Local taxation and urban development. Testing for the side-effects of the Italian property tax

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Local taxation and urban development.

Testing for the side-effects of the Italian property tax♣

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Abstract

Land is an essential yet limited natural resource. Its current unsustainable use asks for a better understanding of the main determinants of urban expansion. A heuristic approach is used to analyze urban development in Italy. In particular, the paper estimates an econometric model to test the impact of the Italian property tax (ICI) on the local authorities' behavior and, in particular, on urban planning and development. It tests whether its introduction has fostered rather than dampened construction activity. The hypothesis put forward is that, because of the concurrent market conditions, the introduction of the tax has facilitated urban development. The structure of the tax and the devolution process that began in the '90s, induced local municipalities to adopt less tight (accommodative) urban policies to offset budgetary needs. A more elastic urban policy reduces price volatility. However, its overall welfare effect is not clearly determined. Indeed, c*eteris paribus*, geographical areas with more elastic housing supply witness larger land consumption. The land use changes we witnessed in the last decades could be the combined effect of financial and fiscal aspects. If this is so, careful attention should be given to the issue of whether leaving urban planning and the power to levy property taxes under the same jurisdiction.

Keywords: property tax; local taxation; housing supply; land use.

JEL Classification: H71; R31; Q24; R38.

1. Introduction

The recent introduction into the Italian tax system of the IMU (Imposta Municipale Unica: single municipal tax), a local property tax on residential and commercial buildings and developable land,

♣ The authors are indebted to all those local administrators and public officials that read the paper, for the time they devoted to us and their useful critics and technical comments. Responsibility for any remaining error is entirely ours.

has revived an old political debate that started in 1993, when Italian municipalities were given permission to tax properties by means of the ICI (Imposta Comunale sugli Immobili). This is a local property tax levied by the local administration. It is an annual levy based on the cadastral rental value of the property (*valore catastale*).

Together with the political debate, a parallel scientific debate developed, mainly dealing with themes such as yardstick competition and the equity aspects of the tax (Pellegrino and Piacenza, 2011; Longobardi, 2008; Baldini *et al*., 2005; Rizzi, 2000; Bordignon *et al*., 2003). To the authors' knowledge, no-one has investigated the possible impact of these taxes on the real estate market. In particular, nobody has explored whether the introduction of the tax dampened the supply of new housing or, almost paradoxically, as a side-effect of its structure, contributed to increasing the issuance of building permits and fostering the Italian urban development and the ensuing soil sealing. Among all the typologies of land use changes, urban development is the most alarming. In contrast to other changes, such as in agricultural land, the development of farmland for new housing or infrastructures is permanent or very difficult and slow to reverse, and only remediable at very high costs (EEA and JCR, 2006). Urbanization is therefore the ultimate "soil consumption" activity (EEA and JCR, 2010). Therefore, considering the important role that soil has in all ecosystem processes (Dominati *et al*., 2010) and the ongoing debate on the economic and environmental impact of soil sealing (Fischer *et al*., 2013), it is of paramount interest to investigate the main determinants of urban expansion and local public policies.

The heuristic is applied to Italian land-use policy. Drawing on experts and local administrators' opinions and empirical evidence, the hypothesis put forward in this study is that, because of the favorable market conditions and the fiscal and institutional reforms passed in the '90s, the introduction of the property tax effectively fostered, or at least did not hinder, construction activity. It has, rather, produced a mutually beneficial interdependency between developers and municipalities. Indeed, as a consequence of the fiscal reform, the ICI tax became the most important tool to increase local revenues and compensate for the reduction of central government transfers to municipalities. Therefore, since municipalities have the power to grant planning and issue building permits, *ceteris paribus,* construction may have benefitted from less stringent (accommodative) land use and/or urban policy. In other words, due to the decentralization process undertaken in the '90s and the increasing financial needs of municipalities that ensued, local administrations may have used urban planning as a way of dealing with budgetary constraints.[1] While this behavior may have reduced price volatility, it has simultaneously caused a larger land use change.

These issues were not dealt with in the Italian literature. They also remained essentially on the sidelines of international scientific debate. Researchers have only recently begun to deal with these aspects, and in particular to analyze the relationship between physical and regulatory constraints and the supply elasticity of new buildings. In this line of investigation, land regulation is

[1] In his study on Catalonia and Galicia, Keating (2001) maintains that, instead of putting in place rigorous urban planning policies, municipalities permit sprawl, hoping to expand the property tax-base as an alternative to increasing rates.

considered for its ability to dampen or promote the swiftness of the supply response to exogenous demand shocks and, therefore, as a factor that can affect the equilibrium price of the real estate market (Hilber and Vermeulen, 2012; Glaeser *et al*., 2008). Other studies have analyzed the relationship between "impact fees", as a particular kind of regulatory policy, and the supply of new housing (Ihlanfeldt and Shaughnessy, 2004; Burge and Ihlanfeldt, 2006a,b). In line with the theoretical expectations, when statistically significant results demonstrate that development or impact fees have a negative (although small) effect on new construction (Mayer and Summerville, 2000a).

Normally, as it is in the case of Italy, development, regulation, impact fees and property taxes are the responsibility of local municipalities. If they are not well implemented and integrated, a trade-off between fiscal and urban planning policies may arise. If this is so, what happens when the local authority's tax revenue goals enter into conflict with its land use aims? If the property tax represents the main source of the municipality's revenue, which of these interests will prevail?

This study aims to spur reflection on such aspects. To this end, following the methodological framework developed in the literature on the topic, it estimates an econometric model to verify the impact of the main economic variables on local urban policy and, therefore, on housing supply. Then, in order to validate the research hypothesis, i.e. that the introduction of ICI tax effectively affected the municipalities' behavior, we test for the presence of a structural break in the series (Chow test). This ascertains no change in the parameters in the period considered. However, the statistical significance of the coefficient of the dummy variable evidences a time effect. It reflects a non stability of the intercept in the sample period and, therefore, a change in the behavior of the endogenous variable (emitted permits). In the authors' opinion, a possible explanation for it is that, due to the decentralization process that started in the '90s in Italy, local municipalities capitalized on the concurrent market conditions to offset budgetary needs.

The remainder of the paper is structured as follows. In the next section we review the literature. Then, before presenting and discussing the results of the empirical analysis, in section 3 we provides useful background information on the Italian context and the evolution of the main social and economic variables. Finally, we discuss the results and present conclusions with some thoughts on future research.

2. Regulation and supply of new housing

At first, the literature on the real estate market, and on new housing in particular, focused mainly on analyzing the elasticity of the supply curve and on the relationship between house prices and certain important variables affecting the demand and supply side, i.e. production costs, ease of access to loan market, interest rates (Muth, 1960; Follain, 1979; Poterba, 1984). Before the *subprime* and ensuing economic crisis, it was a quite firm belief that researchers should mainly focus their attention on estimating the supply function. Indeed, it was a common argument that housing demand was much better understood than the supply side (Ball *et al*., 2010).

