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**Affordability of own housing across
regions of the Czech Republic**

Bachelor's thesis

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Declaration of Authorship

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Prague, July 27, 2021

Daniel Matoušek

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Acronyms

CSO Czech Statistical Office

CNB Czech National Bank

MMR ČR Ministry for Regional Development of the Czech Republic

SILC Statistics on Income and Living Conditions

SLDB Population and Housing Census

IRI Institute of Regional Information

DTI Debt to income

DSTI Debt service to income

LTV Loan to value

FD First-difference model

FE Fixed-effect model

RE Random-effect model

Chapter 1

Introduction

The development of owner-occupied housing has long been regulated by the former socialist regime, which sought to ensure affordable housing for everyone. Consequently, after the Velvet Revolution and related deflection from equalizing policy to market economy, an upsurge of housing affordability disparities across regions in response to real estate price convergence to the market equilibrium began to enlarge (Hampl, 2001). While the housing stock especially in post-communist industrial regions has begun to deteriorate or has grown in price gradually, regions with a high share of urbanized area and economic strength measured by GDP per capita has experienced significant price boom. As an example, one can point out Jihomoravský region with a 273% price growth of flats contrary to just 163% growth in Karlovarský region during the period 2005-2019.

Within the Czech research, the price development of flats investigated Čadil (2009) or Hlaváček & Komárek (2009) who conducted calculation of price-to-income ratio to depict financial burden of real estate purchase together with a regression analysis to identify periods of property price overvaluation above their fundamental value. An effort to explain housing affordability inequalities across regions and different types of households was made by Sunega & Mikeszová (2015), who also tried to explore whether disparities in housing affordability are smaller than inequalities in economic performance.

However, previously mentioned papers suffered from a lack of data as they were provided only with a short time series, which detracts from the strength of their conclusions. In addition, low data coverage of the evolving financial market has prevented them from suitable inclusion of the accessibility to debt

financing and confirmation of its significant importance for housing affordability.

Consequently, this thesis will attempt to extend the regression analysis by longer time series and include relevant variables that would describe and prove the effect of debt financing on housing affordability. Moreover, rather than inspecting factors behind the changes in prices of flats, we will attempt to explore determinants of regional gaps in housing affordability. In order to capture housing affordability from wider perspective, both markets of flats and family houses will be observed. As a subsequent goal, we will attempt to compare results of two different approaches to housing affordability (physical availability and financial affordability) with the output of regression analysis and discuss reliability of both approaches on assessment of housing affordability.

After the introduction, the thesis is organised as follows. Chapter 2 describes specific features of housing market which are further extended to the case of the Czech Republic. Chapter 3 is devoted to different approaches of housing affordability measurement and to regional comparison of physical availability and financial affordability. The last section before the conclusion of the results contains empirical analysis that applies FD model on regionally scaled panel data between 2005-2019.

Chapter 2

Housing market

Housing market represents an important element in decision-making on both microeconomic and macroeconomic level. From the macroeconomic perspective, understanding of the property price development and their determinants is crucial for financial stability and related policy implementation. Historical evidence indicates that a sudden drop in property prices deep below the equilibrium is associated with more serious impacts on economy than similar decline in a stock market. Helbling & Terrones (2003) also pointed out that especially in the presence of significant proportion of housing loans, revival of the economy to its original level is expected to last longer (on average 4 years) in comparison to on average 1,5 year revival after a bubble burst in stock prices.

Changes in housing prices are correlated with credit risks banks have to face when providing housing loans. As real estate usually serves as a collateral to a loan for the purchase of own housing, possible decline in their prices affects value of the collateral that negatively projects to the bank's balance sheet and increases probability of loss given default of the creditor.

From the microeconomic perspective, housing is one of the largest investment of Czech households whose share on total consumption expenditures almost double in the first decade after the transformation period becoming the largest expenditure overall (Sunega & Mikeszová, 2015). Therefore, the growth in property prices increases the value of assets on household balance sheet resulting in so called wealth effect that influences household's decision-making process and encourages further consumption as well as willingness to borrow (Goodhart & Hofmann, 2008).

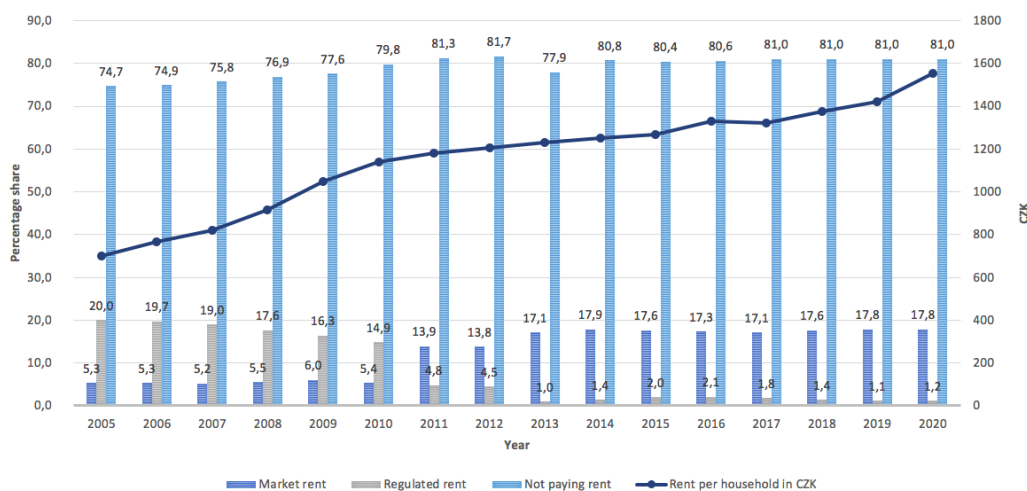
2.1 Housing market in the Czech Republic

The development of the Czech housing market was significantly affected by the long period of socialism. While transfer to the market economy, deregulation of rentals and deflection from the massive build-up of prefabricated constructions began in the West Europe in the early 1960's, local housing development was under the state-controlled central planning until 1989. Socialist state construction policy aimed to cancel out disparities in availability of housing across social classes (Musil, 1985). As a result, construction of especially housing estate without sufficient availability of facilities rapidly increased between years 1951-1980 and supportive programs such as soft loans or state subsidies on housing were set. However, allocation of the construction was not efficient as it was concentrated mainly to regional cities and industrial areas as a supportive tool to heavy industry development (Horská *et al.*, 2002). While prosperity in most of regional cities has continued even after the transformation period, regions of socialist industrialization like northern Bohemia and northern Moravia with high proportion of housing estate experienced structural problems and economic degradation (Temelová *et al.*, 2011).

The above mentioned massive built-up pushed by the shortage of housing stock was partly brought out by the rent regulation. The presence of so called first generation rent in order to provide financially accessible housing for everyone, was marked by fixed rent per square meter for the whole country and at a level well below the market equilibrium. In addition to increased household demand for housing, real rents have been declining over time due to inflation leading to inability of housing cooperatives to cover the costs of property management or to restore the housing stock. Not only was there a gradual deterioration of real estate, but at the same time cheap rent enabled households to overconsume housing stock, i.e. exploit dwellings that would not be financially attainable to them in an environment of market rent (Mikeszová *et al.*, 2009). The Velvet Revolution and related transfer to the market economy brought necessity for power decentralization, price adjustment on the housing market to its equilibrium and revitalization of the housing stock. As a result, a process of privatisation, a cheap sale of real estate into the hands of private owners with a vision of the owner's interest in renovation of newly acquired property has started. Above that, attempts for rent deregulation resulted in so called Deregulation law no. 107/2006 Sb. approved by the Czech government in 2006.

