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## Conference Paper

# Research on house prices, accessibility and socio-economic neighborhood attributes in southern Sweden

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**Research on house prices, accessibility and socio-economic neighborhood attributes in southern Sweden**

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## **Background**

Real estate in large regions is more expensive than real estate in small regions. In the same region, real estate in central locations is more expensive than in peripheral locations. This is a well-known implication of spatial economic theory. The most important reason is that transport costs depend on the accessibility of a location. For firms, distribution costs increase with decreasing general accessibility, while households' commuting costs increase in a similar fashion. In the most symmetrical cities there will be one centre with continuously decreasing land prices with increasing distance from the centre. Such cities exhibit a *monocentric* structure (Alonso, 1964).

Different activities have different willingness to pay for locations with the same accessibility. As a general principle, production activities that require less space or

that face greater transport costs have a greater willingness to pay for central locations than production with extensive land requirements or low transport costs. A consequence is that stock exchanges and other financial services tend to buy or rent real estate in the most expensive and accessible locations. Financial services require unusually small lots for a fixed value added. At the same time, workers in the financial sector are relatively productive and engage in contact-intensive work with relatively high transport costs. The opposite is true of agricultural workers: they need much more space for the same production value, and face lower transport costs.

The willingness to pay for housing is not as unambiguous as the willingness to pay for production sites. The reason is that housing is mainly a consumption good, even if housing can also be bought for speculative investment purposes. The valuation of consumption goods is subjective and can differ substantially between different individuals. Many young single persons as well as many elderly have a willingness to pay for centrally located housing that cannot be entirely explained in terms of commuting cost savings. One reason could be a preference for immediate proximity to various art and entertainment options or to co-located friends and acquaintances. At the same time, empirical research shows that many families with dependent children are prepared to sacrifice accessibility in order to afford a single-family home with an individually owned garden, preferably in neighbourhoods with good schools and low crime rates.

Global metropolises such as New York or London are perhaps the most striking examples of how housing preferences can vary, while at the same time illustrating the presence of various demographic regularities regarding location choice. In New York, for example, there exists a tendency for rich one-person households to locate in Manhattan, whereas less affluent people tend to live in the Bronx or Queens. Conversely, rich families tend to live in large single-family homes on Long Island.

But there are also numerous ‘consumption clusters’ which are attractive for small groups of housing consumers, for example neighbourhoods that offer commercial and social activities for various immigrant groups such as Russians or Chinese or certain areas of Brooklyn or Manhattan that offer interesting environments for artist or writers.

When it comes to the housing market, there are strong theoretical reasons for expecting large, new and accessible housing to be more expensive than the reverse combination. This is true of all urban areas in all parts of the world. On the other hand, the theoretical relationship between neighbourhood socio-economic characteristics and the willingness to pay is much weaker. Obviously, low crime rates are associated with more security as regards future consumption opportunities and good schools are associated with greater expected future income streams, but there is nevertheless much more room for personal subjective variability. Empirically, rich and well-educated neighbourhoods tend to have more expensive housing than poor and ill-educated ones, but this does not imply that the opposite preferences are impossible. Even if neighbourhoods with high incomes and high levels of education are associated with high housing prices around the world, there are still a number of culturally determined differences as regards various other neighbourhood attributes. For example, residents of Asian cities tend to value high population densities to a greater extent than Western households (Andersson, Shyr and Lee, 2012).

Since dwellings differ in terms of size, construction quality, accessibility and many other attributes, it often becomes difficult to interpret market price information. To what extent does a specific price depend on size and to what extent on location? One method for answering such questions is hedonic price analysis.

### **Theory and methodology: Hedonic price analysis**

In hedonic price analysis, the basic assumption is that the observed price of a heterogeneous good depends on numerous quality indicators – so-called ‘attributes’ – that can be estimated empirically with the help of a large number of observations with considerable variability in terms of the combinations of the relevant attributes. If there are hundreds or thousands of combinations of the various attributes it becomes possible to estimate each one of them is worth in the analysed market. An estimated attribute price is called an *implicit price*, as opposed to the explicit price that corresponds to the observable price for the bundle of attributes that make up a specific unit of housing or other real estate.