Two basic approaches have been used to estimate housing supply, with the main aim of estimating the price elasticity of supply: reduced form estimation and structural estimation (DiPasquale, 1999). Perhaps partly due to the different models and datasets used, the results have been quite inhomogeneous (Vermeulen and Rouwendal, 2007; Caldera and Johansson, 2013). Nevertheless, some consensus exists on the variables that can be considered among the main determinants of the supply of new housing: population dynamics; house prices; construction costs; credit constraints; interest rates; land use regulations; impact fees; time elapsed to deliver a permit.

While the results concerning elasticity are neither convergent nor homogeneous, a greater consensus exists on the impact of other variables, such as land use regulation and urban planning policies, on residential development. More than other factors, the latter seem to be the only elements able to dampen the impact of demand shocks on urban growth and, therefore, hinder the economic and environmental consequences of expansion cycles or price bubbles (Caldera and Johannson, 2013; Green *et al*., 2005; Monk and Whitehead, 1996). *Ceteris paribus*, supply elasticity is also affected by: geographical and environmental constraints (Paciorek; 2013; Li *et al*, 2013; Saiz, 2010); customs and historically determined aspects of land use (Meen and Nygaard, 2011); the length of time it takes to obtain planning permission, its cost and the uncertainty of outcomes (Ball, 2011; Ball *et al*., 2009; Mayo and Sheppard, 2001; Mayer and Somerville, 2000a).

Many studies demonstrate that all these aspects reduce housing supply elasticity (e.g., Green *et al*., 2005; Quigley and Raphael, 2005; Saiz, 2010; Ihlanfeldt and Mayock, 2014) whilst raising price volatility (e.g., Glaeser and Gyourko, 2003; Glaeser *et al*., 2005; Quigley and Raphael, 2005; Saks, 2008; Hilber and Vermeulen, 2012; Huang and Tang, 2012; Stevenson and Young, 2014). But, as pointed out by Green *et al*. (2005), while it is a matter of fact that an inelastic supply curve causes higher price volatility, it is also evident that the overall welfare effect is not clearly determined. Indeed, geographical areas with more elastic housing supply respond to a bubble more extensively which may cause additional land consumption.

The responsiveness of the housing supply obviously depends on other important factors too, such as user costs, and in particular interest rates and taxation. However, their impact turns out to be relatively reduced (Levin and Pryce, 2009). As for user costs, empirical models achieve contrasting results, with coefficients that are frequently insignificant or even of the wrong sign (Caldera and Johansson, 2013; Andrews *et al*., 2011; McQuinn and O'Reilly, 2008; Himmelberg *et al*., 2005; McCarthy and Peach, 2004; Case and Shiller, 2003). With regard to taxation, the results are more convergent. Yet empirical data demonstrate that *una tantum* taxes (e.g. impact fees) have limited impact on the housing development of a given area. Indeed, their impact is significantly lower than other forms of regulation, such those that tend to lengthen the development process (Mayer and Somerville, 2000a). In many cases, *una tantum* taxes merely affect the timing of an investment, delaying it (Mayer and Somerville, 2000a; McFarlane, 1999). However, as emphasized by Burge and Ihlanfeldt (2006), when the tax is earmarked for the provision of specific public services, the net effect on the housing supply may be positive.

The same applies to empirical research on property taxes. As expected, the results of these studies, when statistically significant, highlight that a negative (albeit modest) relationship between taxation and investment exists in terms of new houses (Green *et al*., 2005; Plassmann and Tideman, 2000; Malpezzi and Mayo, 1997) or house sizes (England *et al*., 2013). Obviously, this impact also depends on the way the tax is structured and the tax base. According to Arnott (2005), the impact on construction is neutral if the tax is imposed on land, regardless of whether or not it is developed. On the contrary, the relationship is positive if the tax discriminates between developed and undeveloped land (Lyytikäinen, 2009; Johansson *et al*., 2008), penalizing the latter.

In the case of the ICI, it affected buildings, building land and agricultural land, although with different tax rates. Since the fiscal reform of 1993, which comprised some degree of deregulation, reduced central government transfers to local authorities and the expansion of fiscal autonomy, the ICI has represented the main source of revenue for local government. For this reason, many local public administrations have used it as the primary tool to finance their current expenditure. This has led to a kind of *trade-off* between two of the main thorny conflicting areas of local government activities: taxation and land and urban planning[2].

Because of that, and in consideration of the specificities of the European and, especially, Italian system, in particular if compared to the American, we believe the Italian case worth studying. Given its particular political, institutional and regulatory characteristics, it is interesting to verify which of the various aspects dealt with in the literature has exerted greater effect in terms of impact on the supply of new housing and, in particular, which between the tax and the regulation/territorial planning effect prevailed. In our opinion, these aspects merit analysis due to their economic and, above all, environmental consequences. Urbanization, in fact, is the major cause of soil sealing and agricultural land abandonment. Therefore, understanding the key determinants of urban expansion is of utmost importance.

Before presenting and discussing the results of our empirical analysis, we believe it may be helpful to provide a descriptive analysis of the context. In particular, a summary of the dynamics of the main variables in Italy over the last 20 years may facilitate the understanding of the problem.

3. Building and main market determinants dynamics: a descriptive analysis

Historically, the growth of cities and of almost all human settlements has been determined by increases in the urban population. Demographic factors are considered to be important determinant of demand for housing. However, this link is missing in the recent phenomenon of urban development and sprawl (Fischer *et al*., 2013; EEA and JCR, 2006). With respect to Italy, as highlighted by the data, since the second world war population has grown by about a quarter, while the number of houses has more than doubled (figure 1) and now exceeds 29 million, many

[2] Some empirical evidence on this aspect has been find by Chanel *et al.* (2014). However, this does not mean that, although few, interesting long-term sustainable planning experiences exist at local level, like Bologna and Modena (Brunetta and Dansero, 1999).

of which are empty (the nominal vacancy ratio is about 1/5)[3]. During this period the construction sector went through six cycles. If we exclude part of the last, because of the economic crisis still underway, all the remaining periods are characterized by phases of expansion. The growth in the last period of expansion, which began in 1995 and reached its peak in 2005 with an index of 150 (1995=100) is particularly evident (CRESME, 2012). For many analysts and researchers the main determinant of this expansion is the low interest rate level, which fostered demand (McQuinn and O'Really, 2008; DiPasquale and Wheaton, 1994; Topel and Rosen, 1988) and, as a consequence, the supply of real estate assets for both dwellings and investment.