On the basis of the Deregulation law, the regulated rent annually increased according to the predetermined formula over the next six years with the aim to adjust rent to its market level. In the course of the validity of Deregulation law, rent per household increased by almost 58 %. That was roughly in line with the conservative proposal of the optimal level of increase conducted by the team around Martin Lux in the publication *Standardy bydlení 2003/2004*. Consequences of the Deregulation law can be observed in two directions. Households began to gradually substitute from rental housing to owner-occupied housing or other types of rent-free housing and the percentage share of households paying market rents increased by 11.8 % in the period 2006 - 2013, while the share of households paying regulated rents decreased by 18.7 % in the same period.¹ Therefore it is safe to say that rent deregulation motivated households to substitute rental housing for owner-occupied housing which projected to increasing demand and additional pressure on prices and affordability of owner-occupied housing.

Figure 2.1: Impact of Deregulation law on rent market



Except for the changes in household preferences, we can also distinguish periods of significant jumps in property prices that exceeded their fundamental value and that may negatively project to housing affordability. Several studies² focused on retrieval of these so called price bubbles. Within the Czech real estate market, two periods of price bubbles were denoted and their origin was explained by nearly the same determinants across all mentioned studies. The

¹The unexpected drop in the share of households not paying rent in 2013 might be explained by the fact that CSO failed to collect 4 % information about households that year.

²For example Dubská 2009, Čadil 2009, Hlaváček and Komárek 2009

first in years 2002 - 2003 is to a certain extent explicate by the convergence character of the Czech economy to developed economies after the end of socialist regime together with a markdown of interest rates on housing loans (Hlaváček & Komárek, 2008). Studies also identically labelled the announced entrance of the Czech Republic to the European Union in 2004 to be the main driver of the bubble as it was speculated to a price increase related to a boosted purchase of real estate by foreign investors. The latter presence of the price bubble detected between years 2007 and 2008 is predominantly described by pre-supply factor caused by in advance announced increase of VAT rates on construction work since 1.1.2008 together with a factor of increasing demand on owner-occupied housing as a substitute to deregulated rental housing.

On the other hand, subsequent bubble burst and price correction is accompanied with positive effect on housing affordability. Such situation arose during the Global Financial Crises when property prices dropped significantly causing price-to-income ratio, basic indicator of housing affordability, to record more than 31% drop compared to its peak in 2008 (CNB, 2013). However, the overall slump in the Czech Republic was considerably milder and successive recovery faster compared to the USA or Western Europe particularly thanks to the early development of mortgage market in the Czech Republic with only 7% ratio of the total outstanding mortgage loans to the country's GDP in 2006 in contrast to almost 50 % in case of the EU 27 average. This evidence may indicate importance of the mortgage market relative to the country's economic situation and related housing affordability.

Following continuous enlargement of rent as a result of Deregulation law increased rental income to its six-year maximum in 2012 and stimulated demand for real estate as an investment opportunity. However, the dynamics of following property price growth that started in Prague was caught up by the rest of the country with almost three-year lag increasing the price dominance of the capital city that recorded unambiguously the worst affordability of housing in terms of price-to-income (CNB, 2016). Above that, the development on the financial market substantially contributed to the subsequent rise in real estate prices. The expansive monetary policy of the CNB supported interest rate cuts that reached their bottom at the turn of 2016 and 2017 (Somotogyi, 2019). Low lending price of money has motivated households to substitute rental housing for owner-occupied housing with the help of debt financing. This trend has continued even after restrictions on housing loans in the form of LTV, DTI and DSTI indicators were set. Such a dynamic development of housing

prices without sufficient growth in household income has worsened affordability of owner-occupied housing across the country dramatically. Unsatisfactory situation in the Czech Republic might be supported by the results of Deloitte Property Index, a measure similar to price-to-income ratio, that compares 23 European countries and that has labelled the Czech Republic as a country with the worst housing affordability in last four consecutive years.

Chapter 3

Housing affordability

Housing affordability is highly connected to the necessity of households to satisfy their housing needs. The manner of housing needs and their shortage can, however, be understood in different ways and the way we understand them may influence the form of housing affordability understanding and subsequent evaluation. Different perceptions on housing needs were nicely summarized by Ytrehus (2000) who defined four traditions based on the way housing needs are perceived.

Spatial tradition assumes satisfaction of housing needs based on the accessibility to a housing stock, the size of a dwelling and the quality of its equipment. Its purpose is to define minimal spatial dwelling standards that are essential for achieving basic living needs. This tradition can be partially likened to the prime socialist housing policy and its aim to provide accessible housing for everyone.

The second tradition, so called market oriented tradition, describes housing needs as subjective preferences of individuals. Therefore nothing like minimal standards do exist and individual preferences should be determined and satisfied on the free market through the interaction of supply and demand. Market oriented tradition argues that only free market is capable to reflect all the direct and indirect factors that influence both supply and demand for housing good.

Culturally relativistic tradition emphasizes mainly social aspects of housing needs that are correlated to the given time, culture and social context. In other words, housing needs vary over time and each household needs are highly determined by the needs of surrounding households. A failure to meet given standards then leads to social exclusion.

The last tradition of universal standards defines physical health and autonomy of decision-making as basic human needs independent on cultural environment or individual preferences. It is supposed that society determines criteria to attain universal standards and that housing needs could be one of the criteria. These criteria and their weights are changing over time and therefore also indicators for measurement of universal standards fulfilment have to be adjusted over time.

3.1 Measurement of housing affordability

The suitability of individual approaches mentioned above for empirical analysis of housing affordability was discussed and evaluated in the study *Standardy bydlení 2003/2004* by Lux and Sunega. They marked as inappropriate culturally relativistic tradition as it mainly concentrates on social inequalities and social status with housing being only one of the observed determinant rather than main subject of interest. Furthermore, this approach does not account for diverse preferences and utility each household can have from the same housing stock. That makes this approach immeasurable as socially adequate housing is changing over time and across location and is subject to different perceptions.

The tradition of universal standards appears to be inconvenient as well based on the impossibility to make a generally acceptable statement about criteria that lead to an achievement of universal standards in today's society. With regard to the variability of criteria over time, it is unfeasible to define an index that will allow to inspect evolution in universal standards achievement on some longer time series. Therefore only spatial tradition approach labelled as physical availability and market oriented tradition approach marked as financial affordability are said to be relevant for analytical measurement of housing affordability.

A closer look at the approaches of physical availability and financial affordability on assessing the housing issue indicates distinct comprehensiveness. While the physical availability traces only the condition of the housing stock in relation to population, financial affordability examines the relationship between housing costs and household's financial situation. Thus, the two methods encounter different obstacles that can largely affect their reliability.

The physical availability of the housing stock depends on the ability of the supply side of the housing market to react on changes in the household demand in a timely and sufficient manner. The supply side in the Czech environment

is, however, affected by an obsolete Building law that has been in force since 2006 and that does not meet current requirements for flexible and user friendly bureaucracy. Dealing with construction permits takes in the Czech Republic on average 246 days which ranks the country in 157th place out of 190 observed countries according to Doing Business 2020 conducted by the World Bank. Moreover, the situation in the Capital City of Prague is even worse as an issuance of a building permit lasts slightly over three years. That makes supply very inelastic, disables developers to react on changes in household's demand without significant lag and discourages households to build housing on their own.

From the perspective of financial affordability, the housing asset itself is unique based on its dual nature being both commodity and investment asset. Therefore the demand side consists of not only households who aim to satisfy their housing needs but also of investors who speculate on further price increase and earnings from rental or those who simply consider housing asset as a safe option for protection of the value of their funds. Consequently, the price of the housing stock is further influenced by the situation on the financial market and corresponding performance of investment instruments together with rental yields making the price development demanding to predict. One have to also consider heterogeneity on the household side as they differ in size and structure, i.e. number of earners and number of economically inactive members. Social status of a household may predetermine preferences as well as opportunities given by possible inheritance or financial support from relatives for solution of housing needs. The disparities in the level of disposable income and savings directly influence accessibility to housing loans that projects to housing affordability and satisfaction of housing needs of any household.