A single housing market is normally delimited as a spatially unified market with shared demand and supply. In practice, this implies that a single housing market does not exceed the area where daily commuting to the most central parts of the region is possible. There is thus a natural correspondence between a housing market and a regional labour market, although the housing market is occasionally smaller. It can be smaller because some buyers are ignorant of certain location options or because there is systematic segregation, due to regulations or cultural habits.

When one buys the combination of attributes that jointly comprise a housing unit, this does *not* correspond to the situation of combining goods in a supermarket. It is easier to re-combine canned goods than various combinations of size and socio-economic neighbourhood attributes. The difference in transaction costs between the two situations is theoretically meaningful. Among other things, it implies that one should not analyse the explicit price of housing as a linear combination of implicit prices.

When the transaction cost of varying attribute combinations is high, it implies that the price of one attribute is influenced by the quantities of other attributes in the same bundle. Linear hedonic price functions are therefore not desirable. A common

and theoretically defensible alternative is the log-linear function, which yields estimates of mean attribute elasticities.

## **Aim: An empirical study of the housing market in Scania (Skåne), Sweden**

It is never obvious which attributes should be included in a hedonic price analysis. In many cases, the choice of tested variables is influenced by a consideration of which variables have been significant in prior comparable studies (Andersson, 2000), and also by the availability of variables in the analysed market. Since accessibility has a major impact on house prices, there is however generally speaking a need for one or more accessibility measures.

It is not obvious that Scania (i.e. the southernmost metropolitan region in Sweden) is a monocentric region. Preliminary analyses showed that Scania contains two centres with wide-ranging price-distance gradients: one gradient originates in central Malmö (Triangeln), whereas the other gradient emanates from central Helsingborg (Helsingborg Central Station). For this reason, the distances to these two nodes were used as accessibility attributes in the analysis of housing prices in Scania.

The most easily accessible measurements relate to structural attributes that are reported according to standardized measurement methods by estate agents. Five such attributes are available for all housing units in Scania: floor area; number of rooms; the age of the dwelling; dwelling type; and whether the dwelling offers a view of the sea.

The most complicated part of a hedonic price analysis concerns the choice of relevant neighbourhood attributes. On the one hand, it is not immediately obvious which attributes are of sufficient interest to the buyers. On the other hand, neighbourhood delimitations in official statistical publications are often drawn according to political rather than economic criteria. It is only in the case of local tax rates that a political delimitation is to be preferred.

The most common socio-economic neighbourhood attributes in hedonic studies are measures of mean income and education levels. The corresponding measures in

Scania are mean individual income and the share of a district's population with an undergraduate degree. The neighbourhoods are politically determined and consist of municipalities outside of Malmö (the region's largest municipality). The municipality of Malmö is subdivided into 10 city districts. The average population of such "neighbourhoods" is about 30,000.

In addition, there are a number of other neighbourhood attributes that are potentially relevant. In Scania, examples include the share of neighbourhood residents with an immigrant background. The definition of immigrant background is that a person should be born outside of Sweden and/or that at least one of the person's parents is born outside of Sweden. A further socio-economic attribute is the share of residents that belongs to the so-called 'super-creative core', which corresponds to those knowledge-intensive occupations that were identified as 'super-creative' by Richard Florida in 'The Rise of the Creative Class' (2002). Examples of occupations that are included are scientist, teacher, engineer, artist and entertainer.

Table 1 presents the attributes and data sources that were used in the hedonic price analysis. Structural attribute observations are based on information derived from the largest on-line real estate database. Neighbourhood attributes correspond to measurements by Statistics Sweden. Accessibility measures are based on time distances according to Google Maps. The time distances refer to road traffic situations without significant congestion problems in the road network.

