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Price determinants of newly built dwellings in Serbia[2]

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***Abstract**: This paper analyses the determinants of newly built dwelling prices in Serbia in a panel of 24 cities over the period 2011-2014. Results suggest that dwelling prices primarily tend to rise with population growth and real total net wages as a proxy of household incomes, while declines in effective interest rate on housing loans are associated with higher dwelling prices. Additional explanatory variables, such as the level of development of observed cities, geographical distance from the capital, or real GDP dynamics in the country, despite the expected correlation, didn't have a statistically significant influence on the dependant variable.*

***Keywords**:* dwellings, prices, real estate market

Determinante cene stanova novogradnje u Srbiji

***Apstrakt**: Rad analizira determinante cena stanova novogradnje u Srbiji na panel podacima iz 24 grada u periodu 2011-2014. Rezultati su pokazali da na cene stanova novogradnje prvenstveno utiču rast stanovništva i masa isplaćenih realnih zarada kao reprezent dohotka stanovništva, dok sa padom efektivne kamatne stope na stambene kredite raste cena stanova novogradnje. Ocene ostalih objašnjavajućih promenljivih, kao što su nivo razvijenosti gradova, geografska udaljenost od Beograda ili dinamika privredne aktivnosti merena kretanjem realnog BDP-a, uprkos očekivanom znaku, pokazale su se kao statistički nesignifikantne za cene stanova novogradnje.*

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***Ključne reči**: stanovi, cene, tržište nekretnina*

1. Introduction

Buying a real estate (dwelling) for most people is their largest transaction in lifetime. Dwelling means the most significant component of households' expenses and, at the same time, their most valuable assets. But these data are not only essential to households and citizens, but also for economic and monetary policy makers. Data can help them, for example, monitor macroeconomic imbalances and risk exposure of the financial sector, etc.

Soaring dwelling prices are often associated with periods of economic expansion while sliding dwelling prices often coincide with a slowing economy (Goodhart and Hofmann, 2007). Some studies confirm that all the biggest banking crises in developed countries since the mid-1970s were correlated with exploding housing bubble (Reinhart and Rogoff, 2009). Basically, dwelling prices are taken as a leading indicator, despite a debate about whether change in dwelling price is a leading, lagging or coincident economic indicator (EUROSTAT, 2014).

Emphasis on the importance of this subject made us analyse the determinants of newly built dwelling prices in Serbia in a panel of 24 cities over the period 2011-2014.

Serbia's housing market is slowly recovering after the bubble burst during 2011, despite meagre economic growth. Prices slumped by 11.7% in 2012 compared with 2011. Below, we will analyse the possible factors for this trend. Unfortunately, this paper is not comparable with the others, because similar studies have not been conducted in Serbia. Hence, it provides important findings on the determinants of dwelling prices in the country.

2. Literature review

In the literature, we can find different econometric approaches as a tool for modelling numerous factors that impact the housing markets, especially for estimating fundamental dwelling prices based on regional data.

Empirical studies on the housing market distinguish three main types of drivers: macroeconomic drivers, institutional/geographic factors and funding arrangements. Econometric models can be used to compute the "fundamental" price, as determined by demand (derived on the basis of factors such as real disposable income, real interest rates and demographic

developments) and supply (derived from factors influencing the available housing stock).

Having measured the longer-term demographic and economic determinants in the attractive large German cities (survey data included 125 towns and cities, 99 of which are in west Germany) from 2004-2014, some authors showed that household incomes was the long-term common “anchor” of prices and that affordability of housing in recent years benefited from interest rate reductions. Explanatory variables they used to derive an equation for determining house prices are the housing stock at the beginning of period, real mortgage rates and survey-based growth expectations for real GDP. District-specific demographic and economic factors, which may have an impact on housing demand, include current real *per capita* income, population density, the fraction of the population aged between 30 and 55, and unemployment. The results suggest that the effects of demographic variables, such as the population’s middle-aged groups and population density are quantitatively significant. *Per capita* income has only a moderate impact on property prices in the shorter estimation period while no statistically significant effect is evident over the longer horizon (Deutsche Bundesbank, 2013).

Many authors have studied the relationship between demographics and the housing market. An increase in the number of new-borns (baby boom) has a small short-term effect on the housing market but it increases demand for new houses twenty years later. A decrease in the number of births or an increase in the average age of population has a strong influence on demand and on the housing prices (Mankiw and Weil, 1989).