The heterogeneity of the housing stock affects both physical availability and financial affordability in terms of price and quality through inner and outer determinants. Inner determinants include the acreage, disposition, quality of materials used or bonus elements like balcony, cellar or garage that belong to the property. Attractiveness of the location in terms of accessibility to services and proximity to greenery, distance from the city centre or the appearance of the building and the floor real estate is located in are considered to be the outer determinants. Each of the above mentioned factors have a different importance for a household's decision-making such that retrieval of comparable quality levels or price assignment to individual determinants for the comparative purposes is very demanding and prone to shortages.

3.2 Physical availability

In the context of housing needs, physical availability can be understood as a necessity to provide a sufficient number of housing units that would by their quantity, quality and size satisfy the needs and demand of persons or households in any given area. Therefore, assessment of the physical availability can be split into quantitative and qualitative approach that both apply so called aggregate indicators. These indicators express average relations between the population and the housing stock within some greater territorial unit - in our case a region. As an input data, we decided to use the results of the Population and Housing Census that has provided us with the aggregate data about population, households, flats and houses since 1961¹ and that has carried out once a ten years. Unfortunately, the results of Census 1961 are not available on a regional level and the outcomes of Census 2021 are not published at the time of the thesis processing. Therefore, indicators of the physical availability would be constructed and then presented on the period 1970-2011.

Before the application of both approaches, it is important to mention that the qualitative approach in the Czech Republic encounters the problem of inconsistent methodology in data collection, which has fundamental negative impact on comparability of individual indicators over time. When measuring size of dwellings, one have to deal with a change in definition of a habitable room that has emerged in 2011 and that has newly included kitchen with the acreage of 8m² or higher since that time compared to the previous methodology where only its acreage over 12m² was included to the habitable floor area. Such a modification artificially increases values of indicators of both habitable floor area and habitable rooms per dwelling and disables us to retrieve an overview on actual development over time. Even though monitoring technical equipment of occupied dwellings can be done quite conveniently through four-group categorical division of dwellings based on their equipment with district heating system, bathroom and flushing toilet according to the decree no. 60/1964Sb., corresponding data might be quite misleading, too. As an example, in accordance with the results of SLDB 2001, the Capital City of Prague reported deterioration of the quality of the housing stock that did not catch the quality level of 1991 even in year 2011. Such a slightly curious results are according to CSO misleading based on a high level of non-response rate concerning

¹Previous Censuses did not put together data about population, households, flats and houses but rather collect information about population and different types of dwellings separately.

the equipment with the bathroom and flushing toilet in 2001 and 2011. Consequently, as such distorted values will very likely depict the situation on housing market within qualitative approach falsely, we will apply only the quantitative approach that is capable to provide us with more reliable results.

3.2.1 Quantitative approach

Within the quantitative approach, indicators of Dwellings per 100 households and Dwellings per 1000 citizens were chosen as they are considered to be the most commonly used ones (Lux *et al.*, 2004). Although these are simple indicators that put together region-wide values that are easy to interpret, their results might be considerably affected by the type of input data selection and inconsistent methodology of the Population and Housing Census over time. The population census has been affected by the inclusion of the foreign nationals with long-term residence since 2001 or by the transition from the census of population with permanent residence to the census of population with so called usual residence in 2011 in reaction to the growing mobility across the European Union. While inclusion of foreigners increases total population according to the SLDB by 1,2 % and 4,0 % in 2001 and 2011, respectively, the transition to the usual residence defined as a place where a person is a member of a certain household and where he spends periods of his daily rest has, however, minor negative effect of 0,5% change on the total population. Even though we are aware of slight distortion of the indicator values in 2001 and 2011 downward by the inclusion of the foreigners compared to the previous values, we decided not to adjust the total population for foreigners as they participate on the demand side of the housing market and their exclusion might lead to an artificially positive results.

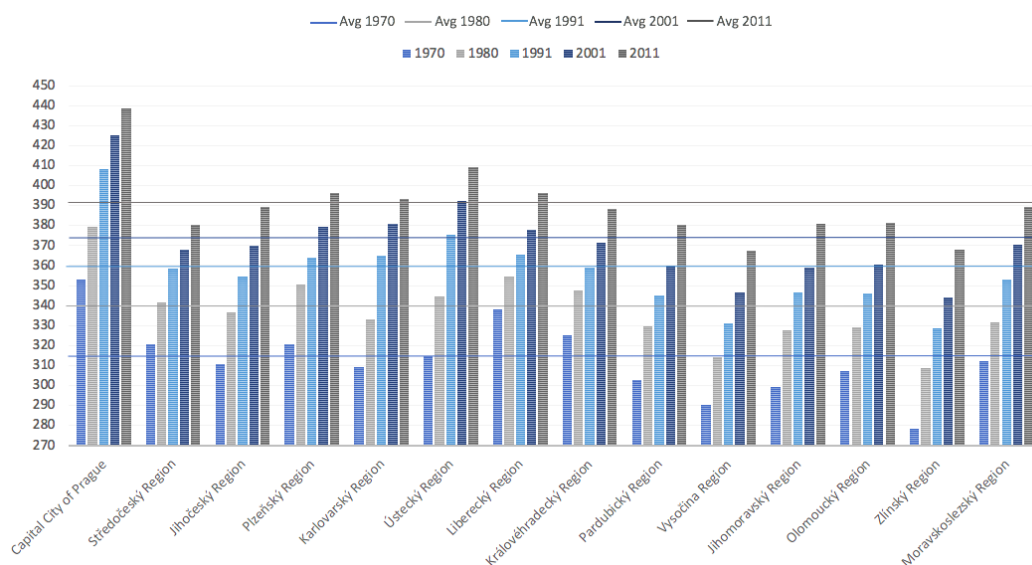
Indicator distortion might be also to some extent caused by the shifts in social preferences. Especially intensive expansion of the second housing intended for recreation greatly transformed development of housing stock occupancy. While the number of occupied dwellings has grown by almost one third from 1970 to the last Population and Housing Census in 2011, the quantity of unoccupied dwellings has risen more than five times in the same period resulting in its share of 13,7% on the total housing stock in 2011 out of which 31% was explained by the recreational usage of the dwelling. Inclusion of the total housing stock would therefore bias the indicators upward as it would display also the dwellings that are in fact not accessible on the housing market. More-

over, regional disparities would even widen as physical availability may come up to artificially positive results in the rural areas and areas with prevailing recreational purpose like Jihočeský region or Vysočina region in comparison to the most urbanized areas like the Capital City of Prague. Consequently, the data for number of occupied dwellings are supposed to reflect the situation on the supply side of the housing market better than the total number of dwellings.

In addition to the changes in methodology and preferences, we can also encounter with diverse definitions of households. While dwelling household refers to persons living in one dwelling and therefore its number equals the number of occupied dwellings, the term housekeeping household brings together those who live and covers expenses together. Even narrowed concept of a census household unites those who fulfil the definition of the housekeeping household and its members have above that any form of kinship relations. The choice of dwelling household is inappropriate by the definition as its usage would disable us to observe any dynamic in the relationship between the size of dwelling stock and the number of households. The application of the census household might also be problematic as the identification of the kinship relations is subjective and not under the proper definition (Lux *et al.*, 2004). Therefore housekeeping households may capture the actual situation on the demand side for housing stock best as an existence of more than one housekeeping household in a dwelling might point out tendency of those households for separation and corresponding future increase on the demand side of the housing market. As a result, both indicators express the relationship of the occupied dwellings to 1000 citizens without any adjustment and to the 100 housekeeping households, respectively.

