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CYCLICAL DETERMINANTS OF REGIONAL HOUSE PRICES IN POLAND

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Abstract: The aim of the article is to present results of the study on the link between business cycle and house prices in 16 regional capital cities in Poland. Using quarterly data for the period 2010–2024, the study finds that regional business cycle effects on cyclical fluctuations in regional house prices are predominantly positive. Following an increase in the National Bank of Poland (NBP) reference rate, house prices are on a decline in 11 out of 16 regional capital cities. The effects of housing quality and the exchange rate on house prices are ambiguous.

Keywords: house prices, business cycle, exchange rate, interest rate, Poland

JEL classification: E37, R30

INTRODUCTION

Although earlier studies considered house cycles to be independent of fluctuations in business cycles, more recent research acknowledges causality between them, especially in the period after the world financial crisis of 2008–2009 [Jadevicius et al. 2014]. Empirical evidence on the link between the business cycle and the house price developments is ambiguous. Causation running from the business cycle to house prices is observed in the OECD countries [Catte et al. 2004], in the UK, Ireland and Poland [Zelazowski 2017], with relevant theoretical arguments in favour of that kind of causality presented in several studies, for example Barras [1994] or Davis and Heathcote [2003]. In Italy, house prices react to the business cycle mostly during the recession [Marzano et al. 2021]. As for Finland, there is a two-way causality between housing and business cycles [André and Garcia 2012]. However, other studies report no significant impact of the business cycle on house

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prices [Leamer 2007; Girouard et al. 2006], or suggest that the effect is weak relative to other types of shocks [Sala-Rios et al. 2018]. It is also possible that structural changes not captured by econometric models contribute to the perceived lack of relationship between the business cycle and house prices [Girouard et al. 2006].

The aim of this paper is to investigate the impact of the regional business cycle on the house prices in Poland's regional capital cities. Several research questions are attempted to be answered within a common empirical framework: Are there any regional differences in how business cycles affect house prices across Poland's voivodships? How sensitive are house prices to changes in the National Bank of Poland (NBP) policy rate? What is the impact of hedonic effects on house prices?

The remainder of the paper is structured as follows. Section 2 outlines relevant theoretical issues. Section 3 discusses data and statistical methodology. Section 4 presents the main empirical results and Section 5 concludes.

THEORETICAL FRAMEWORK

Mechanisms underlying the causal link between the business cycle and house prices can be divided into the supply-side and demand-side factors. Based on empirical evidence that consumption, non-residential investment and residential investment co-move positively, the relationship between house prices and the business cycle is explained using the neoclassical multi-sector model developed by Davis and Heathcote [2003]. The price of new housing is related to the price of its determinants as follows:

$$\log p_t^h = -(1-\phi) + \phi \log y_t^d + \log p_t^d, \tag{1}$$

where p_t^h is the price of new housing, ϕ is the share of land in the construction of new homes, y_t^d is the supply of residential structures (new road construction, declining relative returns to agricultural use, and changes in zoning restrictions) and p_t^d is the price of residential investment. The investment effect leads to an increase in house prices and this relationship becomes stronger in line with higher land requirements. The price effect is explained by the fact that new residential structures must be built on smaller lots, thus requiring bigger (and more expensive) structures to keep housing services at an efficient level.

Notwithstanding the importance of supply-side factors in housing market developments, it is widely assumed that demand-side factors are a dominant force in the short run [Augustyniak et al. 2013]. In particular, demand for housing depends on the real household income, the unemployment rate, the real interest rate, and expectations of future income. If economic boom is accompanied by an excessive optimism about the future income, increased demand for housing can lead to speculative property bubbles.

The observation that economic recovery leads to expansion in the housing market is explained by Barras [1994]. When a higher demand for housing is combined with scarcity of the residential property supply, it results in rising rents

and house prices. In the presence of credit expansion, housing and business cycles are mutually reinforcing, often leading to a construction boom. A subsequent increase in the interest rate in response to overheating of the economy causes a downward correction of demand for housing. Combined with a higher supply of new houses, this leads to falling house prices.

