CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

FACULTY OF ECONOMICS AND MANAGEMENT

DEPARTMENT OF ECONOMICS

BACHELOR THESIS

COMPARATIVE ANALYSIS OF REAL ESTATE IN BEROUN AND KLADNO

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Economics and Management

Thesis title

Comparative analysis of real estate in Beroun and Kladno

Objectives of thesis

The aim of this bachelor thesis is to compare the real estate residential market in districts Kladno and Beroun, to estimate which value creating factors affect price the most by doing a multiple linear regression analysis and to make a pricing comparison of these two villages. The Bachelor thesis is divided into two main parts: The theoretical part and the practical part. The theoretical part serves as an introduction to the topic for a reader and as a source for the analysis and the practical one includes the analysis itself and the interpretation of results.

Methodology

Theoretical part (literature review) will be composed of introduction, body, implications for further research and conclusion and done with methods of extraction, induction and synthesis.

Practical part (analysis) will be done by using methods of comparative analysis as well as methods of regression analysis.

The proposed extent of the thesis
35-40

Keywords
real estate, Kladno, Beroun, price determinants, market value, regression analysis

Recommended information sources
DUŠEK, David. Základy oceňování nemovitostí: vyhláška č. 3/2008 Sb., ve znění vyhlášek č. 456/2008 Sb., č. 460/2009 Sb., č. 364/2010 Sb. a 387/2011 Sb. Vyd. 1. Praha: Oeconomica, 2006, 134 s. ISBN 80-245-1061-8.
KOKOŠKA, Jiří. Ceny nemovitostí podle cenových předpisů: vyhláška č. 3/2008 Sb., ve znění vyhlášek č. 456/2008 Sb., č. 460/2009 Sb., č. 364/2010 Sb. a 387/2011 Sb. Vyd. 1. Praha: Oeconomica, 2012, 83 s. ISBN 978-80-245-1898-5.
ROSS, Franz Wilhelm, Rolf BRACHMANN a Petr HOLZNER. Zjišťování stavební hodnoty budov a obchodní hodnoty nemovitostí: vyhláška č. 3/2008 Sb., ve znění vyhlášek č. 456/2008 Sb., č. 460/2009 Sb., č. 364/2010 Sb. a 387/2011 Sb. 1. vyd. Překlad Pavel Schier. Praha: Consultinvest, 1993, 598 s. ISBN 80-901-4860-3.

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Prague on 11. 03. 2015

Declaration

I hereby declare that I have worked on this thesis titled "Comparative analysis of real estate in Beroun and Kladno " completely on my own and that I have used only literature resources listed in the thesis in the References section.

In Prague _____

_____

Tereza Čermáková

Acknowledgement

Comparative analysis of real estate in Beroun and Kladno

Komparativní analýza nemovitostí v Berouně a v Kladně

Souhrn

Cílem této bakalářské práce je pečlivě analyzovat realitní trh rezidentních nemovitostí v okresech Kladno a Beroun, pomocí vícenásobné regresní analýzy určit, které faktory ovlivňují ceny nemovitostí nejvíce a následně provést srovnání cen těchto dvou obcí. Bylo zjištěno, že Beroun je dražší v cenách domů i bytů. Regresní analýza, zpracovaná statistickým softwarem odhalila, že cena je ovlivněna hlavně stavem nemovitosti, velikostí podlahové plochy, velikostí plochy pozemku (v případě že tam nějaký je), vzdáleností od Prahy, počtem pokojů a také přítomností garáže.

Klíčová slova

Nemovitost, Kladno, Beroun, hodnotvorné faktory, tržní hodnota, oceňování nemovitostí, regresní analýza

Abstract

The aim of this bachelor thesis is to carefully analyse the real estate residential market in districts Kladno and Beroun, to estimate which value creating factors affect the price the most by doing a multiple linear regression analysis and consequently accomplish a price comparison of these two villages. It was discovered that Beroun is more expensive in prices of houses as well as in prices of apartments. The regression analysis processed by a statistical software has indicated that price is affected by the real estate condition, flooring area, land area around the estate (in the case there is some), distance from Prague, number of rooms and also by the presence of garage.

Keywords

Real estate, Kladno, Beroun, price determinants, market value, real estate valuation, regression analysis

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1 Introduction

Generally, real estates are one of the most important investments. But in fact it fulfils a dual role of an investment. It could be a part of a portfolio and also one of the main elements of one´s life. For many people their house or apartment is the largest investment that they will ever make. When comparing it with other types of investments, real estate investing includes a quite convenient risk/reward profile with relatively low liquidity. It was decided to compare Kladno and Beroun, districts closely adjacent with Prague. Nowadays, it is very common for families to buy a residential buildings in some of the Prague satellites, because Prague standards of living tends to be very high and people like to live in cheaper and silent places, nearby the source of employment, culture and all kinds of stores. The transportation availability there is also very good. Mainly there is a question of residential buildings prices: which district is cheaper, which one more expensive and why? Also it will be interesting to see how much different value creating factors affect the price of the real estates. When doing an analysis of the real estate residential market in Prague surroundings, we should know something about late development of the real estates in the Czech Republic.

The financial crisis had an unexpected impact on the real estate market in the Czech Republic. Economic and real estate boom in recent years has changed the prices of new and older housing. Price differences between new and old housing have slowly disappeared. This development was economically incorrect, totally illogical and unsustainable in a long term. Demand has fell by cooling the economy and real estate prices have declined. This resulted in a proper price relations alignment and in the market equilibrium restoration. The real estate prices decline will bring vitalization, but it is not an assumption for an economic miracle. The Real Estate Market has to take into account also the qualitative differences between living in new and old and a lot of other factors, family houses, residences, blocks of flats. Furthermore infrastructure, location, civic amenities, parking or social structure of the population. Since 90s of the 20th century, the Czech Republic became the centre of Europe. Interesting centre for foreign business and real estate investments. Investing in real estate in the Czech Republic has become one of the surest

investments of all. The real market value for certain types of property doubled from 1990 to 2000. The Czech Republic has experienced a huge boom on lease market during these years (both residential as well as commercial). However price level is affected by the real estate parameters, such as regions and localities, real estate type and property type. An important role in the real estate price plays the availability of its financing. The question is whether mortgages are available and economically attractive form of financing for a wide range of buyers in this period. After the joint-stock bubble deflation, the real estate investments have become an alternative to shares investments. Not only households invested in real estates, because of the cheap mortgages, but also many investment funds inserted capital there. The value of real estates in developed countries is 80% of their gross domestic product. In the developed world has been created a huge real estate bubble. Then it declined and there was a significant decline in consumer spending.

There happened a series of changes in the Czech Republic residential market compared to 2012. The situation in the real estate market is quite volatile and changeable. Very low mortgage rates, which have been the domain of the previous year 2014 were very convenient for all those which wanted to have their own housing. Interests below 2% level literally challenged to negotiate an advantage mortgage loan with 3 or 5 year fixation. This fact was naturally good for the dynamics of the real estate market, which after quite unavailing year 2012 and 2013 slightly began to recover again. Thanks to low interest rates and stable economic situation, which is forecasted by experts for the upcoming year 2015, it is expected a slow growth in the number of sold properties. Optimistic forecasts of analysts and real estate agents for 2015 also result from the favourable position of the Czech Republic compared with other countries in the region. It is understandable that an extensive interest in buying properties from the side of clients will be immediately reflected in the prices of sold estates. According to expectations, price growth will be mainly in lower price categories apartments, which remained in a stable price level so far. The most dynamic growth in the real estate market is expected to be in Prague. According to forecasts, the residential market in the Czech Republic will be increasing during the years 2015 and 2016, but this growth will not be any significant. Usually it is discussed a height of 1.9% in 2015 and 2.1% in 2016. An

exception will be our capital city, not to say in the entire Central Bohemian Region, where the growth will be between 4-6%, which would represent about 5,000 sold flats.

2 Objectives and methodology

2.1 Objectives

The main target of the bachelor thesis is a conduction of the real estate price analysis and a comparative analysis of Kladno and Beroun. The main goal of the analytical part is a comparison and evaluation of Beroun and Kladno according to prices of the real estates. Partial goal is the characteristics of the basic value creating factors of the real estate prices and a determination of basic statistical factors. Equally important is an evaluation of figures and tables, displaying prices comparisons and resulting evaluation of results. Sub goal of the theoretical part is a clarification of the current real estate situation in the Czech Republic and its development to the reader and consequently a literature review conduction.

2.2 Methodology

Methodology of the thesis is based on the statistical analysis techniques and quantitative research methods that generate quantitative data. In the analytical part, there is an implementation of a multiple linear regression analysis, comparative analysis and numerical analysis of data. There is a general manipulation of pre-existing statistical data by using computation techniques. Based on a synthesis of theoretical knowledge and the results of own solution, the conclusions of the thesis will be formulated.

Software use: Microsoft Word, Microsoft Excel

3 Literature review

3.1 The Real Estate Market

The basic and the essential thing for the valuation of real estates is a thorough knowledge of the real estate market. A major impact on the real estate evaluation, outside the legal and technical features, has the real estate market itself (Dušek, 2006).

3.1.1 Buyer – demand

A benefit of the buyer is to get a place for his own usage, which serves for housing or a business activity. An objective alternative of buying a property is the lease associated with the rent payment. Rent, as well as purchase price, represent a potential buyer's expense, which he will have to expound on the necessary areas assurance. The buyer decides according to cost minimization and profit maximization in given avail. Demand for real estate is then affected not only by the level of prices of the real estate themselves, but also by the amount of rent.

The second benefit from the real estate are returns from rental income. Buying a property then has a spirit of the investment. Investing in real estate is characterized by a lower risk and long-term, compared to an alternative assets. Productivity and alternative investment instrument risk have an impact on the demand for the real estates.

Finally, the demand for real estate can be also satisfied by its construction. Price of the real estate is then represented by the building costs. Consequently, the demand depends on the amount of construction costs, on the prices of building material and construction work.

Like any other investment, investment in real estate can be also realized from foreign accounts. Most often it is from the mortgage loans. In relation to the demand for the real estate plays a large role the amount of interest and also the availability of credit resources (Dušek, 2006).

3.1.2 Seller – supply

The owner offers an estate in the market when the benefit from the property does not match his needs anymore. An important factor influencing the real estate supply is also a new construction in order to make a profit. The owner of the estate is usually a developer who realizes the project and then sells or hires it to candidates (Dušek, 2006).

3.1.3 Basic relationships in the real estate market

Buyer and seller relationship consists of an exchange of the real estate under the negotiated conditions and for the contractually agreed price. Outside the purchase and sale there exists also the real estate lease relationship on the market. Participants in this exchange are usually: lessor, property owner and the tenant, who wants to use it. The tenant pays the lessor the rent (Ross et al, 1993).

3.1.4 Subjects in the real estate market

The most important subjects are the seller and the buyer. They conclude a purchase contract together and create a market in the narrow-sense. We can talk about the market when it is created by a large number of buyers and sellers. Based on the intersection of supply and demand, which is created by sellers and buyers, there is an origin of the real estate prices.

