THE IMPACT OF ENERGY PERFORMANCE CERTIFICATES ON SALES AND RENTAL PRICES OF DWELLINGS: AN EMPIRICAL EVIDENCE FROM SLOVENIA

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Overview

Buildings represent almost 40% of the total demand for energy in the EU-28 (The Buildings Performance Institute Europe, 2014). Therefore, an increase in energy efficiency in the building sector is one of the key initiatives of the EU's climate and energy policies. The building sector is also one of the main sources of carbon dioxide emissions, according to Directive 2010/31/EU on energy performance of buildings. In addition, the building sector has shown constant growth, which will result in higher energy consumption, and consequently a higher share of greenhouse gas emissions. Directive 2010/31/EU sets the EU's policy instruments for increasing energy efficiency through the use of energy performance certificates (*EPC*). Assuming that the increased energy efficiency of buildings, as indicated by *EPC*, increases sales prices, the price premiums for more efficient *EPC* bands encourages stakeholders to invest in energy efficiency, which explains why *EPC* are an important instrument for increasing the energy efficiency of buildings. *EPC* are a key energy efficiency policy tool which can provide powerful information that complements regulatory and financial incentives to all stakeholders.

Although research on the impact of *EPC* on real estate sales and rental prices should be of key importance for determining the effectiveness of this type of economic policy and regulation in the real estate market, a literature review reveals that studies in this field remain scarce in spite of the growing interest (see for example Brounen and Kok, 2011; Högberg, 2013; Fuerst et al., 2013; Bio Intelligence Service et al., 2013; Christensen et al., 2014 and Davis et al., 2015). Therefore, the objective of our study is to provide useful insights by identifying the impact of the energy efficiency ratings, defined by *EPC* on sales and rental prices of dwellings in the Slovenian real estate market.

Methods

Our empirical research includes sales and rental real estate transactions in the period after the legal enforcement of the *EPC* on real estate sales and rental markets in Slovenia. The first sample consists of all real estate sale transactions in the area of the capital city Ljubljana concluded in 2015 and 2016. We limit our research to the dwellings with a registered *EPC*. According to these criteria, the sample of sold dwellings consists of 2,806 units. The same criteria was used to collect data for the second sample, namely for all rental real estate transactions in the Ljubljana area. The second sample consists of 1,919 observations. Data were collected and merged from three primary sources: (1) data on concluded sales contracts and rental real estate transactions from the Register of the Real Estate Market; (2) data on registered *EPC* from the national E-register of eal estate; and (3) dwelling characteristics from the Real Estate Register, and all of the data was collected by the Surveying and Mapping Authority of the Republic of Slovenia.

Based on theoretical foundations, empirical findings of other studies, and data availability, we estimated a hedonic price model (see, for example, Fuerst et al.) to investigate the impact of energy efficiency ratings, defined by *EPC*, on dwelling sales prices in the Slovenian real estate sales market.

$$P_{it} = \alpha_i + \beta_i \sum_{i=1}^{7} EPC_i + \gamma_j \sum_{j=1}^{n} X_j + \varepsilon_i$$

The dependent variable (P_{it}) takes the logarithmic form since the frequency distribution of the sales price was positively skewed. Besides energy efficiency ratings (EPC_i), we have included several other control variables (X_j) to identify their potential impact on the sales price.

For the *EPC* we have included dummy variables (from band *A* to band *G*), where band *D* was taken as a "hold out" value, meaning that all other *EPC* bands are compared with it. Among control variables, the age of the building and the size (in m^2) are presumably the most important. However, the sales price may also depend on other technical building characteristics, such as the number of apartments (in multi-dwelling buildings), the number of rooms and additional storage spaces (i.e. cellar), and the location of the apartment in the building (cellar, ground, first, or upper floors, attic). Three additional dummy variables indicate if the dwelling is accessible by a lift, if it has a kitchen, and air-conditioning facilities. In multi-dwelling buildings the number of garages and parking places available for residents may also impact the sales price and were therefore included in the model. The renovation of the building

envelope is expected to demonstrate a positive impact and is measured with the time of renovation of windows and the roof. The locational characteristics of dwellings were also accounted for by five dummy variables, where the centre of the city was taken for comparison. The dummy variable was also specified to indicate if the dwelling was registered in the Land Register, which could confirm the settled ownership rights. Finally, we also controlled for the difference in the sales period. Dummy variables were created to identify eight quarterly annual periods. A similar econometric model was used to examine the impact of energy efficiency ratings, defined by *EPC*, on dwelling rental prices in the area of the capital city. The dependent and explanatory variables have been similarly specified as for the real estate sales market.

Results

Results for the Slovenian real estate sales market in the capital city indicate that energy efficiency ratings, represented by *EPC* bands, have a statistically significant impact on dwelling sales prices. Results show that compared to dwellings with energy efficiency rating D, dwellings with other energy efficiency ratings have: (1) *A* 35.4% higher sales price; (2) *B* 4.7% higher sales price; (3) *C* 2.7% higher sales price; while *EPC* bands after *D* demonstrate price discounts: 4.6% , 8.7%, and 11.9% for bands *E*, *F*, and *G*, respectively. As expected, higher prices were realised for dwellings in the centre of the capital city, for those with additional amenities (parking places and garages), better facilities (kitchen, lift), and for newer buildings. Some renovation types (window replacements) also increased the transaction value, while others (roof renovations) did not have a significant impact on the sales price. The registration of the building in the Land Register also positively affected the price. The sales prices have also statistically significantly increased with the time.

The Slovenian rental real estate market shows a lower impact of *EPC* on the rental prices compared to the real estate sales market, although price discounts have been observed in bands *D – G*. Results show that compared to dwellings with energy efficiency rating *C*, dwellings with lower energy efficiency are rented at discounts (5.2%, 6.2%, 7.2%, and 25.8% for *D*, *E*, *F*, and *G*, respectively).

Conclusions

The results of our empirical research contribute to the growing amount of literature on the economic consequences of energy efficiency policy and environmental properties in the building sector, based on *EPC* as a mandatory information tool to increase transparency on energy consumption. The impacts of the *EPC* ratings have been clearly detected in the Slovenian real estate market. *EPC* provide information on the energy efficiency of the building or part of the building to stakeholders, thereby affecting dwellings prices in the Slovenian sales and rental real estate markets. Energy efficiency, signalled by *EPC*, capitalises in higher real estate sales prices (and to a lesser extent in rental prices), which may provide a stimulus for owners to invest in energy efficiency, thereby contributing to the achievement of set energy efficiency goals. *EPC* thus seem to be an effective policy instrument, rather than just an additional bureaucratic requirement, imposing additional costs to owners with its compulsory acquisition prior to renting and sale. In further analysis we also aim to include in our estimations dwellings without the *EPC* in order to investigate the direct impact of *EPC* on the sales prices of comparable dwellings.

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