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Regional variation in the elasticity of supply of housing, and its determinants: The case of a small sparsely populated country

Elias Oikarinen [a,*], Risto Peltola [b], Eero Valtonen [c]

[a] University of Turku, School of Economics, Department of Economics, Rehtorinpellonkatu 3, FIN-20500 Turku, Finland
[b] National Land Survey of Finland, Finland
[c] Aalto University, Finland

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ABSTRACT

Previous empirical investigations provide evidence of substantial regional variation in the supply elasticity of housing. They further show that the elasticity and its variation across cities within the U.S. are significantly influenced not only by regulatory supply constraints, but also by the city level population, population density, and geographic constraints. This paper studies empirically if these findings apply to a country that is notably different from the U.S. with respect to its population density, typical city size, geographic and cultural coherence, and regulatory constraints, i.e., Finland. Based on data for the period 1987–2011, our findings are largely in line with those reported for the U.S. The results support the theoretical models indicating that the supply elasticity is largely a local phenomenon, i.e., dependent mainly on city specific factors rather than the abundance of undeveloped land at the country level. The supply elasticity substantially varies across Finnish cities. The city size, zoning policies, and geographic constraints are found to be the most important factors causing regional elasticity differences, accounting for some 80% of the elasticity variation. While more flexible regulation can increase the supply elasticity, the results imply that the possibilities of local regulation to affect the elasticity are limited even in a sparsely populated country with small cities and abundant reserve of vacant developable land.

1. Introduction

The price elasticity of supply of housing is a key factor in the housing market. It determines the capability of housing supply to respond to changes in housing demand, and therefore the extent to which increasing housing demand induces higher housing prices or greater housing stock. Hence, the supply elasticity has considerable consequences for households and firms, and thereby for the performance of cities and for the economy as a whole. In particular, by causing greater cost of housing for households, lower supply elasticity has notable impacts on the population growth and composition, income growth, income and wealth distribution, migration, and on local labor markets (Glaeser et al., 2006; Saks, 2008; Zabel, 2012; Gyourko et al., 2013). Moreover, less elastic housing supply strengthens housing price cycles (Malpezzi and Wachter, 2005; Goodman and Thibodeau, 2008; Glaeser et al., 2008) which, in turn, can amplify cycles in the overall economy. Since more inelastic housing supply decreases the attractiveness of a city from both firms' and households' point of view hindering the growth of the city, and amplifies housing price cycles, more elastic housing supply can generally be seen as a desirable aim.[1]

Many commentators, including some economists, often argue that in a country with an abundant reserve of vacant developable land, housing supply should be very elastic — after all, land availability should not restrict housing construction, as land is not a scarce resource. This is also the case in Finland, which is one of the most sparsely populated developed countries and where even the largest urban area is small in world standards. It is usual to hear claims that the high housing price level in the Helsinki area, by far the largest urban area in the country, must be mostly due to inefficient zoning practices and ineffective land policies, since the surroundings of the city are rich of undeveloped land that is suitable for housing development and because such land is relatively plentiful even within the borders of the city. What about the other cities that are much smaller than Helsinki and surrounded by vast areas of agricultural land and forests — surely housing supply should be close to perfectly elastic in these areas, at least in the absence of artificial regulatory constraints, it is argued.

Based on the theory, these commentators are missing the point: There are many other factors than the availability of vacant land and regulatory restrictions that are expected to significantly influence the housing price level and elasticity of housing supply in a city (e.g. Capozza and Helsley, 1989; Green et al., 2005). The urban economics theory also implies that the supply elasticity is largely a local phenomenon, i.e., dependent mainly on city specific factors rather than the abundance of undeveloped land at the country level.

* Corresponding author. Tel.: +358 40 5871943.
E-mail address: elias.oikarinen@utu.fi (E. Oikarinen).

[1] Local authorities may also have some incentives to restrict housing supply, though (e.g. Quigley and Rosenthal, 2005; Koster et al., 2012).

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In accordance with the theoretical considerations, empirical research provides evidence of greater city population and population density decreasing the supply elasticity in the U.S. MSAs (Saiz, 2010; Paciorek, 2013). Rose (1989) and Saiz (2010) further show that water bodies can have considerable influences on the supply elasticity. The careful empirical investigation of Saiz (2010) adds topographical constraints in the list of factors affecting the elasticity. In line with the theory, a previous empirical findings also indicate that the supply elasticity of housing can significantly vary across regions (e.g. Goodman and Thibodeau, 2008; Saiz, 2010; Caldera and Johansson, 2013).

The U.S. is in many ways notably different from a country such as Finland, however. In addition to being more sparsely populated, Finland is a country with considerably smaller cities than those in the U.S.: while even Helsinki is small relative to a typical U.S. MSA, the second to tenth largest cities in Finland have populations ranging from less than 250,000 to approximately 80,000. Furthermore, Finland is geographically and culturally a much more coherent country than the U.S., and the regulatory constraints in Finnish cities are typically strict. This raises the question of whether the previous empirical findings hold for a country like Finland, or whether the supply elasticity does not notably vary across Finnish cities and if it does, whether the variation is almost solely due to differences in the city level regulatory constraints.

