SPATIAL DEVELOPMENT OF RESIDENTIAL MARKET IN BRATISLAVA REGION

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Spatial development of residential market in Bratislava region

The real estate market operates in a highly dynamic environment consisting of competing locations, substantially affecting their morphological, functional and social structure within urban regions. Housing submarkets arise typically on the residential real estate market from the interplay between house unit price segmentation, reflecting varying scale and structure of demand by households, and feedback of supply providing housing units of different size in specific local mixture. The question addressed in this paper is if price variation along the housing cycle, the existing settlement structure, and physical qualities of competing locations systematically influence development of different size-segments. We assume that spatial differentiation exists if significant construction of large units occurs in the most desirable, green and accessible locations. The statistical model is applied in the Bratislava self-governing region. A panel of completed housing unit counts indicates that the price variation accompanying the housing cycle interacts with the settlement structure and environment, indirectly implying an ongoing spatial stratification process.

Key words: elasticity, housing, residential market, stratification, Bratislava region

INTRODUCTION

Housing demand generated by households in either rental or owner-occupied sector, sends signals to the real estate market. New residential developments are activated or inhibited. New development also depends on the vacancy rate[1] in the existing housing stock. Demand is typically related to demographic and economic conditions. Households of different size, age composition and income level tend to require housing of different quality. Households can be substantially different in terms of their lifestyles, expected amenities, in acceptable walking or driving distance, and overall sensitivity to the surrounding environment. Preferences and resources available for fulfilling of these preferences set benchmarks for ongoing spatial competition. The competition leads towards the specific nature of local market equilibrium[2].

Patterns in spatiotemporal and structural variability in housing supply potentially reflect the nature of demand undergoing changes. Decisions concerning the location and quality of housing, including size, especially in the owner-occupied sector,

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[1] Vacancy rate is the share of unoccupied units in a pool of properties. It is the opposite of occupancy rate. High vacancy rate indicates that the available properties are not selling or renting fast enough to sustain current development intensity. It is important to remind that in addition to providing housing, owner-occupancy functions as an investment.

[2] Market equilibrium is a situation, in which supply in the market is equal to demand. The equilibrium price is the price of a property in this situation.

are strategic[3], typically requiring a long-term perspective of buyers. Use of financing instruments, on which most of buyers depend, is pushing towards utility-maximizing behavior[4] and at the same time is setting strict limits linked with current and expected income level. Therefore, a focus on housing construction process opens an implicit research path towards local economic status of residents in the owner-occupied sector.

Real estate market and economic context, in which the market operates, have unique dynamic features. One of the most outstanding examples of young real estate markets in global scale can be currently found on the transition trajectory of the EU-accession countries in the Eastern Europe (Bertaud and Renaud 1997 and Stephens 2003). Planning practice and redistribution mechanisms effectively brought cities in this part of the world to a more homogeneous pattern contrasting with typical market-developed highly stratified urban regions. Five of these countries have accessed the Eurozone indicating to some extent advanced institutional transition stage to date: Estonia, Latvia, Lithuania, Slovakia and Slovenia. A common sign in all of these regional economies is a strong polarization in the regional structure (Sokol 2001, Heidenreich 2003 and Stenning and Hörschelmann 2008). The most developed housing markets can be found in their capital city regions. Housing has been gradually transformed into a subject of market forces considerably faster than in the periphery. Price liberalization and participation in the network of global capital flows have simultaneously led to fast development of income inequalities (Bandelj and Mahutga 2010). Along with the change in conditions in these economies growing role of market forces in influencing behavior in housing market segments is anticipated[5].

The urban studies in European transitive societies have predominantly taken a theorizing approach, performing an ambitious overlay of various perspectives on changing societies and their spatial footprints, not necessarily sharing compatible philosophical theoretical perspectives, such as environmentalism, positivism[6], behaviouralism, humanism, managerialism, structuralism, postmodernism, transnationalism, postcolonialism, and moral philosophy, as summarized in Pacione (2009). Our paper is intentionally taking a complementary approach to an established mainstream discourse, placing the economic process in the center of analytical strategy, which is not common in geographical research anymore. We believe this distinction brings a useful reflection to mainstream discourse and even more, opens a new opportunity, linking urban studies community with currently trending self-reflection of technologically fast advancing society – heavily and irreversibly in need to correctly understand its data.

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[3] Difference between investment and owner-occupied property depends on practical plans of buyer. If a property is intended to be used for own living, the decision-making pattern differs from when it is intended for renting, serving the purpose of investment.

[4] Utility is a concept measuring preferences satisfying the consumer of a service provided by the specific property, a measurable economic choice. Utility is revealed indirectly, in different amounts paid for different properties.

[5] Sassen (2010, p. 3) predicts that „as we enter a new century, the city is once again emerging as a strategic site for understanding some of the major new trends reconfiguring the social order. The city and the metropolitan region emerge as one of the strategic sites where major macro-social trends materialize,". She also adds that „among these trends (is) the strengthening presence and voice of specific types of socio-cultural diversity".