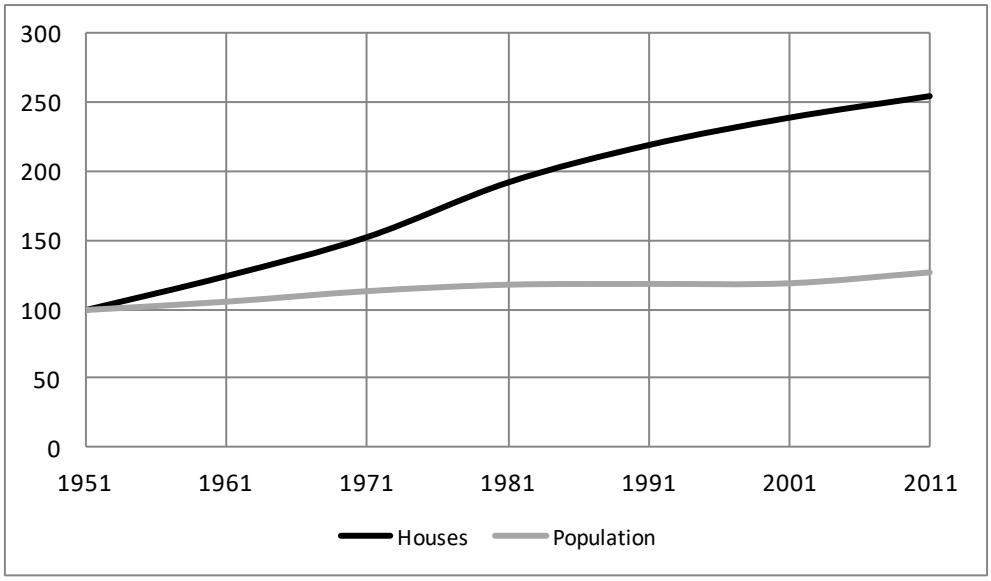

Figure 1: Dwellings and population growth in Italy (1951-2011). 1951=100
Source: *Own elaboration based on the National Institute of Statistics(ISTAT) data 2011*

[3] In a recent (February 2014) article, The Guardian denounced the "scandal" of empty properties in Europe http://www.theguardian.com/society/2014/feb/23/europe-11m-empty-properties-enough-house-homeless-continent-twice

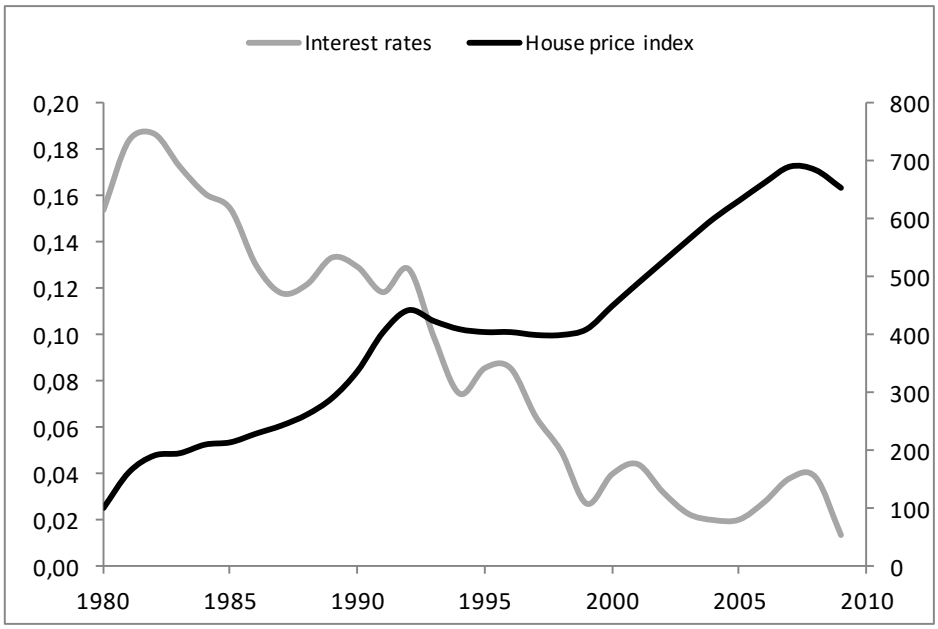

Figure 2: Evolution of house prices (1980=100) and interest rate in Italy (1980-2010).
Source: *Own elaboration based on Banca d'Italia, BCE and Scenari immobiliari data*

According to this interpretation, the dynamics of the building sector complies with theoretical expectations and the classical law of markets. Yet, if we look at the interest rate dynamics, we realize that they fell constantly from the early '80s till the late '90s. This was followed by a more stable period, which ended in 2008. During this time span, notwithstanding the remarkable increase in the housing stock, most of which remained empty, prices kept on rising (figure 2). This is perfectly consistent with the economic theory. It may happen that increases in demand are not driven by actual price but rather by the expectation of further future increases. The latter may motivate some households to accelerate their decision to buy a house before prices rises at even higher levels. But, more important, it stimulates investors who can speculate on price increases (O'Sullivan and Gibb, 2012). Empirical studies demonstrate that this scenario is likely to happen because real estate investors behave "myopically", i.e. tend to extrapolate recent market developments and price movements into the future (Sivitanidou and Sivitanides, 1999).

On the other side, developers may find it convenient to invest in housing development. In fact, according to the Tobin's Q model, in the case of real estate market new investment (construction) is positive as long as Q (the ratio of the market price of new housing divided by its construction cost) is > 1. However, unlike other sectors, here whilst production factors other than land have perfectly elastic long run supply curves, developable land is limited. Therefore, a demand shift raises the price of land and thus the price of housing such that at the new equilibrium Q = 1 and investments return to their steady state level, where new constructions compensate for deteriorated stock. As highlighted by Mayer and Sommerville (2000b), most of the existing empirical work on housing treats construction like other types of investment. However, land makes housing different. Land is inelastically supplied. Within this limit, developable land has, at least in the short run, some degree of elasticity. The latter depends on the urban policy. In fact,

land use change and urban planning are normally subject to public control: they represent two key policies of local government, which should manage them in order to maximize social welfare.

A sufficiently permissive urban planning policy is a necessary condition for a residential development to take place. Constraints on land use or urban development have more significant effects on the elasticity of housing supply (Ihlanfeldt and Mayock, 2014). Indeed, the more stringent the rules are, the more the demand shocks are capitalized into house prices (Hilber and Vermeulen, 2012). According to the stock-flow identity total real estate stock (*S*) at any given time (*t*) is determined as follows:

$$S_t = S_{t-1}(1-d) + Q_{ts} \qquad (1)$$

where:

S_t is the real estate stock at time t;

d is the depreciation rate;

Q_{ts} is the number of new construction.

All else being equal, Q_{ts} is a function of market conditions, in particular price and cost. The higher the property prices and the lower the building costs are, the higher the quantity of the new construction supplied in the market. However, housing development is also influenced by building codes and zoning laws. In particular, the number of building permits (BP) released by local authorities may act as a constraint on the supply of new houses, thus forming an upper bound on actual Q_{ts}. The latter depends on the optimal unconstrained level given demand for new housing (Q_{td}^{*}) and the number of permits available at time t,

$$Q_{ts} = \min(Q_{td}^{*}, BP_t) \qquad (2)$$

The presence of an upper bound implies a shift (and not a movement along) of the supply curve. In this fashion, BP are exogenous determinants of supply elasticity and, thus, of the equilibrium price.

In Italy, like in many others places, local government permission is needed in order to develop land and then build any type of construction on lots. Figure 3 presents the number of annual building permits issued by local governments and the cumulative product of their compound factors. It is quite evident that in the second half of ‘90s the number of permits steadily grew. This period coincides with the last upward cycle of real estate market and an important decentralization and deregulation process that started in Italy at the beginning of the ‘90s and reached its peak in 1999.