In the context of the US Subprime crisis of 2000s, Duca et al. [2021] highlight the interaction between business and housing cycles in a financially advanced economy. During the boom phase of the business cycle, increased banking profits and lower risk of default lead to more comfortable credit conditions, with a further boost of the demand for housing and house prices. In the depression, the same financial sector-linked mechanism implies weakening of the demand for housing and downward pressure on house prices. However, the latter can be attenuated by the loss aversion behavior in the housing market [Genesove and Mayer 2001]. Following a decline in house prices after a boom, house owners often set a higher asking price than it would be in the absence of a loss thus keeping house prices artificially high and extending the average period of house sale. Among other theoretical arguments, income-induced housing market fluctuations could be weaker in the economy with young credit-constrained households and down-payment requirements [Ortalo-Magné and Rady 2001].

As house prices adjust to cyclical conditions more frequently than equity markets [Catte et al. 2004], this can be the result of interest rate developments. Relevant arguments are provided by Augustyniak et al. [2013]. A decrease in the interest rate improves loan availability and fuels demand for housing. Under a strong credit multiplier, even a minor decrease in interest rates can lead to a significant increase in demand for housing. House prices are higher on impact, as supply of housing is fixed, but there are incentives for developers to invest in the housing market. Although a future increase in the supply of housing is expected to exert a downward pressure on house prices, pro-cyclical developments in the housing market are supported by speculative behaviour of market participants, as well as by economic policy initiatives like a relaxation of the down-payment constraint [Ortalo-Magné and Rady 2001]. In the case of a stagnating demand for housing, easy financing for the unsold housing stock can contribute to downward price rigidity, along with expectations for future price increases. On the other hand, declines in house prices may be abrupt if the unsold housing stock is sufficiently large.

Ultimately, the pattern of house price adjustment depends on the price elasticity of housing demand and supply. As demonstrated by Malpezzi and Wachter [2002], both the lagged supply response to house prices and demand conditions are behind house cycles, with the strongest effects of speculations being observed under inelastic supply of housing.

Empirical findings for several European countries reveal that house prices are inertial (with the exception of Germany), being negatively affected by real interest rates and neutral in respect to real income [Annett et al. 2005]. By contrast, the positive effect of income growth on house prices is found in a panel of nine US

regions [Schnure 2005]. An inverse relation between interest rate and house prices is also confirmed, consistent with findings for 24 European countries [Savva 2018], the USA, the UK, Ireland and Spain [Dahl and Góralczyk 2017], and Poland [Olszewski et al. 2015; Shevchuk 2022]. For 22 advanced economies, empirical evidence confirms that credit market conditions may cause cyclical fluctuations in house prices [Igan and Lungani 2012].

DATA AND STATISTICAL METHODOLOGY

Our dataset contains time series of the prices for new residential housing in regional capital cities (in zlotys), the hedonic price index (q-o-q), real regional product in Poland's voivodships (index, 2010=100), the nominal and real effective exchange rates (index, 2015=100), and the National Bank of Poland (NBP) reference rate (in percent). All data come from the GUS (www.gus.gov.pl), the NBP (https://nbp.pl/publikacje/cykliczne-materialy-analityczne-nbp/rynek-nieruchomosci/) and the IMF online databases (www.data.imf.org). For the purpose of this study, annual data series on the real regional product were transformed into quarterly time series with the exponential smoothing procedure. The Hodrick-Prescott filter was used to obtain the cyclical components of house prices and regional output series.

As shown in Figure 1, the pattern of housing and regional business cycles does not differ markedly across regional capital cities. In all cases, fluctuations of housing prices exceed those ones of the regional output. Recently, all cities have experienced a boom in house prices in 2021-2022, followed by an abrupt decline in house prices in 2023 and subsequent recovery. The Granger test results suggest causality running from the regional business cycle to cyclical fluctuations in house prices in Gdansk, Kielce, Lodz, Lublin, Opole, Szczecin, Wroclaw, Zielona Gora, with a two-way causality found for Poznan (results are available upon request). Bydgoszcz is the only city where the regional business cycle is affected by the house cycle.

