increase.

If the immigration to Prague increases, the prices of flats in Prague will increase as a consequence of inreased demand for flats.

If the net population growth in Prague increases, the prices of flats in Prague will increase as a consequence of inreased demand for flats.

If the general unemployment rate in Prague increases, the demand and prices of flats in Prague will decrease.

If the economic activity in the CR increases, the price of flats will increase.

If the ratio of unemployed persons per vacancy in Prague increases, the prices of flats in Prague will decrease.

If the monthly average gross wage in Prague increases, the prices of flats in Prague will increase.

If the price to rent ratio increases, either the prices of flats are higher or the rents are lower, but the price of flats in Prague will be more expensive.

If the volume of long-term loans to households increases, the accessibility of credit will push the prices of flats in Prague higher.

If the interest rate on mortgages increases, the demand for flats and prices of flats in Prague will decrease.

If the net FDI inflow to the CR increases, the prices of flats in Prague will increase.

Therefore the price of flat in Prague is dependent variable in the model and others are independent/explanatory variables.

Variable	Mean	Median	Minimum	Maximum
yt	99.7424	99.3000	95.6000	105.600
x1t	102.406	103.000	96.2000	108.600
x2t	100.691	100.200	99.2000	105.000
x3t	1345.55	1212.00	303.000	3120.00
x4t	1460.02	1013.36	204.745	2992.47
x5t	782.606	791.000	580.000	1039.40
x6t	529.182	537.000	47.0000	1029.00

5.4.1 Summary Statistics, using the observations 2008:1 – 2016:1

74	2135.61	1663.00	2601.00	7950.00
x7t			-2601.00	7850.00
x8t	3.83786	3.69617	1.77000	5.36453
x9t	0.155846	0.125684	-0.272959	0.529234
x10t	4.02105	3.90000	1.70000	7.46261
x11t	33237.8	32966.2	30312.1	36657.9
x12t	100.843	93.4500	89.7287	135.455
x13t	1096.53	1111.76	798.081	1319.89
x14t	3.99121	3.91000	2.35000	5.59000
x15t	2742.20	3074.84	-9313.10	10715.6
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
yt	3.03006	0.0303789	0.377920	-1.09791
x1t	2.93236	0.0286346	-0.0302247	-0.598174
x2t	1.53996	0.0152939	1.82642	2.31184
x3t	558.749	0.415259	1.03569	1.53189
x4t	911.954	0.624619	0.260961	-1.40784
x5t	127.173	0.162499	0.203350	-0.729838
x6t	291.851	0.551513	-0.00505665	-1.21979
x7t	2508.20	1.17447	0.401358	-0.341019
x8t	1.02025	0.265837	-0.443852	-0.435482
x9t	0.194067	1.24525	0.0718321	-0.505288
x10t	1.66563	0.414227	0.233664	-0.834815
x11t	1599.28	0.0481164	0.653994	-0.387540
x12t	13.9551	0.138385	1.57541	1.16767
x13t	135.176	0.123276	-0.361221	-0.665278
x14t	1.10831	0.277687	0.123909	-1.32433
x15t	3256.44	1.18753	-1.32014	4.79702

5.4.2 Interpretation of summary statistics

1) yt

The central tendency of values measuring the price indices of flats in Prague is 99.742. The central value of this variable is equal 99.3000. The mean and median are not very different from each other, which means that in the data, there are no extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 9.181, which means that the data are not dramatically spread out. The relative measure of variability is very low, just 0.0303789.

2) x1t

The central tendency of values measuring the price indices of building plots in Prague is 102.406. The central value of this variable is equal 103. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values.

The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 8.59873517, which means that the data are quite dramatically spread out. The relative measure of variability is low, just 0.0286346.

3) x2t

The central tendency of values measuring the Indices of Material inputs of Construction output by Kinds of Constructions Nomenclature is 100.691. The central value of this variable is equal to 100.2. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), however shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 2.371476802, which means that the data are not dramatically spread out. The relative measure of variability is very low, just 0.0152939.

4) x3t

The central tendency of values measuring Completed apartments in Prague is 1 345.55. The central value of this variable is equal 1 212. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum) also shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 312 200.445001, which means that the data are quite spread out. The relative measure of variability is very low, just 0.415259.

