Panel analysis of home prices in the primary and secondary market in 17 largest cities in Poland

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Robert Leszczyński[1] and Krzysztof Olszewski[2]

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Abstract

We analyse the determinants of house prices in the primary and secondary market of 17 largest cities in Poland during the 2002-2013 period. We find that prices are driven by economic fundamentals, such as income growth or rise in employment. Prices in the secondary market react to increases in the loan availability, that was driven by low interest rates resulting from FX denominated housing loans that were granted since 2006. This finding does not hold for the primary market, which is to a large extent financed with cash. We confirm empirically that the house appreciation in the past period has a strong effect on the current price, which confirms herding behaviour in the housing market. Another finding is that the secondary market has a stronger effect on the primary market than the other way around. This means that housing demand is satisfied in the first place from the secondary market, and if prices rise, potential buyers go to the primary market. Finally, we find that price increases in Warsaw spill over to the local markets of 16 regional cities. This finding is consistent with the contagion theory in the real estate market, according to which price increases in the centre lead to price increases in the periphery.

Key words: housing market, house prices, primary and secondary market, spillover effects

JEL classification: E21, R21, R31

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The paper presents the personal opinions of the authors and does not necessarily reflect the official position of the Narodowy Bank Polski.

1. Introduction

Growth in home prices in the primary and secondary market is the subject of continuous interest of central banks and regulators, as it rapidly translates into changes in real estate construction, drives housing cycles (see Augustyniak et al., 2014a) and generates risk for the banking sector. The recent international financial crises resulted from a housing boom and bust in the US and the lesson that everybody has learned is that housing is of paramount importance for households and the financial system, thus also for the whole economy. The stiffness of supply in short term can cause price shocks and also create bubbles. Mortgage loans constitute the largest liability of households and also a major asset of banks. Even though only a small fraction of housing is traded at a given time, it affects the price of the whole housing stock. During a price boom households and banks are willing to accept high loans. However, during a price bust the loan value can exceed the collateral, which can cause problems to the stability of the financial system.

Our study focuses on determinants of the average price[3] of a square meter of housing in Poland's 17 largest urban markets in the 2002-2013 period. The housing market is of high importance for the economy, and the 17 largest cities account for around 40% of housing loans issued in Poland. In 2013 around 30% of the total number of housing units (all types of housing) was delivered in this largest markets, and among those completed, nearly 80% were produced by housing developers. Further on, those cities constitute the largest labor market, are the regional capitals of the voivodeships and also a significant part of GDP is created in those cities.

The aim of our analysis is to determine which economic variables explain the growth in home prices in the primary and secondary market. We analyse factors that affect the demand for new and existing housing in the largest cities in Poland, using the findings presented in Andrews (2010) and Igan and Loungani (2012), Cameron et al. (2006) and also the results of the analysis of the convergence and differentiation of regional housing markets and structural changes in Poland presented in Baldowska et al. (2014).

The analysis of the Polish housing market (see NBP, 2013 and Augustyniak et al., 2014b) indicates that there is a high demand for owner occupied housing. The desire to own housing has two main reasons. Renting is quite costly, as in many cases

[3] Dwellings in the primary and secondary market display differences in terms of building technology, quality of finishing, as well as in location, thus it would be optimal to use the hedonic price, which accounts for the heterogeneity (see Widłak, 2013). However, such an analysis requires very detailed data that have been collected in the NBP BaRN data base since 2006 Q3 only. If we limited the analysis to the period commencing practically in 2007 we would not be able to capture the behaviour of prices during the period of price stability, that is, in the years 2002 - 2005.

the loan instalment can be even lower than the rent and when the loan is paid back, the owner keeps the house forever. Secondly, there are investment motives, because housing is not only a durable consumer good but also an investment good (see Łaszek, 2013 for a detailed discussion). The desire to own housing can be only satisfied, if the household has enough income to accumulate the down payment and to cover the loan instalments and expects that it will receive income in the future.

The housing demand analysis has a long tradition and we refer to Andrews (2010), Igan and Loungani (2012) and Augustyniak et al. (2014a) for a discussion of theoretical models and empirical results. Factors that increase housing demand are high income and/or low interest rates, that lead to lower loan instalments. Moreover the average unemployment rate is a good proxy for the overall performance of the economy. A falling unemployment rate indicates that the economy is booming and makes people more optimistic. As concerns the investment demand, the appreciation of housing (change of prices from period to period) makes the buyer to speculate that prices will rise further (see Augustyniak et al., 2014a,c). The long memory of house prices was confirmed empirically by Andre et al. (2013), who performed a cointegration analysis of house prices among countries in the euro area. Andrews (2010) finds in an international analysis of house prices that the preferential tax treatment of house owners adds to the demand shock. The abovementioned factors increase the demand for housing, which under fixed supply in the short run leads to house price growth and we formulate the following research hypothesis.

Research hypothesis 1: House prices in the major markets in Poland are determined by fundamental economic determinants and also depend on herding behaviour.

Housing demand can be satisfied with housing from the primary or the secondary market and the consumer choice is determined by price differences and housing availability. The market mechanism, which is described in detail in Augustyniak et al. (2014a), is as follows. First, buyers try to obtain housing from the secondary market, which is usually cheaper. In the secondary market there is a given amount of housing put on the market, for example, because people want to move or because they want to up-size or down-size their housing. If housing demand increases, the supply in the secondary market starts to disappear, yet other households, who did not enter the market so far, become interested in selling their house. Some who had a smaller house decide to sell it and to buy a new, bigger one. At some point the excess demand can be satisfied only from the primary market. But as supply in the primary market is quite rigid in the short run, prices start to rise. Real estate developers observe rising prices and start to increase the production of

new housing and start to sell more pre-sale contracts[4]. The price depends on the construction costs and the profit margin of the developer. We observe interactions between the two markets, investigate them empirically and formulate the second research hypothesis.

Research hypothesis 2: There are strong relations between the primary and secondary housing market in Poland.