According to the ADF test, stationarity at level is indicated for housing and business cycle variables as well as for hedonic indexes (results are also available upon request). Consequently, our statistical model is specified as:

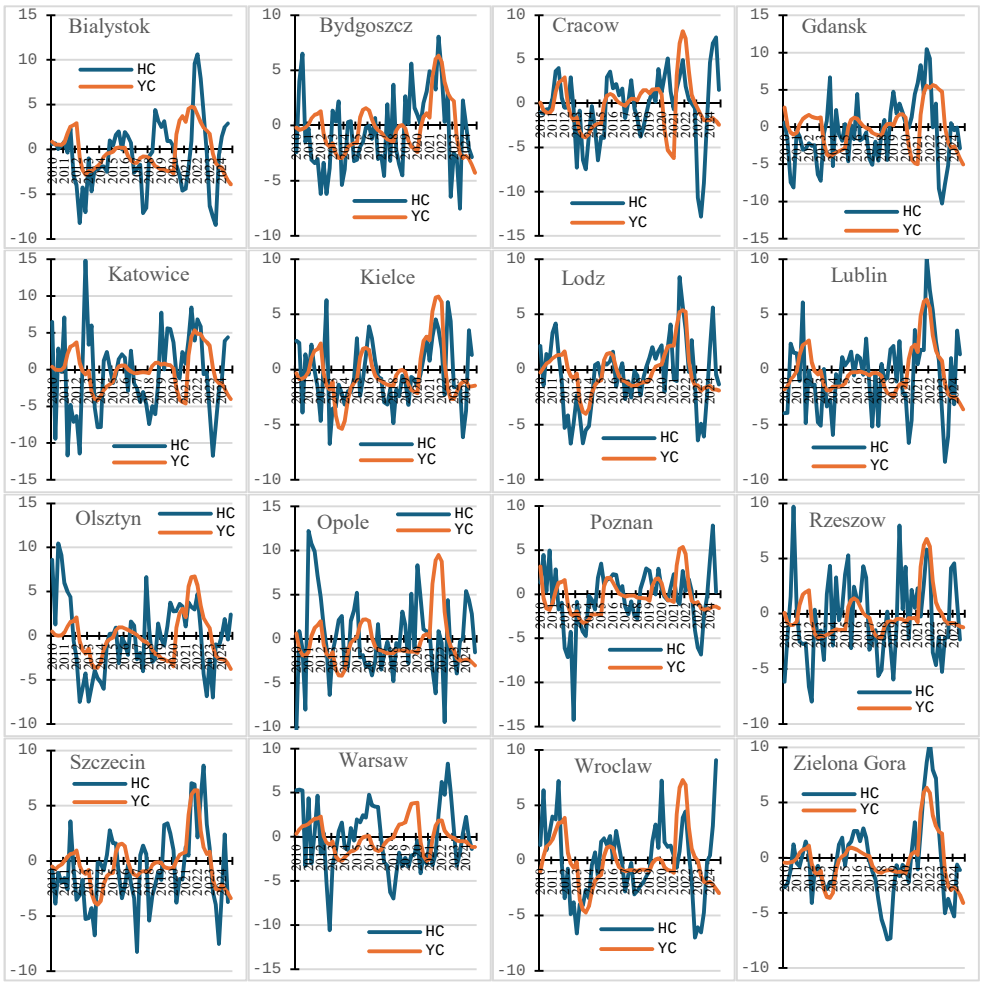
$$HC_t = \alpha_0 + \alpha_1 HC_{t-1} + \alpha_2 YC_t + \alpha_3 \Delta E_t + \alpha_4 RNBP_{t-1} + \alpha_5 HED_t + \varepsilon_t, \quad (2)$$

where HC_t and YC_t are house price and business cycles (%), respectively, ΔE_t is the rate of exchange rate changes (%), $RNBP_t$ is the central bank reference rate (%), HED_t is the hedonic price index (q-o-q), ε_t is a white noise variable.