The indicator of Dwellings per 1000 citizens depicted on the graph below experienced relatively stable growth over the observed period in all the regions of the Czech Republic. This phenomenon is to a large extent caused by the massive built-up during the communist era and by the population decrease between 1994-2004 (Poláková, 2006). However, when looking at the national averages in selected years that are presented by the coloured horizontal lines, we can notice that the growth dynamics of the indicator gradually slowed down. Within a regional comparison, only the Capital City of Prague, Plzeňský region, Ústecký region and Liberecký region reached indicator values at the level of or above the national average in all time periods. On the contrary, the lowest values can be observed for Zlínský region that had at the same time the most apparent 32% increase of the indicator during the observed period followed by

Figure 3.1: Dwellings per 1000 citizens

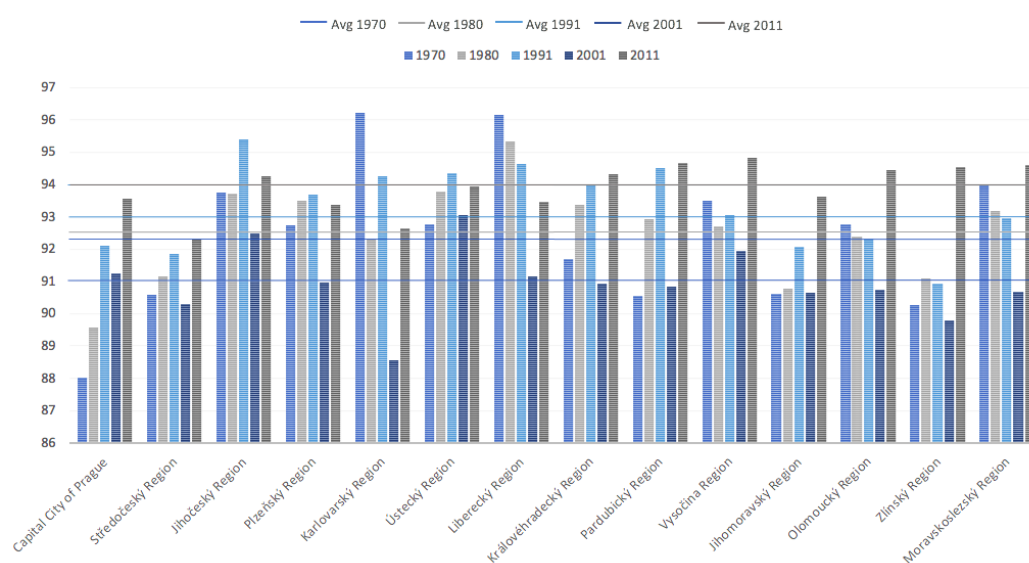


Ústecký region and Jihomoravský region with an increase of 30% and 27%, respectively. Quite surprising might be the outcome of the Capital City of Prague that stood out against all the other regions in the Czech Republic. Such a situation contradicts the general intuition that Prague has long been considered as one of the least accessible region in terms of housing. These positive results can be partly explained by the high share of apartment buildings in the territory of Prague, but may at the same time indicate that the indicator Dwellings per 1000 citizens is not the most suitable one for analysis of housing affordability.

Looking at the graph of the Dwellings per 100 households indicator, we may track completely different results that support our statement about the importance of input data selection. While the indicator of Dwellings per 1000 citizens reported an upsurge between any two observed periods, the values of Dwellings per 100 households differ significantly not only in the direction of the development but also in the size of the change. Especially between years 1991-2001 we can notice a decline in all the regions partially brought about by a considerably low increment of 62 063 finished dwellings in the period 1994-1997 that is approximately only a double of a yearly average increment after the Velvet Revolution. As a result, the national average reaches its bottom within the observed period.

Similarly to findings of Dwellings per 1000 citizens, the best results were on average recorded in Ústecký region and Liberecký region even though they ex-

Figure 3.2: Dwellings per 100 households



perienced the opposite trend trajectory. Furthermore, Ústecký region together with Jihočeský region and Vysočina region were the only three regions that achieved the national average in all periods.

Despite the most prominent growth between 1971-2011, the Capital City of Prague reports one of the lowest values of Dwellings per 100 households that reached national average only in year 2001. The second biggest percentage growth was recorded in Zlínský region, whereas the situation in 2011 compared to 1970 worsen only in Karlovarský region and Liberecký region. These findings completely contradict the outcome of the Dwellings per 1000 citizens indicator and provide us with a question, whether contribution on the demand side of housing market is better described by individuals or households. Such question will be an object of our interest in empirical analysis that will hopefully provide us with an answer, which of these two indicators depict reality better.

3.3 Financial affordability

The financial affordability is most frequently defined as the necessity to ensure a certain standard of housing at a price which does not, according to some third party (usually government), represent an unreasonable burden on households (MacLennan & Williams, 1990). Even though the retrieval of the corresponding price level might be quit problematic, the assessment of the financial affordability has gained in importance with the change of state housing support policy

after the Velvet Revolution. A termination of state housing construction and advantageous state loans put pressure on households and their ability to finance purchased properties as their savings usually did not meet the price of acquired real estate. This situation has contributed to the evolution of financial market and debt financing where building savings and mortgage loans have gradually emerged as key and the most used instruments designed to address the housing issue.

Building saving in the Czech Republic was established by Act No. 96/1993 Sb. following the German model and despite minor adjustments in 2004 and 2011, the basic principle has remained unchanged. It consists of an initial saving which, in addition to the interest on deposit, is supported by the state in the form of a regular financial contribution. After a certain period of saving, which is fixed in advance by contract and depends on an agreed target amount, the participant in the building saving is entitled to a loan up to the target amount, which is the sum of own deposits, interest on deposit, the state contribution and the building saving loan itself.

In contrast, the mortgage loan, which was created by Act No. 84/1995 Sb. and whose current form as a loan for anything subject to a real estate collateral was legally anchored in Act No. 190/2004 Sb., does not require any prior savings. However, even here restrictions in the form of recommended limits DTI, DSTI and LTV have gradually emerged. Both DTI and DSTI indicators introduced in 2018 relate to income as they express the relationship between the total debt of all applicant's loans and the amount of their net annual income and the percentage of all monthly repayments in relation to the net monthly income of the applicants, respectively. On the contrary, LTV indicator set in 2015 relates the total amount of the loan to the value of the mortgaged property, which is calculated on the basis of the bank's valuation.

Hence, the financial affordability of own housing including debt financing has become highly dependent on the level of housing prices and the level of income that projects to the maximum creditworthiness, ability to collect sufficient financial resources and to cover costs connected to acquirement of a property. For the purpose of financial affordability measurement, Lux & Kuda (2008) summarized three essential approaches: indicator approach, reference approach and residual approach. The indicator approach measures the burden of household's expenditures on housing in the form of a ratio of housing expenditures to the household's incomes. The reference approach evaluates financial affordability through the comparison to the situation in other parts of housing

market such as rental market or by the observation of affordability in relation to a certain group of households. Lastly, the residual approach examines so called residual income, which is the net income lowered by the housing expenditures and an amount of living minimum.

For the purpose of this thesis, we will apply the indicator approach out of which the most commonly used indicator for the financial affordability measurement, regularly employed by the Czech National Bank in their Financial Stability Reports, is so called price-to-income ratio (P/I). Generally, it expresses the number of annual salaries that are necessary for the purchase of a property or in other words, how many times are property prices higher than annual income of households or individuals. The higher the indicator is, the less financially accessible housing is and at the same time, low values indicate affordable housing. The advantage of P/I ratio is in its simplicity and ability to observe and compare different territorial units in different time periods without any methodological issues that may distort results. On the other hand, the usage of P/I ratio encounters troublesome determination of the level that would indicate the boundary between affordability and unaffordability.