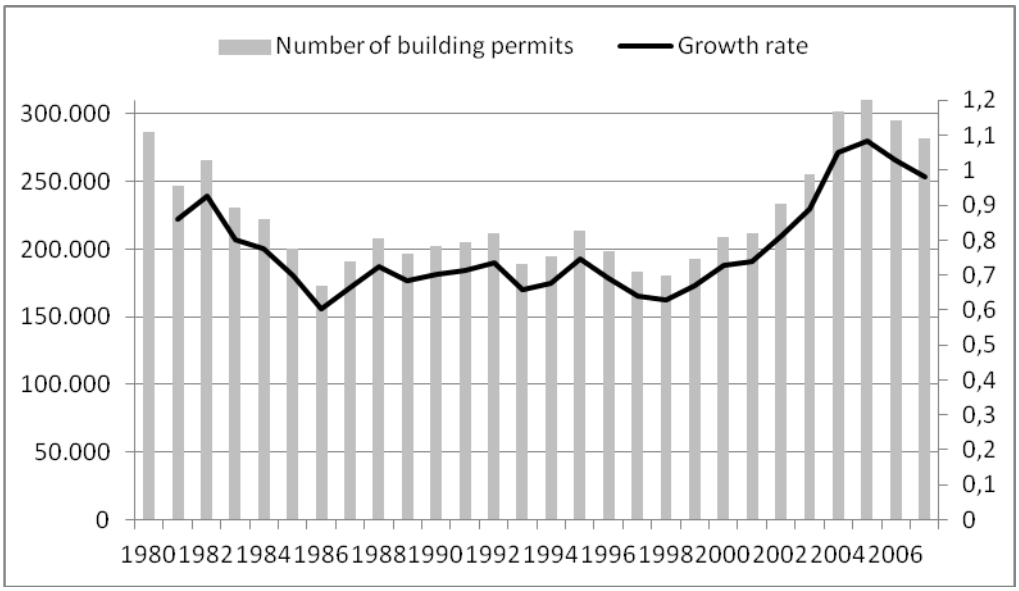

Figure 3: Number of permits issued and cumulative growth rate in Italy.
Source: *Own elaboration on the National Institute of Statistics(ISTAT)*

4. ICI and fiscal decentralization in Italy: an overview

At the beginning of the '90s an important reform occurred that produced a marked reduction of central transfers to local authorities compensated by an increased power of taxation. Looking at the major financial and economic indicators, it is clear that during the period 1990-2008 municipalities' tax revenue power and the budgetary situation changed radically. In 1990 current revenues were mainly made up of central transfers (about 60% of the total) while municipalities' own revenues represented a little more than 15%. In 2007, one year before the abrogation of the ICI on family homes, these two figures were 32.4% and 38.3%, respectively (Pellegrino and Piperno, 2012). However for our purpose the more important aspect is that, starting from 1993, a high and increasing percentage of the total local tax revenue derived from the ICI. Among the various local taxes, the ICI was the most important.

This is a local property tax levied by the local administrations who were allowed to fix the rate between the lower (4‰) and upper (7‰) limit imposed by central government. It is an annual levy and its taxable base is the cadastral rental value of the property (*valore catastale*). The Cadastral Value is a statutory value placed on the property by the Government. The current property valuation system is based on estimates of market rental values from 1988-89. Therefore, though revaluated, the cadastral value is generally substantially less than and not related to the actual market price. As a consequence, ICI's tax revenue is decoupled from house market prices.

Together with the increased power of taxation a simultaneous decentralization of a growing number of functions to local authorities (principle of subsidiarity) and deregulation occurred (in particular see the laws n. 59 and 127 year 1997, and 112/98). This stimulated many of them to use their taxing power to meet their increasing budgetary needs. However, the essence of local authorities' taxation power lies in their real possibility of affecting two specific aspects: the

structure of tax rates and the taxable base. As for the former, their freedom of maneuver has been relatively small, but thoroughly exploited. This is mainly due to the upper limit to the tax rate imposed by central government (7‰). With regard to the taxable base, this is often out of local authorities' control (just think of people's income). The same does not apply to the ICI, whose taxable base is under local authority's control, at least within the limits imposed by the availability of developable land.

Although within a general framework mainly fixed by the Central government and Regions, city planning and building permits issuance are a prerogative of municipalities. Therefore, the hypothesis put forward in this paper is that, profiting from the upward cycle of the real estate market, the combined effects of the above mentioned factors may well have induced municipalities to adopt more accommodating urban planning policies. In fact, once the possibility of increasing the tax rate had been exploited, the only way to increase tax revenues was by expanding the taxable base, through land use change and a looser building permits issuance. It is easy to see that this is also a more fruitful strategy from a political/electoral point of view: it prevents further tax rate increase; slows down price increase; pleases investors. Finding empirical evidence of whether this happened in Italy is the main aim of the econometric model presented in the following section.

5. The model

In this section we present the results of our models. Following the literature and other related empirical studies, we estimate a regression model between the dependent variable - namely the yearly building permits issued by the municipalities - and a selected set of explanatory variables. Building permits is a good proxy to estimating for both the impact of a variable on municipalities' behavior and supply of housing. In fact, though the issuance of a permit is not guarantee that construction will occur, due to the so-called pipeline effect (Rena, 2011), evidence exists of strong relationship (Somerville, 2001). According to Somerville, although builders respond to new information in deciding whether or not to exercise permits, it takes large changes in market conditions to generate small changes in permit exercise rates (Somerville, 2001, p. 183). Because of the limited availably of comparable time series data, here the permits refer only to the housing part of the total investment, i.e. not comprising commercial and industrial buildings. However, it is worth noting that housing represents the majority of all construction.

The explanatory variables are those that, according to the findings of other studies and economic theory, are considered to be the main determinants of housing supply dynamics. In particular, our basic estimating equation treats new buildings (permits) as a function of growth rate of lagged house prices, population and households, GDP and interest rate rather than of their level. Moreover, it considers the lagged value of the index of housing stock. This approach, together being consistent with the above mentioned characteristics of real estate market, is also more consistent with the time series characteristics of the data than the more traditional levels

specification. With lags, the number of building permits in any period is a function of forecast made in the previous period, i.e. forecast based on market and population information.

The aim of the estimate is to capture any short and/or long run relationship between these variables. To this end Error Correction Models (ECM) normally turn out to be useful, also because of their properties, which often have a good fit with social and political theories (Ostrom and Smith, 1992; Durr, 1993). ECM ensure correct estimates of the levels, and not only on the stationarized series required to avoid spurious or nonsense regressions.

However, as often happens with economic data, since most of our time series turned out to be non-stationary (unit root test in the appendix), we first tested for co-integration. This is necessary to verify the presence of any long run relationship between the series. Careful examination of the relationship between the time series did not evidence any co-integration and, therefore, any long run relationship. This was confirmed by the Johansen test. Therefore, we proceeded with the construction and estimation of a simple extended Autoregressive Distributive Lag (ADL) model, that is a temporal regression model with multiple predictors. In this model the series are stationary and the predictors consist of the lagged dependent variable and some explanatory variables, each with its own lag[4]. The general model of temporal regression with multiple predictors is as follows:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \gamma_{11} X1_{t-11} + \gamma_{21} X1_{t-21} + \ldots + \gamma_{q1} X1_{t-21} \ldots + \delta_{1k} Xk_{t-1k} + \delta_{2k} Xk_{t-2k} \ldots + \delta_{qk} Xk_{t-qk}$$

When the series are not stationary, it can be written as follows:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \ldots + \gamma_{11} \Delta X1_{t-11} + \gamma_{21} \Delta X1_{t-21} + \ldots + \gamma_{q1} \Delta X1_{t-21} \ldots + \delta_{1k} \Delta Xk_{t-1k} + \delta_{2k} \Delta Xk_{t-2k} \ldots + \delta_{qk} \Delta Xk_{t-qk}$$

where Δ denotes the first difference operator. This makes it possible to render the series stationary.

