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# EKC and the income elasticity hypothesis Land for housing or land for future?

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ABSTRACT

This paper investigates the relationships between land consumption and per capita gross domestic product (GDP) for a panel of 20 Italian regions over the period 1980–2010. As proxy of land consumption, it uses the supply of new housing, being residential construction the main cause of soil sealing. To test this hypothesis it runs a panel data regression model. In the considered period, results show the existence of an inverted EKC whereas, on a longer period, a N-shaped curve may be inferred. Contrary to the EKC hypothesis, both fixed effect and random effect model estimates show that higher income does not induce greater environmental awareness or, in different words, that the income elasticity hypothesis holds for housing demand rather (or more) than for environment. According to these results, considering the specificity of the resource under consideration, the paper claims for a shift from market to public policy. A tighter urban planning and a higher "environmental" property taxation could be efficient strategies to combat land consumption.



## 1. Introduction

Land is one of most important natural assets. It represents the material base of any human and economic activity. It embraces ecological (soil) and social (landscape) functions. Land use strongly influences soil erosion and soil functions such as carbon storage (EEA and JCR, 2010a).[1] Urbanization is one of the major cause of land use change. Land take for urban development and infrastructure results in soil sealing, the most alarming cause of soil degradation. It represents the loss of soil resources due to the covering of land for housing and infrastructures. It is generally irreversible (EEA and JCR, 2006).

Historically, urbanization and housing consumption patterns have been the main driver of land conversion. Recently, changes in social and consumer preferences modified housing choices, mainly in terms of average per capita living space and housing location (EEA and JRC, 2006; Fischer et al., 2013). This has heavily affected land conversion. In particular, the phenomenon of *urban sprawl*, that is the physical pattern of low-density expansion over large urban areas, mainly into the surrounding agricultural areas, under market conditions (EEA and JCR, 2006) is one of the principal factors impacting on soil's main functions.

Urbanization and housing choices have been normally highly correlated with income level (Jedwaba and Vollrathb, 2015). Considering the above mentioned environmental impacts of urbanization (mainly via land consumption), we believe that it would be worth exploring the relationship between economic growth and land consumption further.

Soil sealing in suburban areas has been normally estimated by using cartographical and statistical data (Munafò et al., 2010), and urban expansion and farmland abandonment have been identified as the main cause of land degradation processes (Smiraglia et al., 2016). Understanding the dynamics of urban expansion and its link with the economic growth could be of interest to develop appropriate land management policies.

One of the main stylized fact about processes of economic growth and environmental dynamic is the Environmental Kuznets

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[1] Soil is defined as the top layer of the earth's crust. It is composed of mineral particles, organic matter, water, air and living organisms—a non-renewable resource which performs many vital functions (EEA and JCR, 2010b).

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Curve. It postulates an inverted U-shaped relationship between per capita income and environmental quality as expressed by various impact indexes (Grossman and Krueger, 1995; Torras and Boyce, 1998). In the last decades, many studies have investigated this relationship looking for certain regularity. Although with mixed results, many have focused on carbon dioxide ($CO_2$) emissions (Aldy, 2006, 2007; Balaguer and Cantavella, 2016; Jebli et al., 2016; Brock and Taylor, 2004; Ezcurra, 2007; Nguyen Van, 2005; Romero-Ávila, 2008; Westerlund and Basher, 2008), per capita $SO_2$ and $NO_x$ emissions (Cole et al., 1997; de Bruyn et al., 1998; Kaufmann et al., 1998; List, 1999; Panayotou, 1995). Others, together with the previous, tested for additional selected environmental indicators. For example: Thomson (2014) tests the existence of an EKC for river pollution, Antle and Heidebrink (1995), Panayotou (1995) and Shafik and Bandyopadhyay (1992) do the same using the rate of deforestation; Bimonte (2002, 2009) use the percentage of protected area, Magnani (2000) and Komen et al. (1997) the public R&D expenditure for environmental protection, while Caviglia-Harris et al. (2009), Wackernagel et al. (1997) and Rothman and Herbert (1996) the ecological footprint. Recently, attention has been devoted to the relationship between income and urban development (Bimonte and Stabile, 2017). To the author's knowledge, research on this field is very scanty while deserving attention.[2]

Building on the research of Bimonte and Stabile (2017), this paper deepens the analysis of the relationship between per capita income and land consumption, as proxied by residential housing. As stated, urbanization has been and still is the main cause of land consumption. Housing, especially residential, represents the majority of all construction. A good proxy of new housing supply is the number of building permits (BP) issued by local authorities. It has been demonstrated that a strong relationship exists between BP and new housing supply (Rena, 2011; Somerville, 2001).

