Commercial property price index for Poland

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Abstract
We present the first hedonic analysis of commercial real estate prices in Poland. It is based on data collected by Narodowy Bank Polski and augmented with Comparables.pl data. We apply separate regressions for the office and retail market, and create a hedonic price index for offices in Warsaw and in the rest of the country and an index for the retail sector for the whole country. It is necessary to apply the hedonic approach, as the quality of the traded property varies significantly over time. We find that office property prices in Warsaw have posted a slight upward trend since 2009, while they are stagnating in the rest of the country. Retail property prices showed strong changes over the analyzed period, but since 2008 the hedonic price has been rather stable.

Keywords: commercial real estate, hedonic price index, time-dummy regression

JEL: E21, R21, R31

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1. Introduction

The precise measure of transaction prices in the commercial property market is a necessary step that improves and simplifies the macroprudential policy actions of central banks (see ECB 2008; 2010; 2011; Hiebert, Wredenburg 2012; Olszewski 2012; 2013). While most of the current research focuses on the residential market, “commercial property and property development have historically posed a greater direct risk to financial institutions’ balance sheets than have housing and mortgage markets” (Ellis, Naughtin 2010, p. 25). Even though in a more silent way than the housing boom, the commercial real estate (CRE, hereafter) boom ended in a bust and added to the problems of banks during the past crisis (see ECB 2008; Ellis, Naughtin 2010; Benford, Burrows 2013). A calculation by Ellis and Naughtin (2010) shows that price increases and later drops of CRE were twice as high as those of residential property.

Transaction prices are driven by growth in the economy, which triggers demand for office space, retail space and warehouses. The first demand shock goes to the office market, as firms want to hire more workers. Those earn more and spend their money, which fuels the demand for shopping facilities, and, in consequence, for warehouse space. Investors begin to supply new space and refurbish old buildings. When the economy starts to slow down, people cut down on consumption and firms fire workers, thus demand for retail and office space declines. As new construction is in the pipeline, and demand goes down, this leads to oversupply and transaction prices should decline. However, when prices go down most investors are not willing to sell, as they would materialize losses immediately.

Commercial property is strongly differentiated in terms of type, quality and location, therefore the analysis of the mean transaction price can give a wrong impression about the market. Transactions are quite rare, and if for example during a downturn only low-quality property is traded, one can get the impression that prices fall drastically. However, if we control for changes in the quality of the traded sample, we get the hedonic price which shows us how the prices in the market behave.

While papers concerning residential property abound, commercial property seems to be neglected in the literature for various reasons. First and foremost, residential property is a political matter and housing problems can easily lead to social unrest. Secondly, residential property is basically bought by residents and financed by the national financial system, while commercial property is financed by international investors. Lastly, it is difficult to obtain data on transactions and their prices in the commercial sector, because they are rather rare and the parties keep the details in secret.

In order to address those problems and discuss the data and price index needs, the BIS, ECB, Eurostat, IMF and OECD organized a conference on commercial property price indicators in 2012. The conclusion was that transaction prices, valuations and rent levels should be collected and analysed. While rent levels for Poland can be found in various professional publications and valuations are reflected in the indices of close-ended investment funds presented in NBP (2014), data on transaction prices is scarce.

Our analysis and data collection is closely related to the hedonic analysis of transaction prices in the housing market in Poland. The hedonic regression, developed by Rosen (1974), was first introduced in Poland by, among others, Łaszek and Widłak (2007), Trojanek (2008), Tomczyk and Widłak (2010), Widłak (2010a; 2010b) and Nehrebecka and Widłak (2012). Narodowy Bank Polski uses this method to analyse home prices and to construct the hedonic price index, presented for example in Łaszek et al. (2013) and NBP (2014).
Before we move on to transaction prices, we would like to give a brief introduction to the Polish CRE market. Figure 1 shows investment in commercial property, of which almost 90% was made by foreign investors. The investment started to grow only shortly before Poland entered the EU and sky-rocketed in 2007. When the first signs of the global financial crisis appeared, investors became more risk averse and the investment volume reached its lowest level in 2009. However, since 2010 the economic situation in Poland has been stable and investors have become more active (see Figure 1).