Recent empirical studies find a contagion effect in the housing market, which means that price increases in one location spill over to other locations. Examples of such studies are Ferreira and Gyourko (2011) for the US, Fry (2009) for the UK and Vansteenkiste and Hiebert (2011) or De Bandt et al. (2010) for the world housing market. Andre et al. (2013) provide a rich overview of the empirical work on the comovement of house prices in different regions. Spillovers can be observed also at the city level, as the recent research for the Warsaw market by Waszczuk (2013) and Widłak et al. (2014) shows. DeFusco et al. (2013) use micro-data for the US and find that the dynamics are stronger during the boom period than during the bust period and the price impulse is stronger from large markets than from smaller markets. Dittmann (2013) analysed this question for Poland and we perform a similar analysis using a longer data set. We formulate the third research hypothesis.

Research hypothesis 3: There are spillover effects from changes in house prices in the capital city to changes in house prices in other major cities.

The remainder of the paper consists of the empirical analysis. In chapter 2 we analyse the primary and secondary market, determine the interactions between those two markets and also search for a spillover effect of price rises in the Warsaw market, that spread to other local markets. Section 3 discusses the main results.

[4] Housing pre-sale contracts are common in Poland and Asia (see Chang and Ward, 1993), while they are less common in Western Europe. According to Augustyniak et al. (2014c, p.2) „Such solutions increase the support elasticity, shorten the cycle and reduce the amplitudę of fluctuations. This helps the supply side to respond faster to strongly rising demand, yet, it involves certain risk. The advantage for clients is that they buy housing at a fixed price, thereby financing the real estate developer's project. Consequently, the developer can continue construction without the need to borrow funds. Yet, the buyer bears the risk of the developer's bankruptcy. On the other hand, the producer of housing will not be able to increase home prices in the future, along with rising prices or costs."

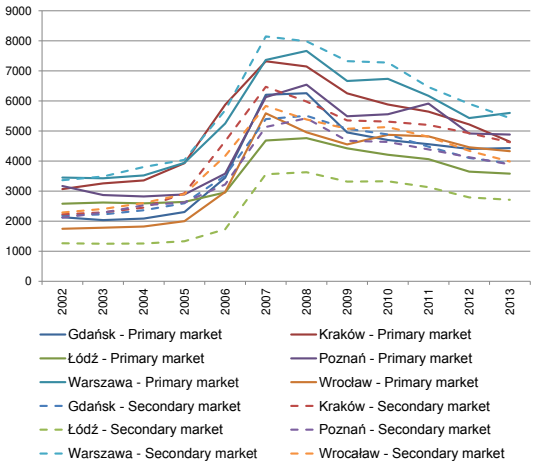
2. Empirics

We use the results from the literature, presented in the introduction as a starting point for our empirical analysis. According to the mainstream literature prices of new housing should be affected by structural factors (i.e. the number of new marriages per 1 000 inhabitants, migration, the ratio of the productive-age population to post-productive age population, etc.) as well as economic factors (income growth, unemployment, loan availability). The analysis of transaction prices of housing in the primary and secondary market of 17 cities in Poland is based on annual data for the years 2002-2013[5]. The analysis takes into account the relatively stable period in the housing market (2002-2005), the housing boom period (2006-2008) and the market's slow return to its equilibrium (2009-2013). Due to data limitations this is the longest period that we can analyse, but it captures at least a full real estate cycle and gives a good picture of the determinants of price changes in the residential market. In 16 largest cities the primary market prices are higher than the secondary market prices, while the opposite is true for Warsaw. For presentation purposes we present the CPI deflated house prices in the primary and secondary market in the six biggest cities on graph 1. Usually new construction is of better quality than the existing housing stock, it is more energy efficient and has many amenities, such as parking space under the building or elevators. It also can be directly used without the need of a general refurbishment. However in the case of Warsaw most of new construction took place in parts of the city that are rather distant from the city centre and which initially lacked a well-developed cultural, educational and transport infrastructure, thus potential buyers were willing to pay less than for the existing housing stock. According to the estimates presented in NBP (2013), in the regional cities approximately around one third of transactions in the housing market took place in the primary market, while two-thirds took place in the secondary market. This results from the lower prices but also from the much higher supply of housing in the secondary market.

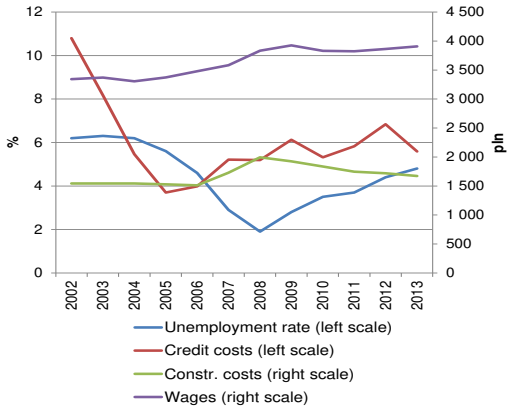
In graph 2 we present the main determinants of house prices for the Warsaw housing market, that is the unemployment rate, credit costs, construction costs and wages. The data shows us that during the whole period wages were rising, while the price boom was preceded and accompanied by a falling unemployment rate and falling credit costs. As a result of the housing boom, the constructions costs started to rise, but declined slowly after the boom faded out after 2008.

[5] Transaction prices of housing for the years 2006-2013 are from the BaRN database (primary and secondary market). Prices in the period 2002-2005 were extrapolated on the basis of primary market offer price growth coming from the PONT Info database .

Graph 1 House prices on the primary and secondary market – 6 biggest cities (CPI defl.)



Graph 2 Unemployment rate, credit costs, construction costs, wages in Warsaw



The main economic and fundamental drivers of housing demand in the remaining cities behave in a similar fashion. On initial, visual inspection of the data suggests to use the abovementioned fundamental variables to explain the house price movements in the local markets. Our empirical model draws on the metropolitan area house price model of Jud and Winkler (2002), the abovementioned empirical literature and the detailed analysis and description of the housing market in Poland, presented in Baldowska et al. (2014). We express the demand for housing Qd as a function of the following determinants:

Qd = f(price, wages, loan availability, economic conditions)

while the housing supply Qs is expressed as:

Qs = f(price, construction costs, profits, local determinants)

Because demand has to equal supply in equilibrium, we can join the two equations and obtain the determinants of the house price:

P=f(wages, loan availability, economic conditions, construction costs, profits, local determinants).