Actually, the ADL model adopted in our case is more similar to a delayed reaction ADL model, whose specification is as follows:

$$rate\_H_t = \beta_0 + \beta_1 \Delta 2Ind\_H_{t-1} + \beta_2 \Delta rate\_GDP_{t-1} + \beta_3 \Delta rate\_Pop_{t-1} + + \beta_4 \Delta Int\_m_{t-1} + \beta_5 \Delta rate\_P_{t-1} + \beta_6 D$$

[4] It is well known that the ECM has the same form as mixed autoregressive models, known as Autoregressive Distributed Lag (ADL), and represents a riparametrization of the ADL (p,q) model. The ECM is a general transformation of an ADL model. In particular, the ADL model can be rewritten as an ECM so that there are no restrictions on the ADL parameters in the ECM representation.

where:

rate_H is the annual growth rate of the supply of new houses (measured by permits issue),
Ind_H is the fixed base index (1980=100) of the cumulative supply of new houses,
rate_GDP is the growth rate of per capita GDP,
rate_Pop is the growth rate of the population,
Int_m is the mean annual interest rate,
rate_P is the annual growth rate of house prices,
D is a dummy variable and
the terms β are the reaction coefficients.

The model was estimated using yearly data from 1980 to 2007. The choice has various justifications. First and foremost, the difficulty of obtaining reliable and comparable data for a long period, especially for building permits. Moreover, the period chosen, as well as complying with the goals of the research, leaves out the period of economic crises that began in 2007. It is also worth recalling that in 2008 the Italian government abolished the ICI on the main family home.

Table 1 presents the main descriptive statistics of the variable used in the model, where the first column represents the number of permits issued annually by local municipalities and the second the annual growth rate of the same variable. The main estimates are presented in table 2. The results are very sound, as shown by all the diagnostic tests. The model shows that all the estimates are coherent with its hypothesis, as highlighted by the F-stat (8.185) and R-squared. The errors are not autocorrelated, as evidenced by both the Durbin-Watson and the Breusch-Godfrey tests. The presence of heteroscedasticity is excluded.

Table 1: Descriptive statistics (1980-2007)

	Housing supply	Growth rate of the housing supply	Growth rate of the population	Growth rate of per capita GDP
Mean	222423.9	-0.069077	0.175856	1.612089
Median	208619.0	1.633605	0.058035	1.432311
Maximum	310978.0	16.46212	0.986686	4.082492
Minimum	173361.0	-15.01905	-0.005301	-0.942530
Std.Dev.	38863.25	8.755913	0.289319	1.280260
Skewness	0.993137	-0.184811	1.944699	0.019875
Kurtosis	2.842139	1.997855	5.418650	2.343028
Jarque-Bera	4.466484	1.283530	23.59945	0.487341
Probability	0.107180	0.526363	0.000008	0.783746
Sum	6005445.	-1.865085	4.748122	43.52641
SumSq.Dev.	3.93E+10	1993.316	2.176350	42.61569
Observations	27	27	27	27

Table 2: Estimation results

Dependent variable: *rate_H*
Sample (adjusted): 1983-2007
Included observations: 25 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.662376	1.679837	-2.180198	0.0428
Δ2(IND_H(-1))	-1.022822	0.233467	-4.381009	0.0004
Δ(rate_GDP(-1))	-1.328328	0.982108	-1.352527	0.1930
Δ(rate_POP(-1))	7.840859	8.563980	0.915562	0.3720
Δ(int_m(-1))	-4.241720	1.078209	-3.934042	0.0010
Δ(rate_P(-1))	0.368657	0.150351	2.451978	0.0246
Dummy	6.509073	2.959409	2.199450	0.0412

R-squared	0.784257	Mean dependent var	-0.474930
Adjusted R-squared	0.712342	S.D. dependent var	10.75304
S.E. of regression	5.767255	Akaike info criterion	6.573766
Sum squared resid	598.7022	Schwarz criterion	6.915051
Log likelihood	-75.17207	Hannan-Quinn criter.	6.668424
F-statistic	10.90542	Durbin-Watson stat	2.029092
Prob(F-statistic)	0.000036		

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.679252	Prob. F(3,15)	0.5782
Obs*R-squared	2.990059	Prob. Chi-Square(3)	0.3932
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.034682	Prob. F(6,18)	0.4354
Obs R-squared	6.411176	Prob. Chi-Square(6)	0.3787

Variables

rate_H	*Annual growth rate of the supply of new houses*
Δ2(IND_H(-1))	*Second derivatives of the cumulative housing supply (fixed base index: 1980=100; lag=1)*
Δ(rate_GDP(-1))	*First derivatives of the growth rate of per capita GDP - lag=1*
Δ(rate_POP(-1))	*First derivatives of the growth rate of the population - lag=1*
Δ(Int_m(-1))	*First derivatives of the mean annual interest rate - lag=1*
Δ(rate_P(-1))	*First derivatives of the annual growth rate of nominal house prices - lag=1*
D	*Dummy 2000*

As for the coefficients of the variables, we can observe that the only ones that turn out to be significant are the interest rate (as a proxy of the cost of credit), the index of the cumulative stock of houses, and the variation in the house price index. Being a supply function, the signs of the coefficients are consistent with the economic theory. Because of the model's characteristics, the coefficients represent elasticities.

Somehow, the estimates are consistent with the expectations generated by the previous descriptive analysis. In particular, unlike the theoretical assumptions, it emerges that the supply of new houses in the period analyzed was not affected by or related to two important economic variables: the growth of both per capita GDP and the population. It also emerges that, compared to the others two variables attaining statistical significance, the house prices is less important as determinant of housing supply. Despite all its limits, the model's estimates confirm and are consistent with the results of the abovementioned studies.

In consideration of the changing social patterns, that in turn are influenced by population and economic dynamics, some authors consider the growth in the number of households as the basic

demographic factor driving long term housing demand. This could be especially true when the housing demand is aimed at satisfying dwelling needs. Therefore, we also estimated a model where the demographic variable was households. Results do not change. As for the coefficient, households turn out to be not significant and with a negative sign.

In consideration of the research aims, the aspects that deserve closer attention are related to the time effect, which was captured by the dummy. This was set at 2000. In fact, in the 2000s housing market went through an "euphoria stage" and all prices began soaring. At the core were the low interest and increase in available savings for investment. This caused the boom of the construction sector.

The dummy was included in additive form. We also run a regression with an interactive dummy variable, but results excluded any interaction with others variable coefficients. The dummy's coefficient turned out to be statistically significant (6.51 with a *p-value* <.05). This evidences a non stability of the intercept in the sample period and, therefore, a change in the behavior of the endogenous variable. The Chow test excluded any presence of structural break in the regression coefficients (F-statistic: 0.375097; Prob. F(6,12): 0.8811).