The strong relationship between GDP, income and the housing market has been also researched in the literature. Lacoviello and Neri analyse the response of GDP to housing market fluctuations (Lacoviello and Neri, 2008). Mikhed and Zemcik concluded that a decline in USA home prices negatively affected the consumption and GDP (Mikhed and Zemcik, 2009). Adams and Füss noticed that the GDP growth had an increasing impact on the housing market (Adams and Füss, 2010).

When the interest rate is rising, the cost of borrowing is also rising and the potential buyers are getting discouraged. As a result, housing demand is falling. Andrews argues that the correlation between house prices and the loan interest rate is negative and depends on the degree of competition in the banking sector (Andrews, 2010). Cross-country panel results from Lossifov, Čihák and Shanghavi showed that the short-term interest rate, and hence monetary policy, has a sizable impact on residential housing prices (Lossifov, Čihák and Shanghavi, 2008).

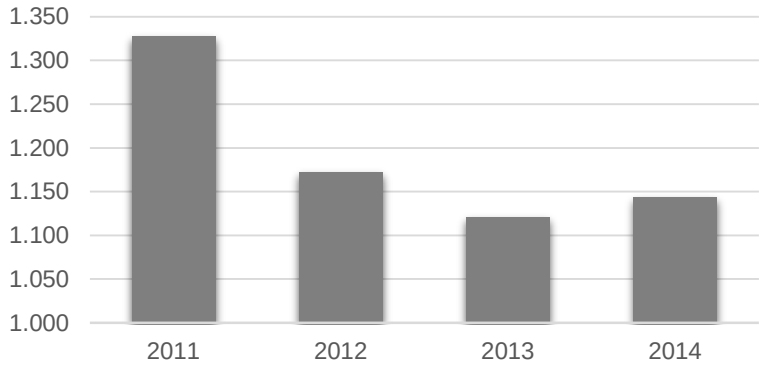
The role of geographical factors on dwelling prices is analysed in more details in the studies on data disaggregated by region or city, such as (Garmaise and

Moskowitz, 2004), (Green, Malpezzi. and Mayo, 2005) or (Himmelberg, Mayer and Sinai, 2005).

3. Methodology

In order to estimate the price determinants of newly built dwellings in Serbia a panel analysis will be used to analyse how the data for each observed cities changed over time. Data analysis will be carried out in STATA v.13 statistical package.

Figure 1. Prices of new-built dwellings in the Republic of Serbia from 2011 (EUR, per sqm)



Source: SORS; authors' calculations

We start our analysis with a commonly researched set of 24 cities in the Republic of Serbia, with available data on newly built dwelling prices over a period 2011-2014 based on the National Statistics Office (SORS, 2015).

Table 1. Observed cities in the Republic of Serbia

Grad Beograd	Sombor	Vršac
Grad Novi Sad	Subotica	Zrenjanin
Valjevo	Šabac	Čačak
Kragujevac	Leskovac	Ćuprija
Grad Niš	Ruma	Pirot
Grad Vranje	Loznica	Jagodina
Pančevo	Sremska Mitrovica	Kraljevo
Paraćin	Vrnjačka Banja	Kruševac

Source: authors' calculations

We assessed the equation:

$$price_{it} = \alpha + x'_{it}\beta + \gamma_i + \varepsilon_{i,t} \qquad i = 1,..., 24; \quad t = 2011,..., 2014 \qquad (1)$$

where variable $price$ is defined as prices of newly-built dwellings, i is (one of) 24 observed cities in the Republic of Serbia, α is constant, x is vector including independent variables (see Table 2 and Table 3), β is vector of corresponding coefficients, t is time period, in this case 2011-2014, and γ is the effect specific for each city and it does not change over time. In our case, these are variables dev and $dist$. $\varepsilon_{i,t}$ that represent a wrong term, which is subject to the assumption of strict exogeneity.

We opted for the method of stochastic, i.e. random effects in the panel, which enables evaluation of γ_i effects, by assuming that γ_i has distribution with 0 mean value and constant standard deviation. Even though the advantages of the method of random effects vs. fixed effects model are obvious, the method can be used on the major assumption that unobserved features of the respective cities are always the same (Baltagi, 2013; Hill, Griffiths, & Lim, 2011).

To test the presence of random effects we use the Breusch-Pagan test statistics.

$$LM^2 = \frac{NT}{2(T-1)}\left\{\frac{\sum_{i=1}^{N}(\sum_{t=1}^{T}\hat{e}_{it})^2}{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{e}_{it}^{\,2}} - 1\right\}^2 \qquad (2)$$

If the null hypothesis $H_0: \mathrm{Var(u)} = 0$ is true, there are no random effects. The original LM test due to Breusch and Pagan used LM^2 with the distribution under H_0 as $\chi^2_{(1)}$ (Breusch & Pagan, 1980)

The choice of explanatory variables reflects the consensus in the reviewed literature that dwelling prices in the short run are primarily determined by fundamentals affecting aggregate demand. Housing demand typically reflects households' economic situation and prospects as well as financial parameters and demographic conditions.