We modify the equation in line with the analytical housing demand model presented in Augustyniak et al. (2014a) and include the lagged price to capture the effect of housing appreciation on housing demand.

We chose the explanatory variables basing on the previously discussed empirical literature and the detailed statistical and graphical analysis of house prices and their drivers in the Polish house market presented in detail in NBP (2013). As a detailed analysis of the above mentioned house price determinants by Baldowska et al. (2013) shows, a considerable part of these variables follows an upward trend only, rather than to display fluctuations likely to explain the ups and downs in prices and the boom period in the housing market. Moreover, some time-series show a strong collinearity. If those variables were included, they would lead to spurious regressions. After running numerous regressions, we decided to include the following explanatory variables: lagged price, average wages in the enterprise sector, the unemployment rate, the loan availability, weighted interest rate and construction costs[6]. All monetary variables are deflated with the CPI in order to exclude the inflation trend. For each market, we use local explanatory variables.

In all the regressions we use the logarithms of the above-mentioned variables, which helps us to capture the non-linear relationships between price changes and the explanatory variables. As a theoretical model of house prices in Augustyniak et al. (2014a) shows, there are important nonlinear relationships between house prices and fundamental variables that need to be accounted for empirically. We apply the fixed effects regression method[7] with robust standard errors (bootstrapped 1 000 times).

We are aware of the problems that the fixed effects regression can cause in dynamic panels (see Kiviet, 1995 and Flannery and Hankins, 2013). We therefore also applied the *bias corrected least squares dynamic panel data estimator* proposed by Bruno (2005). We found that the regression results are nearly identical to the FE ones, thus we stayed with the FE regression. We also tested the Bruno estimator, including time dummies. In this case we face the problem that interest rates or construction costs,

[6] The loan availability is calculated under the assumption that loans denominated in zloty and in foreign currency were granted during the period 2005-2011, whereas in the remaining years only zloty denominated loans were granted.

[7] The choice of the fixed effects regression model has theoretical foundations. This method is used when the selected sample is not a random, but represents the entire population. Moreover, the economic analysis of individual markets, presented by Baldowska et al. (2014), shows that each market has a unique character, which practically does not change over time. The fixed effects method makes it possible to exclude this fixed element which is impossible to detect with any of the included explanatory variables, and would be erroneously attributed to the error term of the model. We also run the Hausman test. It showed that the random effects model can be used, however, the results of this test can be considered reliable only if a much bigger number of observations (at least 20-30 observations in a time-series) is present.

which are identical for all cities, drop out of the regression. It is crucial to capture the effect of the interest rate and the construction costs separately, therefore we had to skip the time dummies.

Home prices and most explanatory variables are non-stationary, yet, the Pesaran test (2004) shows that the error terms are not correlated and we find that the error terms are stationary. This allows us to conclude that the regression models are correctly specified. The tests are repeated for every specification that is presented in this paper.

The empirical analysis is divided into three units. The first and second deal with the primary market and secondary (existing) market analysis, respectively. In the third part we explain prices in the primary market using data from the secondary market and vice versa. We also investigate the price spillover effects from the Warsaw market to other local markets.

2.1 Analysis of the primary market

In the first regression, we explain the transaction price per square meter of housing with its lagged price, the rate of unemployment, building costs and the average wage in the enterprise sector. All explanatory variables are significant at the 1 percent level and the regression seems to be well specified. We find that the current price depends on the past price with an elasticity of around 40 percent. This finding confirms the hypothesis that the appreciation of housing adds to housing demand. A decline in the unemployment rate, thus growth in employment leads to higher housing demand that translates into a rising house price. The elasticity of price changes in response to changes in the unemployment rate is of around -30 percent and the parameter is highly significant. Increases in real wages have a strong positive effect and their elasticity is around 70 percent. Moreover, we included the growth rate of construction costs. Because construction costs depend on the lagged construction level and its price there might be an endogeneity problem. We therefore use the first differences of the construction costs instead of its levels and we find that developers ask for higher prices if construction costs increase.

In regression (2) we add to the core model (1) the weighted interest rate[8] for housing loans, which determines the loan cost. All the core parameters remain the same, but the interest rate does not have any effect on the price level. In order to analyse the potential effect of loans we include the available loan in regression (3). This variable is directly constructed from the income and the weighted interest rate,

[8] The interest rate is the weighted sum of the PLN and FX loan interest rate, weighted by the quarterly volume of loans in domestic and foreign currency.

thus we need to drop those variables in this regression. Contrary to our expectations, the loan availability has no effect on house prices in the primary market. During the bust period interest rates remained low and wages continued to increase, but banks slowed down loan disbursements and house prices started to revert to pre-boom levels slowly. We could expect that the loan availability has the same positive impact as wage increases have, but it turns out to be insignificant. Housing in the primary market is bought at least to some extend with cash (either from savings or from selling another dwelling, see NBP 2013), therefore the loan availability seems to be less important. Interestingly, in this specification the past price has an even higher effect on the current price. One possible explanation is that banks were giving out loans basing on positive expectations as concerns house price movements. The second explanation is that when the interest rate increased (especially in the boom period) people took their loans for longer and longer periods, i.e. for 25 or 30 years instead of 20 years. This extended repayment period allowed households to keep quite low monthly instalments even though interest rates were rising. Another explanation is the fact that developers adjusted prices downwards much slower than they increased them. Therefore, rising interest rates did not lead to strong price declines and therefore they turn out to be insignificant. In all other modifications of core model (1) the interest rate turned out as unimportant.

We also present modifications of the second model in which we use the growth rates of some variables instead of their levels. When we substitute the unemployment rate with its growth rate (regression 4), the results do not change much. However, we observe that the lagged price has a higher coefficient 0,66 and also reacts stronger to growing construction costs (coefficient of 0,85). One conclusion is that the unemployment level has a stronger effect on house prices than its dynamics have. Finally, we substitute the wage levels with their growth rate (regression 5) and rerun the regression. While the lagged price, unemployment level and credit costs have the same effect as in regression (2), the growth rate of wages has basically no effect on prices. Most likely the fluctuations of wages have no effect on the market as potential buyers focus on the general wage movements and base their expectations on them.