[6] Our strategy is taking a positivist perspective with elements of environmentalism and behaviouralism.

Differentiation of unit land plot prices, depending on their location, has created prerequisites for spatial stratification through allocation of different house unit size categories and their specific local mixture. Usual sorting dimensions include center-periphery gradient of unit house price value, preference of accessible amenities, and differentiation between local environmental conditions. Changes have also been seen in differentiation of existing housing stock. Especially, gentrifying historical neighborhoods with unique architecture and street plans have naturally reached a prominent status, enabling home owners to earn a certain kind of distinction from the masses inhabiting socialist housing estates. The connection between income inequality and spatial differentiation through housing construction is expected to be dependent upon various factors, which include scale of the city, its economic base, housing market situation, and natural settings responsible for the more or less scarcity of desirable locations (Sýkora and Bouzarovski 2012, Golubchikov et al. 2013 and Marcińczak et al. 2013).

The main purpose of this paper is to explore spatiotemporal footprints of housing construction and implicit linkage between housing markets and differentiating social landscape. Primarily, we focus on the housing construction reacting to variation of demand through the house prices, together, shifting the market equilibrium along the 11-year cycle[7]. Secondly, we address the research question: Does price variation along the housing cycle, the existing settlement structure, and physical qualities of competing locations systematically influence development of different size-segments? We show that the distribution and timing of housing construction in size-segments along the structural and environmental dimensions indicate spatial sorting of places according to economic status, potentially creating a new pattern of urban social landscape. A statistical model will be constructed for the case study in the Bratislava region, Slovakia.

SPATIAL HOUSING SUBMARKETS

Spatial differentiation of urban housing market may lead to appearance of housing submarkets. The concept of housing submarket has been introduced by Grigsby (1963) as a group of dwellings, which represent relatively close market substitutes. Partitioning of housing stock into submarkets has been later included in the access-space framework, and hedonic price studies (Jones et al. 2004). Typical social dimension focused by studies of spatial sorting in the urban context is ethnic. Considerably less attention is dedicated to segmentation by economic status. At the same time, economic dimension of systematic spatial sorting, recognition of heterogeneous zones has early and continuous presence in literature recently articulated also as housing submarkets (Goodman and Thibodeau 1998, Watkins 2001, Bourassa et al. 2003, Wu and Sharma 2012 and Leishman et al. 2013). Based on affordability, submarkets with a specific mixture of housing stock have been found positively correlated with the average price-level (Ben-Shahar and Warszawski 2015), although this was not the case historically or in public sector (Robinson et al. 1985).

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[7] A cycle is a sequence of repeated events on the market, translated into price and rent fluctuation and resulting vacancy. Physical property cycle between housing demand and supply determines vacancy and rents. Financial property cycle introduces an interplay between capital and prices, linking microscopic local situation with global economic conditions.

Among the earliest formulations is the one in Kohl (1841), who described tendencies among urban territories to segregate between those occupied by the elite in the central part and occupied by the poor in the periphery. Households decide upon their location across urban space according to a specific trade-off between living space and accessibility of economic interactions, namely employment and amenities typically concentrated in city centers, while competing[8] for the most accessible and affordable land at their corresponding status. Brown and Hincks (2008) explain why and how the migration should be used as the defining feature in the delineation of the housing market area. According to the concentric zone model, distance to the central city is the most influential variable differentiating amount of land physically available for development in certain accessibility category. Low-income households and high-income households differ in motives. While former aspire to *escape* from worse conditions, later are motivated to *restrict* access to their land. In the same time, the former's choice is significantly narrowed by commuting expenses.

Both of these motivations indirectly relate to the subject of interaction within and between different income categories among households. The literature offers empirical evidence of mutual influence between the economic status of residents and neighborhoods, in which social interactions unfold. Brueckner and Rosenthal (2009) identify the age of housing stock to significantly correlate with the economic status of residents. Correlation explains the transition between preference for suburban and inner-city neighbourhoods. Guerrieri et al. (2013) assume the existence of positive externality in preference of comparatively rich neighbours, possibly because of lower crime rate, better schools, and neighbourhood amenities. Specifically, the immigrant neighbourhoods are evaluated by Scarpa (2015). Instead of economic housing segregation as resulting from free location choice, case studies indicate that we only observe the outcome of substantially wider processes creating inequality. Tensions from status inequalities across urban regions have naturally been among the key questions addressed by local governments everywhere they cross a line of social acceptability. Jones et al. (2012) see housing market areas as a cornerstone of spatial planning, which is reviewed in detail across the United Kingdom.