Discussion

In consideration of the regression results, it is possible to state that: 1) in contrast to the economic theory forecast, introduction of the ICI did not dampen the new housing market; 2) 2000 can be considered as a breakpoint between two regimes. In the authors' opinion, a plausible explanation for the shift (time effect) is the joint effect of the concurrent market condition and the completion of the decentralization and deregulation processes of the '90s. Others things being equal, this could have affected the behavior of the relationship estimated.

In fact, according to what stated in section 3, a sufficiently permissive urban planning policy is a necessary condition for a residential development to take place. In fact, Q_{ts} is a function of market conditions and building codes and zoning laws, i.e. the number of building permits. But urban planning is a complex activity that takes time. Any change in building regulations or urban planning requires a relatively long approval process, whose effects are displayed with some lag.

In our opinion, the residential development took place because of an accommodative urban policy. This was made possible by the changes in building regulations and urban planning realized in the 90s. The "rationale" of these changes has its root in the decentralization process of the 90s. In fact, the decentralization and deregulation process was comprised of various steps. It developed gradually: it started at the beginning of the '90s and reached its peak in 1999 (see above mentioned laws).

In fact, in 1993 the government introduced the ICI into the Italian tax system, whilst in 1998-99, according to the principle of subsidiarity, a reform reinforced the decentralization process, further reducing central transfers and enlarging local taxation power. Thanks to this reform, municipalities

were allowed to tax residents' personal income (through a supplementary rate with a centrally defined ceiling). In the same period, the legislative decree 446 12th December, 1997 enlarged the local governments' autonomy in designing ICI tax. The joint effect of these factors determined a change in the local governments' behavior.

Our interpretation is the following. Initially, to deal with the new situation, made of a mix of decentralization, reduced central transfers and higher taxation power, municipalities mostly resorted to increasing the tax rate, as shown by the data: the ICI rate rose, on average, from 4.78‰ in 1993 to 6‰ in 2005 (Pellegrino, 2006). Then, once they had used up the margin of autonomy grant by the law, which fixed the maximum tax rate at 7‰, and when it was no longer politically convenient, they started to enlarge the taxable base. This was not possible at the very beginning, because, as stated, any changes in building regulations or urban planning require a relatively long approval process, whose effects are displayed with some lag. This would explain why the time effect appears some years later the introduction of the ICI tax. In our case, changes start to be effective in 1998 and reinforces in 2000 (figure 3), in the middle of the last period of expansion (CRESME, 2012).

In Italy, the deregulation process, together with some political and institutional reforms, allowed/induced the municipalities to use building permits as a financial instrument. Compared to other types of policies, more accommodating urban planning and lax planning permission policies have some advantages: they are completely under the control of local government and are easier to implement because *they avoid voter wrath and keep incumbents in office* (Ihlanfeldt and Willardsen, 2014; Chanel *et al*. 2014). In a way, this is a kind of "pork-barrel" politics. Moreover, it is worth noting that the alternatives, i.e. increasing the tax rate, as well as being more unpopular, allow little room for maneuver. Both in the case of the ICI and the supplementary income tax, the maximum tax rate is set by law. As for the latter, its taxable base is not under local authorities' control: it is an exogenous variable. Although within certain limits, this is not true for the latter.

Obviously, this could only happen because of the favorable market conditions. A combination of low interest rates and a looser credit environment fueled up housing demand and prices. According to the above mentioned statements, this might have motivated some households to accelerate their decision to buy a house and stimulated investors to realize their investments. It is now widely acknowledge that houses have increasingly been considered as an investment (a safe-haven asset during economic crises and a speculative or portfolio management investment in periods of economic growth) rather than merely a place to live.

Unlike other period, this happened in a time of low GDP growth. The house-price to income ratio grew steadily by the end of the '90s. This could explain our results with respect to the income and price variables. However, it is worth noting that in Italy housing prices grew less than other countries. But, this means that developable land was elastically supplied and, therefore, that urban policy was sufficiently accommodating.

The decentralization process and the ensuing increasing financial needs of municipalities may have induced local administrations to use urban planning as a way of dealing with budgetary

constraints. This would be witnessed by the increasing number of permits issued and use of private-public agreements to allow master plan amendments (*edilizia consensuale*)[5]. Because of budgetary constraints, local authorities largely used this kind of "agreements" in order to finance local public works.

Conclusions

The European Soil Charter states that "soil is one of humanity's most precious assets. It allows plants, animals and man to live on the earth's surface" (Council of Europe, 1972). It is an essential element of all ecosystems and, at the same time, the very structure underlying all human activities, in particular the production of food and building of infrastructures.

The EEA calculates that over 60% of the Italian soil consumption is mainly due to residential construction and about 30% to productive-commercial construction. The largest land cover category taken over by urban and other artificial land development was agricultural land (about 94%), while about 5% were forest areas. Therefore, identifying and understanding the main drivers of urban development is of great importance to cope with soil consumption.

Land use and urban planning are subject to public control: they represent two key policies of local government, which should manage them in order to maximize social welfare. Unfortunately, at least in Italy, in many cases, land has become a monofunctional resource to be (over)used in order to extract either a private rent or revenues for the public sector[6]. The introduction of the ICI tax in the Italian system, together with the decentralization and deregulation processes that took place in the '90s, has exacerbated this phenomenon. Obviously, this was possible because of concurrent market conditions. This is what the results of the estimated model seem to tell us.

As stated before, the '90s were characterized by some important administrative and fiscal reforms. The decentralization process, which started in the first half of the '90s, was consolidated by the end of the decade. During this period, the number of functions assigned to municipalities grew, central financial transfers markedly declined, and the taxation power (autonomy) of local authorities simultaneously increased. The central element of these reforms was the introduction into the Italian fiscal system of the ICI, which happened in 1993. The ICI actually became the most important source of tax revenue for almost all municipalities.

Local authorities have used the ICI tax profusely to cope with the drastic reductions in central state transfers in both 1993 and 1998. Initially, to deal with this new situation, municipalities mostly resorted to increasing the tax rate. This strategy bumped into two types of problems: the first was the threshold imposed by the law on the tax rate and deduction; the second was of a political/electoral nature. Once municipalities had used up the margin of autonomy granted by the

[5] This is a kind of reciprocal agreement whereby local authority grants an adaptation of the urban plan and developers, together with realize their investment, commit themselves to realize public infrastructures.

[6] It is worth noting that in Italy there have been various building amnesties, the most important occurred in 1985, 1994, 2003.

law and it was no longer politically convenient, the only way that the local authorities could boost their tax revenues was by enlarging the tax base. This goal could only be achieved by increasing the supply of houses (or their size) or building land. In fact, unlike others cases (Ihlanfeldt and Willardsen, 2014), the ICI is an annual levy based on the cadastral value of the property. Therefore, ICI's tax revenue is decoupled from house market prices.