Housing cycles are likely to be inertial ($\alpha_1 > 0$), consistent with other empirical findings, such as those of Annett et al. [2005]. As mentioned above, the relationship between business and housing cycles is ambiguous ($\alpha_2 <> 0$), even though theoretical arguments in favour of a positive effect of the business cycle on housing prices seem to be stronger. Control for the exchange rate effects is justified due to significant demand for housing from Polish residents employed abroad, which is expected to surge in the case of currency depreciation ($\alpha_3 > 0$). In line with the

logic of conventional relationships in the housing market, an interest rate hike is expected to be inversely related to house prices ($\alpha_4 < 0$). In the absence of time series for the mortgage rate, the National Bank of Poland (NBP) reference rate is used as a proxy for the cost of borrowing.

Figure 1. Housing and regional business cycles (%), 2010–2024



* HC and YC refer to the housing cycle and the regional business cycle, respectively.

Source: author's own work

Finally, it is reasonable to expect that improvements in housing quality are associated with higher prices ($\alpha_5 > 0$). The hedonic price indexes are used to explain the impact on house prices of certain home's characteristics, such as size, number of bedrooms, location, pollution, public parks, local taxes, public school provision or

crime [Hill 2011]. A higher value of the hedonic price index implies the impact of higher preferences for amenities or the importance of location for house prices.

EMPIRICAL RESULTS

Empirical estimates of the determinants of house prices in regional capital cities are presented in Table 1. The value of the determination coefficient R^2 ranges from as low as 0.14 to as high as 0.79. Although housing cycles in such cities as Katowice, Kielce or Bydgoszcz are not sufficiently explained by the regional business cycle and control variables, explanatory power of the regression model is significant for most of the cities, including Cracow, Warsaw and Wroclaw. As implied by the Durbin-Watson statistics, there is no autocorrelation in the residuals (results are available on request). Also, both the Augmented Dickey–Fuller and the Phillips–Perron tests indicate that there is no unit root in the residuals, thus allowing for a correct interpretation of the results.

Table 1. Estimates of the house price cycle determinants (baseline model)

Regional capital cities	Explanatory variables					
	HC_{t-1}	YC_t	ΔE_t	$RNBP_t$	HED_t	R^2
Bialystok	0.605^{***}	0.185	0.137	-0.548^{*}	0.223	0.52
Bydgoszcz	0.227^{***}	0.473^{***}	-0.260^{**}	-0.636^{***}	0.238^{**}	0.23
Cracow	0.580^{***}	0.295^{**}	0.115	-0.605^{**}	0.258^{**}	0.47
Gdansk	0.322^{***}	0.129	0.209	-0.923^{***}	0.419^{**}	0.33
Katowice	0.270^{**}	0.296	–0.093	-0.762^{**}	0.378^{*}	0.14
Kielce	0.226^{**}	0.309^{**}	0.106	-0.401^{**}	0.158	0.17
Lodz	0.329^{***}	0.448^{**}	–0.102	-0.578^{***}	0.254^{***}	0.52
Lublin	0.404^{***}	0.879^{***}	-0.334^{***}	0.060	–0.018	0.45
Olsztyn	0.610^{***}	0.190^{*}	-0.308^{**}	-0.411^{**}	0.227^{**}	0.43
Opole	0.248^{***}	-0.448^{***}	1.060^{***}	0.523^{***}	-0.291^{**}	0.29
Poznan	0.270^{***}	0.257^{*}	0.302^{*}	-0.425^{**}	0.188^{*}	0.30
Rzeszow	0.445^{***}	0.532^{***}	0.519^{***}	0.503^{***}	-0.299^{**}	0.29
Szczecin	0.401^{***}	0.898^{***}	-0.340^{***}	0.187	–0.118	0.55
Warsaw	0.574^{***}	–0.237	0.711^{***}	0.271^{*}	-0.167^{*}	0.47
Wroclaw	0.619^{***}	0.307^{***}	-0.608^{***}	-0.395^{**}	0.202^{*}	0.56
Zielona Gora	0.522^{***}	0.599^{***}	0.131^{**}	-0.144^{*}	0.073	0.79

Note: here and hereafter *, **, *** imply statistical significance at the 10%, 5% and 1% level, respectively.
Source: author's own work

As expected, housing cycles are inertial in all cities, especially in Wroclaw, Bialystok and Warsaw. A positive relationship between business and housing cycles is strongest in the estimates for Szczecin and Lublin, followed by those for Zielona Gora and Rzeszow. Opole is the only city with a statistically significant inverse

relationship between YC_t and HC_t, with neutrality observed in the estimates for Bialystok, Gdansk, Katowice and Warsaw.