5) x4t

The central tendency of values measuring marriages in Prague is 1 460.02.

The central value of this variable is equal 1 013.36. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 831 660.098116,

which means that the data are not dramatically spread out. The relative measure of variability is very low, just 0.624619.

6) x5t

The central tendency of values measuring divorces in Prague is 782.606. The central value of this variable is equal 791. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 16 172.971929, which means that the data are quite dramatically spread out. The relative measure of variability is low, just 0.162499.

7) x6t

The central tendency of values measuring the Natural population growth in Prague is 529.182. The central value of this variable is equal 537. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 85 177.006201, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.551513.

8) x7t

The central tendency of values measuring the Net immigration Prague is 2 135.61. The central value of this variable is equal 1 663. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 6 291 067.24, which means that the data are not dramatically spread out. The relative measure of variability is low, just 1.17447.

9) x8t

The central tendency of values measuring the General unemployment rate in Prague is 3.83786. The central value of this variable is equal 3.69617. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 1.040910063, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.265837.

10) x9t

The central tendency of values measuring the Economic activity rate in the CR is 0.155846. The central value of this variable is equal 0.125684. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 0.037662, which means that the data are not dramatically spread out. The relative measure of variability is low, just 1.24525.

11) x10t

The central tendency of values measuring the Unemployed persons/vacancy Prague is 4.02105. The central value of this variable is equal 3.90000. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 2.774323297, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.414227.

12) x11t

The central tendency of values measuring the average monthly gross wage in Prague is 33237.8. The central value of this variable is equal 32 966.2. The mean and median are not very different from each other, which mean that in our data, there are not any extreme

values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 2 557 696.5184, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.0481164.

13) x12t

The central tendency of values measuring the Price of flat to rent of flat ratio in the CR is 100.843. The central value of this variable is equal 93.45. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 194.74481601, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.138385.

14) x13t

The central tendency of values measuring the Volume of long-term loans to households is 1 096.53. The central value of this variable is equal 1 111.76. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 18 272.550976, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.123276.

15) x14t

The central tendency of values measuring the IR on mortgages is 3.99121. The central value of this variable is equal 3.91000. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 1.228351056, which means that the data are not dramatically spread out. The relative measure of variability is low, just 0.277687.

70

16) x15t

The central tendency of values measuring the Net FDI inflow to the CR is 2742.20. The central value of this variable is equal 3074.84. The mean and median are not very different from each other, which mean that in our data, there are not any extreme values. The range (maximum-minimum), shows us that difference between the extreme values is not high. The average square of deviation from the mean is equal to 10 604 401.4736, which means that the data are quite spread out. The relative measure of variability is 1.18753.

The summary statistics showed that the data are not dramatically spread out and the ranges between minimum and maximum are not high. Therefore there should not be heteroscedasticity in the model.

5.5 Regression model

5.5.1 Mathematical description of regression model:

Linear function with variables and parameters.

5.5.2 Declaration of variables:

- yt Indices of realized prices of new flats Prague
- x0t Constant term
- x1t Building plot price indices, previous period = 100
- x2t Indices of Material inputs of Construction output, previous period = 100
- x3t Completed apartments in Prague
- x4t Marriages Prague
- x5t Divorces Prague
- x6t Natural population growth in Prague
- x7t Net immigration in Prague
- x8t General unemployment rate in Prague (%)
- x9t Economic activity rate in the CR (q-o-q change)
- x10t Unemployed persons per 1 vacancy in Prague
- x11t Average gross wage in Prague (CZK)
- x12t Price of flat to rent ratio in the CR
- x13t Volume of long-term loans to households (mil. CZK)
- x14t Interest rate on flats (%)
- x15t Net inflow of Foreign direct investment in the CR (bil.CZK)

5.5.3 Function 1: General model

 $yt = \beta 0 + \beta 2x 2t + \beta 3x 3t + \beta 4x 4t + \beta 5x 5t + \beta 6x 6t + \beta 7x 7t + \beta 8x 8t + \beta 9x 9t + \beta 10x 10t + \beta 11x 11t$

 $+\beta 12x12t +\beta 13x13t +\beta 14x14t +\beta 15x15t+\epsilon t$,

where $\beta 0$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$, $\beta 6$, $\beta 7$, $\beta 8$, $\beta 9$, $\beta 10$, $\beta 11$, $\beta 12$, $\beta 13$, $\beta 14$, $\beta 15$

are parameters of corresponding variables and *et* is the error term at time t.