An important segment of the real estate market is leasing, represented by lessor (supply side) and potential tenant (demand side). There also arises a market rent, from assumptions of adequate supply and demand.

Real estate companies or more precisely real estate brokers play an important role on the real estate market. They enter the market as a mediator between seller and buyer and also between tenant and lessor. Their main importance is to focus the real estate supply and demand in one place at given time. They create their profit thanks to commissions from contract parties.

An important entity in the real estate market are banks. They allow real estate financing from foreign sources, mainly through mortgage loans.

Mortgage loan is a loan, whose repayment (including fixtures) is secured by Chattel mortgage, even if it is deployed. Real estate must be located in the Czech Republic, the member state of the EU or another state of the European Economic Area (Dušek, 2006).

Loans are accompanied with interests, depending on the currency of the loan, its amount, the long-term and agreed stable interests and bonding capacity of the debtor. Other costs are the fees associated with provision of the loan (Vichnarová and Nováková, 2007).

According to Dušek (2006), an essential role has also the state, which creates a legal environment. The role of the state is in setting the rules of protection, property rights and rights of leaseholders. The state also affects the real estate market through the tax system. In the Czech Republic, the state also affects the maximum amount of rent for a certain group of tenants of residential property, so-called regulated rent. Recently the rent deregulation is constantly debated. Rent deregulation would greatly influence rents and even real estate prices.

3.1.5 Types of Real Estate

According to Act no.151 / 1997 Coll., about Property Valuation, real estates can be divided into:

Land

A part of the earth's surface which is separated from other adjacent parts by the administrative boundary, by an ownership border or by a land type boundary.

House

Family house, in which are at least two-thirds of a total floor area flats and which includes no more than five habitable rooms, without counting in the kitchen, or in which upon a larger number of these rooms the total floor area does not exceed 120 m^2.

Apartment

It is a room or set of rooms, which are designated for housing by the construction administration decision.

Real estate

According to the Civil Code it is a land or a structure, steadily connected with the foundation of the country.

Property can be also divided into two main groups: lands and buildings.

Buildings

Buildings are divided into:

a) Land structures, which are

1) Buildings, which means a spatially centred structure, outwards mainly closed by circumferential walls and roof constructions, with one or more bordered utility spaces,

2) Outdoor modifications

b) Engineering constructions and special underground frames, for example traffic and water structures, those for energy distribution and water supply, sewerages, towers, chimneys, area modifications, wells and other special ones

c) Water tanks and ponds

d) Other structures

Lands

a) Building grounds

1) Undeveloped lands, registered in the Land Registry in individual categories, that were appointed to be settled

2) Lands registered in the Land Registry in the kind of built-up areas and courtyards

3) Land areas seriously built-up by constructions, regardless of the Land Registry status

b) Agricultural lands registered in the Land Registry as arable land, hop field, vineyard, garden, orchard, meadow and pasture,

c) Forest lands, which are registered in the Land Registry and forested non-forest lands

d) Lands registered in the Land Registry as water reservoirs and rivers,

e) Other lands, which are for example economically unusable lands and barren soil, such as gorge, boundary with stones, levee, swale, everglade.

3.2 Price, value, the market value

In our law, there is no distinction between value and price and the importance of these concepts coincides, even though there is a substantial difference between them.

The term price is used for offered and truly paid amount of good or service (Kokoška, 1998).

On the other hand the value is actually not the paid price. When determining the value, it is only an estimate. The value is a benefit for the owner of good or service on the date, when the estimate is made. We distinguish several kinds of values: pragmatic, revenue, market etc., nevertheless each of them can be entirely different. Therefore it is important to define which value we want to estimate when valuing (Bradáč, 2004).

3.2.1 The purchase price

The purchase price is the price at which it was possible to buy the product at the time of its acquisition. Considering realities, it is mainly the price at which it was possible to build a realty. The most often, we meet with the purchase price in accounting (Bradáč, 2004).

In the Accounting Act no.563 / 1991 Coll. It is defined in § 25 par. 4 point. a) as a purchase price *("price at which the assets were acquired and costs are related to its acquisition").*

3.2.2 Reproductive price

Reproductive price is the price at which it is possible to buy the same or comparable thing at the estimation time, without deducting the abrasion. Reproductive price for real estates is determined by a cost calculation, detailed itemized budget or by using aggregated items. But practically it is determined with the help of technical and economic indicators the most often - unit price per 1 m^3 of the area, 1 m^2 of built up area etc. (Bradáč, 2004).

3.2.3 Material value

Material value or also "substantial value" or according to legal terminology "time value", is the reproductive price, reduced by a costs for reparations of serious defects, which precludes immediate usage of the product (Bradáč, 2004).

Accounting Act no. 563/1991 Coll. defined in § 25 par. 4 point as: reproductive unit cost ("the price at which the assets were acquired at the time of its accounting").

3.2.4 The yield value

Generally, it is a sum of all the future net incomes from the estate to present value. It results from the achieved annual rent from the real estate, reduced by annual costs associated with the estate operations. These costs primarily include: property write-offs, annual maintenance, property management, tax, insurance etc.

Assuming a long-term stable rental income it is possible to compare the yield value to the principal that must be saved for the interest rates to be the same as net earnings from the realty.

But expression of the estate value using the interest rate is not entirely accurate when inflation is higher and there is an existence of regulated flat´s rent. The reason is allegiance of the material value on the prices of construction work and material. When there is an inflation of building supplies, reproductive price of the property rises by the same rate, while in the bank it is more devalued. On the other hand, the weakness of an immovable property is liquidity, therefore a marketability for an actual reproductive price (Kokoška, 1998).

3.2.5 The usual price (the general price)

Bradáč (2004) says: *"The price at which is possible to sell or buy the same or comparable thing, in a given place, given time and in the free market."*

The term "general price" is today often replaced by a more appropriate term "market price" Act no. 151/1997 Coll., about property valuation § 2 defines the usual price as follows: *"Property and services are valued by the usual price, unless this Act provides another way of evaluation. By the usual price, for this Act´s purposes, it is meant the price that was achieved while selling the same or similar assets or while*

providing the same or similar service during the ordinary commercial relation, in the Czech Republic, on the valuation date. At the same time all the circumstances are considered. Those which affect the price, but they don´t reflect in its level influences of emergency market circumstances, the personal relationship of the seller or buyer nor the specific popularity effects. By extraordinary market circumstances it is meant for example a state of emergency of the seller or buyer, the consequences of natural or other calamities. Other conditions include mainly property, family or other personal relationships ".

In practice, the usual price, respectively the market price, is determined by comparing already realized sales of the similar real estates in a given time and location. If there is not available a relevant statistical file for comparison, it has to be used an alternative methodology, such as the evaluation by the real price, yield value and averaging these values.

Bradáč (2004) says: *"In the market economy there exist forces which drive the value to a reproductive cost in the long-term average".* The reason is obvious: if the demand for a particular kind of lucrative real estate will grow, there will be an effort to build this type of estate. This offer will exceed the demand, there will be a problem with renting the property and its profitability will drop. This cycle is nothing special for the market economy and it appears not only in the dead stock area. But considering real estates, this cycle is characterized by a long-term, which is given by the construction complexity and by the difficult acts. Consequently the offer cannot respond to the demand as quickly as it is normal in other market segments.

The market price itself is created in the actual conflict between the supply and the demand, therefore in the sale, itself and it can significantly differ from the detected value. It cannot be determined exactly. Nowadays we already meet with the term "the emergency market price", thus the price at which the property is quickly purchasable (Štefan, 2003).

The general price

For general price appreciation we can already use an information from price regulation. Creators of the price regulation tried to approach the prices, at which the properties are sold in the given place. This regulation contains a set of merchantability coefficients, that in the breakdown by districts indicate how many times cheaper or more expensive the property is sold against the price surveyed by a cost method. The coefficients are determined from the Czech Statistical Office from reports of financial offices. The disadvantage is, that not always the price in the contract is the actually agreed price. The valuation by price rule is not very accurate by then, but it is very close to the general price (Bradáč, 2004).

3.2.6 The stop price

The stop price is a historical phenomenon, which we could have seen in the Czech Republic respectively Czechoslovakia in the period before the Second World War. In 1939 it was forbidden to raise prices of real estate existing by 20. 6. 1939, from the Prime Minister´s order. This establishment was valid for lands until 1979 and for privately owned buildings until 1984 (Kokoška, 1998).

3.2.7 International valuation standards

With the accession to the EU and with a progressive integration, efforts for valuation standardization of the property intensifies. National specifics and the effort for standardization are in the conflict. Several institutions were established because of these problems. For example the International Standards Valuation Committee (ISVC). The standards include not only expert problems, but there is great emphasis on work ethics of appraisers. The content of the standard are not any detailed descriptions of specific methods, only circumstances which should be taken into a consideration (Bradáč, 2004).

3.3 The value creating factors of real estates

The crucial role, when considering the value of real estate, plays its position. It has a significant impact on a number of factors, which are linked to the property value.

These are mainly:

- The rent amount
- Rentable, the occupancy rate
- Amount of construction costs
- The value of the land
- Marketability

Particular types of real estates have their own specific factors, which affect their value (Mařík, 2007).

3.3.1 Land value-factors

The basic characteristic of lands is their limited and practically infinite life. The value of the real estate relies not only on its limited number, but also on the ability to bring some benefit. An important benefit that land can bring to its user, is the amount of constructions which can be realized on them (Mařík, 2007).

An important value creating land characteristics are these:

- Location

The location of the property is generally considered as the most important factor, affecting not only its value, but also its marketability. In terms of impact on the land value, we can distinguish to a macro location and a micro location. The macro location sees the location in a broader sense, e.g. within one city. The micro location specifies the area into a smaller one, for example the district or the street in the city.

- Total area

Another factor is the total land area. It is valid, that the larger the plot is, the higher is its value in CZK. Conversely, the land value in CZK/m2 is usually a decreasing function of its size.

- The utilization method

Profit (or more precisely a potential yield) fundamentally affects the possible way of the land usage and has an impact on the final value of the land.

- The degree of regional planning

In terms of the most common use of the land, which is as a building plots, it is important to ensure the right of construction on the particular land. Impossibility of the construction strongly reduces the land value, compared to the value which the land would have, if it would be a houselot.

- The land shape

Irregular or too narrow shape of the land is negative in terms of the possible usage and it decreases the value of the land. The best shape of the edificial land has a rectangular character, while the shorter side of the plot is oriented northward - to the access road. It is also recommended to prefer the land, where it is possible to build a habitable rooms to the southeast and the southwest.

- Engineering sets

Existence of engineering set (electricity, gas, sewer, water) has a positive effect on the land value, because the price of engineering utilities installation can often exceed the price of the land itself.

(Mařík, 2007)

3.3.2 The value creating factors of administrative buildings

- Location

Many of those using administrative buildings for a business put the accent on the prestige of a given locality and are willing to pay much higher rents for it. The transport accessibility also increases a locality attractiveness a lot.

- Construction

The construction itself has an effect on the amount of construction costs and on the economic life of the building.