Among other results, the quality of housing - as measured by the hedonic price index - contributes to higher house prices in 9 out of 16 cities. Opole, Rzeszow and Warsaw are the cities where the hedonic factor is negatively related to house prices. Such a relationship can be explained by a shift in buyer's preferences toward smaller apartments and houses in not very attractive locations, which are seen as a decline in quality of housing (hedonic price). In other words, buyers have to buy smaller apartments in the less comfortable segments of the housing market when the overall prices are on the increase. Another likely explanation is that there are preferences for higher quality energy-efficient housing against the backdrop of declining overall prices. No link between HED_t and HC_t is found for Bialystok, Kielce, Lublin, Szczecin and Zielona Gora.

The exchange rate depreciation is procyclical in Opole, Rzeszow and Warsaw, where the hedonic factor has negative impact on house prices. In Bydgoszcz, Lublin, Szczecin and Wroclaw, a weaker currency is associated with a decrease in de-trended house prices. An inverse relationship between the NBP reference rate and house cycle is observed in 11 out of 16 cities. Again, estimates for Opole, Rzeszow and Warsaw (to less extent) demonstrate a different pattern in the relationship between an independent variable and house cycle.

Table 2. Estimates of the house price cycle determinants (specification with the REER)

Regional capital cities	Explanatory variables					
	HC_{t-1}	YC_t	ΔRER_t	$RNBP_t$	HED_t	R^2
Bialystok	0.607^{***}	0.200	0.155	-0.309^{*}	0.215	0.53
Bydgoszcz	0.220^{***}	0.444^{***}	-0.291^{**}	-0.695^{***}	0.262^{**}	0.24
Cracow	0.688^{***}	0.258^{*}	0.114	-0.495^{*}	0.226^{*}	0.44
Gdansk	0.316^{***}	0.230	0.223	-0.990^{***}	0.432^{**}	0.37
Katowice	0.275^{**}	0.264	0.017	-0.727^{**}	0.350	0.13
Kelce	0.238^{**}	0.313^{***}	0.122	-0.399^{**}	0.160	0.17
Lodz	0.340^{***}	0.425^{**}	–0.134	-0.609^{***}	0.264^{***}	0.52
Lublin	0.388^{***}	0.846^{***}	-0.273^{**}	0.041	–0.018	0.43
Olsztyn	0.600^{***}	0.151	-0.256^{*}	-0.442^{**}	0.233^{***}	0.43
Opole	0.273^{***}	-0.303^{**}	0.924^{***}	0.626^{***}	-0.307^{*}	0.25
Poznan	0.272^{***}	0.298^{*}	0.365^{**}	-0.344^{*}	0.162^{*}	0.31
Rzeszow	0.449^{***}	0.644^{***}	0.541^{***}	0.508^{***}	-0.284^{**}	0.30
Szczecin	0.373^{***}	0.911^{***}	-0.349^{***}	0.187	–0.118	0.54
Warsaw	0.578^{***}	–0.164	0.617^{***}	0.299^{**}	-0.177^{*}	0.44
Wroclaw	0.590^{***}	0.250^{**}	-0.450^{**}	-0.469^{**}	0.230^{*}	0.51
Zielona Gora	0.546^{***}	0.584^{***}	0.149^{**}	–0.116	0.058	0.79

Source: author's own work

The robustness of our main findings is confirmed when the statistical model incorporates percentage changes in the real exchange rate, ΔRER_t, as presented in Table 2. Among several differences, statistical significance of the coefficients on YC_t, $RNBP_t$ and $HED_t$is not retained in the estimates for Olsztyn, Zielona Gora and Katowice, respectively. As a robustness check, the NBP reference rate is substituted in the baseline model with the Taylor rule-implied rate, $TAYLOR_t$. Following Shevchuk [2022], a standard Taylor rule-implied interest rate was calculated using equal weights of 0.5 for both inflation and output gaps. The results are presented in Table 3. Similar to specifications above with the NBP reference rate (Tables 1 and 2), the Durbin–Watson statistics and unit root tests do not reveal any problems with the residuals if the Taylor rule-implied rate is used as a proxy for the cost of borrowing.