Based on another review of related research, Cheshire (2012) criticizes urban policies oriented towards artificially increasing social mixture, treating the symptoms instead of the true causes. Sharkey and Faber (2014) question even traditional focus on single directed neighborhood effect. Clark et al. (2014) describe and explore a more complete picture of social mobility, concluding that the influences combine individual with contextual factors. Housing market, in particular the market institutional setting, are pointed at as a highly important channel. Corresponding to that finding, Andersson and Turner (2014) present a case study of economic segregation in consequence of conversion between public rental and market housing. Gentrification of the inner city and residualization of non-converted suburban parts appear to be manifestations of the same process. Kadi (2015) discusses the transformation of housing into a commodity as weakening decommodified residen-

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[8] Bid rent effects were originally developed in non-urban agricultural context: D. Ricardo, who defines rent on the most productive land based on advantage over the least productive; J. H. von Thünen, who adds the notion of transport costs; and the concentric land-use structure in urban context introduced by W. Alonso.

tial environment, such as the one healing from socialism in our case. Instead of segregation, dualization is recognized among low-income households, part of which remains left out of the actual market.

Market house price is a complex endogenous variable combining unit price and house size, which allows households to substitute housing for other expenses. Theoretically, households purchase more housing as they move away from the central city towards the periphery. Controlling for other variables, size is expected to increase even without income differences between households (Abelson et al. 2013). Following the hedonic price studies, market price combines at least two separate groups of price-segments. These include structural house characteristics, the first of which is its size, and quality of environment, one of which is accessibility. Both groups are expected to interact. Concerning temporal heterogeneity of the unfolding market situation, we add third, cyclical dynamics, also expected to interact with former two.

Accessibility

The main purpose of existence of urban structures is human interaction. Clustering of interactions, either on labour market or retail market, exchanging goods and services, has found its way into the explanatory models of spatial heterogeneity. Household members typically commute to interact with others, either through selling of their labour to employers, or use retail centers for providing of goods and services. An umbrella term, network accessibility also used by Xiao et al. (2015), includes two variables, distance from the central city, and population size of the local settlement approximating scale of local interaction potential. Accessibility allows for a variety of spatial scales, across which the impact on property prices can be expected. The combination of the two reflects the hierarchy in the local settlement structure concentrating employment and amenities in a polycentric urban setting, the roots of which are being identified in evolution dynamics (Broitman and Czamanski 2015).

Quality of local environment

Locations equal in accessibility of interactions can substantially differ in physical qualities affecting overall desirability. To some extent, attractiveness of certain environmental qualities is subjective. But in the same time, landscape openness, presence of natural elements including trees, water or clean air (Chay and Greenstone 2005) appears to be valued consistently throughout history of urbanization. Kuminoff et al. (2010), Panduro and Veie (2013) document evidence of the varying positive effect of trees and grass areas on house prices. Tyrväinen and Miettinen (2000) find a 5.9% decline in price per kilometer increase in the distance to the nearest forested area, and an additional effect of view onto forests – with similar characteristics otherwise. The limited spatial reach of the effect is also supported by a study of Sander et al. (2010), in which tree cover beyond 250 meters has no significant contribution to market value. Theoretically, unit values should be translated in market segmentation, allowing development of larger houses in less desirable locations, and vice versa. Any diversion in the development of housing size-segments indicates inequality among locating households, and spatial sorting between developing high-status and developing low-status places. Physical conditions in Bratislava region offer a unique opportunity to test for the existence and size of similar variable effect on the residential market. The slopes of the Malé

Karpaty Mountains, covered by forest land in contrast with surrounding agricultural lowland sharply differentiate all distances between the very central city and furthest suburban villages at the edge of administrative territory.

Cyclical dynamics of housing market

The endogenous nature of housing cycle has been explored and well documented. Driven mostly by expectations of buyers concerning the future value of properties, it is a variable setting the complex urban structure in motion, irregularly distributing opportunity of change in time, concentrating in periods of higher construction activity. Exogenous effects expanding or shrinking demand can additionally send the market on an upward trajectory or slow-down the activity (Novy-Marx 2009), including namely demographics (Mankiw and Weil 1989) and changing composition of buyers over the housing cycle phases (Zabel 2015).

LOCAL HOUSING MARKETS IN POST-SOCIALIST CONTEXT

Privatization processes, price liberalization and development of newly-created institutional structures, enabling the operation of financing mechanism, created a real estate market, replacing previous institutional settings (Reiner and Strong 1995 and Pichler-Milanovich 2001). Spatial redistribution of various population groups has been gradual and rather slow. Speed of change has limits given by historical legacies, such as the existing built environment, the government's policy targets or other inertia effects (Marcińczak et al. 2015). Ruoppila and Kährik (2003) question straightforward connections between residential mobility and increasing differentiation.

Prior to the end of socialism, real estate market practically did not exist in the Central and Eastern Europe. The actual costs of housing in this environment were not reflected in rents and formal prices. The losses to the economies resulting from this approach were vast. The situation started to drift significantly after the change of political regime. Ongoing construction of public apartments was stopped and only a few projects in progress were completed. Supply outage forcefully affected society used to chronic shortage and created a serious disequilibrium without any market mechanisms on hand for correction. Halás and Džupinová (2007) offer a detailed overview of historical development and a resulting typology of housing areas in Bratislava, consisting of five distinct urban fabric types, which can be found in cities across wide post-socialist region.