Additionally, we may encounter with different definitions and applications of the indicator throughout the Czech literature. The CNB defines P/I as a ratio of the average transaction price of $68m^2$ dwelling to a moving average of a yearly income in a given year (CNB, 2013). The development of the indicator is published annually in the Financial Stability Report, where it appears in two irregularly alternating forms - for the Czech Republic excluding Prague and Prague separately or for the Czech Republic as a whole and for five selected cities. (Brno, Hradec Králové, Praha, Ústí nad Labem, Ostrava). Such a split disables us to adopt their results for the NUTS 3 regional comparison. The Ministry of Regional Development provides the P/I indicator only on a national level while distinguishing between existing properties and new properties when constructing the P/I indicator. Both cases utilize a number of average yearly net household income of a given year for which it is possible to buy a dwelling of $61m^2$ habitable area or a family house of $660m^3$ acreage. The prices of properties are then derived as an average transaction price from tax returns in a given year for existing properties and as an average price for which it would be possible to build similar real estate for new properties. Consequently, the P/I for new properties is expected to be biased downward as actual transaction prices are perceived to be higher than construction costs. In the commercial environment, we may find Deloitte Property Index that measures the multiple

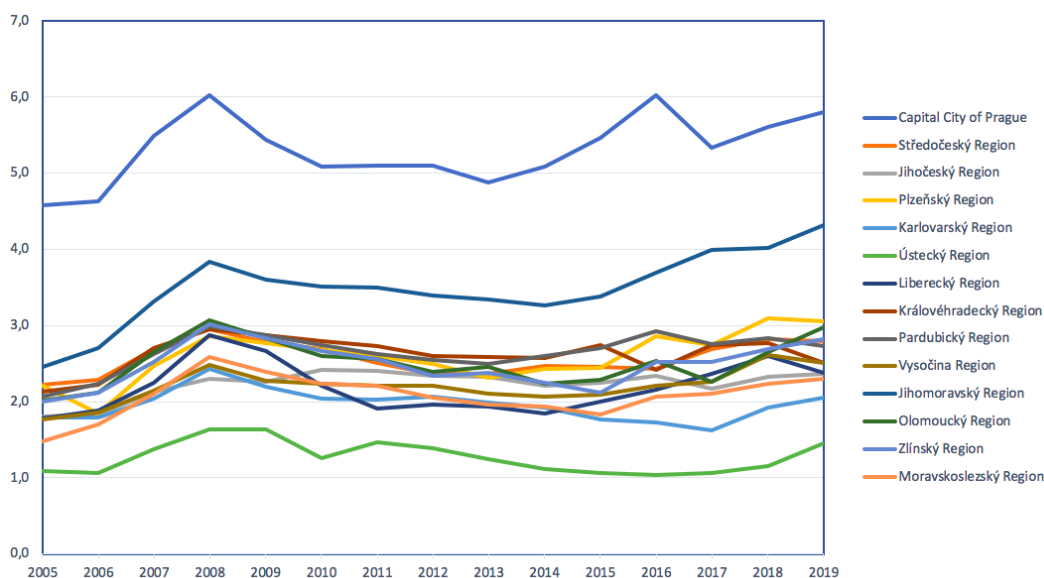
of annual gross salaries to purchase a $70m^2$ dwelling under average transaction price of a given year. Its main disadvantage is quite short time span as it has been published since 2012 and there is not sufficiently described methodology of the data that are collected by Deloitte offices in observed countries. Furthermore, it is calculated only on the national level which disables us to conduct any regional comparison but at the same time enables us to make an international comparison of 23 included countries in the Europe.

In this thesis, the income part of the P/I ratio will be represented by net disposable income per household as it is taken for the main factor influencing the ability of households to repay loans so that it at least partly captures the option of debt financing (CNB, 2004). These data are obtained by the division of total net disposable income of all households from the regional accounts of the CSO that are available for the period 1995-2019 and the number of house-keeping households per region from EU-SILC that has been conducted since 2005. The costs of purchased properties will be expressed by the transaction prices of real estate from the tax returns that are collected by the CSO and that cover wide range of property types such as flats, family houses, building plots or garages on a regional scale. Even though these prices might be slightly downward biased concerning possible tax evasion and inclusion of the information only about existing properties as new properties are not subject to tax returns, they are considered to be the closest approximation to the actual real estate market situation and its long-term development (CNB, 2017). Above that they are said to have the shortest time lag as they lead the development of other possible data sources like supply prices from CSO, supply prices from Institute of Regional Information etc (Hlaváček & Komárek, 2009). These regional data are obtained from the yearly publication Prices of selected types of real estate published by the CSO since 2000. According to the time span of all input data, we will present P/I ratio for the period 2005-2019.

As we are aware of the different heterogeneity between family houses and flats as well as of their possible different price dynamics and development over time, we will construct indicators of P/I for flats and for family houses, separately. Further, we will add the price of the building plot to the total average price of family houses as it is a common component of a family house purchase and its exclusion would underestimate the results. For the construction of average transaction price of both types of properties, we will refer to the methodology of the Institute of Regional Information (IRI) as their methodo-

logy is frequently applied in the Czech research papers². IRI labels as an average dwelling a flat of $68m^2$ acreage and a family house of $350m^2$ acreage with a building plot of $900m^2$. However, the average acreage of a sold building plot in observed period accounted for $430m^2$ with a median of $465m^2$ according to the data of CSO. Consequently, the acreage of a building plot for the purpose of average transaction price calculation will be adjusted to $450m^2$.

Figure 3.3: Price-to-income of flats



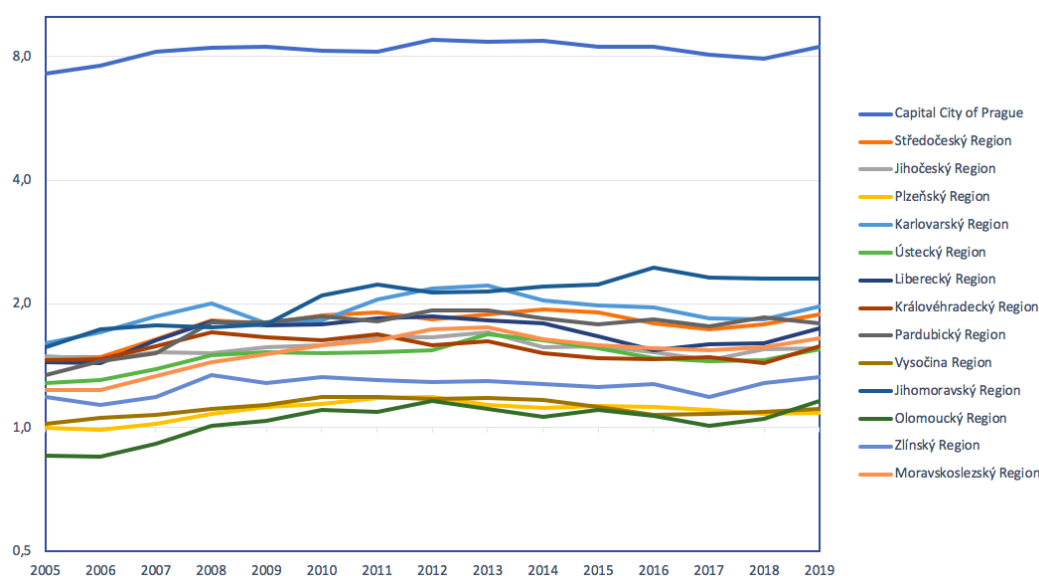
When comparing the two graphs, we can observe significantly greater dynamics of the P/I ratio for flats, where at the same time greater regional inequality is evident. Low regional differences together with minimal variability over time in P/I of family houses could pose a major obstacle to quality and reliability of the model in econometric analysis. Nevertheless, the indicator of both types of dwellings experiences overall growth over time with more considerable increase in case flats indicating greater deterioration of the financial affordability of flats compared to family houses. Slightly more financially affordable across the regions appears to be an average flat, for which the P/I reaches lower values compared to an average family house. This finding is consistent with the general intuition that living in family houses is a matter of primarily more creditworthy families.