The value of outstanding commercial property loans in Polish banks is relatively low, and oscillates around PLN 45 billion, whereas the value of outstanding housing loans is around PLN 320 billion. Loans for offices amount to around PLN 10 billion and the share of impaired loans hovers around 5% (see Figure 2).

The valuation of closed-end investment funds, which reflects the rent levels and income a property can generate, shows that there was a strong increase of rents and values from 2005 to 2008, but since 2009 the valuations have followed a downward trend (see Figure 3).

In the remainder of the paper we present the hedonic estimation of transaction prices in the Polish office and retail property market and create a price index.

**2. Empirical analysis of transaction data**

Commercial real estate is bought by an investor to generate a stream of income, which he obtains by leasing space to tenants. The price of the property is the discounted rent income, which depends on the attributes of the property such as its type, location and quality and also on the current state of the market. We focus on the analysis of the attributes of the commercial property, which allows us to explain its price. Such an analysis of all transacted commercial property helps to determine whether the market price is growing because of the rising quality of the traded property, or whether there is a price boom. The analysis of the commercial property market prices on transaction data for the US can be found in Fisher, Geltner and Pollakowski (2007), for Germany in Keiler (2013) and for Italy in Zollino (2013), and we follow their ideas to construct this index for Poland.

Following Fisher, Geltner and Pollakowski (2007), we estimate the transaction price based on individual characteristics of the traded building, such as its type, location and quality. We include time-dummy variables to capture the year of the transaction and use them directly to determine the time-dummy hedonic index. The number of transactions and their frequency does not allow to analyze transactions on a quarterly or semi-annual basis, as then we would have very few or even sometimes no observations. We apply data that is collected by Narodowy Bank Polski in the BaNK questionnaire, which is augmented with transaction information from Comparables.pl. In case some attributes were missing, we collected them from homepages of owners or from large brokers. The analysis covers the period 1999–2014 for offices and 2002 to 2014 for retail space. Before the respective starting dates there were very few transactions and the market was in its initial stage, thus we excluded those years from the analysis. For the construction of the hedonic index we chose the year 2004 in which Poland entered the European Union as the benchmark year.

We analyze the price of square meter of leasable space in the office and retail markets using two separate models, as price developments in both markets can follow quite different patterns and
are determined by different variables. Price determinants are divided into three categories, namely location, market segment and individual characteristics of the building.

The first price determinant is the location of the building in the country and also its location within the city. The analysis of price distribution allowed us to create three groups, the Warsaw agglomeration, large cities (Gdańsk, Poznań, Wrocław, Kraków) and the remaining cities. This choice is very similar to the one found in the Polish housing market and we can say that the economic potential of a city, especially its job market and income levels directly affect the prices of residential and commercial property. For the office market we distinguish between the Central Business District (CBD) of Warsaw and the rest of the city, because offices in the CBD obtain significantly higher transaction prices.

Retail units are divided into shopping centers, retail parks, outlet centers and shops. An average shop unit was taken into account for each subcategory, as we expect the concentration of shops in a retail unit to affect its price. Moreover, we consider whether the retail unit is located in the economic center of the city or not.

For the office and retail markets we consider the number of parking spaces, which is the sum of those underground and above ground. The age of the building, measured as the difference between the transaction year and the construction year or the year of the latest general renovation was taken into account. Buildings which were 5 years old or younger at the date of the transaction obtained higher prices. This variable takes into account that as time goes by, buildings become outdated and depreciate.

The dependent variable is the logarithm of the transaction price per square meter of leasable area, measured in euro. Most of the transactions are concluded in euro and the logarithm allows to capture elasticity between the explanatory and the dependent variable. We estimate two models, one for office buildings:

\[
\ln\text{\_price\_EUR} = f(\text{city size}, \text{location}, \text{building class}, \text{age}, \text{leasable area}, \text{parking spaces}, \text{time dummy})
\]

and one for retail buildings:

\[
\ln\text{\_price\_EUR} = f(\text{city size}, \text{location}, \text{retail type}, \text{age}, \text{size of an average store unit}, \text{parking lots}, \text{time dummy})
\]

The estimation method is based on the time-dummy hedonic regression (see de Haan, Diewert 2011; Diewert Heravi, Silver 2009). We estimate the log price per square meter of leasable area of a building \(i\) at a given point in time \(t\) \(\ln(p_t^i)\) on the hedonic characteristics of the building \(\beta_k z_{ik}^t\) and the time dummy \(D_t^i\) that captures the pure price inflation. The model we estimate is:

\[
\ln(p_t^i) = \beta_0 + \sum_{t=1}^T \delta_t D_t^i + \sum_{k=1}^K \beta_k z_{ik}^t + \varepsilon_i
\]