Housing construction in the region restarted about after a half-decade later. It has been connected with major changes in government housing policy and institutional setting. Apartments were privatized, tax assistance for housing saving, vital conditions for lending, as well as the system of state support for housing starts were established. Demand for apartments in smaller residential buildings and single family houses grew. Reforms in further policies took place after another half-decade enabled the introduction of standard market-based financing channels, which further increased accessibility of housing. At the same time, private ownership of collectivized agricultural land was restored. Considering the growing demand for land plots in attractive locations with advantageous transport connection, sudden value motivated many private owners to sell their returned land. That was happening in close coincidence with the absence of coordination by the new-introduced local governments, responsible but inexperienced in territorial develop-

ment. In consequence, a significant process of suburbanization has developed (Schmidt et al. 2015). The initial stage of suburbanization has been dominated by up-market housing in most desirable urban locations spreading in space with ongoing transition. Improving labor market, increasing purchasing power of households, and accessible funding schemes created prerequisites for massive construction in certain places.

In general, the most intensive developments are documented out of central cities in nearby small settlements. The scope of construction reflected their attractiveness for development, mixing small-town environment with good accessibility of major regional job concentrations. The scale of development in many settlements in the immediate suburban hinterland has multiplied their size in expense of former agricultural landscape (Baus et al. 2014).

The scale of development undertaken since the collapse of socialism was first reduced radically. Reduces reflected in a growing imbalance in the market led to a sudden rise in market value. Spatial layout of neighbourhoods, lack of basic retail services, poor transport infrastructure and reduction of green areas also led to a declining quality of housing in certain parts of the city. Escape to suburban region as soon as economic improvement and financing mechanisms were introduced arrived very naturally. At the same time, Kovács and Herfert (2012) remind that socialist housing estates remain socially stable and offer affordable housing at the start of housing career. But their remark also contains assumption of spatial mobility over the housing career. Construction of different housing size segments and tendency of their local mixing are analyzed in empirical part.

DATA AND METHODOLOGY

Housing supply can be quantified in several dimensions measuring different stages of the process. There are three basic kinds of indices recognized and available as numerical data. 1) Housing starts include all units that have been granted a construction permit by the municipal authority within a specified time period. From that date, units can be aggregated into the number of 2) housing units under construction. The third available dataset includes all housing units that have been 3) granted an occupation permit and are registered in the registry.

The source of differences among these three datasets is the time needed for actual construction. Time is built in the base of elasticity in housing supply. Since completions can be significantly delayed in comparison with starts, their use in real estate market research also differs (Head et al. 2014). Completions include continually evolving feedback from the demand side, therefore, fit much better as dependent variable intended to capture the behaviour of households. On the contrary, housing stats appear to fit better in research focusing developers' behaviour.

The real estate market has a crucial temporal dimension (Ball et al. 2010 and Ihlanfeldt and Mayock 2014). The existing stock of real estate is slowly depleted by depreciation, which has influence on the market balance translated into rents and market prices. A certain level of development maintains a stable level of supply even without external factors. Moreover, demand changes with local economic conditions and reacts to migration. Growing markets are shaped by forces very different to stagnating markets. The housing market is closely related with business cycle, firstly by the availability of resources and secondly by migrants using opportunities created in the labor market increasing demand for housing. Data on com-

pletions are aggregated by the Statistical Office of the Slovak Republic (2015) on an annual basis, same as data on the average annual price per square meter of a housing unit collected by the National bank of Slovakia[9] (2015). Prices used in this study were inflation-adjusted to the constant 2 013 €.

Correlated with prices, location of residence remains crucial feature. Variation in levels of rents and market prices are heavily dependent upon the attributes of housing unit itself and quality of location. Some location features pre-exist, like natural landscape on which properties stand, configuration of water areas, and historically-developed urban plans. Some location features interactively appear and change with new development, like distribution of jobs, transport hubs and corridors, bringing valued architectural qualities in the area or preventing further development because of regularly bad traffic.

The structure of local settlements has evolved into a unique hierarchy over decades of urbanization. Territories of cities, towns and rural settlements cover the inhabited area in a patchwork of places. The city area in Bratislava consists of 17 urban municipalities. Suburban area in Bratislava extends to 72 more, one of which is the military district Záhorie without permanent population. This unit was removed from our sample limited to the Bratislava region. Despite that functional urban region, Bratislava includes wider territory and has a more complicated internal structure (Šveda and Podolák 2014), this practical limit allows addressing the sorting process developing better, towards a specific institutional entity. Moreover, a real Bratislava housing area extends across the national borders with Austria and Hungary. The empirical territory as defined here is used throughout the entire paper without any further modifications or local sub-sampling. All models and interpretations relate to the Bratislava region except the military district Záhorie. A key variable characterizing settlement units is population size. We use it as a proxy for the scale and variety of amenities available to residents. The size of the local market puts strict limits on services and their economic viability. Deciding to live in a smaller settlement usually means a lower scale and variety of consumption possibilities. Commercial services aside, public services are also limited by the efficiency criteria affecting direct access to other places of urban region. Many aspects of everyday life, starting with regular commuting and including accessibility of schools, health care, and availability of basic goods must be planned more carefully compared with households choosing homes in central city locations.