Using Gretl software, ordinary least squares (OLS) method is applied. The best

econometric model was constructed, when no variable was lagged. The author assummed,

that the determinants of residential real estate prices affect the price in time frame of one quarter.

5.5.4 Function 2: Estimated model

 $\begin{array}{l} Yt = & 33.7927 + 0.52601 \ x1t \ -1.07713 \ x2t \ -0.00113915 \ x3t \ -0.000144444 \ x4t \ -0.00475949 \ x5t \ +0.000717618 \ x6t \ +0.000132801 \ x7t \ -0.333647 \ x8t \ -5.26754 \ x9t \ -0.328862 \ x10t \ -0.00062933 \ x11t \ +0.267497 \ x12t \ +0.0785986 \ x13t \ +7.30324 \ x14t \ -2.65423e \ -0.5 \ x15t \ + \ \epsilon t, \end{array}$

	Coefficient	Std. Error	t-ratio	p-value	
const	33.7927	74.232	0.4552	0.65470	
x1t	0.52601	0.141344	3.7215	0.00170	***
x2t	-1.07713	0.654745	-1.6451	0.11831	
x3t	-0.00113915	0.000740675	-1.5380	0.14246	
x4t	-0.000144444	0.000531516	-0.2718	0.78908	
x5t	0.00475949	0.00316481	1.5039	0.15096	
x6t	0.000717618	0.00143488	0.5001	0.62340	
x7t	0.000132801	0.000203711	0.6519	0.52318	
x8t	-0.333647	0.962504	-0.3466	0.73311	
x9t	-5.26754	1.81417	-2.9035	0.00989	***
x10t	-0.328862	0.344922	-0.9534	0.35373	
x11t	-0.00062933	0.000297984	-2.1120	0.04979	**
x12t	0.267497	0.102595	2.6073	0.01840	**
x13t	0.0785986	0.0131093	5.9956	0.00001	***
x14t	7.30324	1.38525	5.2721	0.00006	***
x15t	-2.65423e-05	8.98623e-05	-0.2954	0.77129	

Model 1: OLS, using observations $2008:1-2016:1$ (T = 33)
Dependent variable: Indices_of_realized_prices_of_n

Mean dependent var	99.74242	S.D. dependent var	3.030061
Sum squared resid	33.88687	S.E. of regression	1.411859
R-squared	0.884660	Adjusted R-squared	0.782890
F(15, 17)	8.692715	P-value(F)	0.000031
Log-likelihood	-47.26255	Akaike criterion	126.5251
Schwarz criterion	150.4692	Hannan-Quinn	134.5816
rho	0.187025	Durbin-Watson	1.623085

5.6 Interpretation of the OLSM result

It is not necessary to interpret the result for the case when values of all independent values are equal to zero since it is unrealistic.

If the indices of building plots in Prague increases by 1, the price index of realized prices of flats in Prague will increase by 0.52601, ceteris paribus.

If the price index of material inputs of construction output of flats in Prague increases by 1, the price index of realized prices of flats in Prague will decrease by -0.00113915, ceteris paribus.

If the the completed flats in Prague increases by 1 flat, the price index of realized prices of flats in Prague will decrease by -0.00113915, ceteris paribus.

If the the marriages in Prague increases by 1, the price index of realized prices of flats in Prague will decrease by -0.000144444, ceteris paribus.

If the divorces increases by 1, the price index of realized prices of flats in Prague will increase by 0.00475949, ceteris paribus.

If the natural population growth increases by 1 person, the price index of realized prices of flats in Prague will increase by 0.000717618, ceteris paribus.

If the net immigration to Prague increases by 1 person, the price index of realized prices of flats in Prague will increase by 0.000132801, ceteris paribus.

If the general unemployment rate increases by 1%, the price index of realized prices of flats in Prague will decrease by -0.333647, ceteris paribus.