The variables used in the following regression models are defined in Table 2.

Table 2. The variables used in the regression models

Variable	*Definition*	*Source*
price	Prices of dwellings of new construction in the Republic of Serbia observed by cities per square metre in EUR, for period 2011-2014.	Statistical Office of the Republic of Serbia (SORS)
popgr	Average annual population growth rates in observed cities for a period 2002-2013.	SORS
wage	Total net salary paid per month in observed cities, in millions of EUR	SORS
i	Effective interest rate on housing loans to household and non-financial sectors, for new business	National bank of Serbia
dev	The level of development of observed cities	National Agency for Regional Development, Republic of Serbia
gdp1	Gross domestic product, real growth rate in period 2011-2014. with one period lag	SORS
dist	Distance from Belgrade in km	ViaMichelin Maps&Routes

Source: authors' calculations

We did not consider inflation as an explanatory variable because all the real estate prices in Serbia are in EURO or indexed to this currency.

On the other hand, there are other interesting peculiarities of the Serbian housing market. In particular, most of the housing stock is privately owned, free and clear of any loans, as a result of a massive privatization drive 20 years ago (Nikolić, I., Kovačević M., 2014; Nikolić, I., 2011). While new housing purchases are typically financed via mortgage loans, trade in the older housing units is often conducted via cash-only transactions (Šoškić, D., Urošević, B., Živković, B., Božović, M., 2012).

The expected sign of regression coefficients is in square brackets:

- [+] *popgr* - is demographic variable approximating the number of potential buyers in the market. A lager population is likely to be associated with higher prices. In some way, this variable contains the effect of migration, which has also had a big impact on the dwelling market;
- [+] *wage* - is proxy for real purchasing power, i.e. real demand of the population. Surely it follows that higher income implies a higher price;
- [-] *i* - is proxy for the opportunity cost of investments in owner-occupied dwelling. Higher opportunity costs are likely to decrease demand for owner-occupied dwelling, and thus dwelling prices;
- [+] *gdp1* - is the broadest approximation of economic activity in the country. Should have a positive impact on prices;

- [-] *dist* - it is expected that demand for newly built dwellings falls as we move toward the periphery of the country. It certainly pulls lower prices;
- [+] *dev* - proxy for the level of development of observed cities. Higher development is therefore likely to be associated with higher dwelling prices.

Table 3. A panel summary statistics

Variables		Mean	Std.Dev.	Min	Max	Observations
t	overall	2012,5	1,1239	2011	2014	N = 96
	between		0	2012,5	2012,5	n = 24
	within		1,1239	2011	2014	T = 4
price	overall	735,6342	214,2556	484,9652	1795,063	N = 96
	between		209,7276	551,943	1568,871	n = 24
	within		57,52245	639,0363	979,8254	T = 4
dev	overall	1,8333	0,7492	1	3	N = 96
	between		0,7614	1	3	n = 24
	within		0	1,8333	1,8333	T = 4
popgr	overall	-0,4203	0,5930	-1,3039	1,3313	N = 96
	between		0,6026	-1,3039	1,3314	n = 24
	within		0	-0,4204	-0,4204	T = 4
wage	overall	20,4448	52,1667	1,5824	269,2269	N = 96
	between		52,9983	1,6900	263,8711	n = 24
	within		1,1162	12,7063	25,8006	T = 4
gdp1	overall	0,8856	1,3119	-1,0152	2,5717	N = 96
	between		0	0,8856	0,8856	n = 24
	within		1,3119	-1,0153	2,5717	T = 4
i	overall	5,345	0,5213	4,46	5,76	N = 96
	between		0	5,345	5,345	n = 24
	within		0,5213	4,46	5,76	T = 4
dist	overall	148,9625	85,4647	0,1	343	N = 96
	between		86,8469	0,1	343	n = 24
	within		0	148,9625	148,9625	T = 4

Source: authors' calculations

It should be emphasized that pursuant to the Law on Regional Development, all cities in Serbia i.e. local self-government are classified according to the level of development in four groups. The first group consists of 40 units with the level of development above the national average, the second group consists of 23 units with the level of development ranging from 80% to 100%, the third group consists of 36 units with the level of development ranging from 60% to 80% (underdeveloped), and the fourth group consists of 46 LS units with the level of development below 60% of the national average (highly underdeveloped LS). Observed cities in this research are classified in the first three groups (NARR, 2015).