Because we pool all the cross-sections for all periods together, more room for maneuver and the standard errors are smaller than in case we run an OLS regression for each period separately (see de Haan, Diewert 2011). The hedonic parameters capture the differences in the quality of the analysed buildings, while the time-dummy accounts for the changes in the quality adjusted for average prices over time. The advantage of time-dummy regression over other hedonic regressions is that it can be applied to estimate the hedonic index, even when there are quite few observation in each single period. The heteroscedasticity in the pooled cross section is corrected with the use of a robust OLS estimation.
We use the exponential of the parameter of the time dummy to calculate the price change between
the base period 0 and the analyzed period \( t \) (see de Haan, Diewert 2011). This procedure is repeated and
we obtain a time series of hedonic prices.

### 2.1. Empirical analysis of the office sector

All hedonic factors (except the log of leasable office space) are statistically significant and affect the
transaction price. We tested many configurations of our regression model with different factors and
the final one is presented below. The reader should not worry about the fact that most of the time
dummies are insignificant, because this is an usual property of this type of regressions.\(^1\) We find that
offices in Warsaw and the remaining large cities have different price dynamics. Prices have been on
an rise in Warsaw, especially after 2009, while in the other cities no clear trend is visible. The Warsaw
market is divided into offices located in the Central Business District and the rest of the city, where the
first group obtains significantly higher transaction prices. The next factor that strongly influences the
price level is the construction or renovation date of a building. Buildings younger than 5 years have
significantly higher prices than the older ones. We also find that the price per square meter of space
increases with the number of parking places. Probably office buildings that want to attract daily clients
have more parking spaces, while typical business outsourcing centers have fewer ones. The office class,
which captures the quality of a building and its architecture significantly affects transaction prices.
A-class offices have higher price than B- or C-class in all regional markets. Because we did not find any
significant difference between B- and C-class office prices, we analyse them jointly. The relationship
between the floor size and its price is statistically insignificant, but we decide to factor it in because of
its economic importance. Probably the floor size of each building was optimized to the land prices at
a given location in order to gain the highest possible investment return. In sum, the regression results
are in line with our expectations. The detailed regression results are presented in Table 1.

We exponent the estimated parameters of the time-dummies and obtain the price change in
relation to the base period. The average prices are presented in Figure 4 and the price dynamics and
the hedonic price index are presented in Figure 5. The hedonic index behaves similarly as the pure price
change. Over the whole analysed period the office transaction prices are more volatile in the remaining
cities than they are in Warsaw. The reason is that the majority of office space is located in Warsaw and
developers reacted quite quickly with new supply. In the remaining cities there were considerably fewer
transactions and each local market is relatively small.

### 2.2. Empirical analysis of the retail property sector

Similarly as for the office sector, the empirical analysis of retail properties confirms that prices per
square meter differ significantly between Warsaw and big or small cites.\(^2\) However, the differences

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\(^1\) Changing the base year the constant term and also the time-dummies change, but the dynamics are always the same.
Also the statistical significance of the dummy variables changes, which results from the way how the standard error is calculated for dummy variables.

\(^2\) At the beginning of our survey all cities were divided into 3 groups: Warsaw, big cities (Trójmiasto, Poznań, Wrocław, Kraków) and small cities (the rest of voivodeship cities in Poland).
are only in levels, while the price trend is the same for all cities. We observe a significant difference between transaction prices of retail units located in the “economic center” of a city and outside of it (this is captured by the dummy variable “building in the city center”). The age of the building, measured as the difference between its construction or renovation date and the transaction date has no impact on transaction prices, as this variable is insignificant. Older retail buildings are located in the city center and this seems to have a positive influence on their price and cancels the age effect out. For all types of retail buildings, prices are negatively and significantly correlated with the size of an average store. This parameter is a proxy for the quality of the retail unit, as high-quality shopping centers have many small shops, while lower quality ones consist of a large supermarket and some small shops with basic goods. Surprisingly, the number of parking spaces has no significant effect on the transaction price. It seems that differences in the number of parking spaces in various retail buildings are not so large. The regression results are presented in Table 2.