Table 1. Regression results for the primary housing market in 17 cities, 2002-2013

L_price_prim	(1)	(2)	(3)	(4)	(5)
L_price_prim	,3819***	,4001****	,5488***	,6689***	,5422***
L1	[,1017]	[,1044]	[,0583]	[,0488]	[,0802]
L_unemployment	-,3350***	-,3168***	-,3409***		-,3592***
	[,0693]	[,0711]	[,0574]		[,0698]
L_unemployment				-,2084***	
D1				[,0480]	
L_constr_costs	,4266***	,4671***	,2777*	,8525***	,3071
D1	[,1691]	[,1780]	[,1692]	[,1435]	[,2109]
L_wages	,7023***	,6997***		,7499***	
	[,2026]	[,1703]		[,1943]	
L_wages					,0107
D1					[,4232]
L_credit_costs		-,0315		-,0739	-,0346
		[,0766]		[,0651]	[,0699]
L_loan_availability			,1525		
			[,0948]		
constant	0,1815	,0708	2,4835*	-3,0822**	-,0346
	[1,1286]	[1,0060]	[1,3853]	[1,2656]	[,0699]
No. Obs.	187	187	187	187	187
R-sq. within	0,8735	0,8739	0,8643	0,8628	0,8624
between	0,6240	0,6373	0,7675	0,8242	0,7920
overall	0,7503	0,7585	0,8176	0,8445	0,8344

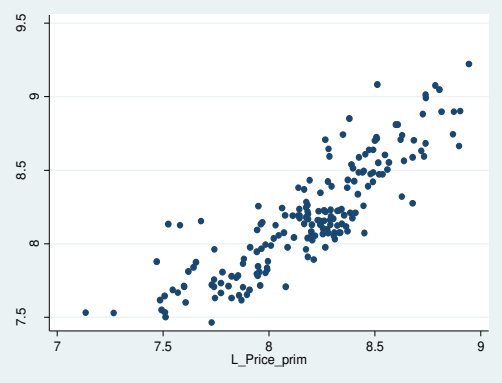
*Level of significance: 10% - *; 5% - **; 1% - ***; robust standard errors in brackets.*

The analysis of the price determinants in the primary market leads us to conclude that house prices depend on the past price, thus the housing appreciation has an impact on housing demand. Moreover, the unemployment level has a negative effect on house prices, while they rise with the wage level. These findings seem to confirm that fundamental variables have a major impact on house prices and that buyers form expectations on past prices. The loan availability or the cost of credit measured with the weighted interest rate does not have any impact on prices. While this is quite counterintuitive, it might result from the fact that a significant share of primary market housing is bought with cash, thus loans might be relatively less important. Finally we observe that rising construction costs make developers increase prices and to transfer the higher costs to the buyers.

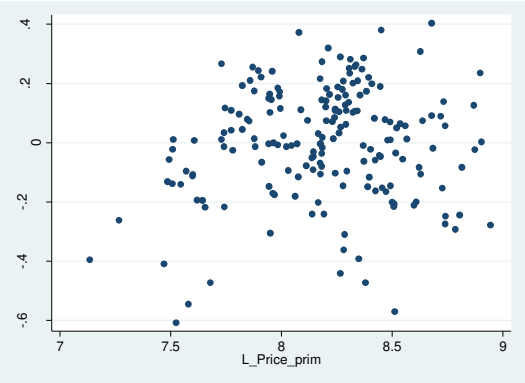
We also perform an analysis of the actual observed prices and predicted prices in individual cities, which confirms that the model is well specified (graphs 3-6). To improve the visibility of the results, we divide the cities into eight large and nine

smaller ones[9]. The fit is quite good in most cities and only in the case of Katowice we observe a significant shift between actual and predicted data (see graph 6). Katowice is a quite small market in the whole Silesian agglomeration, shows a very high average wage level and a low unemployment rate. The city has a large housing stock in relation to its inhabitants. Many people who work in Katowice live outside of the city. The housing demand in the city is well satisfied and therefore the real housing demand is lower than the predicted one. In consequence the house price in Katowice is overestimated, if we base it on macroeconomic fundamentals. We also tried to run regressions 1-5 without Katowice but the results do not alter significantly in the remaining cities.

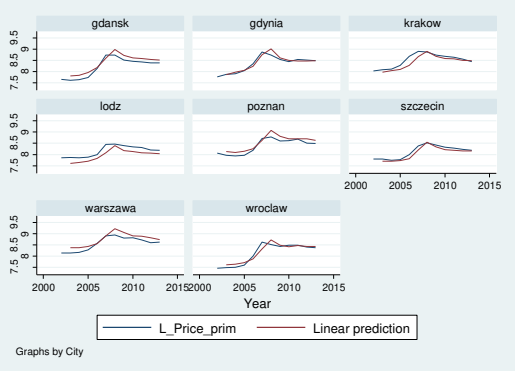
Graph 3 Predicted and actual observations for Model (1) – Primary market



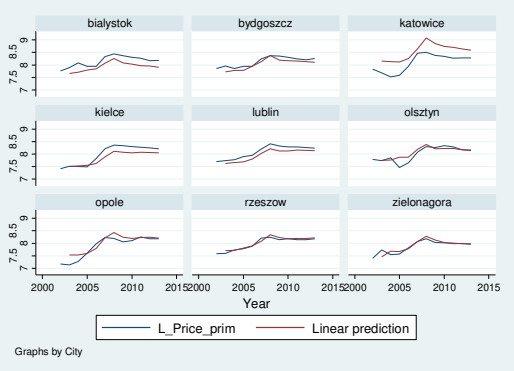
Graph 4 Error and real data for Model (1) – Primary Market



Graph 5 Predicted and actual observations for Model (1) for „big cities"



Graph 6 Predicted and actual observations for Model (1) for „small cities"



[9] The division was based on the number of inhabitants in a particular city. "Large" cities, i.e. with population exceeding 400 thousand inhabitants include: Gdańsk and Gdynia (as one big market), Kraków, Łódź, Poznań, Szczecin, Warsaw and Wrocław. The group of "small" cities, i.e. with population of less than 400 thousand inhabitants include: Białystok, Bydgoszcz, Katowice, Kielce, Lublin, Olsztyn, Opole, Rzeszów and Zielona Góra.