If the economic activity rate in the CR increases by 1, the price index of realized prices of flats in Prague will increase by 0.000132801, ceteris paribus.

If the unemployed persons per vacancy in Prague increases by 1, the price index of realized prices of flats in Prague will decrease by -0.328862, ceteris paribus.

If the average monthly gross wage in Prague increases by 1 CZK, the price index of

realized prices of flats in Prague will decrease by -0.00062933, ceteris paribus.

If the ratio of price to rent in the Czech republic increases by 1, the price index of realized prices of flats in Prague will increase by 0.267497, ceteris paribus.

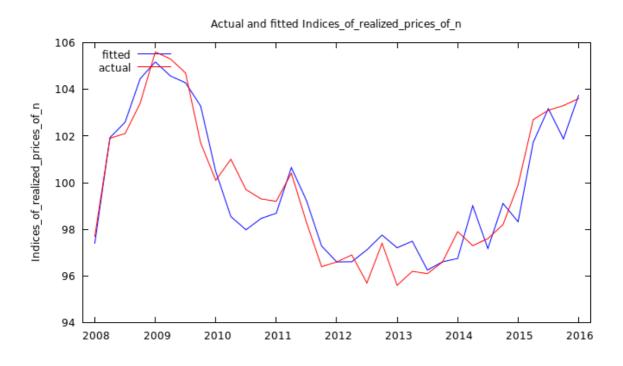
If the volume of long-term loans to households increases by 1 mil. CZK, the price index of realized prices of flats in Prague will increase by 0.0785986., ceteris paribus.

If the interest rate on mortgages increases by 1%, the price index of realized prices of flats in Prague will increase by 7.30324, ceteris paribus.

If the net FDI inflow to the CR increases by 1 billion CZK, the price index of realized prices of flats in Prague will decrease by -2.65423e-05., ceteris paribus.

5.7 Statistical verification

Goodness of fit/R squared = 88.46 % variance of dependent variable explained in this model. Below is shown the actual versus fitted curve graph.



5.8 Confirmation of assumptions

H0: test statistic is equal to 0, statistically insignificant result

H1 : test statistic is not equal to 0, statistically significant value

P value $\alpha=0,05$ $\Gamma 1 = 0.00170 < \alpha=0,05 \dots$ reject H0 , parameter is significant $\Gamma 2 = 0.11831 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 3 = 0.14246 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 4 = 0.78908 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 5 = 0.15096 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 6 = 0.62340 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 7 = 0.52318 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 8 = 0.73311 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 9 = 0.00989 < \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 10 = 0.35373 > \alpha=0,05 \dots$ don't reject H0 , parameter is insignificant $\Gamma 11 = 0.04979 < \alpha=0,05 \dots$ don't reject H0 , parameter is significant $\Gamma 12 = 0.01840 < \alpha=0,05 \dots$ reject H0 , parameter is significant $\Gamma 13 = 0.00001 < \alpha=0,05 \dots$ reject H0 , parameter is significant $\Gamma 14 = 0.00006 < \alpha = 0.05 \dots$ reject H0, parameter is significant $\Gamma 15 = 0.77129 > \alpha = 0.05 \dots$ don't reject H0, parameter is insignificant

Fulfilment (or not) of assumptions, explanation of relationships:

Statistically significant parameter is valid generally for all population. Statistically insignificant parameter is valid for the sample, but generally effect of the explanatory variable (which belongs to tested parameter) is zero -> explanatory variable has no effect on the dependent variable.

Based on this model, indices of building plots in Prague, economic activity rate in the CR, average monthly gross wage in Prague, price of flat to rent of flat ratio in the CR, volume of long-term loans to households and interest rate on mortgages are the general determinants of the housing prices in Prague.

If the level of significance α is equal to 0,1, then gama2, gama3, gama5, gama6 have no effect on dependent variable.