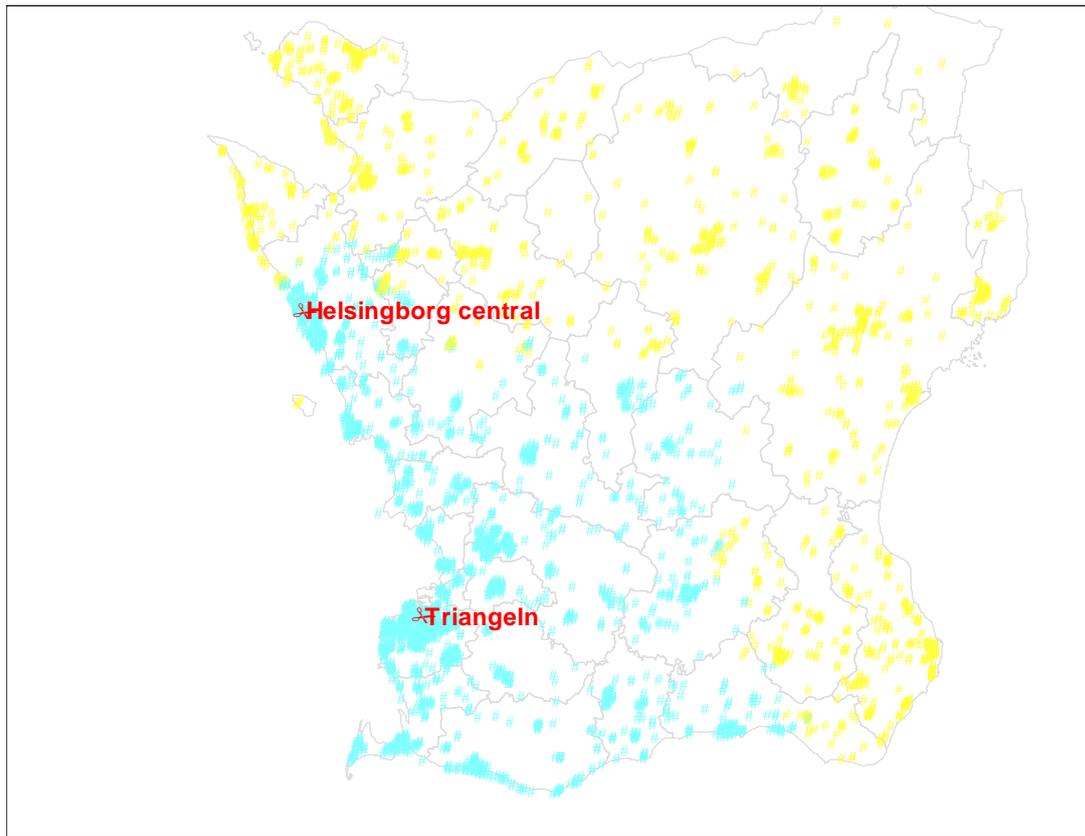
*Table 1: Prices and housing attributes for hedonic price estimation, Scania*

<b>Price/attribute</b>	<b>Definition</b>	<b>Source</b>
<b>PRICE</b>	Asking price in SEK	www.hemnet.se
<b>AREA</b>	Floor area (sq m)	www.hemnet.se
<b>ROOMS</b>	Number of rooms	www.hemnet.se
<b>AGE</b>	Age of dwelling (years)	www.hemnet.se
<b>HOUSE</b>	1=single-family home; 0=other	www.hemnet.se
<b>COOP</b>	1=coop housing; 0=other (www.hemnet.se)	www.hemnet.se
<b>VIEW</b>	1=sea view; 0=other	www.hemnet.se
<b>EDU</b>	Percentage of municipal [Malmö: district] labour force with at least 3 years of higher education, 2009	Statistics Sweden
<b>INC</b>	Total disposable income per capita in the municipality [Malmö: district], 2008	Statistics Sweden
<b>FOR</b>	Percentage with immigrant background in the municipality [Malmö: district], 2010	Statistics Sweden
<b>SCC</b>	Percentage of the labour force in the municipality/district belonging to the 'super-creative core', 2008	Statistics Sweden, calculations by Charlota Mellander
<b>TAX</b>	Municipal income tax rate, 2011	Statistics Sweden
<b>TRI</b>	Shortest time distance by car to Triangeln Station, Malmö (minutes)	maps.google.com
<b>HBG</b>	Shortest time distance by car to Helsingborg Central Station	maps.google.com