Table 3. Estimates of the house price determinants (specification with the Taylor rule-implied NBP reference rate)

Regional capital cities	Explanatory variables					
	HC_{t-1}	YC_t	$\Delta NEER_t$	$TAYLOR_t$	HED_t	R^2
Bialystok	0.618***	0.093	0.203	–0.071	–0.036	0.48
Bydgoszcz	0.297***	0.426***	–0.366***	–0.088*	0.010	0.14
Cracow	0.586***	0.344*	0.074	–0.157**	0.071	0.47
Gdansk	0.544***	–0.182	0.268	–0.037	0.023	0.24
Katowice	0.294**	0.167	–0.033	–0.162*	0.113	0.10
Kelce	0.187*	0.456***	0.052	–0.131**	0.043	0.15
Lodz	0.285*	0.590**	–0.060	–0.123***	0.024	0.46
Lublin	0.438**	0.578**	–0.255*	–0.135*	0.048	0.21
Olsztyn	0.595***	0.273**	–0.346**	–0.096*	0.092	0.41
Opole	0.255***	–0.397***	1.059***	0.115***	–0.144*	0.27
Poznan	0.238***	0.373**	0.344*	–0.105*	0.078	0.25
Rzeszow	0.500***	0.437**	0.575***	0.118**	–0.093	0.26
Szczecin	0.362***	0.605***	–0.204**	–0.091	0.012	0.35
Warsaw	0.633***	–0.231	0.838***	0.072*	–0.093	0.47
Wroclaw	0.598***	0.353***	–0.642***	–0.125**	0.103	0.55
Zielona Gora	0.789***	0.603***	0.082	–0.067**	0.046	0.80

Source: author's own work

The change in the specification of the regression model does not result in any significant alterations in the estimated effects of the business cycle and exchange rate on the housing cycle. However, in the specification using $TAYLOR_t$ a causal link between and the hedonic index and house cycle almost completely disappear, with the exception of the estimates for Opole. The pattern of relationship between the Taylor rule-implied rate and house cycle coincides with the estimates for the NBP reference rate effects in 13 out of 16 cases. Among the observed differences, the causal relationship between the interest rate and house prices is no longer evident in the

estimates for Bialystok and Gdansk, whereas the conventional inverse relationship between these variables emerges in the estimates for Lublin.

SUMMARY

This study investigated the relationship between regional business cycles and house prices in regional capital cities in Poland. Cyclical fluctuations in house prices in Poland's largest cities are found to be predominantly positively associated with regional business cycles. An exception is observed in Opole, where an inverse relationship emerges, while in Bialystok, Gdansk, Katowice and Warsaw, the relationship appears neutral. Following an increase in the NBP reference rate, house prices decline in 11 out of 16 cities, being in line with empirical studies for Poland and other countries. However, this pattern does not hold for Opole, Rzeszow and Warsaw where interest rate hikes are of positive impact on house price cycles. The pattern of interest rate effects on the house price cycle is confirmed for 13 out of 16 cities when the Taylor rule-implied interest rate is used. As indicated by the hedonic house price index, higher quality of housing is associated with an increase in house prices in 9 cities, however, this effect is no longer observed when the model includes the Taylor rule-implied interest rate. Opole is the only city in which a negative relationship between quality of housing and house price cycle is observed, regardless of the regression model specification. Among other findings, depreciation of the zloty – both in nominal and real terms – exerts a downward pressure on house prices in 5 cities, while in another 5 cities an opposite effect is observed.

Our study highlights the need for further research into the sources of heterogeneity in the relationship between exchange rate and housing price cycles across Poland's regional capital cities. Additionally, it is important to explore the underlying mechanisms linking the hedonic price index to housing market cycles, particularly given indications that his relationship may be influenced by expectations of the NBP interest rate policy.

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