5.9 Evaluation of the result using statistical software

5.9.1 White's test for heteroscedasticity

Null hypothesis: heteroskedasticity not present

Test statistic: LM = 32.8361 with p-value = P(Chi-square(30) > 32.8361) = 0.329701

5.9.2 LM test for autocorrelation up to order 1

Null hypothesis: no autocorrelation Test statistic: LMF = 1.37401 with p-value = P(F(1,16) > 1.37401) = 0.258283

5.9.3 RESET test

RESET test for specification (squares and cubes) Test statistic: F = 0.310019, with p-value = P(F(2,15) > 0.310019) = 0.738

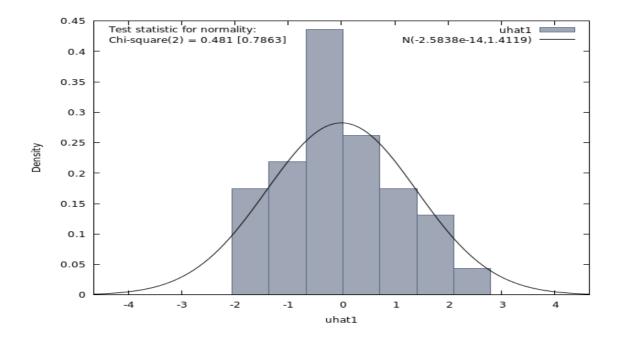
RESET test for specification (squares only) Test statistic: F = 0.095400, with p-value = P(F(1,16) > 0.0954004) = 0.761

RESET test for specification (cubes only) Test statistic: F = 0.091506, with p-value = P(F(1,16) > 0.0915062) = 0.766

5.9.4 Test for normality of residual

Null hypothesis: error is normally distributed

Test statistic: Chi-square(2) = 0.480934 with p-value = 0.786261

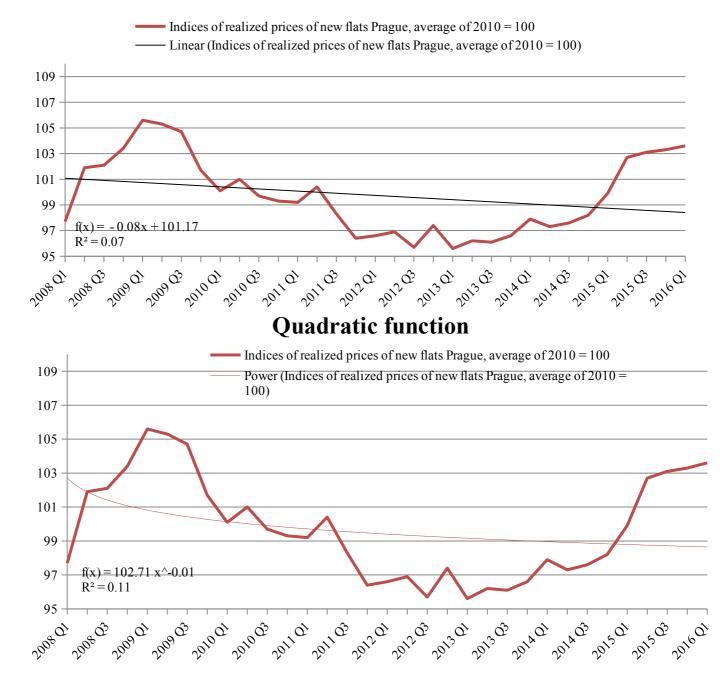




Null hypothesis: no structural break

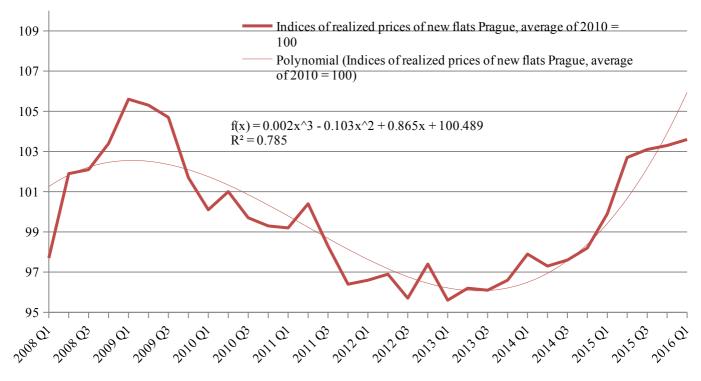
Test statistic: F(4, 13) = 3.47187 with p-value = P(F(4, 13) > 3.47187) = 0.0387054