This is exactly what local government did, also because it was profitable in electoral terms. In general, our hypothesis is that the municipalities "exploited" this opportunity by loosening their controls and/ or adopting less stringent urban planning policies. They were also encouraged to do so because, together with the ICI, they had the possibility of collecting two impact fees. The latter are imposed by local government on new or proposed development projects, to contribute to the costs of providing public services to the new development. Unfortunately, most Italian municipalities used this tax revenue to finance their current expenditure[7], laying the foundations for future economic, and perhaps especially environmental, deficits (Ihlanfeldt and Mayock, 2014)[8].

To conclude, whether our results may be agreed upon, we can surely state that the introduction of the ICI tax did not affect the construction sector. The stability of regression's coefficients proves it. However, the estimated model evidences a change in the behavior of endogenous variable. With all due caution, the results of this study allow us to suppose that, although not foreseen or desired, the most important (alarming) consequence of the fiscal decentralization process was the emergence of an adverse alliance between the watchers (controllers) and the watched (those controlled). The way in which the ICI was implemented and structured produced an acceleration, rather than a slowing, as could be expected in theory, in the process of changing land use and, therefore, in soil sealing. If this is so, the structure of the Italian property tax and/or the efficiency and the convenience of leaving urban planning and the power to levy property taxes under the same jurisdiction warrant careful consideration.

Obviously we are aware that the argument, although interesting, requires more in-depth analysis. In particular, we think that our hypothesis would be better addressed by using local data. Unfortunately, the unavailability of data and/or the lack of uniformity make this work very difficult to realize. However, whilst the use of national series is problematic, because it could hide interesting variation across regions, it is a methodology widely used in studies on the supply of new housing (Mayer and Sommerville, 2000b). Therefore, using national series makes results comparable with those of the existing literature on housing starts.

[7] Since 2001 this was also permitted as a consequence of the law 380/2001.

[8] Ihlanfeldt and Mayock (2014) assume that local governments have in principle an incentive to block developments that could strain the public coffer, caused by the increase in the demand for public services that any development implies. Although this is rational, it depends on the country' specific context. Moreover, one has to consider politicians are normally shortsighted.

However, it is worth noting that census and, where available, annual data evidence that no relevant differences exist between regions. The phenomenon is quite widespread across all the country. This is also indirectly confirmed by data on regional soil sealing (ISPRA, 2011).

Nevertheless, the aim of the study was to prompt thought about a very engaging subject, not deliver incontrovertible interpretations. After all, Kant defines power of judgement as the capacity of a person to apply general rules to specific situations. Considering the robustness of the estimates and diagnostic tests, we think that this result has been achieved and the analysis could constitute a starting point for more exhaustive and complementary studies, at least regarding the Italian situation.

References

Andrews, D., Caldera Sánchez, A., Johansson, A., (2011). Housing markets and structural policies in OECD countries. OECD Economics Department *Working Papers*, No. 836, OECD, Paris.

Arnott, R. (2005). Neutral property taxation. *Journal of Public Economic Theory*, 7, 27–50.

Baldini, M., Bosi, P., Guerra, M.C. and Silvestri, P. (2005). L'impatto distributivo dei tributi locali: un'applicazione sul Comune di Modena. *Rivista Italiana di Politiche Pubbliche,* N. 1, 2005, pp. 89-114.

Ball, M. (2011). Planning delay and the responsiveness of English housing supply. *Urban Studies*, 48: 349-362

Ball, M., Meen, G., and Nygaard, C. (2010). Housing supply price elasticity revisited: Evidence from international, national, local and company data. *Journal of Housing Economics,* 19, 255–268.

Ball, M., P. Allmendinger and C. Hughes (2009) Housing Supply and Planning Delay in the South of England. *Journal of European Real Estate Research*, 2(2), pp. 151-169.

Bordignon M., Cerniglia F. and Revelli F. (2003). In search of yardstick competition: a spatial analysis of Italian municipality property tax setting. *Journal of Urban Economics* 54, 199–217.

Brunetta, G. and Dansero, E. (1999). Planning sustainability in urban policies: The Italian perspective after the Aalborg conference. *European Urban and Regional Studies,* 6 (3): 280–286.

Burge, G., Ihlanfeldt, K., (2006a). Impact fees and single-family home construction. *Journal of Urban Economics* 60, 284–306.

Burge, G., Ihlanfeldt, K., (2006b). The effects of impact fees on multifamily housing construction. *Journal of Regional Science* 46 (1), 5–23.

Caldera, A. and Johansson, Å (2013). The price responsiveness of housing supply in OECD countries. *Journal of Housing Economics*, 22(3), 231–249.

Case, K.E., Shiller, R.J., (2003). Is there a bubble in the housing market? *Brookings Papers on Economic Activity,* 2, 299–342.

Chanel, O., Delattre, L. and Napoléone, C. (2014). Determinants of local public policies for farmland. Preservation and urban expansion: A French illustration. *Land Economics*, 90 (3), pp. 411-433.

CRESME, CNAPPC, ANCE, Riuso 2012. Città mercato e rigenerazione 2012. Analisi del contesto per una nuova politica urbana, Roma, 2012

DiPasquale, D. (1999). Why don't we know more about housing supply? *Journal of Real Estate Finance and Economics*, 18(1), 9-23

DiPasquale, D. and Wheaton, W.C. (1994). `Housing Market Dynamics and the Future of Housing Prices. *Journal of Urban Economics*, 35(1), 1-27.

Dominatia, E., Patterson, M. and Mackay, A. (2010). A framework for classifying and quantifying the natural capital and ecosystem services of soils. *Ecological Economics*, 69(9), 1858–1868.

Durr, R. H. (1993). What Moves Policy Sentiment? *American Political Science Review*, 87:158–170.

EEA and JCR (2010). *The European environment: state and outlook 2010. Land use*. European Environmental Agency, Copenhagen.

EEA and JRC, (2006). Urban Sprawl: the ignored challenge, *EEA report* n°10/2006, European Environmental Agency and Joint Research Centre, Copenhagen.

England, R.W., Qiang Zhao, M. and Ju-Chin Huang (2013). Impacts of property taxation on residential real estate development. *Journal of Housing Economics,* 22, 45–53

Fischer, B., Klauer, B. and Schiller, J. (2013). Prospects for sustainable land-use policy in Germany: Experimenting with a sustainability heuristic. *Ecological Economics,* 95, 213–220.

Follain, J. R. (1979). `The Price Elasticity of the Long-Run Supply of New Housing Construction. *Land Economics*, 55(2), 190-199.

Glaeser, E.L., J. Gyourko and R.E. Saks (2005) Why is Manhattan so Expensive? Regulation and the Rise in Housing Prices. *Journal of Law and Economics* 48 (2), pp. 331-369.

Glaeser, E.L., Gyourko, J. and Saiz, A. (2008). Housing supply and housing bubbles. *Journal of Urban Economics*, 64, 198–217

Green, R., Malpezzi, S. and Mayo, S.K. (2005). Metropolitan-Specific estimates of the price elasticity of supply of housing, and their sources. *The American Economic Review*, 95(2), 334-339

Hilber, C.A.L. and Vermeulen, W. (2012). The Impact of Supply Constraints and House Price in England, *CPB Discussion Paper*, 219.