- Equipment

Office building equipment is reflected in the amount of its utility. Nowadays the existence of an air conditioning, computer networks, respectively high speed internet, elevators quality of sanitary equipment is already a standard.

- Process layout
- Number of parking places

Parking places next to the office buildings were neglected in the past, resp. they were not emphasized. With the growing increase in a motor traffic, basement garages or a large parking areas are today a common part of administrative buildings.

- Tenants and apartment buildings

Administrative buildings are often a subject of tenant relationships. Financial standings of tenants as well as the basic parameters of the release, are factors affecting the value of a given building.

(Mařík, 2007)

3.3.3 Value creating factors of shops and warehouses

- Location

Considering manufacturing and storage objects (not office buildings), there is not such an emphasis to the prestigious busy location, but mostly on the availability of freight transport, rail and other transportation. It should be also noted that in the ground plan of most of the larger cities are for heavy shops dedicated only some locations and the shop construction aside of these locations is hardly viable.

- Construction

The construction of the hall is another important factor, great influence has especially the height of storage spaces. With the modernization of storage techniques and equipment, halls with a height of 6-10 m are common today.

- Tonnage

Tonnage of aprons in particular floor levels significantly affects the usage of the property, in terms of placing a heavy machinery for different types of production and it is thus one of the main determinants of real estate prices.

- Office areas

In the case of factory halls connected with administrative operations it is important not only separation of these two parts, but also the ratio of warehouse and office areas.

- Type and usage of halls

(Mařík, 2007)

3.3.4 Value creating factors of residential estates

As with other types of real estates, the main factor influencing the real estate prices is the property location. In contrast to office buildings and warehouses, the most desirable locations for living are quiet parts of the city or the town surroundings, but also villages close to large cities, which over time become so-called satellite towns. Other ulterior factors which play an important role in the evaluation of residential buildings is a disposition of the house or apartment, size of the adjacent land, parking availability, own garage, balcony and more (Kokoška, 1998).

3.3.4.1 *Durability, construction depreciation*

A very important factor that affects the price of the property determined for living is its durability, respectively actual depreciation. Potential demanders place a great emphasis on the real estate statement and on needed investments for a reconstruction. The building durability is defined as the time that goes by since the creation of the building to its decadence. Residential buildings lifetime is generally indicated from 70 to 300 years, depending on the quality of the building design. The term construction depreciation reflects the fact that the construction gradually wears by its aging and its using. A number of methods is used for express the building depreciation. Among the most famous methods belongs the linear method, which calculates with the constant abrasion of the building in course of time. Conversely a square method takes into a consideration the fact that the depreciation is low in the beginning and it rises really steeply in the end of the durability (Bradáč, 2004).

3.4 Real estate valuation

Act no. 151/1997 Coll., about the property valuation, §4 states: *"Unless the law specifies differently, building or its part is valued by cost, yield or comparative method or by their combination, whose usage in different kinds is laid down by an edict. The building, which is not connected to the ground with a consistent foundation, is valued according to the purpose of its use, by same manner as an immovable structure of the same use. "*

An estate valuated by the cost method, results by the Act no. 151/1997 Coll., about the property valuation, § 5: *" a) from the basic prices for a building measurement units or from an acquisition costs b) from taking into an account a character, size of the building, its equipment, location and merchantability c) from a technical depreciation of the building. "*

According to Act no.151 / 1997 Coll., about Property Valuation, For the valuation of the building by the yield method the edict specifies a method for price calculation, method for discovering the amount of income and the amount of capitalization rate for a given time period.

3.4.1 Basic components for the valuation

3.4.1.1 Register

The register discusses a detail real estate registrations. It represents a list, a description and geometric and positional determination of selected estates in the Czech Republic and it also includes an evidence of proprietary and other tenures and other rights to these properties, defined by the law. This compact, continuously updated, computer controlled information system, about lands, selected buildings and selected apartments and non-residential areas, creates one of the basic information systems of the CR public administration (Kuba and Olivová, 2005).

Everyone has the right of taking free copies, extracts or blueprints from the land registry and in the presence of the cadastral office employee. Extracts, transcripts or copies from the geodetic information file and from the set of descriptive information and identification of plots are public documents, if they contain a date, round stamp from the cadastral office with the national emblem, name, surname and signature of

the office employee, which executed them a stamp of course (Kuba and Olivová, 2005).

By the extract, transcript or a copy from the land registry, which is a public document, is meant: complete or partial list of plots, buildings or units of the owner or any other authorized person from other law, pertaining to the ownership sheet with more detailed data of the land registry, which are connected to listed parcels, buildings or units. This list is denoted as the "Extract from the land registry."

- Listing of the dates about a house with apartments and non-residential areas, without more detailed specification of the data from the land registry, relating to units and conjunct areas of the house and lands in the joint ownership of the owners. Even this list is denoted as the "Extract from the land registry."
- A copy of a cadastral map or any other cartographic base that displays parcels. As another cartographic base is also considered a map, portraying parcels in a simplified evidence. As a copy of the cadastral map in digital form is considered even a print output marked as the "Cadastral map copy"(Kuba and Olivová, 2005).

Binding for the legal acts relating to real estate held in the land registry, are only some of the data, namely: parcel number, geometric assessment of the estate, name of the cadastral area and a geometric determination of the cadastral area. This implies, that unless another law rule specifies differently, other land registry data are not binding, not even those about legal relations to real estates (Kuba and Olivová, 2005).

In the land registry there are filed:

- Lands in the form of plots
- Buildings attached to the ground with a solid foundation
- Apartments and non-housing areas
- Buildings under construction
- Buildings attached to the ground with a solid foundation, which is established by a special regulation (Štefan, 2003).

3.4.1.2 *Regional planning*

The main goal of the regional planning is to systematically deal with functional land use, to establish the principles of its organization and dispassionately and temporally coordinate the construction and development activities affecting a given area. Regional planning is closely related to register of real estates, because on the one hand it based on the land registry and on the other hand the results of the regional planning are screened into the land registry (Pekárek and Průchová, 2004).

Regional planning tools are:

a) Regional planning materials

b) Regional planning documentations

c) Spatial decision

Regional planning data

Regional planning data is the common name of two devices of solving the problem in the given area.

These are:

a) Urban Studies - solving chosen problems in the given area, usually in several versions. It serves as a basis for regional decisions in areas with complicated urbanistic conditions.

b) General development plan – deals with a detailed questions of the regional development issues. Solves especially development of individual components of the landscape settlement, such as housing, industry, agriculture, transportation, etc. The general development plan is processed, assuming the need of deepening a certain settlement component, proposed in the regional planning documentation, mainly its impact on the land use and it is the basis for the regional planning documentation (Pekárek and Průchová, 2004).

Regional planning documentation

The regional planning documentation is the main planning instrument of the regional planning. The law distinguishes a regional plan of the large territorial unit, a regional plan of the village and an adjustment plan.

a) The regional plan of the large territorial unit is processed for a larger territory of more villages. It defines the main development areas, the main transport corridors and also technical infrastructures.

b) The regional plan of the village is being developed for the entire community area or only for its parts. It solves functional space utilizing, an arrangement and it determines the boundaries of the village area, where can be constructed.

c) The adjustment plan establishes the functional usage of individual plots. And it also sets the boundaries of the village area, where new estates can be constructed, on condition that the regional plan of the village is not executed (Pekárek and Průchová, 2004).

Zoning decision

It is distinguishes between the following types of spatial decision making:

a) Land determines the zoning decision about the location of the construction, the location of buildings on it and conditions for the construction project preparation

b) The zoning decision about land use sets conditions for grading, that change the environment look and also for planting and processing of vineyards, hops, forests etc.

c) The zoning decision about protected areas

d) The zoning decision about a building enclosure determines the territory, where the construction activity is temporarily or permanently prohibited or restricted

e) The zoning decision about division or consolidation of lands

(Pekárek and Průchová, 2004)

3.4.1.3 Price maps

The price map is a graphic base, from which it is possible to detect the price of lands. These days, price maps evolve mainly regional capital cities and some other larger villages. They are developed in varying degrees of accessary. When creating price maps, it is drawn from already realized businesses in a given area. The village is usually divided according to the estate character and for this character the spatial prices of $1m^2$ of the edificial area are identified (Mařík, 2007).

3.4.1.4 Real Estate Advertising

An important basis for the valuation of real estate can be a real estate advertising, both in its classic form or nowadays in an increasingly important online form. When pumping an information from the real estate marketplace, it is important to take into consideration that the offered properties prices are usually the prices at which the trade will be accomplished. So it is clear that the prices in the real estate advertising create a ceiling for the estimated real estates. So the estimated price cannot be higher than the current bid price of the real estate in the real estate advertising (Mařík, 2007).

3.4.2 Basic methods of real estate valuation

The most basic property valuation methods are so-called comparative methods, directly based on a comparison of already sold properties of the same type and characteristics. This comparison may be direct, thus the valuated real estate is directly compared with the already sold one, or either indirect. Indirect comparison is based on the sold properties data average. The valuated estate is then compared with this average.

Another frequently used method is the cost method, which is based on the reproductive cost of the property, thus it is based on the property purchase price. The opposite of the cost method is a yield method. Its essence are profits that the given property may return in the future through the rent payment. These profits are subsequently discounted to a present value and added together.

Among others, although less frequently used methods of real estate valuation are included: method of price determination by simple, respectively weighted average, index methods, valuations based on a book value, leftover methods (Ross et al, 1993).

3.4.2.1 The comparative method

A real estate appraisal method that compares a piece of property to other properties with similar characteristics that have been sold recently. The sales comparison approach takes into account the affect that individual features have on the overall property value, meaning that the total value of the property is a sum of the values of

all of its features. Real estate agents and appraisers may use this approach when evaluating properties to sell.

The sales comparison approach often entails looking at local properties to see what they have in common. This allows appraisers to determine values for property features, such as fireplaces or two car garages, and requires less sophisticated statistical methods than checking on sales of properties in a wider geographic area (Investopedia, 2015).

3.4.2.2 *The cost method*

A real estate valuation method that surmises that the price someone should pay for a piece of property should not exceed what someone would have to pay to build an equivalent building. In cost approach pricing, the market price for the property is equivalent to the cost of land plus cost of construction, less depreciation. It is often most accurate for market value when the property is new.

The cost approach methodology requires certain assumptions, such as the availability of land. If land is not available to build on then it is not possible to substitute existing property. Additionally, the method does not address whether an exactly equivalent structure must be built is to be built, or what if the cost of an equivalent building can be effectively estimated (Investopedia, 2015).

4 Analytical part

To fulfil the nature of the practical part of the work, there were selected two urban areas: Kladno and Beroun. In the thesis there is a regression and comparative analysis, for a deep research of the topic. For the implementation of a regression analysis were collected 400 different random estates (divided according to: a house or an apartment, in Kladno or in Beroun). Each house has 13 different characteristics (variables) and each apartment 12. One of the characteristics is price of the estate, which is a dependent variable and it is affected by others, independent variables (value creating factors). For the comparative analysis there were performed basic statistical methods, to determinate the price level in particular sections.