The transaction price is shown in Figure 6, while the price dynamics and the hedonic index are shown in Figure 7. We observe that prices rose from 2004 till 2008 (the end of the housing market boom). In next three years prices declined somewhat and peaked again in 2012. In general, retail property prices have followed a slow upward trend since 2004.

3. Conclusions

The analysis of hedonic retail and office prices shows the behavior of transaction prices in the Polish CRE market since the beginning of the twenty-first century. The changes of retail prices were much more pronounced and also higher than those in the office sector. In the boom year of 2008 retail prices were two times higher as in the base year 2004. At the end of the analysed period they show a small decline, but remain high.

Prices in the Warsaw office market were slowly, but continuously growing, while in the remaining cities they oscillated around their long-run mean. We did not observe a typical boom-bust period but, we observed a strong growth of space supply, especially in the office market (see also NBP 2014). This caused a dip in rental yields and growth in vacancy rates. The situation in the retail and office market needs further attention and research. The analysis of transaction prices needs to be augmented with the indicator analysis of rent levels, vacancy rates and transaction volumes, which should improve the R² of the regression. Not only the location and the quality of a building, but also the income it generates and also the financial situation of its current owner have a strong impact on the transaction price. Unfortunately, such detailed data is to a large extent unavailable, and can be only inferred from the general condition of the market at the time of the transaction. This requires further statistical work.
References


Diewert W.E., Heravi S., Silver M. (2009), Hedonic imputation versus time dummy hedonic indexes, in: W.E. Diewert, J.S. Greenlees, Ch.R. Hulten (eds.), *Price index concepts and measurement*, University of Chicago Press.


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

Figure 1
Investment in CRE in Poland

![Graph showing investment in CRE in Poland by year and property type]

Source: Comparables.pl.

Figure 2
Real estate loans to corporations and share of doubtful loans

![Graph showing real estate loans and share of doubtful loans by year]

Note: data exclusive of BGK.

Source: NBP.
Figure 3
Performance indicators of closed-end real estate investment funds operating on the commercial real estate market (Q2 2008 = 100)

Note: in the case of investment funds Arka BZ WBK and Skarbiec the valuation is for the end of January, April, July and October, whereas it is presented as the quarterly valuation.

Source: websites of closed-end investment funds.

Figure 4
Office property transaction prices, in EUR per square meter of leasable area

Source: NBP.
Figure 5
Office property price index and hedonic price index, 2004 = 100

Note: the price change for the remaining cities in 2011 was calculated as the mean between the values for 2010 and 2012, as there were no observations in 2011.

Source: NBP.

Figure 6
Transaction prices in the retail sector, in EUR per square meter of leasable area

Source: NBP.
Figure 7
Retail property price index and hedonic price index, 2004 = 100