5.10 Trend analysis and short-term prognosis



Linear function

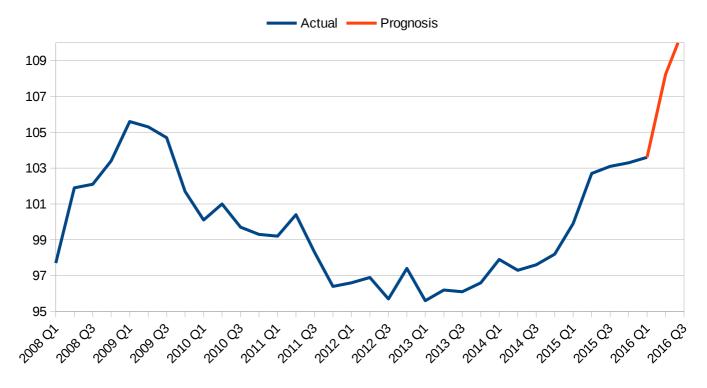
Cubic function



Comparison of the models

	R-squared	n	р	n-1	n-p	Ad. R-squared
Linear function	0.0713	32	2	31	30	0.0403
Quadratic function	0.1075	32	3	31	29	0.0459
Cubic function	0.7846	32	4	31	28	0.7615

Based on the trend line analysis and comparison of Adjusted R-squared for linear, quadratic and cubic function trend line of price of flats in Prague in CZK/m2, cubic function $y=0.0024739409x^3-0.1028596654x^2 + 0.8653796937x + 100.4893817204$ was chosen for short-term prognosis. The result of projected development is shown in the graph below. The result is discussed in the chapter of Results and discussion.



Prognosis of development of indices of realized prices of flats in Prague

6 Discussion of the results

6.1 Confirmation of hypotheses

In the model, there are two paradox effects of statistically significant explanatory variables on the explained variable.

The first paradox is the effect of economic activity rate in the Czech republic on indices of realized prices of flats in Prague. There might be problem, because the economic activity is not just in Prague, it is for the whole Czech republic. Quarterly data of economic activity rate in Prague were not available, so the data for all the CR were used, which might have slightly influenced the model. Czech republic and Prague are also two very different regions, as Prague is the economic island in the CR, it has more FDI inflow and the economic activity rate of the population is always higher than in the rest of the country. The second paradox is interest rate on flats. This relationship was however expected by the author, because the interest rate was declining in reaction to economic recession and monetary policy of the CNB since the end of year 2010 (see p. 58, illustration 24, 25) and the logic of relationship between IR and prices of flats was not respected.

6.2 Results of the statistical verification

6.2.1 White's test for heteroscedasticity

P-value is higher than 0.05, therefore there is no heteroscedasticity in the model. The main problem that causes heteroscedasticity are the outliers in the model. Another reason is skewnes in the distribution of one or more repressors included in the model and incorrect data transformation or functional form³⁵³⁶. The presence of outliers was denied by the analysis of summary statistics. Some data (economic activity rate) were transformed due to high correlation with other variables. The consequences of the heteroscedasticity are that the OLS estimators are biased and inefficient, the tests of hypotheses are not valid and the tests and predictions are inefficient. However, problem of heteroscedasticity is more likely in cross-sectional than in time-series data.

³⁵ Greene, W.H. (1993), Econometric analysis, Prentice Hall, ISBN 0-13-013297-7

³⁶ Verbeek, Marno (2004), A Guide to Modern Econometrics, 2.Edition, Chicester: John Wiley&sons

6.2.2 LM test for autocorrelation up to order 1

The p-value is higher than 0.05, meaning that there is no autocorrelation. Autocorrelation would mean that OLS coefficients are still unbiased and consistent, but inefficient, forecasts are inefficient and variances of coefficients biased and tests are invalid. R-squared overestimates the fit indicating a better fit than actually present, and tvalues imply significance when in essence insignificant coefficients.