4.1 Regression analysis

The term of regression (backward step, reversed procedure) is used in statistics for examining the relationship between one random variable on one side (the response, depending variable) and one or more random variables on the other hand (autonomous variable, predictors, independent variables). In other words, the dependence of the response variable on the autonomous variable. The task of the regression analysis is to find an ideal mathematical function that would express the character of the dependence in the best possible way. This mathematical function is called a regression function. We will deal with conditional distribution of the random variable Y upon fixed value of the random variable X. The regression function then becomes the mean value E (fiX == x). Simultaneously with the exploration of the dependency process, we are also interested in power (intensity) of the dependence, which also testifies about the quality of the regression function.

Kubanová (2004) states that value dependency of one variable on the values of the other variable is expressed in mathematics by a functional relationship $y = f(x)$. In this case we can exactly determine which values will have the y variable from the knowledge of the specific values of x. Such dependence is called a functional one. In practical tasks the situation is not nearly so simple. The monitored variable is usually not affected only by one random variable X, but usually there are more of them. Often we cannot even identify them and describe their exact relationship to the tracked variable. In a case like this it is not a functional dependence between

variables X and Y, but nevertheless we still speak about dependent variables. We speak about the stochastic dependence. Using the regression function we can predict which values will gain one random variable if we know the value of the second random variable. Because Y is a random variable, x of a random variable X doesn´t have to always gain the value of E (Y | x) (the value of E (Y | x) the random variable gains "in average" there), but it will gain values diffused around it. The purpose of this method is to find out which of the 12 value creating factors of the real estate has the greatest influence on the final price. There are created hypotheses and after the testing of hypotheses by the p-value with 0,025 level of significance.

4.1.1 Economic model

Price of the real estate is affected by the distance from Prague, land area, flooring area, floor number, transportation availability, number of rooms, condition, location, presence of balcony, basement, garage and parking place.

4.1.2 Value creating factors - declaration of variables

To be able to conduct a linear regression, it is necessary to determine definitions of variables.

Dependent (endogenous) variable, Y:

Price (CZK) – price of the real estate (of a house or an apartment) in the Czech crowns…..Y_t

Independent (exogenous) variable, X:

<u>**Distance from Prague**</u> **(km)** – the real estate distance from Prague boarders, calculated in kilometres by the road. In the case of Kladno it is counted from the Václav Havel Airport to the Kladno city centre. In the case of Beroun it is counted from the Zličín district to the Beroun city centre….. X_1t

<u>**Land area**</u> **(m^2)** – size of land (or garden) area, which belongs to the estate, given in square meters….. X_2t

<u>**Flooring area**</u> **(m^2)** – size of the real estate floor area, given in square meters….. X_3t

<u>**Floor number**</u> - *House*: number of floors in the house. A ground floor house is marked by 1, two storeyed house is marked by 2, etc.

– *Apartment*: specification of a real estate floor number, counted upwardly….. **X_4t**

Transportation availability – index of a transportation availability of the estate. Bus availability = 1 point, train availability = 1 point and car availability = 0 points. Points are added up subsequently. For example when the estate has bus and car availability: 1 + 0 = 1 ….it is marked by number 1….. **X_5t**

Number of rooms – total number of habitable rooms in house or apartment….. **X_6t**

Condition – index of the real estate condition (current situation), marked upwardly. Bad condition is marked by 0, good condition by 1, very good condition by 2 and new estate is marked by 3….. **X_7t**

Location – index of the real estate location. The real estate is either in the city outskirt, marked by 0 or in the city centre, marked by 1…… **X_8t**

Balcony – index of presence or absence of a balcony as a part of the real estate. If there is no balcony attached it is marked by 0, if there is some it is marked by 1….. **X_9t**

Basement - index of presence or absence of a basement as a part of the real estate. If there is no basement attached it is marked by 0, if there is some it is marked by 1…... **$X_{10}t$**

Garage - index of presence or absence of a garage as a part of the real estate. If there is no garage attached it is marked by 0, if there is some it is marked by 1….. **$X_{11}t$**

Parking - index of presence or absence of a parking place as a part of the real estate. If there is no parking place attached it is marked by 0, if there is some it is marked by 1….. **$X_{12}t$**

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}$….unknown coefficients, which are estimates of the least squares method

4.1.3 Regression model

$$Y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + \beta_5 x_{5t} + \beta_6 x_{6t} + \beta_7 x_{7t} + \beta_8 x_{8t} + \beta_9 x_{9t} + \beta_{10} x_{10t} + \beta_{11} x_{11t} + \beta_{12} x_{12t} + \varepsilon_t$$

4.1.4 Determination of hypotheses

H0: Price is not dependent on the distance from Prague.

H1: Price is dependent on the distance from Prague.

As the only factor, the distance from Prague will not be directly proportional to the price, it is indirectly proportional. The hypothesis is, that if the distance from Prague is shorter (smaller number), the price goes up and reversely. **negative economic sign**

H0: Price is not dependent on the land area.

H1: Price is dependent on the land area.

Price is directly proportional to the land area size. **positive economic sign**

H0: Price is not dependent on the flooring area.

H1: Price is dependent on the flooring area.

Price is directly proportional to the flooring area size. **positive economic sign**

H0: Price is not dependent on the floor number.

H1: Price is dependent on the floor number.

Price is directly proportional to the floor number. **positive economic sign**

H0: Price is not dependent on the transportation availability.

H1: Price is dependent on the transportation availability.

Price is directly proportional to the transportation availability. **positive economic sign**

H0: Price is not dependent on the number of rooms.

H1: Price is dependent on the number of rooms.

Price is directly proportional to the number of rooms. **positive economic sign**

H0: Price is not dependent on the real estate condition.

H1: Price is dependent on the real estate condition.

Price is directly proportional to the real estate condition. **positive economic sign**

H0: Price is not dependent on the real estate location.

H1: Price is dependent on the real estate location.

Price is directly proportional to the real estate location. **positive economic sign**

H0: Price is not dependent on the presence of balcony.

H1: Price is dependent on the presence of balcony.

Price is directly proportional to the presence of balcony. **positive economic sign**

H0: Price is not dependent on the presence of basement.

H1: Price is dependent on the presence of basement.

Price is directly proportional to the presence of basement. **positive economic sign**

H0: Price is not dependent on the presence of garage.

H1: Price is dependent on the presence of garage.

Price is directly proportional to the presence of garage. **positive economic sign**

H0: Price is not dependent on the presence of parking place.

H1: Price is dependent on the presence of parking place.

Price is directly proportional to the presence of parking place. **positive economic sign**

The null and the alternative hypotheses can be enlisted as:

H0: $\beta 1 = 0$ X H1: $\beta 1 \neq 0$ etc.

The assumtion is that all the independent variables have an impact on the price of the real estate. Some of them bigger and some of them smaller. Propably the most important will be the flooring area and the land area (in the case of houses). Also the condition of the estate will be an important factor.

Table 1: Example of the Excel data from Kladno houses sheet

ID	Price (CZK)	Distance from Prague (km)	Land area (m2)	Flooring area (m2)	Floor number	Transportation availability
B00499	2 920 000	21,2	202	127	2	0
415450	2 430 000	29,4	249	240	2	0
381	1 720 000	15,5	100	148	2	0
191	1 249 000	16,9	50	90	2	1

ID	Number of rooms	Condition	Location	Balcony	Basement	Garage	Parking
B00499	5	3	0	0	0	0	1
415450	3	2	1	0	0	0	1
381	3	3	0	0	0	0	1
191	4	3	0	1	0	1	0

Source: Own data processing

4.1.5 Houses in Kladno – regression analysis

Table 2: Houses in Kladno - regression statistics

Regression Statistics	
Multiple R	0,773356459
R Square	0,598080213
Adjusted R Square	0,542643001
Standard Error	1160564,931
Observations	100

Source: Own data processing

Goodness of fit:

R^2 … coefficient of determination

59, 8 % of variability of price was explained with this model using already mentioned variables. The coefficient is greater than 50 %, which means good fit of the data to the model.

Adjusted R^2 … adjusted coefficient of determination

Means that the data we have used explain the price on 54,2 %.

Table 3: Output of Kladno houses regression analysis

	Coefficients	Standard Error	t Stat	P-value
Intercept	-331597,266	791274,4597	-0,4190673	0,6762
Distance from Prague (km)	-17238,9412	31642,61201	-0,5448015	0,587284
Land area (m2)	2520,040361	505,4404137	4,98583076	3,12E-06
Flooring area (m2)	5330,045895	2778,263873	1,9184808	0,058329
Floor number	249292,5931	218184,8669	1,14257509	0,25635
Transportation availability	4030,478272	181235,1144	0,02223895	0,982308
Number of rooms	65284,58234	106270,5552	0,61432428	0,540604
Condition	425282,5227	118674,7602	3,58359707	0,000558
Location	421338,389	292505,7301	1,44044491	0,153331
Balcony	-172769,903	408768,6704	-0,4226594	0,673587
Basement	171213,1056	257912,0424	0,66384301	0,508546
Garage	737601,398	290776,0396	2,53666498	0,012975
Parking	204320,9233	260187,2437	0,78528417	0,43442

Source: Own data processing

Statistical significance of parameters:

Table 4: Statistical significance of Kladno houses parameters

p-value	Statistical significance
0,676199806	> 0,025 not reject null hypothesis, not sign.
0,587283908	> 0,025 not reject null hypothesis, not sign.
3,11766E-06	< 0,025 reject null hypothesis H0, stat. sign.
0,058329498	> 0,025 not reject null hypothesis, not sign.
0,2563497	> 0,025 not reject null hypothesis, not sign.
0,982308276	> 0,025 not reject null hypothesis, not sign.
0,540604289	> 0,025 not reject null hypothesis, not sign.
0,000558177	< 0,025 reject null hypothesis H0, stat. sign.
0,153330722	> 0,025 not reject null hypothesis, not sign.
0,673586635	> 0,025 not reject null hypothesis, not sign.
0,508546231	> 0,025 not reject null hypothesis, not sign.
0,012975359	< 0,025 reject null hypothesis H0, stat. sign.
0,434420317	> 0,025 not reject null hypothesis, not sign.

Source: Own data processing

According to p-value T-test, only variables **land area, condition** and availability of **garage** are statistically significant.

Final estimated equation:

$Y_t = -331597,3 - 17238,9x_1t + 2520,0x_2t + 5330,1x_3t + 249292,6x_4t + 4030,5x_5t +$

$65284,6x_6t + 425282,5x_7t + 421338,4x_8t - 172769,9x_9t + 171213,1x_{10}t +$

$737601,4x_{11}t + 204320,9x_{12}t$

Economic significance of parameters:

After determination of a statistical significance, it is also very important to evaluate which of the coefficients are economically significant and how much they affect the price.

In the case of Kladno houses economically significant are variables with positive sign, which are: land area, flooring area, floor number, transportation availability, number of rooms, condition of the estate, location, present of basement, garage and parking place.

β_0: If all extended variables are zero, then price of the Kladno houses is negative, i.e. -331597,3 CZK.