Due to the importance of the elasticity regarding not only housing economics but also urban economics and urban decision-making in general, empirical research on the theme has substantially increased during the last decade. As Gyourko (2009) states, "research on housing supply has grown owing to improved data combined with heightened interest in policies such as local land use regulations." Nevertheless, empirical research on the extent to which various factors cause regional elasticity differences is very limited. Indeed, while the investigation of regional elasticity differences and its determinants has concentrated on the U.S. and U.K., a very densely populated country, there does not appear to be similar examinations using regional level data for a country such as Finland. Therefore, the statement by Cheshire and Sheppard (2004) according to which "understanding the variety of ways in which housing supply responds to land use regulation, and empirical measurement of the magnitude of these responses is an important area for future research" still holds today.

This study aims to contribute to filling the gap in empirical examination of regional variation in the price elasticity of housing supply and its determinants. In addition to focusing on a small sparsely populated country, this appears to be the first investigation on the theme using city level data for a European market. Finland also provides a good standpoint for empirical research because of the extensive and reliable data on Finnish urban housing markets. Besides examining whether the theoretical considerations and previous empirical implications apply to Finland, our aim is to investigate if the arguments according to which possible regional elasticity differences are a consequence of variations in the regulatory constraints only hold true.

In the methodological side, the paper has three contributions to the literature. First, we show how the Johansen Maximum Likelihood cointegration technique can be used to estimate elasticity values. Second, this technique allows us to use housing stock data rather than flow data. It is well known that, in time series analysis, information is lost when differenced (i.e. flow) variables are used instead of the levels (stock). This is the case, in particular, when the aim is to examine longer-term dynamics. In previous empirical studies, the supply elasticity estimates are modeled based on housing starts, newly completed construction or change in the housing stock, or indirectly utilizing a housing price equation. Third, we use a recursive analysis to investigate whether there have been notable changes in the elasticities over time. As far as we know, recursive analysis to study the temporal variation has not been conducted in earlier literature. The recursive analysis helps us to conclude whether the estimated elasticity values are relevant still in today's environment.

We use quarterly data for 15 Finnish cities for the period 1987–2011 to estimate directly the dependence of overall housing supply on the housing price level. While the estimated elasticities may not reflect the elasticity values over the (very) long-horizon due to the sample period being no longer than 25 years, the reported values can be considered as elasticities over the medium term (or 'relatively' long-term). Generally, the *short-term* elasticity notably differs from the medium- and long-term ones, as housing supply adjusts only sluggishly. The longer-term elasticities are of great interest, as they essentially determine how various regional variables react to different economic shocks, such as productivity shocks, over the longer horizon.

After estimating the supply elasticities, we examine the factors behind the observed regional differences. For that purpose, we construct an index to measure the regulatory constraints for housing supply in a similar manner to that of Gyourko et al. (2008). We also add demographic variables and variables aiming to capture the geographic supply restrictions in the cross-section estimations investigating the key determinants of elasticity variations across cities.

The results show that supply elasticity can considerably vary across cities even in a much smaller, more sparsely populated, and more coherent country than the U.S. The elasticity estimates range from 0.2 to 0.8, i.e., housing supply is far from perfectly elastic. The stability of the elasticities over the sample period cannot be rejected based on the recursive analysis. In line with the previous findings for the U.S., both regulatory and geographic constraints are significant contributors to the elasticity and its regional variation. Despite the small number of cross-sectional observations these constraints, together with city size, are statistically significant explanatory variables for the elasticity, and account for some 80% of the observed elasticity variation across cities. The notable regional elasticity differences and the importance of city size in the cross-section models are in line with the theoretical models of housing supply which indicate that the supply elasticity is a local phenomenon: Despite the large land reserves in the country, it is the city size and availability of developable residential land within the city that essentially determine the elasticity. The results further indicate that, while more flexible regulation can obviously increase the supply elasticity, the possibilities of local regulation to influence the elasticity are limited despite the abundance of vacant developable land in the country.

The next section presents a brief theoretical discussion on the determination of the price elasticity of housing supply. The previous empirical literature is reviewed in section three. Section four describes the empirical methodology used in the study. Empirical findings are reported in sections five and six, after which the study is concluded.

2. Theoretical considerations

In an extension of a model developed by Mayer and Somerville (2000a), Green et al. (2005) derive the following formula for the price elasticity of housing supply to examine regional variation of the elasticity:

$$e = \left(\frac{2}{\phi\sqrt{n}}\right)\frac{\lambda - g}{k}\,p. \tag{1}$$

Eq. (1) shows that the elasticity (e) is adversely influenced by greater population of the city (n), population density (ϕ is a factor of proportionality that is increasing in density), growth rate for the city (g), and transportation costs (k). The elasticity is increased, in turn, by higher after-tax cost of capital (λ), and the house price level (p denotes the price level at some fixed point in the city). Intuitively, Eq. (1) shows that the key factors determining the supply elasticity can be broken down into components (Kim et al., 2012). The term in brackets measures the impact of the size of the city, and ($\lambda - g/k$) is the city's expected growth rate relative to the discount rate, divided by the cost