Himmelberg, C., Mayer, C. and Sinai, T. (2005). Assessing high house prices: bubbles, fundamentals and misperceptions. *Journal of Economic Perspective*, 89 (2005) 323–336.

Huang, H. and Tang, Y. (2012). Residential land use regulation and the U.S. housing price cycle between 2000 and 2009. *Journal of Urban Economics*, 71 (1), 93–99.

Ihlanfeldt, K.R. and Mayock, T. (2014). Housing Bubbles and Busts: The Role of Supply Elasticity. *Land Economics*, 90(1): 79-99.

Ihlanfeldt, K.R. and Willardsen, K. (2014). The millage rate offset and property tax revenue stability. *Regional Science and Urban Economics,* 46 (2014) 167–176

Ihlanfeldt, K.R., Shaughnessy, T.M., (2004). An empirical investigation of the effects of impact fees on housing and land markets. *Regional Science and Urban Economics* 34, 639–661

ISPRA (2011). *Tematiche in primo piano. Annuario dei dati ambientali 2011*. Istituto Superiore per Protezione e la Ricerca Ambientale, Roma.

ISTAT (2011), *Conti aggregati economici delle amministrazioni pubbliche* – Anni 1980-2010

ISTAT (2012). *Conti aggregati economici delle amministrazioni pubbliche – Anni 1990-2011*

ISTAT (2011). *L'Italia in 150 anni: Sommario di statistiche storiche 1861-2010*. Istituto Nazionale di Statistica, Roma.

Keating, M. (2001). Rethinking the region: Culture, institutions and economic development in Catalonia and Galicia. *European Urban and Regional Studies*, 8(3): 217–234.

Johansson, Å., Heady, C., Arnold, J., Brys, B., and Vartia, L., (2008). Taxation and Economic Growth. OECD Economics Department *Working Papers*, no.620, OECD, Paris.

Levin, E.J. and Pryce, G.B.J. (2009). What Determines the Price Elasticity of House Supply? Real Interest Rate Effects and Cyclical Asymmetries. *Housing Studies*, 24(6), pp. 713-36

Li, M., Wu, J.J. and Deng, X. (2013). Identifying drivers of land use change in China: A spatial multinomial logit model analysis. *Land Economics*, 89 (4), pp. 632-654

Longobardi, E., (2008), *Economia tributaria*, McGraw-Hill, Milano.

Lyytikäinen, T. (2009). Three-rate property taxation and housing construction. *Journal of Urban Economics*, 65, 305–313

Malpezzi, S. and Mayo, S.K. (1997). Getting housing incentives right: A case study of the effects of regulation, taxes, and subsidies on housing supply in Malaysia. *Land Economics*, 73(3), 372-391

Mayer, C.J. and Somerville, T. C. (2000a). Land use regulation and new construction. *Regional Science and Urban Economics*, 30, 639–662

Mayer, C.J. and Somerville, T. C. (2000b). Residential construction: Using the urban growth model to estimate housing supply. *Journal of Urban Economics,* 48, 85-109.

Mayo, S. & Sheppard, S., (2001) Housing Supply and the Effects of Stochastic Development Control, Journal of Housing Economics, Elsevier, vol. 10(2), pages 109-128,

McCarthy, J. and Peach, R. (2004). Are home prices the next bubble? *Economic Policy Review*, 10 (3), 1–17.

McFarlane, A. (1999). Taxes, Fees, and Urban Development. *Journal of Urban Economics*, 46, 416-436.

McQuinn, K. and O'Reilly, G. (2008). Assessing the role of income and interest rates in determining house prices. *Economic Modelling*, 25, 377–390

Meen, G. and Nygaard, C. (2011). Local housing supply and the impact of history and geography. *Urban Studies*, 48(14) 3107–3124.

Monk, S. and Whitehead, C. M. E. (1996). Land Supply and Housing: A Case-Study. *Housing Studies*, 11(3), pp. 407-23

Muth, R. F. (1960). "The Demand for Non-Farm Housing," in: A. Harberger (ed.), *The Demand for Durable Goods.* Chicago: Univ. of Chicago Press.

Ostrom, C., and Smith, R. (1992). Error Correction, Attitude Persistence, and Executive Rewards and Punishments: A Behavioral Theory of Presidential Approval. *Political Analysis*, 4:127–183.

O'Sullivan, A. and Gibb, K. (2012). Housing taxation and the economic benefits of homeownership. *Housing Studies*, 27(2), 267–279.

Paciorek, A. (2013). Supply constraints and housing market dynamics. *Journal of Urban Economics*, 77, 11–26

Pellegrino, S. (2006). L'ICI: una valutazione a un decennio dalla sua introduzione. *Working Paper* No 477, Società Italiana di Economia Pubblica.

Pellegrino, S. and Piacenza M. (2011). Developing a static microsimulation housing taxation in Italy. *International Journal of Microsimulation*, 4(2), pp. 73-85.

Pellegrino, S. and Piperno, S. (2012). L'autonomia tributaria delle regioni e degli enti locali alla luce dei più recenti provvedimenti: "l'albero è più dritto?" *Research Paper del Centro Studi Federalismo*

Plassmann, F. and Tideman, T.N. (2000). A Markov chain Monte Carlo analysis of the effect of two-rate property taxes on construction. *Journal of Urban Economics,* 47, 216–247.

Poterba, J.M. (1984). Tax subsidies to owner occupied housing: an asset market approach. *Quarterly Journal of Economics*, 99, 729-752.

Quigley, John M., and Steven Raphael. (2005). "Regulation and the High Cost of Housing in California." American Economic Review, 95(2): 323-328

Rena Mourouzi-Sivitanidou (2011). Market analysis for real estate. Edited by Petros Sivitanides

Saks, R.E. Job creation and housing construction: Constraints on metropolitan area employment growth. Journal of Urban Economics, vol. 64, issue 1, 2008, 178-195

Saiz, A. (2010). The geographic determinants of housing supply. *The Quarterly Journal of Economics,* 125 (3), pp. 1253-1296.

Sivitanidou, R. and Sivitanides. P. (1999). Office Capitalization Rates: Real Estate and Capital Market Influences. *Journal of Real Estate Finance and Economics*, 18:3, 297-322.

Somerville, T. (2001). Permits, starts, and completions: Structural relationships versus real options. *Real Estate Economics*, 29(1), pp. 161-190

Stevenson, S. and Young, J. (2014). A Multiple Error-Correction Model of Housing Supply. *Housing Studies*, 29(3), pp. 362-379

Topel, R. and Rosen, S. (1988). Housing Investment in the United States. *Journal of Political Economy,* 96(4), pp. 718-740.

Vermeulen, W. and Rouwendal, J., (2007). Housing supply in the Netherlands. *Tinbergen Institute Discussion Papers*, 87,Tinbergen Institute.

Appendix

Null Hypothesis: the variable has a unit root	t-Statistic	P-value
*Rate_H**	-3.750880	0.0372
IND_H	-1.255453	0.8747
Rate _GDP	-2.905108	0.0584
Rate_pop	2.036241	0.9997
Rate_price	-3.211581	0.1049
*Rate_households**	-3.969193	0.0055
Inter-m	-2.770222	0.2192

* Stationary series (*p-value* < 0.05)