β_1: If distance from Prague increases by 1 km, the price of the estate decreases by 17238,9 CZK. – expected direction

β_2: If the land area increases by 1 m^2, the price of the estate increases by 2520 CZK. – expected direction

β_3: If the flooring area increases by 1 m^2, the price of the estate increases by 5330 CZK. – expected direction

β_4: If floor number increases by 1 unit, the price of the estate increases by 249292,6 CZK. – expected direction

β_5: If the transportation availability increases by 1 unit, the price of the estate increases by 4030,5 CZK. – expected direction

β_6: If number of rooms increases by 1 unit, the price of the estate increases by 65284,6 CZK. – expected direction

β_7: If the condition increases by 1 unit, the price of the estate increases by 425282,5. – expected direction

β_8: If the location increases by 1 unit, the price of the estate increases by 421338,4 CZK. – expected direction

β_9: If the presence of balcony increases by 1 unit, the price of the estate decreases by 172769,9 CZK. – unexpected direction

β_{10}: If the presence of a basement increases by 1 unit, the price of the estate increases by 171213,1 CZK. – expected direction

β_{11}: If the presence of a garage increases by 1 unit, the price of the estate increases by 737601,4 CZK. – expected direction

β$_{12}$: If the presence of a parking place increases by 1 unit, the price of the estate increases by 204320,9 CZK. – expected direction

Figure 1: Dispersion of dependent variable
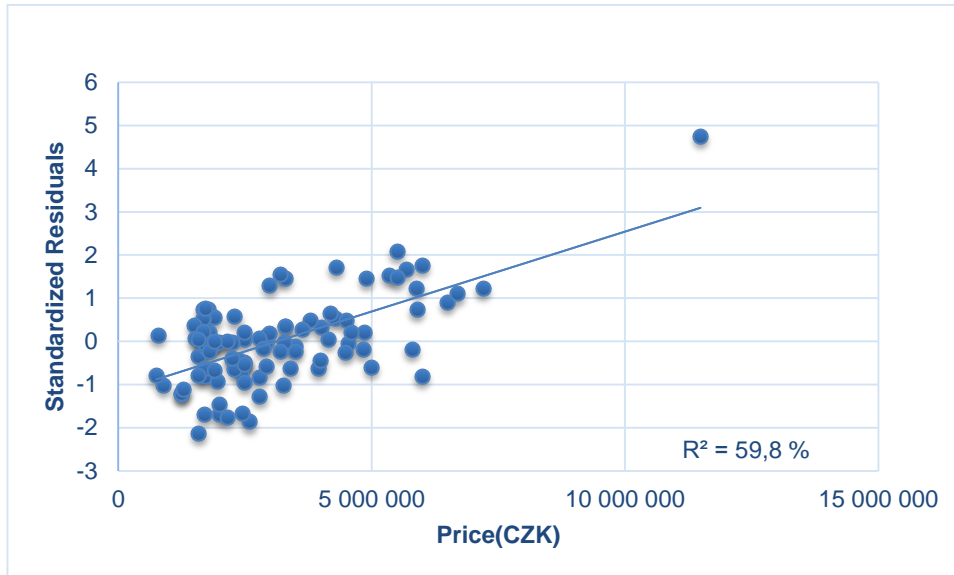
The figure above reflects a dispersion of residuals by an estimate of its standard deviation. It shows a strength of a correlation relationship.

4.1.6 Apartments in Kladno – regression analysis

Table 5: Apartments in Kladno - regression statistics

Regression Statistics	
Multiple R	0,924837849
R Square	0,855325047
Adjusted R Square	0,837240678
Standard Error	243692,6275
Observations	100

Goodness of fit:

R^2 … coefficient of determination

85, 5 % of variability of price was explained with this model using already mentioned variables. The coefficient is very high, which means very good fit of the data to the model.

Adjusted R^2… adjusted coefficient of determination

Means that the data we have used explain the price on 83,7 %.

Table 6: Output of Kladno apartments regression analysis

	Coefficients	Standard Error	t Stat	P-value
Intercept	-768266,69	235118,4793	-3,2675726	0,001548
Distance from Prague (km)	34181,62	10736,94066	3,183553	0,002012
Flooring area (m2)	18945,084	1786,063337	10,607174	2,06E-17
Floor number	1101,302	10641,8963	0,1034874	0,917812
Transportation availability	28530,309	51583,34112	0,5530915	0,581603
Number of rooms	114577,66	48723,21506	2,351603	0,020925
Condition	96795,522	36036,48005	2,6860427	0,008642
Location	-1512,0499	56189,3761	-0,0269099	0,978593
Balcony	-19978,497	54747,39994	-0,3649214	0,716046
Basement	17348,512	61576,39969	0,2817396	0,778805
Garage	194475,75	99338,54764	1,9577068	0,053433
Parking	70396,135	63001,42867	1,1173736	0,266876

Source: Own data processing

Statistical significance of parameters:

Table 7: Statistical significance of Kladno apartments parameters

p-value	Statistical significance
0,001547817	< 0,025 reject null hypothesis H0, stat. sign.
0,002011737	< 0,025 reject null hypothesis H0, stat. sign.
2,05725E-17	< 0,025 reject null hypothesis H0, stat. sign.
0,91781164	> 0,025 not reject null hypothesis, not sign.
0,581603129	> 0,025 not reject null hypothesis, not sign.
0,020925326	< 0,025 reject null hypothesis H0, stat. sign.
0,008642412	< 0,025 reject null hypothesis H0, stat. sign.
0,978592538	> 0,025 not reject null hypothesis, not sign.
0,716045636	> 0,025 not reject null hypothesis, not sign.
0,77880465	> 0,025 not reject null hypothesis, not sign.
0,053433028	> 0,025 not reject null hypothesis, not sign.
0,26687596	> 0,025 not reject null hypothesis, not sign.

Source: Own data processing

According to p-value T-test, variables **price, distance from Prague, flooring area, number of rooms** and **condition** of the real estate are statistically significant.

Final estimated equation:

$Y_t = -768266{,}7 + 34181{,}6x_1t + 18945{,}1x_2t + 1101{,}3x_3t + 28530{,}3x_4t + 114577{,}7x_5t + 96795{,}5x_6t - 1512{,}0x_7t - 19978{,}5x_8t + 17348{,}5x_9t + 194475{,}7x_{10}t + 70396{,}1x_{11}t$

Economic significance of parameters:

In the case of Kladno apartments economically significant are variables with positive sign, which are: distance from Prague, flooring area, floor number, transportation availability, number of rooms, condition of the estate, the present of the basement, garage and parking place.

β_0: If all extended variables are zero, then price of the Kladno apartments is negative, i.e. -768266,7 CZK.

β_1: If distance from Prague increases by 1 km, the price of the estate increases by 34181,6 CZK. – unexpected direction

β_2: If the flooring area increases by 1 m^2, the price of the estate increases by 18945,1 CZK. – expected direction

β_3: If floor number increases by 1 unit, the price of the estate increases by 1101,3 CZK. – expected direction

β_4: If the transportation availability increases by 1 unit, the price of the estate increases by 28530,3 CZK. – expected direction

β_5: If number of rooms increases by 1 unit, the price of the estate increases by 114577,7 CZK. – expected direction

β_6: If the condition increases by 1 unit, the price of the estate increases by 96795,5. – expected direction

β_7: If the location increases by 1 unit, the price of the estate decreases by 1512 CZK. - unexpected direction

β_8: If the presence of balcony increases by 1 unit, the price of the estate decreases by 19978,5 CZK. – unexpected direction

β_9: If the presence of a basement increases by 1 unit, the price of the estate increases by 17348,5 CZK. – expected direction

β_{10}: If the presence of a garage increases by 1 unit, the price of the estate increases by 194475,7 CZK. – expected direction

β_{11}: If the presence of a parking place increases by 1 unit, the price of the estate increases by 70396,1 CZK. – expected direction

Figure 2: Dispersion of dependent variable
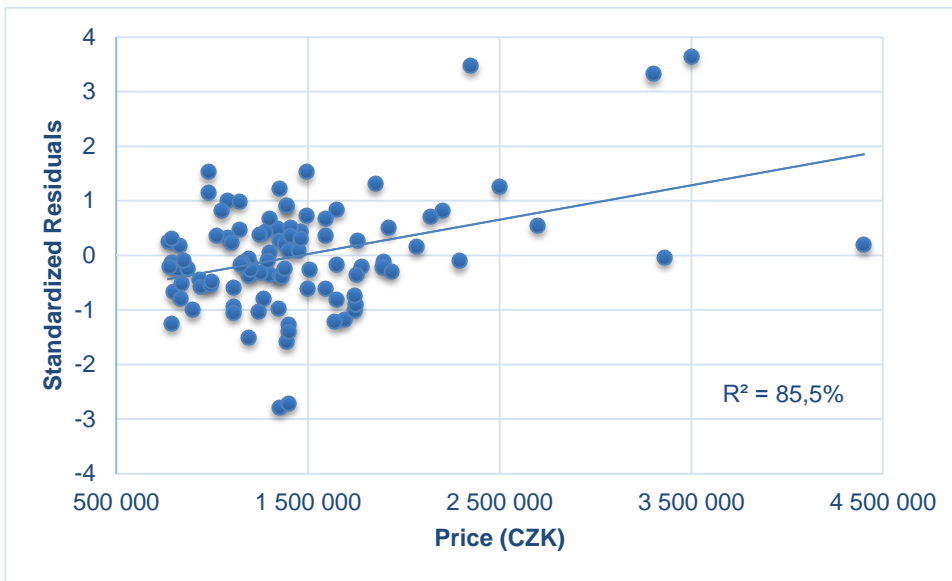
The figure above reflects a dispersion of residuals by an estimate of its standard deviation. It shows a strength of a correlation relationship.

4.1.7 Houses in Beroun – regression analysis

Table 8: Houses in Beroun - regression statistics

Regression Statistics	
Multiple R	0,617676722
R Square	0,381524534
Adjusted R Square	0,296217573
Standard Error	3662373,25
Observations	100

Goodness of fit:

R^2 … coefficient of determination

38, 1 % of variability of price was explained with this model using already mentioned variables. The coefficient is not even 50%, which means that the fit of the data to the model is not very good.

Adjusted R^2 … adjusted coefficient of determination

Means that the data we have used explain the price on 29,6 %.