Everyday travel between different places within urban region manifests itself in the size and structure of transportation system and the structure of transportation demand. The major feature is a polarity between central city and peripheral places. Distance between central Bratislava and each of the outlying municipalities allows differentiating commuting zones around the central city, modified by the radial road corridors. Railway lines are underdeveloped in this area and have limited importance for commuting, except places directly linked.

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[9] Cár (2006, p. 12) documents the process of collection and processing of residential property prices in cooperation with the National Association of Real Estate Offices of Slovakia. He reminds that their „database on the prices of houses and apartments only contains data for a particular part of executed real estate transactions, since only around one in ten of the entities which mediate the purchase and sale of real estate are actually members of the association. The output compilations of prices for existing apartments and houses are made on the basis of classified advertisement records".

Central and more desirable locations absorb more development with time. Open space is, depending on design and density, partially or totally consumed by building environment. Paradoxically, brown-fields long avoided by the market for 25 years suddenly increase their market potential precisely due to their open landscape resemblance. However, the quality of open space, in Bratislava not rare polluted by the chemical industry in the past or traffic, is much different to a high-quality environment in municipalities located along the hills covered by vineyards and forests.

Direct access to natural landscape gains market value at the similar pace as it disappears under layers of new buildings. Buildings also grow in height with density and block valuable views. Environmental criterion in this paper is generalized into a single variable measuring the share of forest area from the total area of each municipality. This variable indirectly translates in land constraints of the local regulation (Saiz 2010) since forests are among most protected land uses. We take data from the aggregated statistics of land use based on land registry, which classifies plots of land into a variety of agricultural and non-agricultural classes.

Finally, completions are differentiated according to the key dimension, size segment. The housing units are categorized simply according to the count of rooms between one and five, which also includes properties with more than five rooms. The number of rooms is roughly correlated with the size of the unit in square meters; however, there can be a significant discrepancy among the smaller housing categories. A large loft apartment in an up-market condominium is surely distinct from a minimalist studio apartment, but these will appear alike in our dependent variable. Our dataset offers no distinction between flats and houses or between self-provision and commercial development, which would be critically important for the real estate market viewed from an institutional perspective (Theurillat et al. 2015).

New homes are constructed across the metropolitan area in the Fig. 1 in reaction to the changing household formation, their residential preferences, and the availability of resources to finance a development. The observations include choices at multiple stages, made by many kinds of economic agents and shifted by delays due to limited elasticity of supply. A certain generalization, however, allows examination of end users and their choices, of households in either rented or owner-occupied sector. An excess vacancy in the existing housing stock or the development of new projects creates a feedback loop, which limits more construction in less-desirable locations, or in a combination of location and segment.

Zero-count observations frequently appear in the dependent variable if there are no completions in specific size-segment, year and place. The regression model suitable in this situation is negative binomial, including an additional random term reflecting unexplained variance in an overdispersed non-negative integer variable, as compared with the baseline Poisson model. Gardner et al. (1995) provide a detailed review of econometric problems with using ordinary least squares (OLS) regression. Violation of its assumptions may result in biased standard errors, significance tests, and problematic statistical power.

Housing completions are simply counted by i places, k size-segments, and t years. In addition to the effects from five included explanatory variables, we also decided to test two kinds of interaction effects. First, the price was interacted with population, distance and environment in order to measure how the importance of these dimensions has changed over the housing cycle captured by the inflation ad-

justed price itself. Secondly, all of these were interacted with size-segment dummy variables controlling potential spatial submarkets in case that we find them statistically significant in expected direction within following equation:

Housing completions$_{i,k,t}$ = f(Price$_t$, Population$_{i,t}$, Distance$_i$, Environment$_{i,t}$, Market segment$_k$)
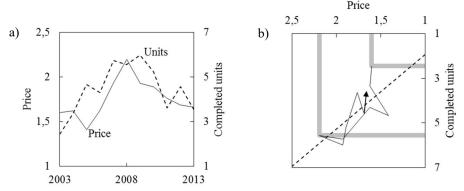

Fig. 1. Bratislava region. Average market price per square meter and completed housing units, 2003 – 2013

Legends: a) – Thousands of constant € 2013 and thousands of units, b) – Solutions between a minimum in 2003 and a maximum in 2008 (transparent boxes) along with asset price.
Source: National Bank of Slovakia (2015), Statistical Office of the Slovak Republic (2015).