2.2 Analysis of the secondary market

The next step in our analysis is the secondary market. The estimation of various model specifications leads us to the same models that we apply to the primary market. The model for the primary market (Model 1) seems to be well suited for the secondary market too, has even better R-sq values and most explanatory variables are significant at the 1 percent level. In model 6 the current price depends positively on the lagged price with an elasticity of around 50 percent. The arising unemployment level decreases price levels with a parameter of around -0,3 while they rise with wages. Surprisingly, the growth of construction costs has a significant impact on house prices in the secondary market, too. One possible explanation is that if construction costs in the primary market rise, consumers tend to substitute primary market housing with cheaper housing from the secondary market. This pushes secondary market prices upwards.

Table 2. Regression results for the secondary housing market in 17 cities, 2002-2013

L_price_sec	(6)	(7)	(8)	(9)	(10)
L_price_sec L1	,5166*** [,0451]	,5794*** [,0469]	,6190*** [,0309]	,7741*** [,0295]	,6504*** [,0369]
L_unemployment	-,3047*** [,0483]	-,2309*** [,0504]	-,2716*** [,0530]		-2520*** [,0587]
L_unemployment D1				-,1909*** [,0318]	
L_constr_costs D1	,5587*** [,1598]	,7091*** [,1511]	,4811*** [,1488]	,8776*** [,1216]	,5947*** [,1847]
L_wages	,3642** [,1459]	,3725*** [,1232]		,3610*** [,0865]	
L_wages D1					,1019 [,3655]
L_credit_costs		-,1461*** [,0390]		-,1542*** [,0300]	-1405*** [0409]
L_loan_avaliability			,2218*** [,0507]		
constant	1,6398 [,9936]	1,1719 [,8312]	,8552 [,7819]	-,7481 [,5535]	3,5848*** [,3701]
Nr. Obs.	187	187	187	187	187
R-sq within	0,8990	0,9067	0,9010	0,9032	0,9042
between	0,7494	0,8044	0,8084	0,9472	0,8950
overall	0,8384	0,8672	0,8612	0,9180	0,9007

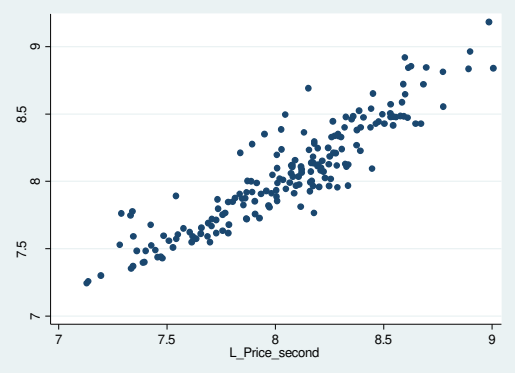
*Level of significance: 10 % - *; 5 % - **; 1 % - ***; robust standard errors in brackets.*

We extend the model and include the cost of credit in regression 7. While the remaining parameters do not change significantly, the cost of credit has a significant negative effect on house prices. This finding is in line with the fact that a large share

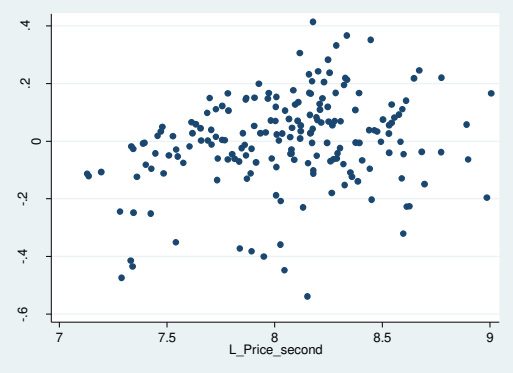
of secondary market housing is financed with a loan. Rising interest rates make loans more costly and less available and therefore curb the price growth in the secondary market.

In all specifications the current price depends a little bit stronger on the past period price than it happens in the primary market. This finding can be explained in the following way. On the primary market supply is quite inelastic, thus increasing demand leads to strong price increases. On the secondary market, as prices rise, more and more people decide to put their house on the market. This way supply is more elastic than in the primary market and the price increases slower.

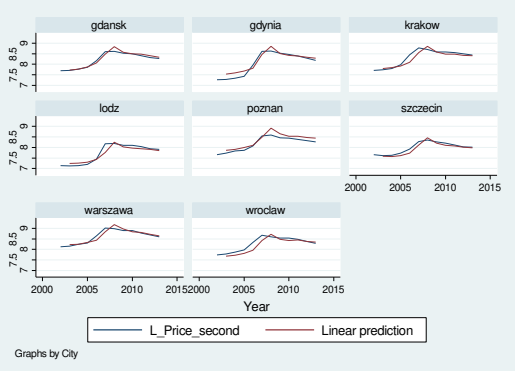
Graph 7 Predicted and actual observations for Model (6) – Secondary market



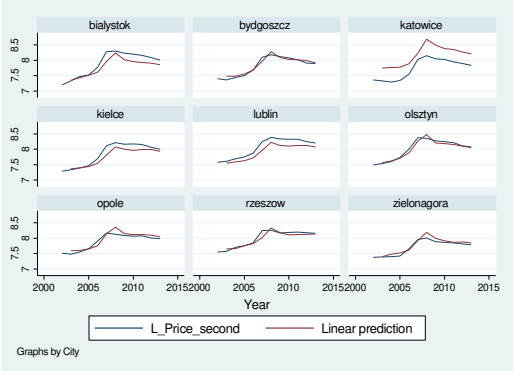
Graph 8 Error term and actual observations for Model (6) – Secondary Market



Graph 9 Predicted and actual observations for Model (6) for „big cities"



Graph 10 Predicted and actual observations for Model (6) for „small cities"



The graphical analysis of the predicted and actual observations as well as the error terms, presented in graphs 7-10, indicates that the model for the secondary market is well specified and suitably explains the price changes in the local markets. Again the results for Katowice are overestimated and the same explanation as for the primary market applies. Moreover, the prices for Bialystok, Lublin and Kielce are systematically underestimated. Those cities have a very high unemployment rate and quite low official wage levels. We as-

sume that there is a significant share of people who work unofficially or work in larger cities or even abroad and buy housing with a salary that is higher than the city average. Another important factor is the unofficial trade with eastern countries, which boosts the income of people who live in those cities.