Table 9: Output of Beroun houses regression analysis

	Coefficients	Standard Error	t Stat	P-value
Intercept	-594476,766	3241629,046	-0,18339	0,8549201
Distance from Prague (km)	-84876,8974	78612,30629	-1,07969	0,2832645
Land area (m2)	623,1905193	546,0203867	1,141332	0,2568636
Flooring area (m2)	11688,02431	6183,901468	1,890073	0,0620778
Floor number	445985,8006	752017,6554	0,593052	0,5546847
Transportation availability	-1220235,08	541286,305	-2,25432	0,0266874
Number of rooms	567004,8252	379677,2875	1,493386	0,138954
Condition	1041446,756	475530,3539	2,190074	0,0311943
Location	511980,1716	988188,452	0,5181	0,6057038
Balcony	1331084,316	893750,0204	1,489325	0,1400181
Basement	90894,43205	826851,5246	0,109928	0,9127194
Garage	1213117,955	888782,943	1,36492	0,1757976
Parking	31690,17311	902450,0908	0,035116	0,9720679

Source: Own data processing

Statistical significance of parameters:

Table 10:Statistical significance of Beroun houses parameters

p-value	Statistical significance
0,854920097	> 0,025 not reject null hypothesis, not sign.
0,283264529	> 0,025 not reject null hypothesis, not sign.
0,256863631	> 0,025 not reject null hypothesis, not sign.
0,062077806	> 0,025 not reject null hypothesis, not sign.
0,554684702	> 0,025 not reject null hypothesis, not sign.
0,026687416	> 0,025 not reject null hypothesis, not sign.
0,138954042	> 0,025 not reject null hypothesis, not sign.
0,031194255	> 0,025 not reject null hypothesis, not sign.
0,605703787	> 0,025 not reject null hypothesis, not sign.
0,140018093	> 0,025 not reject null hypothesis, not sign.
0,912719368	> 0,025 not reject null hypothesis, not sign.
0,175797628	> 0,025 not reject null hypothesis, not sign.
0,972067921	> 0,025 not reject null hypothesis, not sign.

Source: Own data processing

According to p-value T-test, none of Beroun houses variables is significant.

Final estimated equation:

$Y_t = -594476,8 - 84876,9x_1t + 623,2x_2t + 11688,0x_3t + 445985,8x_4t - 1220235,1x_5t + 567004,8x_6t + 1041446,8x_7t + 511980,2x_8t + 1331084,3x_9t + 90894,4x_{10}t + 1213118,0x_{11}t + 31690,2x_{12}t$

Economic significance of parameters:

In the case of Beroun houses economically significant are variables with positive sign, which are: land area, flooring area, floor number, number of rooms, condition, location, presence of the balcony, basement, garage and parking place.

β_0: If all extended variables are zero, then price of the Beroun houses is negative, i.e. -594476,8 CZK.

β_1: If distance from Prague increases by 1 km, the price of the estate decreases by 84876,9 CZK. – expected direction

β_2: If the land area increases by 1 m^2, the price of the estate increases by 623,2 CZK. – expected direction

β_3: If the flooring area increases by 1 m^2, the price of the estate increases by 11688 CZK. – expected direction

β_4: If floor number increases by 1 unit, the price of the estate increases by 445985,8 CZK. – expected direction

β_5: If the transportation availability increases by 1 unit, the price of the estate decreases by 1220235,1 CZK. - unexpected direction

β_6: If number of rooms increases by 1 unit, the price of the estate increases by 567004,8 CZK. – expected direction

β_7: If the condition increases by 1 unit, the price of the estate increases by 1041446,8. – expected direction

β_8: If the location increases by 1 unit, the price of the estate increases by 511980,2 CZK. – expected direction

β_9: If the presence of balcony increases by 1 unit, the price of the estate increases by 1331084,3 CZK. – expected direction

β_{10}: If the presence of a basement increases by 1 unit, the price of the estate increases by 90894,4 CZK. – expected direction

β_{11}: If the presence of a garage increases by 1 unit, the price of the estate increases by 1213118 CZK. – expected direction

β_{12}: If the presence of a parking place increases by 1 unit, the price of the estate increases by 31690,2 CZK. – expected direction

Figure 3: Dispersion of dependent variable
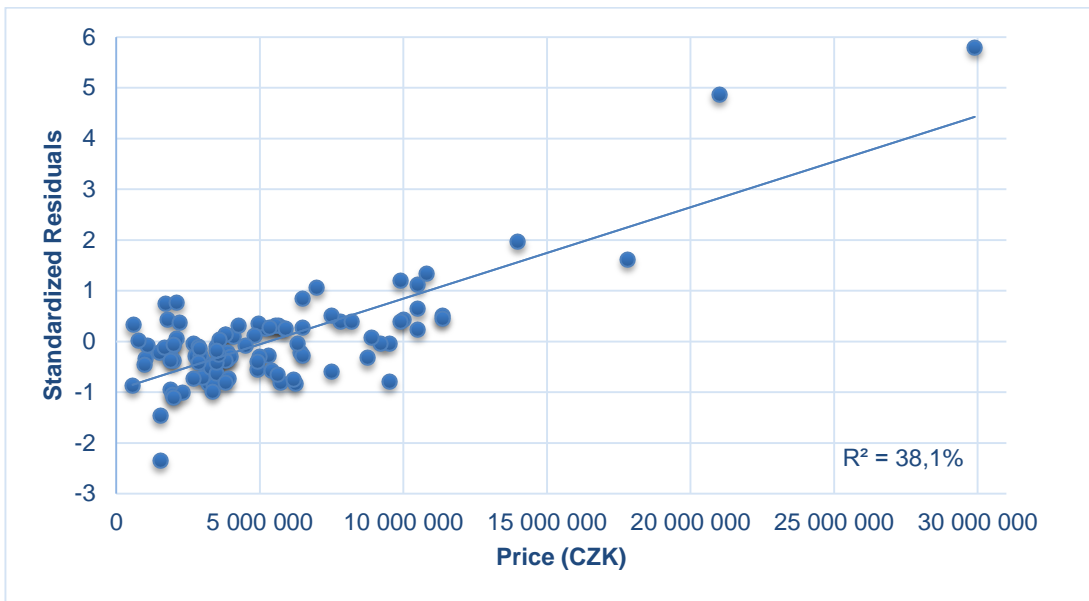
Source: Own data processing

The figure above reflects a dispersion of residuals by an estimate of its standard deviation. It shows a strength of a correlation relationship.

4.1.8 Apartments in Beroun – regression analysis

Table 11: Apartments in Beroun - regression statistics

Regression Statistics	
Multiple R	0,928908066
R Square	0,862870194
Adjusted R Square	0,845728969
Standard Error	448783,8902
Observations	100

Source: Own data processing

Goodness of fit:

R^2 … coefficient of determination

86, 2 % of variability of price was explained with this model using already mentioned variables. The coefficient is very high, which means that there is a very good fit of the data to the model.

Adjusted R^2… adjusted coefficient of determination

Means that the data we have used explain the price on 84,6 %.

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Table 12: Output of Beroun apartments regression analysis

	Coefficients	Standard Error	t Stat	P-value
Intercept	1848563,306	1082502,566	1,70768	0,09122231
Distance from Prague (km)	-92356,5839	47441,99313	-1,94673	0,05475725
Flooring area (m2)	22899,10372	3771,201572	6,0721	3,1299E-08
Floor number	-41059,3647	21617,23098	-1,89938	0,06079011
Transportation availability	109169,2131	89135,58588	1,22475	0,22393612
Number of rooms	300679,639	95945,35547	3,13386	0,00234415
Condition	234224,4131	63553,89167	3,68545	0,00039402
Location	-192903,472	104693,6833	-1,84255	0,06876192
Balcony	-62619,4029	116787,016	-0,53618	0,59318375
Basement	-485776,739	129542,1469	-3,74995	0,00031609
Garage	539605,1303	126046,6672	4,28099	4,7255E-05
Parking	50111,61123	95188,00461	0,52645	0,59990083

Source: Own data processing

Statistical significance of parameters:

Table 13:Statistical significance of Beroun Apartments parameters

p-value	Statistical significance
0,09122231	> 0,025 not reject null hypothesis, not sign.
0,054757247	> 0,025 not reject null hypothesis, not sign.
3,12988E-08	< 0,025 reject null hypothesis H0, stat. sign.
0,060790106	> 0,025 not reject null hypothesis, not sign.
0,223936115	> 0,025 not reject null hypothesis, not sign.
0,002344149	< 0,025 reject null hypothesis H0, stat. sign.
0,000394021	< 0,025 reject null hypothesis H0, stat. sign.
0,068761924	> 0,025 not reject null hypothesis, not sign.
0,593183748	> 0,025 not reject null hypothesis, not sign.
0,000316089	< 0,025 reject null hypothesis H0, stat. sign.
4,72553E-05	< 0,025 reject null hypothesis H0, stat. sign.
0,599900825	> 0,025 not reject null hypothesis, not sign.

Source: Own data processing

According to p-value T-test, variables **flooring area, number of rooms, condition** of the real estate, presence **of basement** and presence **of garage** are statistically significant.

Final estimated equation:

$Y_t = 1848563,3 - 92356,6x_1t + 22899,1x_2t - 41059,4x_3t + 109169,2x_4t + 300679,6x_5t + 234224,4x_6t - 192903,5x_7t - 62619,4x_8t - 485776,7x_9t + 539605,1x_{10}t + 50111,6x_{11}t$

Economic significance of parameters:

In the case of Beroun apartments economically significant are variables with positive sign, which are: price, flooring area, transportation availability, number of rooms, condition of the estate, presence of the garage and parking place.

β_0: If all extended variables are zero, then price of the Beroun apartments is positive, i.e. 1848563,3 CZK.

β_1: If distance from Prague increases by 1 km, the price of the estate decreases by 92356,6 CZK. – unexpected direction

β_2: If the flooring area increases by 1 m^2, the price of the estate increases by 22899,1 CZK. – expected direction

β_3: If floor number increases by 1 unit, the price of the estate decreases by 41059,4 CZK. – unexpected direction

β_4: If the transportation availability increases by 1 unit, the price of the estate increases by 109169,2 CZK. – expected direction

β_5: If number of rooms increases by 1 unit, the price of the estate increases by 300679,6 CZK. – expected direction

β_6: If the condition increases by 1 unit, the price of the estate increases by 234224,4 CZK. – expected direction

β_7: If the location increases by 1 unit, the price of the estate decreases by 192903,5 CZK. - unexpected direction

β_8: If the presence of balcony increases by 1 unit, the price of the estate decreases by 62619,4 CZK. – unexpected direction

β_9: If the presence of a basement increases by 1 unit, the price of the estate decreases by 485776,7 CZK. – unexpected direction

β_{10}: If the presence of a garage increases by 1 unit, the price of the estate increases by 539605,1 CZK. – expected direction

β_{11}: If the presence of a parking place increases by 1 unit, the price of the estate increases by 50111,6 CZK. – expected direction

Figure 4: Dispersion of dependent variable
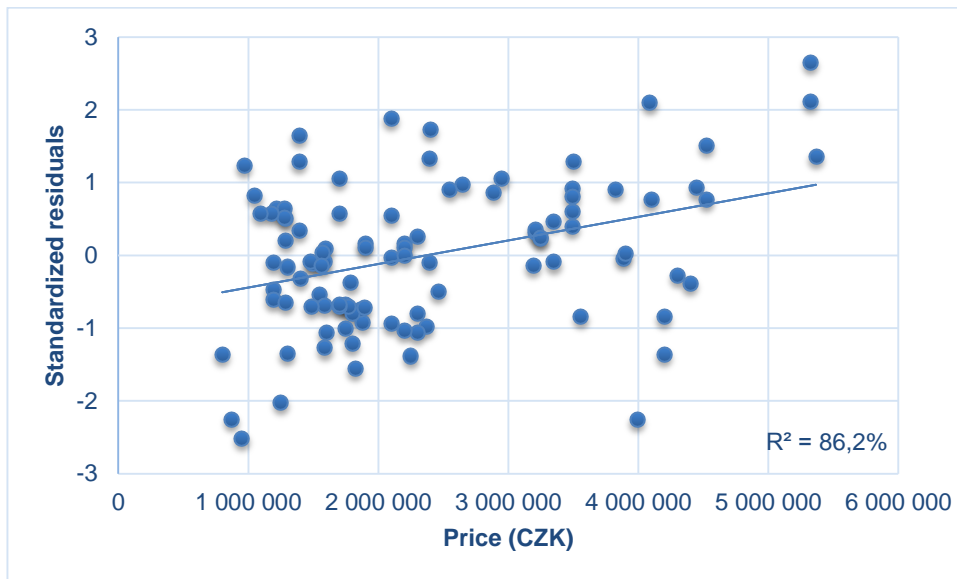
The figure above reflects a dispersion of residuals by an estimate of its standard deviation. It shows a strength of a correlation relationship.