The choice of this variable is also consistent with the paper's aim, because it accounts for public environmental concern and policy, since BP are under the public control. The paper tests whether the Income Elasticity Hypothesis (IEH) holds in the case of land consumption induced by residential housing. The EKC, in fact, rests on the assumption that environment is income elastic: once the income reaches a threshold level, the demand for environmental quality starts to grow with income. In some case, it grows more than proportionally with respect to income, i.e. the income elasticity becomes greater than one and, therefore, environment converts into a luxury good (Dinda, 2004; Roca, 2003; McConnell, 1997).

The idea that lies behind the IEH is that when a country gets a sufficiently high standard of living, people appraise more the environment with respect to other goods and, consequently, they demand for better environmental conditions (Pezzey, 1989; Selden and Song, 1994). This turns into higher defensive expenditures and donations, but also in demand for less damaging products/activities and public policies that tend to reduce environmental degradation (Dinda, 2004).

In order to test for the IEH, we run a panel regression model. The data is from the 20 Italian regions, and cover the 1980 to 2010. The main reason for this choice is that it is very difficult to get continuous, reliable and comparable data for a longer period. Moreover, in 1980, the Italian National Institute of Statistics (ISTAT) modified the data collection system. However, it complies with our goal. The postwar reconstruction phase and the following economic boom period (the *Italian miracle*) were very special periods, characterized by population growth, massive interregional migration, especially from south to north and from rural to urban areas, and social policy reforms. This led to an explosion of urban areas and infrastructural investment. The data set stops at 2010 to exclude the effects ensuing two important events: the economic crisis and the abrogation of the ICI (the Italian property tax) on family homes.

## 2. Land consumption and the EKC: an essential literature review

The EKC hypothesis postulates that the environmental impacts of economic activities will increase in the first stage of economic development and then decrease once per capita income passes certain threshold (Grossman and Krueger, 1995; Torras and Boyce, 1998). A sizeable literature now exist on EKC, of theoretical and empirical nature.[3] Evidence of the existence of variables, other than income level, that may influence the relationship have been tested (for example Balaguer and Cantavella, 2016; Bimonte, 2002; Grossman and Krueger, 1995, 1996; Magnani, 2000; Selden and Song, 1994; Suri and Chapman, 1998; Unruh and Moomaw, 1998). However, while some studies support and are consistent with the existence of an EKC others question it from different point of view (Aşici and Acar, 2016; Bagliani et al., 2008; Caviglia-Harris et al., 2009; Harbaugh et al., 2002; Stern and Common, 2001; Stern et al., 1996; York et al., 2004).

Though with heterogeneous results, the majority of the studies test countries' efficiency rather than the EKC. In fact, environmental impact is expressed in intensity of use terms, i.e. per capita or per dollar emissions. This is unfortunate, because even if the per capita or per unit environmental impacts converge to a tiny level, different from zero, in the long run the total impact could increase because of population or income growth (Common, 1995). Moreover, they do not always account for the environmental performance or the overall environmental status of a country (Bimonte, 2012; Rothman and de Bruyn, 1998; Stern et al., 1996). The overall environmental quality or state depends on concentrations and stocks rather than on emissions and flows, although these measures are related. The distinction is particularly relevant when the impact has a stock-effect, as it is in the case of land.

On the base of previous considerations, in this paper we test the relationship between per capita income and land consumption, as proxied by BP. Although narrow and partial, the latter index fits with the paper aim. In fact, together being locally determined, it is a stock-sensitive variable, subject to saturation effect. In order to test for IEH, this is a very useful feature. IEH rests on the assumption that marginal appraisal of goods vary with income. However, in line with economic theory, the relative importance of goods (their marginal rate of substitution) varies also with the available quantity of a good: the less (more) remains of a good, in relative terms, the higher (lower) the assigned value (decreasing marginal utility). Moreover, unlike other indicators, such as pollutants, it is only marginally (or indirectly) affected by atmospheric conditions, international trade and displacement effect (Bimonte, 2002). Finally, it may be considered as a direct measure of public environmental concern and policy. Indeed, urban planning is a prerogative of the public sector. Land use change and any construction activity needs local authority permission. A sufficiently permissive urban planning policy is a necessary condition for residential development to take place. Among the various determinant of housing development, like interest rate (McQuinn and O'Really, 2008; Di Pasquale and Wheaton, 1994), expectation on future price increase (O'sullivan and Gibb, 2012) and others, building codes and zoning laws seems the more effective (Caldera and Johansson, 2013; Green et al., 2005; Hilber and Vermeulen, 2012).

[2] On this issue see the Africa Consensus Statement to Rio + 20 (UNCCD, 2012).

[3] For a critical survey, see Carson (2010) and Dinda (2004).