2.3 Interdependence between the primary and secondary market and spillover effects

In the third section of this paper we investigate the mutual interdependence between the primary market prices and secondary market prices (Model 11 and 12). We also analyse the price spillover effects from Warsaw to other local cities for both markets (Model 13-16).

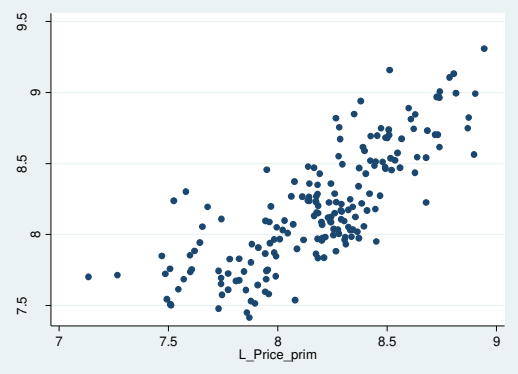
We use the same set of explanatory variables as in regression 1 and 6 to explain prices in the primary or secondary market, but add the lagged price of the other market. The most important empirical result is that lagged prices in the secondary market help to explain the prices in the primary market, but it does not work the other way around. This means that price signals from the secondary market spread to the primary market. The explanation of this result follows the empirical observations of the market described in NBP (2013) and also bases on the theoretical model of interactions between the primary and secondary market proposed by Augustyniak et al. (2014a). Firstly, if demand in the secondary market is excessive, at some point the housing demand can be only satisfied with newly constructed housing from the primary market, thus its prices increase. Secondly, housing developers are able to use marketing techniques to rise prices in the primary market above a value that fundamentals could explain. On the other hand, when prices in the primary market rise, they have little effect on the secondary market. The secondary market is huge and along with rising prices more and more owners decide to sell their housing, which has a stabilizing effect on price increases.

Table 3 Primary Market explained with secondary market and vice versa; Price spillover effect from the Warsaw market to other local markets, 2002-2013

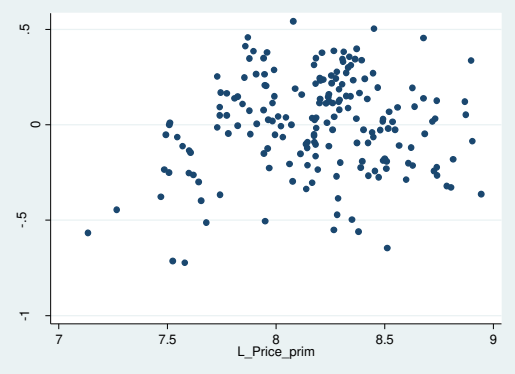
L_price_prim	(11)	--	(13)-W	--	(15)-W	---
L_price_sec	--	(12)	--	(14)-W	---	(16)-W
L_price_prim L1	--	,1218 [,0796]	,3892*** [,0924]		--	--
L_price_sec L1	,1905** [,0973]	--		,5240*** [,0435]	--	--
L_unemployment	-,4246*** [,0742]	-,4793*** [,0654]	-,3345*** [,0637]	-,3050*** [,0498]	-,2823*** [,0830]	-,1291* [,0702]
L_constr_costs D1	,1618 [,1609]	,1719 [,2206]	,4270*** [,1630]	,5632*** [,1607]	-,1933** [,0927]	-,1499 [,1491]
L_wage	1,0109*** [,2394]	1,3322*** [,2117]	,6875*** [,1774]	,3545** [,1445]	,8634*** [,1632]	,7387*** [,1264]
L_price_prim_WAW					,4713*** [,0882]	
L_price_sec_WAW						,7456*** [,0740]
constant	-,5003 [1,5176]	-2,5321 [1,5733]	,2472 [1,0966]	1,6583* [0,9968]	-2,1389 [1,7351]	-4,0062*** [1,2425]
No. Obs.	187	187	176	176	176	176
R-sq within	0,8492	0,8419	0,8731	0,9013	0,8637	0,9209
between	0,4611	0,3499	0,5028	0,6200	0,2340	0,1067
overall	0,6246	0,5468	0,7264	0,8130	0,6432	0,6734

*Level of significance: 10 % - *; 5 % - **; 1 % - ***; robust standard errors in brackets.*

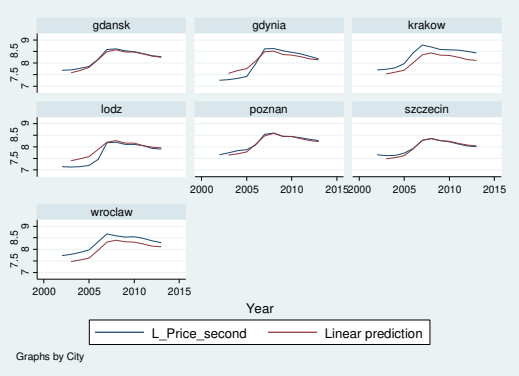
Graph 11 Predicted and actual observations for Model (11)



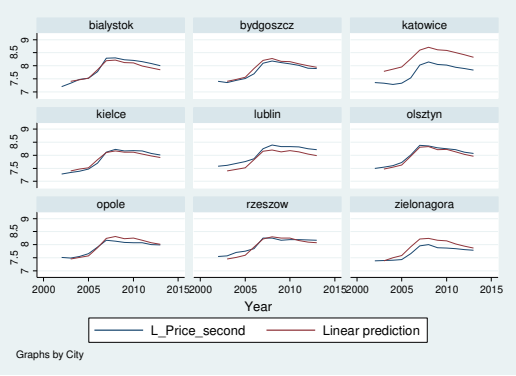
Graph 12 Error term and actual observations for Model (11)



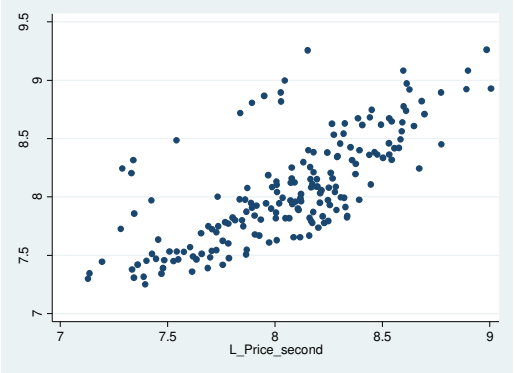
Graph 13 Predicted and actual observations for Model (11) for „big cities"