4.2 Comparative analysis

For contrasting Kladno and Beroun, it has been decided to use a comparative analysis as the best solution. Via the basic statistical functions (methods) compare the prices and directly evaluate the results. For a comparison there were used 400 values of prices in total (100 Kladno houses, 100 Kladno apartments, 100 Beroun houses and 100 Beroun apartments). The values were collected into the Excel 2013 program and consequently evaluated with the help of mean, median, mode, minimum, maximum, variance and standard deviation.

Table 14: Calculation of basic statistical functions of houses and apartments from the price

|	Kladno houses (czk)	Kladno apartments (czk)	Beroun houses (czk)	Beroun apartments (czk)
Average (mean)	3124190,37	1461949,83	5321551	2370096,31
Maximum	11490000	4400000	29900000	5366358
Minimum	749000	769000	565000	799000
Median	2545000	1350010,5	3895000	1999500
Mode	1690000	1650000	3500000	3490000
Variance	2,94499E+12	3,64871E+11	1,90584E+13	1,30554E+12
Stand. dev.	1716096,788	604045,223	4365594,502	1142602,23

Source: Sreality.cz

From the table above were obtained average prices of houses and apartments in Kladno and in Beroun. By comparing them it is clear that the most expensive are houses in Beroun, with average price 5 321 551 CZK. Houses in Kladno have the average price of 3 124 190 CZK, which is much cheaper. The similar results are in the apartment sections. Apartments in Beroun have the average price 2 370 096 CZK while apartments in Kladno cost only about 1 461 950 CZK. This indicates in both cases (houses and apartments) higher prices of real estates in Beroun and lower prices in Kladno. That generally affirms the assumption that Beroun is more expensive city and urban area than Kladno. The maximum function displays the most expensive real estate of all the collected data, which is the one with cost of 29 900 000 CZK in the Beroun houses category. Conversely thorough the minimum function it is possible to see the lowest price of the real estate, which is 565 000 CZK in Beroun houses category as well. The median number separates the higher half of the data sample from the lower one, it is the average of the two middle values, after arranging them upwardly (in our case there is always even number of data). The mode is the most often appeared number in the set of data, in our case it is the most often appeared price. Variance represents the propability diversion of the price among its middle value; how far a set of numbers is spreaded out. In the table there are very low numbers in the variance row, that means the data points are very close to the mean and to each other as well. The standard deviation function measures the amount of variation (dispersion) of a set of collected prices.

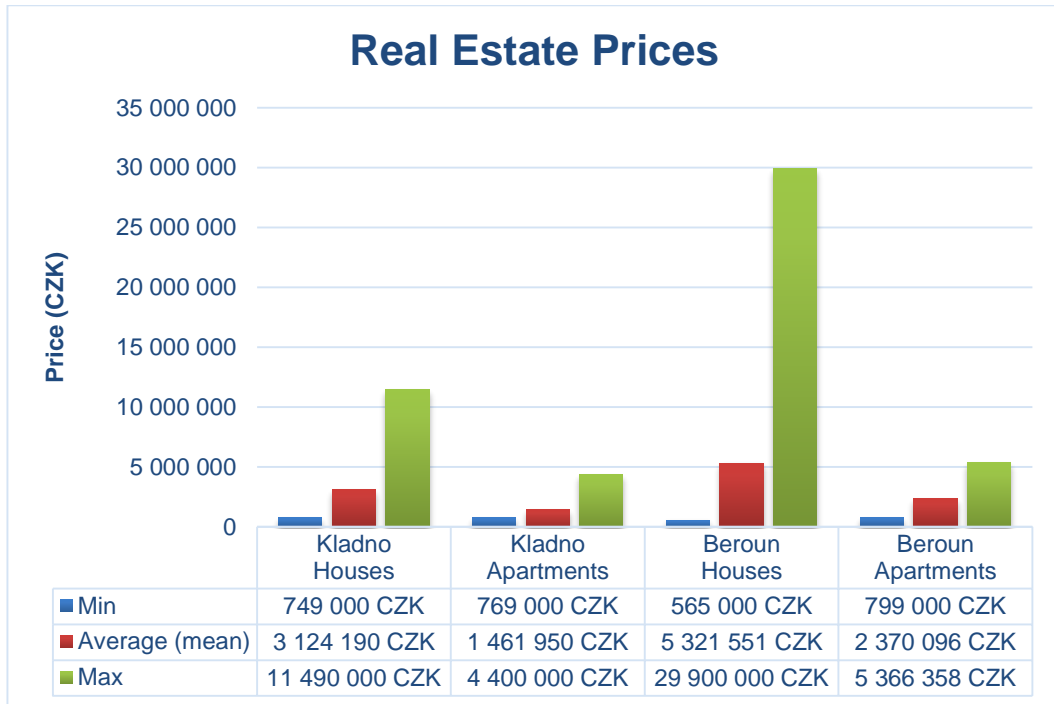*Figure 5: Normal (Gaussian) distribution of houses*

Source: Own data processing

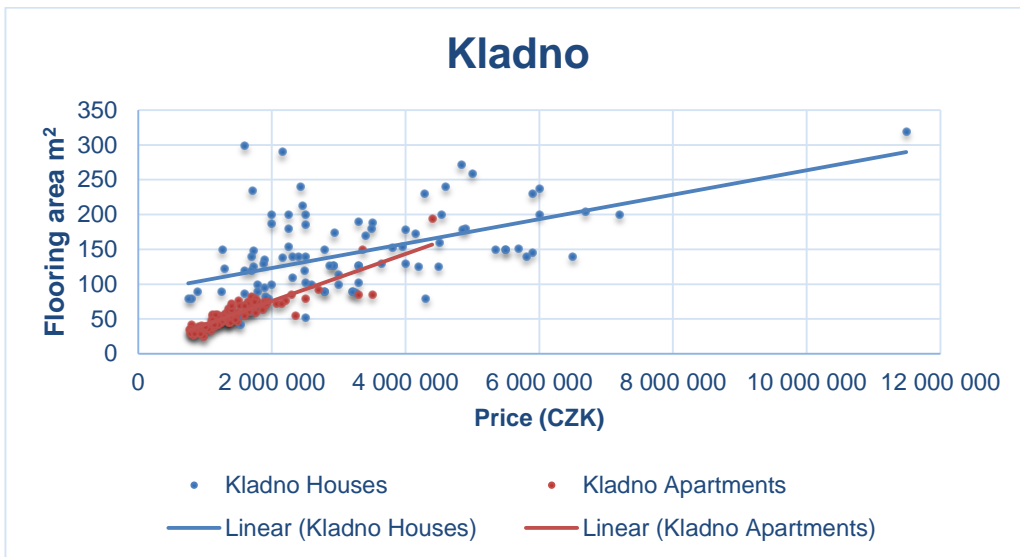*Figure 6: Normal (Gaussian) distribution of apartments*
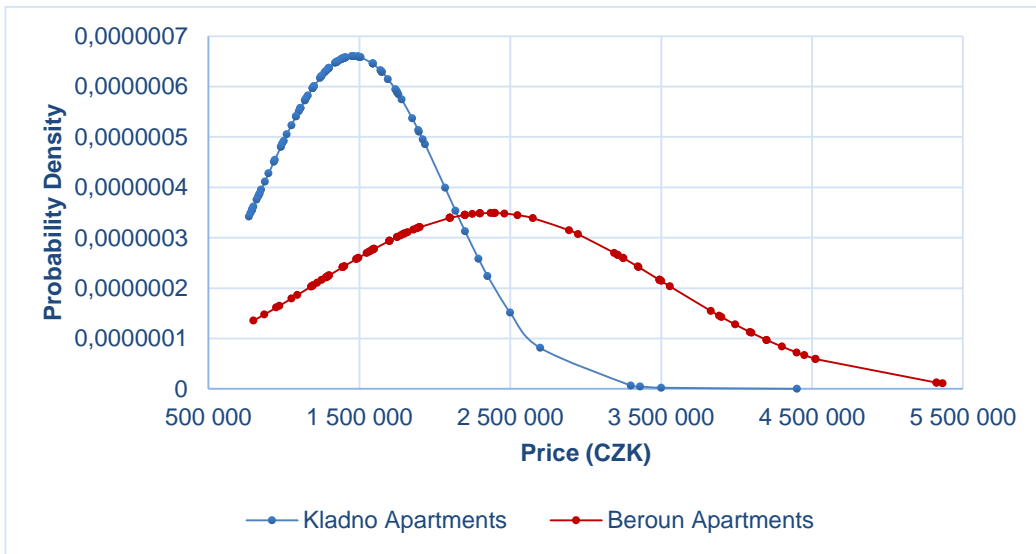
Source: Own data processing

Figure 7: Prices of the real estate in Kladno and Beroun, illustrated by the statistical functions

Real Estate Prices

	Kladno Houses	Kladno Apartments	Beroun Houses	Beroun Apartments
■ Min	749 000 CZK	769 000 CZK	565 000 CZK	799 000 CZK
■ Average (mean)	3 124 190 CZK	1 461 950 CZK	5 321 551 CZK	2 370 096 CZK
■ Max	11 490 000 CZK	4 400 000 CZK	29 900 000 CZK	5 366 358 CZK