6.2.3 RESET test

RESET test for specification (squares and cubes): p-value is higher than 0.05 RESET test for specification (squares only: p-value is higher than 0.05 RESET test for specification (cubes only): p-value is higher than 0.05 RESET Test Result: At 5% significance level and less, we reject the null hypothesis which states that the functional form is correctly specified. Thus, there is no functional form misspecification. Specification error occurs when an independent variable is correlated with the error term. The RESET test showed that no variable was omitted from the model and there is no omitted-variable bias.

6.2.4 Test for normality of residual

P-value is higher than 0.05, the error term is normally distributed.

6.2.5 Chow test for structural break at observation 2009:1

There is no structural break in the model as p-value is lower than 0.05. The economic crisis, that reached the Czech republic between year 2008 and 2009 did make huge structural break to the data and model should not be influenced by it.

6.3 Result of the prognosis

The prognosis based on trend analysis showed, that there will be an increase in prices of flats in Prague. Verification of the result is not possible yet at the time of finishing this thesis. The expected result of the verification is that the prognosis based on the trend line is not quite correct, because factors like GDP growth, private consumption growth and low interest rates on mortgages and savings will increase the demand for housing, however the forecasted growth seems too steep.

7 Conclusion

This thesis analysed the macroeconomic determinants of the residential real estate prices in Prague. Determinants were chosen based on study of correlation between single explanatory variable and explained variable in the chapter 4.4. Determinants of housing prices. Collected data served to estimate econometric model using Ordinary Least Square method. OLSM showed that the determinants of residential real estate prices in Prague are changes in prices of building plots in Prague, economic activity rate in the Czech republic, average monthly gross wages in Prague, price to rent ratio in the CR, volume of long-term loans lent to households and IR on flats. The analysed period (9 years quarterly observations) is still relatively short, so the results should be interpreted with caution. There is however conformity between results of Hlavacek and Komarek and results of this thesis. Both works came to conclusion that building plot prices and monthly rents are the determinanants of property prices in Prague.

The short-term prognosis showed, that there might be a steep increase in the indices of realized prices of flats in Prague. The author however doesn't think that such a steep increase is possible. The price index in Q1 2016 was on level 103.6 (base is average of year 2010) and the proposed development should reach the level of 111 in the end of Q3 2016. Verification of the prognosis based on trend analysis is not possible at the time of finishing this thesis. However, there are some novelties that will affect the demand for flats. Firstly, since the 1st November, tax on transfer of real estate will no longer be paid by the seller. The tax will be paid by the purchaser and its principle will change, so it will not be tax on transfer of real estate, but tax on acquirement or purchase of real estate. The tax is in amount of 4% of invoice price, which means that on each 1 000 000 CZK of flat or house, the purchaser will pay additional 40 000 CZK. The author assumes that some sellers will need to discount the prices by some proportion of this tax, to motivate buyers when the demand will decrease. Nowadays, however, demand is higher than supply and the sellers don't need to discount. In fact since 1st November, the real estate prices rose in doublings even though the nominal value rests the same; no discount is made by the seller and the purchasers have to pay the tax. The banks will not lend money on this tax together with mortgage, so purchasers will need to pay the tax from own finance, or ask for another

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general purpose loan³⁷. Exception could be made if the tax is comprised in the invoice price of real estate.

Another planned novelty is the restriction prepared by the Czech National Bank. Since the 1st October 2016, banks should restrict the maximal LTV (loan to value) ratio to 95%. Additionally, banks should only lend 10% of the mortgages in interval of 85-95% of LTV. This restriction should not decrease the demand for flats, as the banks say, that most of the mortgages are on value lesser than 90% of LTV. However a restriction on mortgages on 80-90% of LTV is planned in spring 2017, which might reduce the market by 15%.³⁸ The author assumes that there might be a decrease in demand for mortgages and flats in near future as with so many restrictions, purchasers will need to have almost 20% of the invoice price of flats, which will affect the accessibility of credit for wide spectre of bank clients.

³⁷ According to Tůma, O., retrieved from <u>http://www.penize.cz/hypoteky/317854-bod-zlomu-konci-boom-hypotek</u> on 15.11. 2016

³⁸According to Tůma, O., retrieved from <u>http://www.penize.cz/hypoteky/317854-bod-zlomu-konci-boom-hypotek</u> on 15.11. 2016

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