Source: NBP.
### Table 1
Determinants of transaction prices in the office sector

<table>
<thead>
<tr>
<th>In_price per square meter in EUR</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building outside Warsaw</td>
<td>-0.4507174</td>
<td>0.1046792</td>
<td>***</td>
</tr>
<tr>
<td>A-class building</td>
<td>0.2711212</td>
<td>0.0440179</td>
<td>***</td>
</tr>
<tr>
<td>Building outside CBD</td>
<td>-0.165349</td>
<td>0.0492409</td>
<td>***</td>
</tr>
<tr>
<td>Building 5-year old or younger</td>
<td>0.1259305</td>
<td>0.0450661</td>
<td>***</td>
</tr>
<tr>
<td>Ln parking places</td>
<td>0.0181333</td>
<td>0.0222339</td>
<td></td>
</tr>
<tr>
<td>Ln of average floor size</td>
<td>-0.0423415</td>
<td>0.0337849</td>
<td></td>
</tr>
<tr>
<td>Year 2000 – Warsaw</td>
<td>-0.0970231</td>
<td>0.2144201</td>
<td></td>
</tr>
<tr>
<td>Year 2001 – Warsaw</td>
<td>-0.1882186</td>
<td>0.1408351</td>
<td></td>
</tr>
<tr>
<td>Year 2002 – Warsaw</td>
<td>-0.1763847</td>
<td>0.1326898</td>
<td></td>
</tr>
<tr>
<td>Year 2003 – Warsaw</td>
<td>-0.4279435</td>
<td>0.1367432</td>
<td>***</td>
</tr>
<tr>
<td>Year 2005 – Warsaw</td>
<td>-0.2024246</td>
<td>0.0861758</td>
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</tr>
<tr>
<td>Year 2006 – Warsaw</td>
<td>-0.1283675</td>
<td>0.1120219</td>
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<td>Year 2007 – Warsaw</td>
<td>0.1242218</td>
<td>0.0992265</td>
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<tr>
<td>Year 2008 – Warsaw</td>
<td>0.0017196</td>
<td>0.1190768</td>
<td></td>
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<tr>
<td>Year 2009 – Warsaw</td>
<td>-0.0699865</td>
<td>0.1681131</td>
<td></td>
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<tr>
<td>Year 2010 – Warsaw</td>
<td>-0.0420792</td>
<td>0.0946349</td>
<td></td>
</tr>
<tr>
<td>Year 2011 – Warsaw</td>
<td>0.0672842</td>
<td>0.0905894</td>
<td></td>
</tr>
<tr>
<td>Year 2012 – Warsaw</td>
<td>0.1097297</td>
<td>0.1052697</td>
<td></td>
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<tr>
<td>Year 2013 – Warsaw</td>
<td>0.0587076</td>
<td>0.1108817</td>
<td></td>
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<tr>
<td>Year 2014 – Warsaw</td>
<td>0.1159745</td>
<td>0.1005921</td>
<td></td>
</tr>
<tr>
<td>Year 2002 – outside Warsaw</td>
<td>0.5048366</td>
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<tr>
<td>Year 2005 – outside Warsaw</td>
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<td>Year 2006 – outside Warsaw</td>
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<td>Year 2008 – outside Warsaw</td>
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<td>0.1206358</td>
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</tr>
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<td>Year 2009 – outside Warsaw</td>
<td>0.019779</td>
<td>0.1906306</td>
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<tr>
<td>Year 2010 – outside Warsaw</td>
<td>0.147705</td>
<td>0.0838243</td>
<td>*</td>
</tr>
<tr>
<td>Year 2012 – outside Warsaw</td>
<td>0.2427577</td>
<td>0.0925383</td>
<td>***</td>
</tr>
<tr>
<td>Year 2013 – outside Warsaw</td>
<td>0.39364</td>
<td>0.2191173</td>
<td>*</td>
</tr>
<tr>
<td>Year 2014 – outside Warsaw</td>
<td>0.0232688</td>
<td>0.106666</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>8.159604</td>
<td>0.1864999</td>
<td>***</td>
</tr>
</tbody>
</table>

Notes:
The regression was run with a robust OLS, including 261 transactions and the $R^2$ is 42%.

***, **, * statistical significance at the 1%, 5% and 10% level.
Table 2
Determinants of transaction prices in the retail sector

<table>
<thead>
<tr>
<th>ln_price per square meter in EUR</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings outside Warsaw</td>
<td>-0.27289</td>
<td>0.110201</td>
<td>***</td>
</tr>
<tr>
<td>Buildings in the city center</td>
<td>0.135444</td>
<td>0.075932</td>
<td>*</td>
</tr>
<tr>
<td>Buildings 5-year old or younger</td>
<td>0.118839</td>
<td>0.086972</td>
<td></td>
</tr>
<tr>
<td>Ln average shop size</td>
<td>-0.17551</td>
<td>0.059441</td>
<td>***</td>
</tr>
<tr>
<td>Ln parking places</td>
<td>-0.00213</td>
<td>0.022023</td>
<td></td>
</tr>
<tr>
<td>Year 2001</td>
<td>0.396842</td>
<td>0.2173</td>
<td>*</td>
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<tr>
<td>Year 2002</td>
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<td>Year 2006</td>
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<td>Year 2007</td>
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<td>Year 2008</td>
<td>0.649521</td>
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<td>Year 2009</td>
<td>0.511767</td>
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<td>Year 2010</td>
<td>0.504489</td>
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<tr>
<td>Constant</td>
<td>8.170759</td>
<td>0.462942</td>
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</table>

Notes:
The regression was run with a robust OLS, including 126 transactions and the R^2 is 28%.
***, **, * statistical significance at the 1%, 5% and 10% level.