For the P/I of flats, we can point out an upsurge between 2007-2008 followed by a drop that corresponds to the findings of a price bubble described in the second chapter of the thesis. A significant upward fluctuation of the value

²Sunega & Mikeszová (2008) or Hlaváček & Komárek (2009)

of P/I, recorded especially in the Capital City of Prague and partially followed by other regions, except for Ústecký and Karlovarský region, can be observed around 2016. The growth in P/I followed by a strong correction afterwards may indicate the presence of another price bubble as a reaction to record low interest rates on mortgage loans together with a pre-supply factor caused by expected introduction of DTI, DSTI and LTV limits. A decrease of the unemployment rate to the level close to the situation before the Global Financial Crises, 3% year-on-year growth in nominal wages or more that 30% growth rate in the volume of housing loans to households between 2013 and 2014 might also belong to contributors on the jump of P/I. However, such a phenomenon is not completely consistent across regions as the increase of indicator in Plzeňský, Liberecký, Jihomoravský, Zlínský, Moravskoslezský and Vysočina region has continued consistently even after 2016. Similarly to the results of Lux & Kuda (2008), the Capital City of Prague shows the highest values of P/I followed by the Jihomoravský region that seems to be slowly converging to the Capital City of Prague. The lowest values representing the best financial affordability of housing are then recorded in Ústecký and Zlínský region. Other regions are relatively comparable in terms of P/I of flats and disparities between them are not such evident.

Figure 3.4: Price-to-income of family houses with a building plot



The indicator results for family houses show only moderate fluctuation over time compared to the results for flats. At the same time, it is possible to observe certain clusters of regions in which housing affordability measured by P/I is

similar. The most affordable housing is located in the Plzeňský, Olomoucký and Vysočina regions. Satisfactory financial affordability can be observed also in the Zlínský region. The other regions show a similar trend of moderate overall growth, but the Středočeský region stands out in terms of the dynamics. This can be to some extent explained by the trend of moving from Prague flats to family houses in the proximity of Prague, which led to an increasing demand for building plots and construction work there, which was reflected in the subsequent increase in their prices. Similarly to the P/I of flats, multiply higher values of P/I are recorded in the Capital City of Prague, but the distance from other regions is much wider than in case of flats. This might be partly explained by extremely high prices of building plots in the center of Prague that contribute on the overall average prices of building plots in Prague which are, compared to the national average throughout the observed period, more than five times higher.

Chapter 4

Empirical analysis

4.1 Data selection

4.1.1 Supply factors

The supply of real estate is predominantly determined by the costs of construction that directly influence decision-making and willingness of developers to build. As their main objective is to maximize return on investment, an increase in construction activity is expected in the situation with low construction costs and high market prices of real estate. To capture the overall costs of construction analytically, we will apply *Construction works 'S' by place of construction per capita* that, according to CSO methodology, displays costs of material used together with worker's wages for construction firms with 20+ employees. It is said by Hlaváček & Komárek (2009) to be a great proxy for the supply side of the housing market that affects the price of the real estate with a lag. Construction works can be seen as an appropriate indicator of current supply-side activity, which may display into future housing affordability both positively through higher worker's wages and negatively through growth in property prices associated with higher construction costs. Appropriateness of its lagged version inclusion along with the determination of its estimator's sign will be a subtask for the analysis.

To capture the dynamics of current supply, Hlaváček & Komárek (2009) suggest to apply *Number of finished dwellings* per 1000 inhabitants. Even though their study did not succeed to confirm its significance arguing probable opposite direction of the causality, the relevance of its inclusion to the model may be supported by the significance of its static version Number of dwellings per 1000 citizens in their following publications from 2010 and 2011

or by its observed high variability across regions according to the results of Sunega *et al.* (2009). Its increase with a subsequent expansion of the supply is expected to positively affect housing affordability resulting in a negative sign of its estimator.

One should also consider inclusion of the *Prices of building plots* that are perceived as essential part of total costs in terms of family houses acquisition or developer's total costs of construction. However, they are pretty much correlated with price growth of dwellings and there is a substantial risk of potential endogeneity inflicted by unknown causality with apartment prices (Hlaváček & Komárek, 2009). Moreover, as we decided to include them in the P/I ratio of family houses concerning the advice from Čadil (2009), it does not make sense to add them into the model.

4.1.2 Demand factors

The demand side of the housing market is predominantly made up of the *Number of households* seeking to meet their housing needs. Declining number of occupants per dwelling as well as reduction in the size of households lead to a relatively faster increase of the number of households compared to population growth, which may result in greater pressure on aggregate demand on housing market pushing up housing prices and worsening housing affordability.

Another factor contributing to the overall demand for own housing is population growth, which, according to Hlaváček & Komárek (2011), should be further differentiated into *Natural increase* and *Net migration*. Although both components of population growth should increase the demand for real estate, push the price upward and thus reduce housing affordability, the magnitude of the effect of natural increase is expected to be considerably smaller than the size of the effect of net migration, since new births usually born to already existing households. Consequently, merely some cases of new birth of an offspring lead to the formation of a new household or decision of households to substitute rental housing for housing ownership. On the other hand, net migration relates to the entrance of new households on a regional market that directly projects in an upsurge on the housing market demand side. Positive values of net migration may also to some extent suggest an attractiveness and economic strength of individual regions as improved income situation is considered as one of the main incentives of migration (Dickey, 2014). Therefore,

its effect on housing affordability is expected to be strongly negative following the results of Hlaváček & Komárek (2010) or Dubská (2009).

Demand factors can also incorporate the age structure of the population, with the economically active part of the population being the group that addresses its housing needs and thus contributes to the overall demand for own housing. The higher the share of economically active, the higher the pressure on housing prices causing a drop in housing affordability. Within the relevant Czech literature, one should find the Share of population 20-34 years old and the Share of population with the age of 65+ to be the representatives of the age structure of the population in the paper by Mikeszová *et al.* (2009) where only significance of the latter one on housing prices was proven indicating indirect importance of the economically active sub-population for housing affordability. Inclusion of the Share of population 20-39 can be further observed in the paper from Čadil (2009) who determined significance of its first-difference logarithmic form and who estimated its contribution of 10% to the flat prices development and of 11% to the family houses price development. Consequently, we will take into account for further analysis the *Share of population 20-39* as a representative of the sub-population that will most likely attempt to satisfy its own housing needs together with a *Share of population 15-64* as a proxy to economically active sub-population.

The final demographic factor that we will consider in relation to housing demand is marital status. Here, we will be particularly interested in indicators of *Marriage rate* and *Divorce rate* that follow the CSO methodology and describe the number of demographic events in relation to 1000 inhabitants of each region. Marriage and divorce rates are expected to project negatively to housing affordability as it is assumed that marriage creates an entirely new household and divorce splits an existing household into two separate units resulting in an increase in housing demand. However, amongst the literature reviewed by the author, only divorce rate reached the statistical significance at 10% level in the paper of Hlaváček & Komárek (2010) who explained the insignificance of the marriage rate by the fact that new marriages occur mainly when the household has already resolved their housing needs.

Household income is, in addition to already described demand factors, a key determinant for housing affordability. In relation to household income, educational attainment is of crucial importance as it is considered to be the leading determinant explaining roughly 30 % of income variability (Jurajda, 2005). The increasing importance of education on household income has subsequently

been confirmed by Večerník (2013), who investigated relationship of experience, education, gender and household structure on wages between 1988-2009. The effect of education on household income was also documented by Hlaváček & Komárek (2009) who emphasized its direct influence or by the Mikeszová *et al.* (2009) who found the *Share of population 15+ with university degree* to be a significant determinant of own housing affordability that is expected to project positively, i.e. with a negative sign of its estimator.