## **Results I: Determinants of house prices in western Scania**

According to the commuting-based definition of labour market areas, Scania consisted of two labour market areas in 2010, with Malmö and Kristianstad as their largest municipalities, respectively. The Malmö labour market area consists of western Scania and contains important concentrations of employment in Helsingborg, Malmö and Lund. For the hedonic analysis, we decided to include dwellings that are located within a one hour time distance from the most important regional node. In western Scania, the most important regional node is the city centre of Malmö, which implies that the analysed region extends from Helsingborg in northern Scania to Vellinge in southernmost Scania (and Sweden). The eastern boundary of the analysed

area extends from Hoor via Hörby to Ystad in south-eastern Scania (see Map 1). The area accounts for 70 per cent of all housing transactions in Scania.



- 61-114 minutes to Triangeln in Malmö (1450 observations)
- 0-60 minutes to Triangeln in Malmö (3469 observations)

*Map 1: Dwellings within a one-hour time distance from Triangeln in Malmö*

The mean housing price in the spring of 2011 was SEK2,100,000 (=US\$300,000), and the typical dwelling had been built in the middle of the 1960s. Western Scania has a rather decentralized population, one illustration of which is that the average time distance of housing units (within a 60 minute time distance) to central Malmö is more than 28 minutes. Some socio-economic attributes exhibited substantial variability, particularly the share of residents with an immigrant background. That share varied from less than 10 per cent in some of the smaller municipalities to over 90 per cent in

the district of Rosengård in the municipality of Malmö. Table 2 presents descriptive statistics for all analyzed variables.

*Table 2: Descriptive statistics for single-family homes and co-operative apartments within a time distance of one hour from Triangeln in Malmö, 2011*

<b>Attribute</b>	<b>Mean</b>	<b>Standard deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>PRICE</b>	2122987.20	1431667.18	13000.00	8000000.00
<b>AREA</b>	207.57	264.74	19.00	3165.00
<b>ROOMS</b>	4.60	4.26	1.00	45.00
<b>AGE</b>	46.00	38.01	0.60	310.00
<b>COOP</b>	0.50	0.50	0.00	1.00
<b>VIEW</b>	0.03	0.16	0.00	1.00
<b>EDU</b>	26.70	10.18	10.80	47.04
<b>INC</b>	218.63	55.33	127.00	303.50
<b>FOR</b>	24.39	15.04	8.67	91.94
<b>SCC</b>	18.77	4.88	11.43	32.03
<b>TAX</b>	30.62	0.69	28.89	31.32
<b>TRI</b>	28.47	17.11	0.65	60.00
<b>HBG</b>	47.58	20.82	1.16	93.49

The hedonic price analysis shows that western Scania is a region with two centers (regional accessibility peaks). Both Triangeln (Malmö) and Helsingborg Central Station are associated with a surprisingly steep price-distance gradient, which may be a reflection of a rather underdeveloped public transport network as compared with more densely populated metropolitan regions. Consistent with earlier analyses, there is no price-distance gradient centred on Lund (Andersson, 1997).

The population share with a high level of education has a highly significant impact on house prices. The share of immigrants has a significant negative impact on house prices, which may be a reflection of the higher unemployment rate among residents with immigrant backgrounds. One of the aims of this study was to estimate

whether the occupational structure is a more important determinant of house prices than other socio-economic attributes. However, the results show that the share of super-creatives and the mean income are less important than education and the share of people with immigrant backgrounds. Neither super-creatives or the mean income have a statistically significant effect on house prices, after controlling for education and immigration. Table 3 summarized the results.