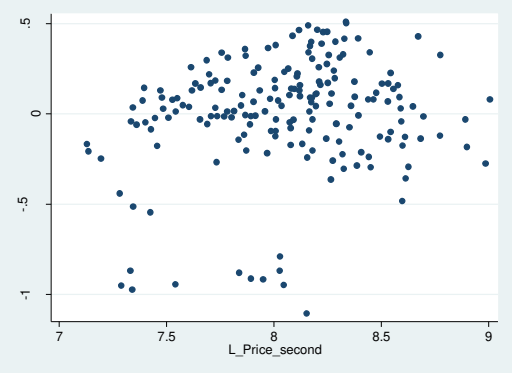
Graph 14 Predicted and actual observations for Model (11) for „small cities"



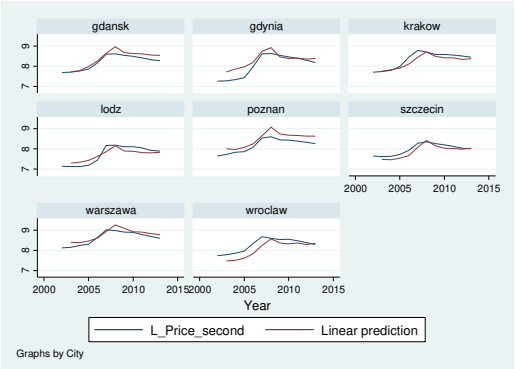
Graph 15 Predicted and actual observations for Model (12)



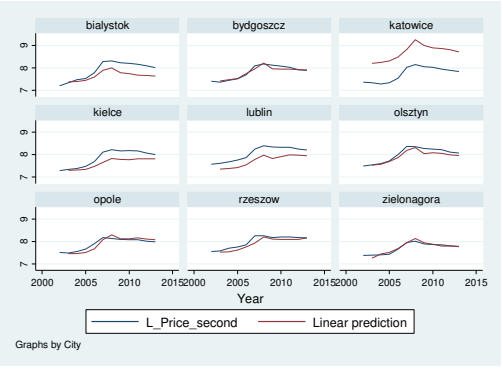
Graph 16 Error term and actual observations for Model (12)



Graph 17 Predicted and actual observations for Model (12) for „big cities"



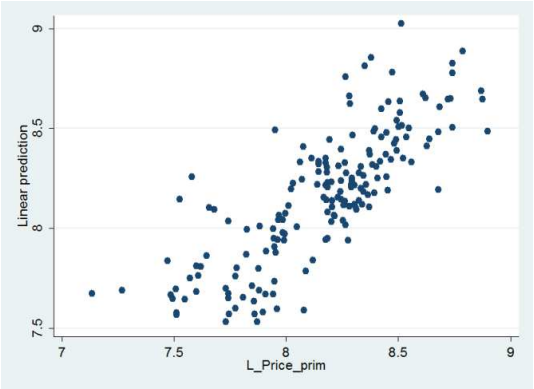
Graph 18 Predicted and actual observations for Model (12) for „small cities"



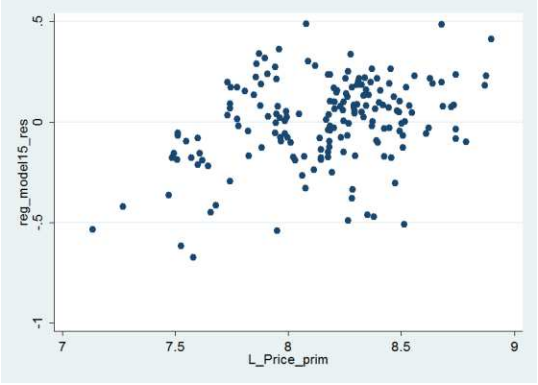
In the last set of regressions, we investigate whether there is a contagion effect from rising prices in Warsaw that spread to other local markets. In regressions 13-16 we include all cities but Warsaw. First, we run regressions 13 and 14 that replicate regressions 1 and 6, respectively, and find that the results stay very similar. Basing on this specification, we add the current price of housing in the Warsaw market as an explanatory variable. We have to exclude the lagged price in the local market, because the price levels are collinear. If we include

the Warsaw price and the lagged price we would get a spurious regression. We include the price in Warsaw in the same year, because we expect that news about rising prices spread from Warsaw to other cities in the same period. Indeed the regression results of regression 15 and 16 indicate that the Warsaw market has a significant impact on the primary and secondary market. In the primary market the effect of the unemployment level remains unchanged in comparison to regression 13, while the wages have a slightly higher effect on prices. The rise of prices in Warsaw affects the local price with a parameter of 0,47. Surprisingly, the effect of the increase of construction costs has a negative sign. It is possible that the effect of the Warsaw price and the wages is overestimated and therefore the construction costs obtain a negative sign. In the secondary market we find that impact of the Warsaw market price has a parameter of 0,74. The effect of the unemployment level is lower than in regression 14, but still remains significant. The elasticity of prices in relation to wages is around two times higher than in regression 14. As in the case of the primary market the effect of rising construction costs is negative, although insignificant. The regression results, measured with the distribution of the error terms seem to be better for the primary market than for the secondary market.