RESULTS FROM ELASTICITY MODEL

The combinations of completed housing units in 88 places (*i*) over the years between 2003 and 2013 (*t*) and five size-segment classes (*k*) allows to analyze variation among 4,840 observations. A significant part of these combinations are unobserved (1,885 or 38.9% of the total), or observed only once (539 or 11.1%). Additional combinations appear in a marginal frequency between two and five completions (941 or 19.4%). Empirical distribution shows that less than one third (30.5%) of all observations aggregate more than five housing units completed in the size-segment, place and year. There is an obvious structure in timing, location, and size depending upon our criteria.

Tab. 1 provides a descriptive summary of the volume of added supply and its distribution among the basic classes of place location possibilities. During the expansive period of 2003 – 2008 a total of 26,069 of housing units were completed, followed by 22,970 added over the following recessive period of 2009 – 2013. The distinction between the two is clear in the Figure 1. The difference between the annual averages is 5.7%, partly perhaps as a consequence of construction delay in consequence of limited elasticity of supply.

About two thirds of the added supply were located in central places having their population greater than 10,000, one third in smaller places. Former drop by 8.2% between these periods, while later grow by 13.3%. Construction tended to move out of a dense urban area, which indicates anticipated structural suburbanizing trend. New construction left areas of easy accessibility of services and amenities. Nearly half of the housing construction was located within a circle of 15 minutes driving time from the metropolitan centre. Nine of ten new housing units were add-

driving time from the metropolitan centre. Nine of ten new housing units were added within a circle of 30 minutes of driving time. The share of new units in the most central zone drops by 4.8%. Intermediate zone is basically stable with an increase of 3.3% and the most distant zone grows by 8.5%.

Tab. 1. Average number of completions per year by size and place location with percentage shares in parentheses

Population	2003 – 2008	2009 – 2013
Under 5,000	1,291 (29.7)	1,462 (31.8)
5,000 – 10,000	342 (7.9)	498 (10.8)
Above 10,000	2,712 (62.4)	2,634 (57.3)
Distance		
Under 15 minutes	1,989 (45.8)	2,002 (43.6)
15 – 30 minutes	1,947 (44.8)	2,125 (46.3)
Above 30 minutes	408 (9.4)	467 (10.2)
Environment		
Under 25%	3,242 (74.6)	3,044 (66.3)
25% – 50%	435 (10.0)	558 (12.1)
Above 50%	668 (15.4)	992 (21.6)
Size-segments		
1-room	525 (12.1)	448 (9.8)
2-room	973 (22.4)	960 (20.9)
3-room	1,311 (30.2)	1,397 (30.4)
4-room	949 (21.8)	1,075 (23.4)
5-room	587 (13.5)	713 (15.5)

Source: Statistical Office of the Slovak Republic (2015).

The quality of local environment represented by share of forest land appeared as an important choice factor. Three quarters of the completions were located in areas with less than 25% of forest land in the expansive period. In the later period it was only two thirds. Share in these places drops by 11.1%. On the other hand, locations with more than 50% of forested land increase their share on added supply by 40.3%. One of every five homes was added to these places during the recessive period.

The last considered dimension differentiated between housing units of different size-segments. Average 3-room units dominated in both periods, representing three of every ten completed units. The least frequent choice was for 1-room and for 5-room units. This distribution, however, shifted rather asymmetrically between the two periods. Share of smaller than average housing units (1 – 2 rooms) drops by 11.0%, while the share of larger than average units (4 – 5 rooms) increases by 10.2%.

Descriptive analysis uncovers a case of market evolving in spatial terms from one placing more small units in dense, central locations into one placing more large units in green, peripheral locations. The structure revealed by shifting weights might be pointing at a polarizing pattern in the development process in the built environment, based on available resources for the realization of preferences on an

evolving demand side and reacting supply side in the same time. The impact of recession seems to be putting limits on choice for smaller housing units in expense of the growing number of large housing units in more desirable locations requiring more driving time. Regression analysis will further isolate each effect separately and will also look for hypothetical interactions between some of them.

Tab. 2. Parameter estimates from a panel of completed housing unit counts (88 places in the Bratislava region, 2003 – 2013)

