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SINFONIA Project Mass Appraisal: Beyond The Value Of Energy Performance In Buildings

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Abstract

Energy retrofit of existing buildings stock is today a major urban challenge and opportunity. Although a market appreciation of green buildings is generally recognized, specificities related to different countries, contexts and sectors still need further investigation. Moreover, the energy retrofit carries with it multiple elements, ranging from monetary savings to personal fulfillment of living greener. The ongoing European smart city project SINFONIA offers the chance to analyze a double international case study, and to estimate expected positive effects on dwellings' value, due to energy retrofit measures undertaken at the district level. This paper, starting from previous similar experiences, designs an operational approach based on spatial hedonic price method and analytic hierarchy process. Finally, it suggests how to develop a spatialized mass appraisal by linking results with a geographical information system. Such approach will contribute to assess the socio-economic impact of SINFONIA project and to evaluate the effectiveness of further smart city initiatives.

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Keywords: "spatial hedonic price; analytic hierarchy process; mass appraisal; energy retrofit; smart city"

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1. Introduction

Sustainable buildings are attracting the interest of academics from different fields, including engineers, architects, urban planners, sociologist, and economists. As a result, studies on this topic explores different directions, mainly related to the implementation of new materials and energy efficient technologies, innovative design approaches, understanding of users behaviors and health conditions, and implementation and maintenance costs and benefits (Acre & Wyckmans, 2015; Aelenei et al., 2013; Preval, Chapman, Pierse, & Howden-Chapman, 2010; Stuart, 2012; Thatcher & Milner, 2012). Moreover, real estate operators and specialized research departments are interested in deepening the knowledge about energy and overall sustainability performance of specific categories of buildings and their market value (Antoniucci, D'Alpaos, & Marella, 2015; Antoniucci, Marella, & D'Alpaos, 2015).

So far, this issue has been approached from the perspective of sales price premium for certified green or high efficient buildings, compared with the average value of existing building stock (Eichholtz, Kok, & Quigley, 2010; Stuart, 2012). However, the real estate value, according to Forte (1973) and Orefice (1984), is not only related to categories of factors concerning the building itself, its systems, and its attitude to generate an income. Also relevant are the context where the asset is located and the legal framework to which it is subjected.

The decision to energy retrofit a single-family house is usually undertaken by the owner, on the basis of individual needs and ambitions. On the contrary, refurbishing a large block of flats involves multiple owners or, at least, several tenants under a single ownership, having different expectations and priorities. Moreover, urban projects may jointly address not only the building level but also the district level, aiming at the overall improvement of the local conditions (European Commission, 2013). Consequently, the implementation of project measures will modify at least three out of four above-mentioned categories of factors (with the exception of the legal framework), thus raising specific questions. First: how the value of refurbished dwellings will change, qualitatively and quantitatively? Second: because the category "energy refurbishment" encompasses multiple interventions on hard (envelope, windows, systems) and soft elements (consumer awareness, acceptance), which are the most representative in the definition of the dwelling price, at a reference level of energy performance? Finally, how will the overall value of the urban residential building stock change if energy retrofit measures are extensively replicated?

One of the aims of the SINFONIA smart city project is to develop a spatialized model, based on quantitative and qualitative variables, to answer these questions. The proposed spatially-explicit appraisal model combines hedonic regressions with hierarchical processes, in order to understand the effects of the foreseen refurbishment on dwelling's prices. In this paper, a brief review of similar experiences in this field is presented, together with an operational approach, taking advantages both from hedonic price method and multi-criteria analysis propose to investigate two case studies. Insights gained from this mixed method are then linked to spatialized information of urban building stock, to perform a mass appraisal and to estimate the overall increase in retrofitted buildings value.

2. The toolbox: spatial hedonic price method, multi-criteria analysis and geographic information systems

The object of the investigation is to estimate the expected change in real estate value, generated by (i) the SINFONIA project intervention in selected buildings, (ii) the development of a massive refurbishment program at the urban scale. Finally, (iii) a deeper investigation of single elements contributing to the definition of the whole value is performed.

The value of real estate proprieties, defined as the most probable selling price on the market, is estimable by applying different appraisal methods. A first distinction should be done between indirect (or analytic) and direct (or synthetic) methods. Indirect methods are adopted when the market for a certain typology of propriety is poor or even absent. They estimate the value as a function of expected actualised cash flow (rents), or as a function of production costs (unitary prices multiplied per quantities). Conversely, having an existing and active market, with real transactions, the analysis is usually done with a comparison between the object to be evaluated and the market prices of similar proprieties. Such direct appraisal methods are in turn classified as monoparametric or pluriparametric. The first are based on the comparison of a single paramount characteristic, mainly the dwelling's surface, and provide reliable results only if considered goods are enough homogeneous. The latter investigate multiple variables affecting the final real estate value and are useful in contexts where good's heterogeneity is predominant. One of the