4. Research results

As it can be seen in Table 4 the estimation takes the form of a panel model with random effects. Explanatory variables that might be correlated with the unobserved effect are replaced by instrumental variables, which are based on suitable transformations of the model variables. To this end, the means of the city-specific regressors classified as exogenous are used alongside the deviations of the city-specific variables from their mean values.

The results based on all four specifications (SP's in Table 4) suggest that the effects of demographic variables, such as average annual population growth rates in observed cities and economics variables, such as total net salary paid per month in observed cities and effective interest rate on housing loans to household, on dwelling prices are statistically significant. More specifically, prices tend to increase with gains in households' disposable income (proxied by total net salary in EUR) and, in turn, real dwelling prices. Reductions in real interest rates are found to increase dwelling prices.

The coefficient of determination is rather high in all models (about 80%) and Wald χ^2 statistics is significant at 1%.

However, this is only conditionally, since estimations of explanatory variables, such as distance from Belgrade and real growth rate of GDP, are expected to be correlated, but aren't statistically significant. Moreover, variable, like the level of development of observed cities, is not expected to be correlated. This paradox can be explained by dwelling price bubble in major and developed Serbian cities.

Stata, as the most contemporary statistical software, provides warnings (for example, usually based on the variance inflation factor- VIFs) if substantial collinearity is found among the independent variables. There was no problem. Collinearity appears only in cases if we spread the model by adding new variables, such as unemployment rate or the real effective exchange rate. But

this is expected because the collinearity is often found in data sets with few observations, where there is a greater chance of spurious correlation.

Table 4. Random effect models estimates of prices of newly-built dwellings in Serbia

Variable	***SP 1***	***SP 2***	***SP 3***	***SP 4***
popgr	124,27***	114,65**	124,13***	124,03***
	(33,17)	(35,62)	(33,14)	(33,76)
wage	2,75***	2,71***	2,76***	2,68***
	(0,38)	(0,38)	(0,38)	(0,41)
i	-39,95**	-39,96**	-39,77**	-39,96**
	(12,25)	(12,25)	(12,33)	(12,25)
dev	-	-20,93	-	-
		(26,37)		
gdp1	-	-	2,2	-
			(4,90)	
dist	-	-	-	-0,12
				(0,22)
_cons	963,1***	998,43***	960,1***	983,1***
	(70,4)	(83,33)	(71,05)	(79,31)
N	96	96	96	96
R^2: overall	0,7985	0,8026	0,7987	0,8004
R^2: between	0,8509	0,8553	0,8509	0,8529
R^2: within	0,1242	0,1244	0,1266	0,1245
Wald chi^2	129,59	128,04	129,93	125,79
Prob > chi^2	0,0000	0,0000	0,0000	0,0000
sigma_u	78,8407	79,6901	78,7537	80,4555
sigma_e	62,1802	62,1802	62,6191	62,1802
rho	0,6165	0,6216	0,6127	0,6261

legend: * p<0.05; ** p<0.01; *** p<0.001; std.err. in parenthesis

Source: authors' calculations

To test the presence of random effects we use the Breusch-Pagan test statistic.

Table 5. Breusch and Pagan Lagrangian multiplier test for random effects

price[id,t] = Xb + u[id] + e[id,t]

	Var	sd=sqrt(Var)
price	45905,47	214,2556
e	3866,379	62,18
u	6215,85	78,841

Test

Var(u) = 0

chibar2(01) = 48,78

Prob > chibar2 = 0,0000

Source: authors' calculations

Due to the fact that our χ^2 is large, implying zero p-value, we reject the null hypothesis and conclude that random effects are appropriate. This is evidence of significant differences across observed cities.

5. Conclusions

This paper's analysis and implications are contributions to the academic research of the determinants of newly-built dwelling prices, but depart from the conventional aspect of the pricing problem in Serbian property market.

In order to estimate the price determinants of newly built dwellings, we will apply a panel analysis to see how the data for each of 24 observed cities changed in period 2011-2014. Results suggest that dwelling prices primarily tend to rise with population growth and real total net wages as a proxy of household incomes, while declines in effective interest rate on housing are associated with higher dwelling prices.

Additional explanatory variables, such as the level of development of observed cities, geographical distance from the capital, or real GDP dynamics

in the country, despite the expected correlation, didn't have a statistically significant influence on the dependant variable.