Source: Own data processing

Figure above displays three basic statistical functions: mean, minimum and maximum of Kladno and Beroun prices. Urban areas are divided into houses and apartments. That means there are four categories. KH means Kladno houses, KA meands Kladno apartments, BH means Beroun houses and BA means Beroun apartments. It is clearly visible that the average prices of Beroun houses are the highest, followed by Kladno houses, Beroun apartments and the lowest real estate prices are in Kladno apartments. As it was already mentioned, Beroun is much more expensive than Kladno. Another displayed function is minimum. This function shows the lowest price of the randomly selected data in each category. The minimum function is in the Beroun houses category. The maximum function has its highest number in Beroun houses category as well, that means that the most expensive estate is also situated there. This signs that even if the most expensive category is Beroun houses, there can be found also the estates with very low prices.
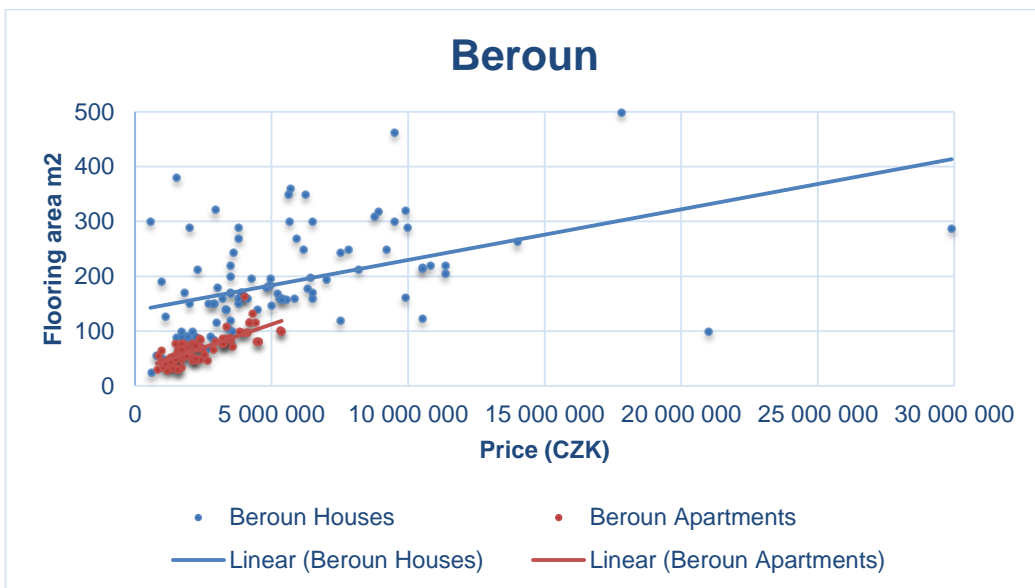
Figure 8: Dependency of the flooring area on the price in Kladno

The figure of linear dependency of Kladno houses and apartments graphically indicates the amount of area in m2, which could be purchased for the given price. Linear line represents the average of the real estate prices in both cases. The Linear line of Kladno apartments is much steeper than the linear line of houses. That means the higher price you pay, the bigger flooring area you get, , concerning Beroun apartments, but also Beroun houses. There exists a direct proportion. For example for the price of 4 000 000 CZK you get 150 m^2.
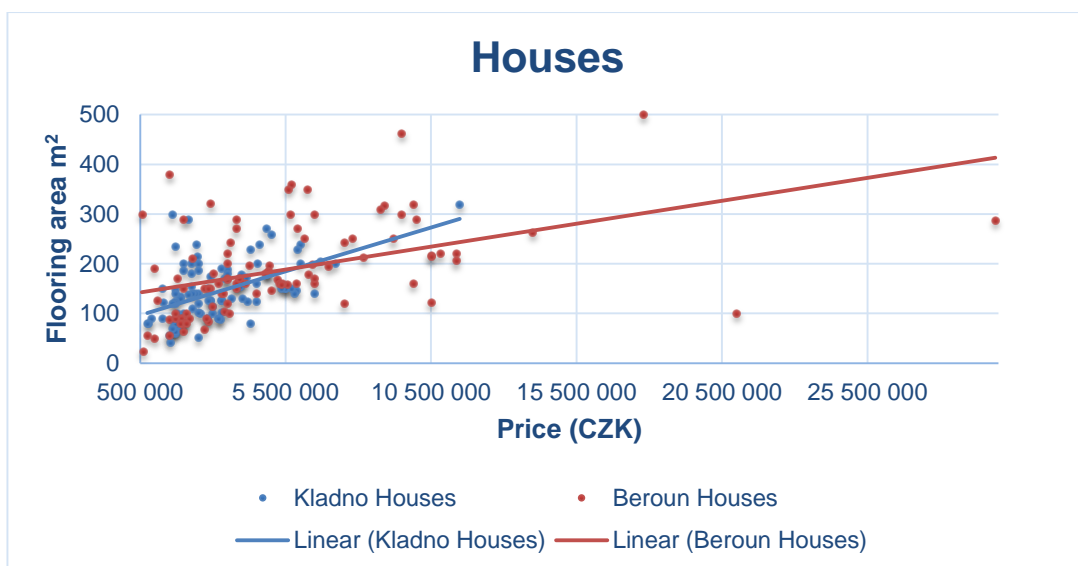
Figure 9: Dependency of the flooring area on the price in Beroun

The figure of linear dependency of Beroun houses and apartments graphically indicates the amount of area in m2, which could be purchased for the given price. Linear line represents the average of the real estate prices in both cases. The Linear line of Beroun apartments is steeper than the linear line of houses, but not so prominently as in the case of Kladno. That means the higher price you pay, the bigger flooring area you get, concerning Beroun apartments, but also Kladno houses. There exists a direct proportion. For example for the price of 5 000 000 CZK you get 200 m^2.
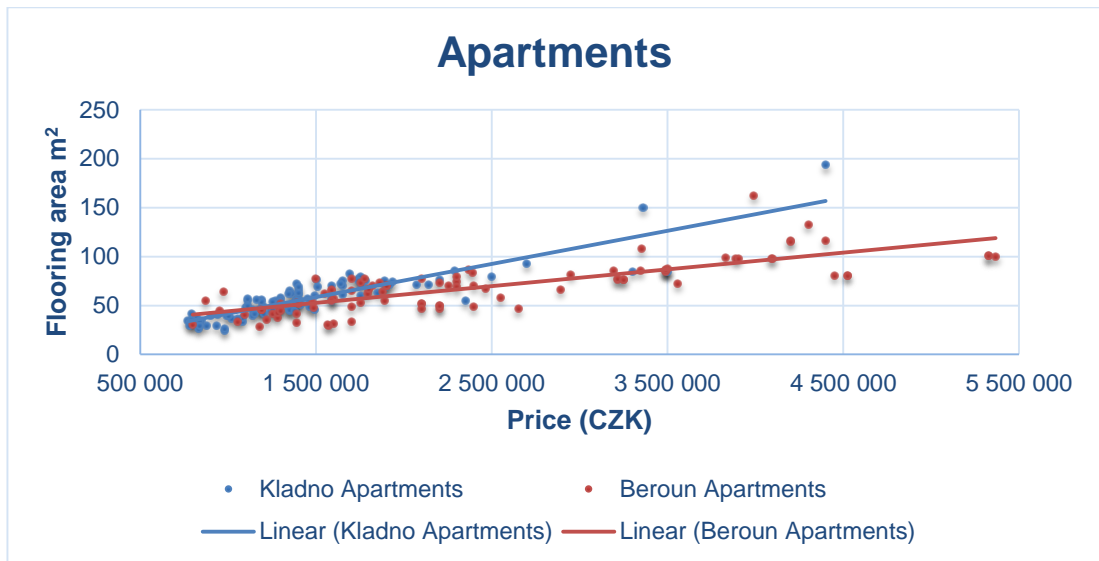
Figure 10: Dependency of the flooring area on the price in terms of houses (Kladno and Beroun)

Source: Own data processing

The figure of linear dependency of houses in Kladno and Beroun graphically indicates the amount of area in m2, which could be purchased for the given price. Linear line represents the average of the real estate prices in both cases. The linear line of Kladno houses is much steeper than the linear line of Beroun houses, the two linear lines create an interception. That means the higher price you pay, the bigger flooring area you get, concerning both Kladno and Beroun houses. There exists a direct proportion. For example for the price of 5 500 000 CZK you get 180 m^2.

Figure 11: Dependency of the flooring area on the price in terms of apartments (Kladno and Beroun)

Apartments

The figure of linear dependency of apartments in Kladno and Beroun graphically indicates the amount of area in m2, which could be purchased for the given price. Linear line represents the average of the real estate prices in both cases. The linear line of Kladno apartments is much steeper than the linear line of Beroun apartments, the two linear lines also create an interception. That means the higher price you pay, the bigger flooring area you get, concerning both Kladno and Beroun apartments. There exists a direct proportion. For example for the price of 2 500 000 CZK you get 75 m^2.

5 Evaluation of results

5.1 Conclusion

Results of the bachelor thesis led to the main conclusion of a comparative analysis, that houses and apartments are much cheaper in Kladno than in Beroun. The average price of house in Kladno is only 3 124 190, 37 CZK, while in Beroun it is 5 321 551 CZK and the average price of Kladno apartment is 1 461 949,83 CZK, while in Beroun it is 2 370 096,31 CZK. This can be explained by the fact that Kladno is more industrial city (and urban area), with older types of residential buildings and on the other hand in Beroun there is nowadays constructed more residential buildings for living. The distance from the centre of Prague is quite similar in both cases.

Considering the regression analysis of value creating factors, in the case of Kladno houses there was pretty good fit of collected data, the price was explained by 59,8 % by a coefficient of determination. There was performed a statistical significance with the help of p-value (on the 0,025 level of significance) of the particular variables, which marked land area, condition of the real estate and availability of garage as statistically significant variables. After evaluation of the economic signification we have obtained following variables: land area, flooring area, floor number, transportation availability, number of rooms, condition of the estate, location, present of basement, garage and parking place. That means the real estate prices of houses in Kladno are influenced the most by the condition of the real estate, availability of garage and also by the land area around the estate.

In the case of Kladno apartments there was a very good fit of collected data, the price was explained by 85,5 % by a coefficient of determination. There was also performed a statistical significance with the help of p-value (on the 0,025 level of significance) of the particular variables, which marked distance from Prague, flooring area, number of rooms and condition of the estate as statistically significant variables. After evaluation of the economic signification we have obtained all variables except the location and the present of a balcony. That means the real estate prices of apartments in Kladno are influenced by the distance from Prague, flooring

area, number of rooms and condition the most, because these factors are both statistically and economically significant.

Considering Beroun houses there was not very good fit of collected data, the price was explained by 38,1 % by a coefficient of determination. It may be caused by selection of variables which do not influence price the most. There was also performed a statistical significance with the help of p-value (on the 0,025 level of significance) of the particular variables, which didn´t marked any of the them as statistically significant. After evaluation of the economic signification we have obtained all variables except transportation availability. But anyway the real estate prices of houses in Beroun are the most influenced by the present of garage, balcony and the real estate condition, even if these are not statistically significant.

In the case of Beroun apartments there was a very good fit of collected data, the price was explained by 86,2 % by a coefficient of determination. There was also performed a statistical significance with the help of p-value (on the 0,025 level of significance) of the particular variables, which marked flooring area, number of rooms, the real estate condition, the present of basement and garage as statistically significant variables. During evaluation of the economic signification we have obtained all variables except floor number, location and the present of balcony and basement. That means the real estate prices of apartments in Beroun are influenced by the flooring area, number of rooms, the real estate condition and the present of garage the most, because these are both statistically and economically significant.

Not confirmation of some hypothesis was surprising, it has been proved that not all the value creating factors have an impact on the final price. But on the other hand most of them do. But still it is very difficult to rigorously estimate data, because there are many different factors affecting the real estate prices in Kladno and Beroun and in the thesis there has been calculated only with some of them.

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