4.1.3 Labour market factors

Another factor that is considered as a direct determinant of household income is the *Unemployment rate* that can be related to household income through the Phillips curve. Phillips curve describes the inverse relationship between the unemployment rate and the inflation rate that projects to the rise of wages. Its validity for the case of Czech republic was confirmed in the paper from Sepu-tiene (2011) who analysed the relationship between wages and unemployment in the European Union on the data between 2000-2010. From the perspective of Czech regions, the relevance of unemployment rate to the financial affordability of own housing has been confirmed by Mikeszová *et al.* (2009).

The unemployment rate together with number of *Job vacancies* per 1000 citizens describe the labour market factors. Compared to the unemployment rate, the number of job vacancies is applied less frequently in the Czech literature and its effect on household income is less significant. Such a smaller effect is explained by Hlaváček & Komárek (2009) through lower labour mobility across regions in the Czech Republic as free job positions are often solved by recruiting foreign workers whose interest in real estate ownership is negligible. Job vacancies relevance is observed only in the last years of the period 1998-2008 in their study, so the confirmation or refusal of its relevance may be a sub-objective of our analysis.

4.1.4 Financial factors

As a descriptive statistic to economic performance and financial wealth, we may stick to the study of Sunega & Mikeszová (2008) who used as a proxy *GDP per capita*. However, they were not able to prove its cognation to housing affordability. The same is not true for Égert & Mihaljek (2007), who concluded that GDP per capita is a strong upward determinant of housing prices. That can be described by positive relation between GDP per capita

growth and periods of prosperity with positive household expectations that enhance the willingness of households to borrow and make commitments. On the other hand, labour productivity that might be proxied by the GDP per capita was found by Nikulin (2015) to be positively correlated also with wages according to her analysis conducted for six EU member countries including Czech republic. Consequently, the direction of the effect of GDP per capita on housing affordability is subject to further analysis.

As the purchase of a property is associated with significant financial costs, which frequently exceed household savings, the accessibility to debt financing is crucial for the affordability of home ownership. Several foreign studies such as Égert & Mihaljek (2007), who did so through dynamic panel regressions on CEE data, confirmed the positive effect of interest rate on housing loans and the negative effect of housing loans volume on housing affordability. In the Czech research, the statistical significance of these factors was not confirmed until the paper from Hlaváček & Komárek (2010). In their previous study from 2009, they mentioned the exponential nature of mortgage volume development between 2002-2008 as main obstacle for the verification of its importance for the housing affordability. For the purpose of this theses, we will utilize purely *Mortgage loan volume* as it is the only source of housing loans for which data are available on regional scale.

Except for the discussion of theoretical appropriates of selected variables, we will take a look at a few general statistics as we aim to include in the model only those variables that have sufficient variability over time and across regions in order to be able to explain desired differences in housing affordability across regions. Variability of the data was measured by a percentage of standard deviation to its time-relevant mean and the results are presented in the table below, where EYP represents end-of-year population and where names some of the variables are presented in their abbreviate form. Last two columns of the table display regions that most frequently reached the lowest and the highest values within selected variables in each year of the observation, respectively.

Variable	Unit	Variab. across regions	Variab. over time	Minimum across regions	Maximum across regions
Construction works	1000 CZK	32%	16%	Liberecký	Prague
Number of finished dwellings	1000 citizens	37%	22%	Moravskoslezský	Středočeský
Natural population growth	% of EYP	636%	849%	Moravskoslezský	Středočeský
Net Migration	% of EYP	312%	235%	Moravskoslezský	Středočeský
Share of population 15-64	% of EYP	1%	4%	Královéhradecký	Prague
Share of population 15-39	% of EYP	2%	7%	Ústecký	Prague
Share of university degree	% of EYP	37%	22%	Královéhradecký	Prague
Number of households	number	45%	3%	Karlovarský	Prague
Marriage rate	1000 citizens	4%	9%	Ústecký	Prague
Divorce rate	1000 citizens	9%	11%	Vysočina	Karlovarský
Unemployment rate	%	33%	36%	Prague	Ústecký
Job vacancies	1000 citizens	38%	83%	Moravskoslezský	Prague
GDP per capita	1000 CZK	40%	14%	Karlovarský	Prague
Volume of mortgage loans	1000 citizens	108%	35%	Středočeský	Prague

Table 4.1: Preliminary statistics of selected variables

The results in Table 4.1 show very low variability of Share of population 15-64 and Share of population 20-39 across regions and over time, suggesting their weak explanatory power for the purpose of our analysis. Similar conclusions can be drawn in case of marital status indicators, where the variability across regions, which is crucial for assessing inequalities in housing affordability, reports low values for both Marriage rate and Divorce rate. Consequently, we exclude these indicators from the subsequent regression analysis. In addition to the findings concerning the variability of the variables, we can observe a dominant position of the Capital City of Prague, which reaches the highest values in nine out of fourteen variables, while its lowest value reported for the unemployment rate can also be considered positively. On the contrary, the lowest values across the regions can be repeatedly observed in the Ústecký, Moravskoslezský and Karlovarský region. Similar results are also obtained for the indicator Price-to-income of flats, which could to some extent intimate the appropriateness of the choice of selected variables in relation to the affordability of flats.

4.2 Model specification

For the econometric analysis, we rely on a panel of size 14 in cross-section and 15 in time-series that is formed by 14 regions of the Czech republic in

cross-section and years 2005-2019 in time-series. As an explained variable, P/I as a proxy of owner-occupied housing affordability will be set with the aim to explicate its development by the reduced number set of 10 out of 14 explanatory that are listed in Table 4.1. Even though we attempt to apply as many explanatory variables as possible, the risk of omitted variable bias is still present as the task we deal with is fairly complex. One should be aware of the analytically immeasurable constant effects that predetermine position of a region, perception of households in the context of housing needs solution or that might be correlated with selected explanatory variables.

Therefore, to control for the risk of omitted variables and related unobserved heterogeneity, First-difference model (FD) that "difference away" the unobserved effect was selected over other models with similar property. Firstly, we successfully rejected the null hypothesis of Hausman test¹ indicating preference of Random-effect model (RE) over Fixed-effect model (FE). Thereafter, selection over Fixed-effect model (FE) was verified by Wooldridge first-difference based test for AR(1) errors² that does not rely on large T-asymptotics and is therefore suitable for our small size of panels. Two specifications of the test for both FE and FD models were applied suggesting presence of serial correlation in idiosyncratic errors in the model in levels and no presence of serial correlation in the FD errors on standard level of significance, respectively. Such evidence led to the selection of FD model over FE model as FD is more efficient than FE when serial correlation in idiosyncratic errors in levels is present (Stock, 2011). Furthermore, with the utilisation of FD model, we also controlled for possible presence of serial correlation. General expression of the model is provided below:

$$\Delta Y_{it} = \delta_0 + \beta_1 \Delta X_{it} + \dots + \beta_k \Delta X_{it} + \Delta u_{it} \quad I = 1 \dots, N; t = 1 \dots, T$$

where u_{it} represents idiosyncratic error, δ_0 corresponds to intercept and $\Delta X_{it} = X_{it} - X_{i(t-1)}$ will be in further expressions of models replaced by "fd".