References

Adams, Z., & Füss, R. (2010). Macroeconomic determinants of international housing markets. *Journal of Housing Economics,* 19(1), 38-50. doi:10.1016/j.jhe.2009.10.005

Andrews, D. (2010). Real House Prices in OECD Countries: The Role of Demand Shocks and Structural and Policy Factors. In *OECD Economics Department Working Papers*. OECD Publishing.

Baltagi, B.H. (2013). *Econometric Analysis of Panel Data, 5th*. New York: John Wiley and Sons.

Breusch, T.S., & Pagan, A.R. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *Review of Economic Studies,* 47(1), 239-253. doi:10.2307/2297111

-Deutsche Bundesbank. (2013). *The determinants and regional dependencies of house price increases since 2010,*. (pp. 13-31). Monthly Report October. Retrieved from http://www.bundesbank.de/Redaktion/EN/Downloads/Publications/Monthly_Report/2013/2013_10_monthly_report.pdf?__blob=publicationFile.

-EUROSTAT. (2013). *Handbook on Residential Property Prices Indices (RPPIs), Methodologies & Working papers*. European Commission.

Garmaise, M.J. (2003). Confronting Information Asymmetries: Evidence from Real Estate Markets. *Review of Financial Studies,* 17(2), 405-437. doi:10.1093/rfs/hhg037

Goodhart, C., & Hofmann, B. (2007). *Financial Conditions Indices, in House Prices and the Macroeconomy: Implications for Banking and Price Stability*. Oxford: Oxford University Press.

Green, R.K., Malpezzi, S., & Mayo, S.K. (2005). Metropolitan-Specific Estimates of the Price Elasticity of Supply of Housing, and Their Sources. *American Economic Review,* 95(2), 334-339. doi:10.1257/000282805774670077

Hill, R.C., Griffiths, W.E., & Lim, G.C. (2011). *Principles of Econometrics, 4th*. John Wiley & Sons, Inc..

Himmelberg, C., Mayer, C., & Sinai, T. (2005). Assessing High House Prices: Bubbles, Fundamentals, and Misperceptions. In *NBER Working Paper*. doi:10.3386/w11643

Iacoviello, M., & Neri, S. (2008). Housing market spillovers: Evidence from an estimated DSGE model. In *Economic working papers*. Bank of Italy, Economic Research and International Relations Are.

Iossifov, P., Cihák, M., & Shanghavi, A. (2008). Interest Rate Elasticity of Residential Housing Prices. In *IMF Working Paper, WP/08/247*. (p. 34). doi:10.5089/9781451871050.001

Kubirić, M. (2013). Model for determing the average cost of property territorial units in Serbia. *Geonauka,* 1(1), 12.

-NARR - National Agency for Regional Development, Republic of Serbia. (2015). *Legislative and Strategic Framework of Regional Development Policy*.

Retrieved from http://narr.gov.rs/index.php/narr-en/About-regional-development/Legislative-and-Strategic-Framework-of-Regional-Development-Policy

Nikolic, I., & Kovacevic, M. (2014). The impact of privatization: Empirical analysis and results in Serbian industry. *Industrija,*42(1), 63-86. doi:10.5937/industrija42-4846

Mankiw, N.G., & Weil, D.N. (1989). The baby boom, the baby bust, and the housing market. *Regional Science and Urban Economics,* 19(2), 235-58. pmid:12283640. doi:10.1016/0166-0462(89)90005-7

Mikhed, V., & Zemčík, P. (2009). Do house prices reflect fundamentals? Aggregate and panel data evidence. *Journal of Housing Economics,* 18(2), 140-149. doi:10.1016/j.jhe.2009.03.001

Panagiotidis, T., & Printzis, P. (2015). On the macroeconomic determinants of the housing market in Greece: A VECM approach. In *Hellenic Observatory Papers on Greece and Southeast Europe, GreeSE Paper*.

Reinhart, C.M., & Rogoff, K.S. (2009). *This Time is Different; Eight Centuries of Financial Folly*. Princeton and Oxford: Princeton University Press.

-SORS - Statistical Office of the Republic of Serbia. (2015). *Anual prices of dwellings of new construction in period 2011-2014*. Retrieved from http://webrzs.stat.gov.rs/WebSite/Public/PageView.aspx?pKey=121.

Šoškić, D., Urošević, B., Živković, B., & Božović, M. (2012). The Housing Market in Serbia in the Past Decade. In A. Bardhan & et al. (Eds.), *Global Housing Markets: Crises, Policies, and Institutions*. (p. 576). John Wiley & Sons.