	Poisson Distribution	Negative Binomial Distribution
Constant	2.918 (0.140)***	0.522 (0.889)
Price	0.774 (0.077)***	2.110 (0.494)***
Population	0.016 (0.001)***	0.090 (0.014)***
Distance	-0.050 (0.005)***	0.003 (0.026)
Environment	-0.013 (0.002)***	-0.001 (0.009)
Size-segments		
1-room	-1.690 (0.145)***	-2.128 (0.727)***
2-room	-0.933 (0.116)***	-1.469 (0.663)**
4-room	-0.075 (0.115)	0.102 (0.637)
5-room	0.048 (0.133)	0.621 (0.647)
Interaction variables		
Price : Population	-0.002 (0.001)**	-0.028 (0.008)***
Price : Distance	-0.014 (0.003)***	-0.047 (0.014)***
Price : Environment	0.008 (0.001)***	-0.004 (0.005)
Price : 1-room	0.307 (0.075)***	0.664 (0.374)*
Price : 2-room	0.297 (0.060)***	0.579 (0.341)*
Price : 4-room	-0.018 (0.060)	0.008 (0.328)
Price : 5-room	-0.190 (0.069)***	-0.336 (0.332)
Population : 1-room	0.009 (0.001)***	0.019 (0.005)***
Population : 2-room	0.005 (0.000)***	0.013 (0.005)**
Population : 4-room	-0.010 (0.001)***	-0.033 (0.005)***
Population : 5-room	-0.017 (0.001)***	-0.042 (0.005)***
Distance : 1-room	-0.029 (0.002)***	-0.058 (0.010)***
Distance : 2-room	-0.022 (0.002)***	-0.032 (0.009)***
Distance : 4-room	0.002 (0.002)	0.000 (0.009)
Distance : 5-room	-0.016 (0.002)***	-0.023 (0.009)**
Environment : 1-room	0.013 (0.001)***	0.019 (0.003)***
Environment : 2-room	0.013 (0.001)***	0.017 (0.003)***
Environment : 4-room	0.000 (0.001)	0.007 (0.003)**
Environment : 5-room	0.010 (0.001)***	0.019 (0.003)***

The models are based on 4,840 observations. Standard errors are in parentheses, estimates are significant at *0.1, **0.05, and ***0.01.
Source: Research results.

The first column in Tab. 2 shows the estimates of the baseline Poisson regression model, the second column shows the estimates for negative binomial regression model. The difference between them is in the treatment of overdispersion. Overdispersion is indicated by the significant likelihood ratio test of the null hypothesis of the Poisson model equal to the restricted negative binomial model estimated as 58,030.7 with probability 0.00. The dispersion parameter $\theta = 0.498$ (0.013) measures overdispersion ($\mu + \mu2/\theta$) with respect to the Poisson alternative (μ).

Considering the basic set of explanatory variables in the first panel, two of them appear significant. Completions are elastic to the housing cycle reflected in a positive parameter. Price changes lead to corresponding changes in construction, which is a consistency empirically observed in Fig. 1. Larger places during the same time systematically absorbed more construction. The distance from the central city and the forest-rich landscape did not affect the construction of the reference category (3-room) in a significant way, as a result of changing preferences over the years and variation covered by interaction terms, including those with market segments.

The general segment shape of the added supply is given by two significant variables. The choice for smaller than average (1- and 2-room) housing units is considerably less frequent, which once again indicates a preference for larger housing units. Interaction with population size reveals that construction of units smaller than average is systematically more frequent in more populated urban places and construction of units larger than average occurs in less populated locations. Considering commuting distance, smaller homes and also 5-room homes tend to be located closer to the metropolitan centre than 3-room and 4-room units. Environmental preferences appear to be important in all size-segments compared with the reference category, however the strongest effect was found in the 5-room size-segment.

Finally, price changes correlate with two of the considered choice criteria, population and distance. Higher prices lead to somewhat reduced general preference for more populated urban locations. Households are willing to accept less amenity-rich locations more frequently during times with high price levels and supply when competition is heavy. Commuting distance gradient receives importance among preferences during the peaking stage in the real estate cycle. Households are less willing, and perhaps even can't afford, to be indifferent to travel expenses.

CONCLUSIONS

Market-based size-segmentation of added housing supply, hypothetically linked with economic stratification between competing locations, appears to be clearly manifested. Empirical evidence shows a systematic pattern in the timing, place location, and preference for various size-segments. Construction of new housing units tends to indicate a continuing structural suburbanizing trend. Development tends to be located increasingly away from amenities, leaving households dependent upon transportation. Consideration of the environment is important in their housing choice. A metropolitan real estate market evolves from its previous situation, locating more small housing units in dense, central place locations into one locating more large homes in peripheral locations. Possibilities for differentiation between places, concentrating different size-segments, most probably also occupied by different income groups of residents, grows.

Supply added, as observed in size-segmented construction activity, is found to be highly elastic to the housing cycle. Small and largest housing units remain located closer to the central city than average-size units. Environmental preferences appear to be strongest precisely within the largest and most expensive segment, indicating signs of development potentially leading to inequality in access to environmentally high-quality locations. These places appear to be transformed into a specific market niche. The impact of recession period seems to be putting limits on choice for smaller homes at the expense of a growing number of large homes in more desirable locations. Higher prices lead to less general preference for larger urban places. Households are willing to accept less desirable locations more frequently in times with relative a relatively high price and supply level. Commuting distance gradient also becomes highly important among preferences.