Once the model has been selected on the basis of the results of tests described in previous paragraph, unit root tests were applied to check stability of the data as potential non-stationarity may lead to wrong estimation of relationship between variables resulting in a distortion of R^2 . When selecting appropriate

¹For the results, see Appendix A

²For the results, see Appendix B

tests, we have to take into account their reliability on short panels. Therefore, Im-Pesaran-Shin (2003) unit root test that requires autoregressive processes in panels and allows for heterogeneity as well as serial correlation in residuals was applied. It tests presence of unit root in all regions under the null hypothesis with the alternative that allows presence of unit root in some of the regions. Its selection is based on a great performance over small samples with $T \in \{10, 15\}$ according to Im *et al.* (2003). Additionally, Levin, Lin and Chu (2002) test was selected. Under the null hypothesis, a unit root in all cross-sections is tested against the alternative that at least one cross-section is stationary. Even though it is suggested to be well-performing for datasets of size between 10 and 250 in cross section and 25 to 250 in time series, it is said by Hlouskova & Wagner (2006) to be overperforming Im-Pesaran-Shin for $T \geq 15$, which is at the edge of the size of our dataset. According to the results of both test from Appendix B and C, we can reject the null hypothesis of the presence of unit root at 1% level of significance. Furthermore, statistics of individual variables did not provide us with an evidence that any variable is subject to unit-root.

Next, one should be aware of strict exogeneity as highly restrictive assumption that is crucial for unbiasedness of estimators. To control for its validity at least partially, we may add lags of variables suspected from possible endogeneity or detrend these variables. Since the first option would involve the inclusion of a large number of lagged variables that will considerably decrease our data set in the size of time series, removing the trend seems to be more appropriate solution. Looking at the data, variables of the Share of population 15+ with university degree (`pop_degree`), Number of households (`households`) and GDP per capita (`GDP`) seem to be subject to trend and were therefore detrended such that the linear trend from each of the variable was removed. Afterwards, lagged variables of `const_work`, `mortgage_vol`, `mortgage_num` were added into the models in order to capture their potential projection to housing affordability with a delay.

Finally, it was tested for potential presence of the heteroskedasticity with the use of Breusch-Pagan test (BP). While there was not enough evidence to reject the null hypothesis of homoskedasticity in the model for flats, the same was not true in case of family houses. Except for the presence of heteroskedasticity that biases standard errors of estimates and consequently also statistical inference, all models for family houses with a building plot recorded very low explanatory power in terms of R^2 . Such evidence proved our concerns of P/I

ratio not being suitable explained variable for analysis of determinants of regional disparities in affordability of family houses based on its low regional differences and minimal variability over time. Therefore, only the final model for identification of determinants of regional disparities in affordability of flats is presented below and its results will be discussed.

$$\begin{aligned}
 fd_afford_flat_{it} = & \delta_0 + \beta_1 fd_const_work_{it} + \beta_2 fd_lag1_const_work_{it} \\
 & + \beta_3 fd_fin_dwellings_{it} + \beta_4 fd_pop_growth_{it} \\
 & + \beta_5 fd_net_mig_{it} + \beta_6 fd_dt_pop_degree_{it} \\
 & + \beta_7 fd_dt_households_{it} + \beta_8 fd_unemp_{it} \\
 & + \beta_9 fd_job_vac_{it} + \beta_{10} fd_dt_gdp_{it} \\
 & + \beta_{11} fd_mortgage_num_{it} + \beta_{12} fd_lag1_mortgage_num_{it} \\
 & + \Delta u_{it}
 \end{aligned}$$

4.3 Results

Before discussing the results of the housing affordability model itself, it should be noted that despite the expansion of the size of the dataset in time series dimension, we are still working with a small dataset and therefore the results should be taken with some caution.

Looking at the overall performance of the model, we managed to explain roughly 40 % of the variability of the dependent variable. Overall, six of twelve variables appeared to be statistical significant at least on the 5% level. There is only one variable, *fin_dwellings*, whose direction is in contradiction with our expectations and economic theory.

From the perspective of estimates for individual variables, we succeeded to confirm significance of the *const_work*. Furthermore, even its lagged variable is reported as significant that enables us to support the Hlaváček & Komárek (2009) statement that it makes sense to include the variable in the regression in lagged form. Looking at the direction of the effect, growth in construction works projects to an increase of P/I and thus to corresponding decrease in affordability of flats. Retrieved sign of the effect allows us to answer to one of our subtask addressed in the thesis that subsequent increase in price of flats overweight growth in wages of construction workers. Such evidence is quite intuitive as while only a small fraction of people profit from growth in wages

on construction works, an increase in construction costs projects to prices of all flats.

Out of the supply factors, *fin_dwelligs* appeared to be significant as well which goes in hand with Mikeszová *et al.* (2009) who proved its participation on regional disparities in affordability of flats. Its significance may suggest that indicators of physical availability might hold some explanatory power. However, as neither number of households nor population growth or net migration are amongst significant variables, we are not able to provide an answer whether indicator of Number of dwellings per 100 households or Number of dwellings per 1000 citizens is more reliable. Quite surprising might be the direction of the effect that does not meet our expectations. Possible answer can be provided by its interconnection to prices of flats as higher prices may motivate developers to build more with the belief in higher subsequent profits.

Both labour market factors proved their significance. While the significance of *unemp* corresponds to results of most of the papers such as Hlaváček & Komárek (2010) or Mikeszová *et al.* (2009), the same is not true for *job_vac*. Notable increasing significance of Job vacancy on housing prices was mentioned by Hlaváček & Komárek (2009), however, its statistical significance was not to the author's best knowledge empirically validated yet. Both variables show positive effect on affordability of flats as their increase results in a decline in dependent variable P/I. Nevertheless, quite interesting might be higher size of the effect of Job vacancies compared to Unemployment rate. This phenomenon might be explained by lower effect of unemployment on wages through wage curve than is the willingness of employers to increase financial rewards to attract labour force on job positions for which they are unable to find relevant employees.

As a main contribution of the thesis to existing literature, we successfully proved significance of *mortgage_vol* on 1% level making Mortgage volume to be the strongest determinant of regional disparities in affordability of flats across the model in terms of its significance level. The higher the volume of mortgages in a given region is, the higher the prices of flats are expected to rise in the future as the lagged variable is the one that is significant. The significance of lagged variable may be explained by slow reaction of flat prices to situation on financial market. However, unlagged version of the variable is not far from being labelled as significant, too. Furthermore, such a strong significance indicates that it would make sense to add more lags into regression as the volume may project to the housing affordability even with higher delay.

Unfortunately, small size of our panels does not give us a space to do so making space for future improvements of our research.

Chapter 5

Conclusion

The aim of this thesis was to investigate the availability of owner-occupied housing across the regions of the Czech Republic. This was done sequentially using three approaches. Firstly, indicators Number of dwellings per 1000 citizens and Number of dwellings per 100 households assessing the physical availability of housing were constructed. Their varying results confirmed the importance in the choice of input data in relation to subsequent results. Next, the financial affordability price-to-income ratio indicator was calculated separately for the average flat and the average family house with a building plot. The results of the P/I ratio outlined a markedly different dynamics of housing affordability development between flats and houses with the dominance of Prague as the region with the least affordable housing in both cases. Possible presence of another price bubble around 2016 was also identified.

The empirical part of the paper focused on identifying the determinants of disparities in housing affordability across regions. Therefore, only those variables that exhibited sufficient variation across regions were selected as explanatory variables in the first-differences model. The lack of variability in the P/I of houses caused inability to construct reliable model for affordability of family houses. The model for flats was able to confirm the significance of debt financing in relation to the disparities in housing affordability through the lagged variable of mortgage volume. In addition, the number of finished dwellings, the volume of construction works in both the lagged and unlagged specification and finally the unemployment rate together with the number of job vacancies proved to be significant determinants of housing affordability inequalities of flats across regions of the Czech Republic.

As a possible extension of the research, assuming availability of longer time

series, another levels of lagged variables could be included to examine potential significance of higher degrees of lagged variables. Further thought could be given to selecting a different proxy for housing affordability of family houses that would hold more variability over time and that would also help to create a more reliable model for family houses. Finally, an analysis of the indicated potential presence of a price bubble in 2016 could be conducted.

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