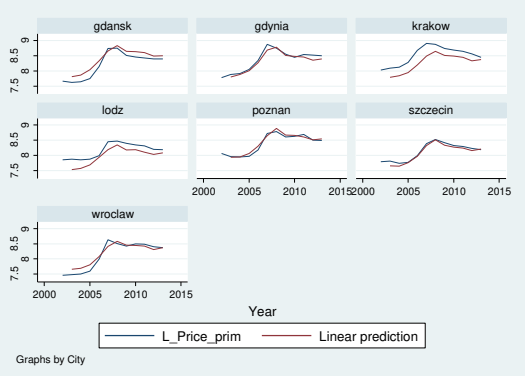
Graph 19 Predicted and actual observations for Model (15)



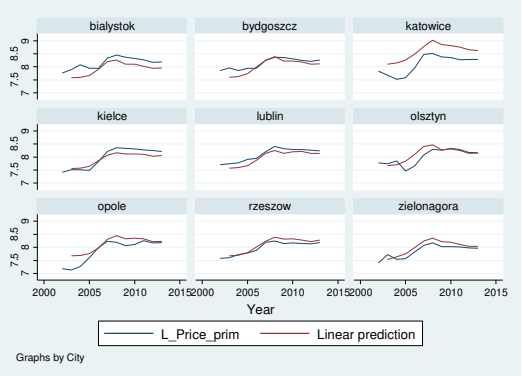
Graph 20 Error term and actual observations for Model (15)



Graph 21 Predicted and actual observations for Model (15) for „big cities"

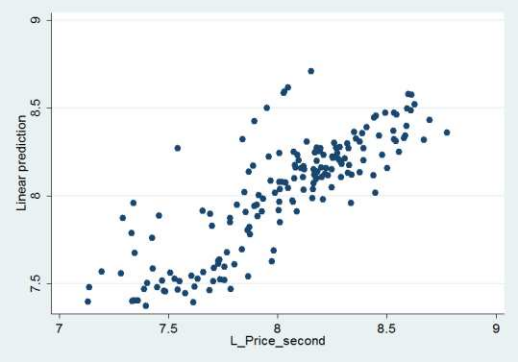


Graph 22 Predicted and actual observations for Model (15) for „small cities"

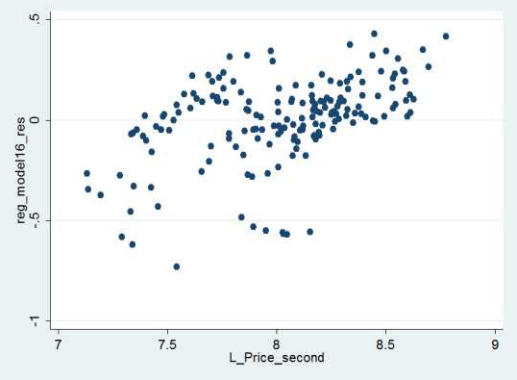


When we include the spillover effect of the Warsaw prices to local markets, the regression results for Białystok, Kielce and Lublin improve significantly. While in regression 11 and 12 we see that the prices in those markets, both in the primary and the secondary market, are underestimated, now the predicted prices is very close to the empirical one. This confirms our previously mentioned assumption that wages in those three cities are underreported. The price development in Warsaw is a proxy for performance of the overall economy, therefore it explains the price developments in those small cities well.

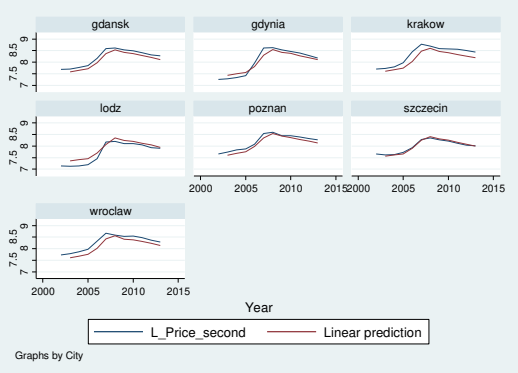
Graph 23 Predicted and actual observations for Model (16)



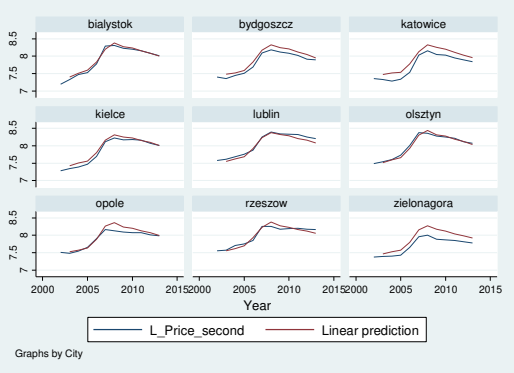
Graph 24 Error term and actual observations for Model (16)



Graph 25 Predicted and actual observations for Model (16) for „big cities"



Graph 26 Predicted and actual observations for Model (16) for „small cities"



3. Conclusions

The analysis confirms that transaction prices in the primary and secondary market in 17 largest cities in Poland depend on fundamental variables such as wages, the rate of unemployment and construction costs. Moreover, we confirm empirically that the appreciation of housing has a positive effect on the price level in the next period. We conclude that appreciation affects the utility function of the household

and impacts on its optimal decision, which strengthens the theoretical results presented in Augustyniak et al. (2014a).

We also find that that prices in the secondary market help to explain the prices in the primary market, however this relationship cannot be inverted. This finding confirms that the demand shock goes first to the secondary market and then to the primary market. Potential buyers try to find housing in the secondary market first, because it is usually cheaper. But if demand exceeds supply, they have to go to the primary market, which increases the prices in the primary market. However, price rises in the primary market have little effect on the prices in the secondary market. Most likely, if prices in the secondary market start to increase, more and more owners put their housing on sale, thus supply increases and becomes more flexible. This prevents price bubbles in the secondary market.

Finally, we confirm the existence of a contagion effect of price rises in the Warsaw market, that spill over to the other largest cities. As news of rising prices in the capital city spread over the country, developers and house owners in local markets adjust their price expectations. We find that the spillover effect is stronger in the secondary market than in the primary one. Intuitively, one would expect that the primary markets, which are often operated by the same developers behave similarly. However, it turns out that the price of the secondary market in Warsaw is a good proxy for the economic performance of the whole economy. It helps to properly estimate the house prices, which in some cases, most likely due to underreported wages and unofficial employment, were underestimated.

Our results should be useful for other countries, both highly developed and for those who are still emerging. To our best knowledge this is the first study that investigates the quite complicated relationships between the primary and secondary market for an Eastern European Country, which allows to determine how a demand shock affects different segments of the market and shows which fundamental variables have a significant impact on the primary or secondary market. The results can be especially useful for emerging markets, which are faced with a high demand for housing and where the existing housing stock is quite depreciated. The results also indicate that the primary and secondary market, which have different price and demand determinants, need to be monitored carefully and analysed separately.

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