Even in a situation of limited data coverage of the real estate market operation and generalized methodological approach taken, the residential landscape in the Bratislava region clearly appears to be systematically shaped by market mechanisms. As the correlation between house prices and construction activity suggests, similar results are highly probable in the case of transaction price regression modeling, more usual in real estate economy literature reviewed. However, such attempts would only partially cover the full extent of the development process differentiating locations across the area. Important determinants, including institutional factors on the supply and demand side, the entrepreneurial context of real-estate developers, as well as position and activity of local governments were not explicit in this study. We also pay no attention to the role of individual decisions-makers: households, landowners, etc. As a result, some parts of the region appear to become locations of commercial residential development, scaled by availability of resources sensitive to the phasing of the cycle. Others become locations of choice for those relatively independent on the cycle. Among these the model points, especially at environmental quality affecting choice of non-standard households. Geographical context enters this differentiation at least in one more way. Commuting distance from the centre is a powerful stratifying factor, allowing the mixture of typical preferences biased towards more privacy and greener location only to the wealthiest among the households.

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PRIESTOROVÝ VÝVOJ REZIDENČNÉHO TRHU V BRATISLAVSKOM KRAJI

Trh s nehnuteľnosťami na Slovensku vznikol a vyvinul sa do súčasnej podoby počas dlhého obdobia. Pre svoje normálne fungovanie potrebuje dynamiku kapitálu umožnenú jeho samotnou prítomnosťou, ako aj zodpovedajúcou infraštruktúrou, ktorá z kombinácie viacerých dôvodov v regióne chýbala a dodnes aj v ekonomickej periférii krajiny chýba. Po plošnom kolapse riadenej bytovej výstavby sa dianie už na novej báze obnovuje najrýchlejšie v regióne hlavného mesta. Dostupné záznamy z posledného desaťročia poukazujú na systematickú zmenu lokálneho prostredia, ktoré podlieha v kontexte štandardnej cyklickej dynamiky zrejmej stratifikácii. Po desaťročiach vývoja rezidenčného prostredia bez trhových motívov v rozhodovaní aktérov sa mesto so svojím zázemím ocitlo v situácii voľnej súťaže medzi lokalitami s rôznymi parametrami samotného priestoru vhodného na výstavbu, parametrami dostupnosti, ale aj environmentálnych kvalít územia. Tieto vo vzájomnej kombinácii môžu v budúcnosti mesto čoraz viac premieňať na suburbanizáciou rozptýlenú a polarizovanú štruktúru sídiel diferencovaných podľa ekonomického statusu rezidentov, tak ako priestor poznáme z tradičných trhových prostredí vo svete. V tejto štúdii sme rezidenčný trh nesledovali v celej jeho komplexnosti. Do centra nášho záujmu sme umiestnili premennú merajúcu intenzitu výstavby, ktorá udržuje a v čase expanzie rozširuje ponukovú stranu trhu. Teoreticky, a ako sme ukázali aj prakticky koreluje s cenou nehnuteľností v priebehu cyklu, čo korešponduje s očakávaniami štandardnej rovnovážnej perspektívy dynamiky trhu s nehnuteľnosťami. Pozorovania sme diferencovali podľa veľkosti skolaudovanej bytovej jednotky, čím v generalizovanej podobe môžeme sledovať meniacu sa preferenciu pre veľkostné segmenty v rôzne veľkých lokalitách, rozličnej vzdialenosti od centra mesta a environmentálnej kvalite. Tieto parametre nám model umožnil kontrolovať súčasne a vo vzájomnej interakcii, navyše v priebehu cyklu. Výskumnou otázkou je, či variácia ceny v čase mení priestorovú distribúciu veľkostných segmentov bytových jednotiek dodávaných na trh a či je táto distribúcia v interakcii s kvalitami lokálneho prostredia. Výsledok modelovania intenzity výstavby poukazuje na štandardné pôsobenie trhových síl s výstavbou priamo škálovanou úrovňou ceny a historickou kontinuitou výstavby. Veľké mestské štvrte expandujú viac než malé vidiecke lokality bez potrebnej infraštruktúry a deje sa tak v časoch, keď sú ceny na úrovni umožňujúcej výhodné zúročenie investícií. V tomto čase však súčasne mnoho domácností trh z týchto lokalít, kde sú prítomné pracovné miesta a je aj dobre rozvinutá sieť služieb, vytlačí do menej atraktívnych častí regiónu. Podobne aj gradient dochádzkových nákladov vtedy posilní svoju váhu v rozhodovaní. Do husto zaľudnených štvrtí a bližšie k centru mesta sa majú tendenciu častejšie lokalizovať menšie než

priemerné byty. Priestor je tu vzácnejší a drahší. Viac súkromia vo väčších než priemer-
ných bytoch niektoré domácnosti preto nachádzajú v malých lokalitách a ďalej od centra
mesta. Najväčšie bytové jednotky vo všetkých dimenziách korelujú s preferenciami kombi-
nujúc súkromie, dostupnosť aj environmentálne kvality bez závislosti na cykle, čo indikuje,
že vrstvy s vysokým ekonomickým statusom súťaž o najatraktívnejšie lokality na voľnom
trhu vyhrávajú.