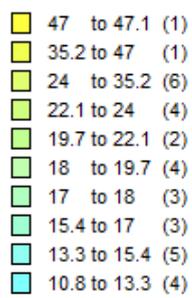
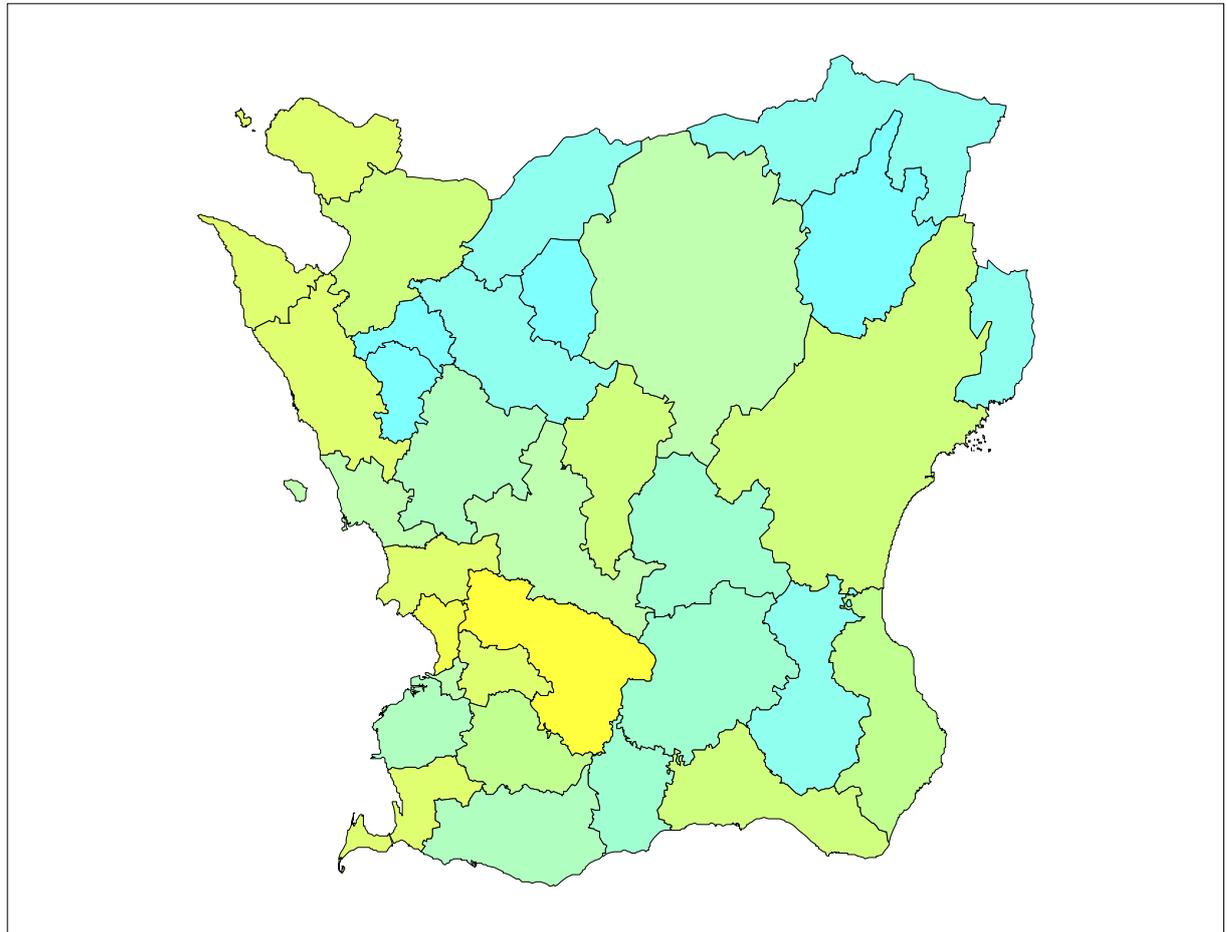
*Table 3: Hedonic price function for dwellings in western Scania, 2011 (dependent variable: natural logarithm of asking price in SEK)*

<b>Variable (attribute)</b>	<b>Transformation</b>	<b>Coefficient</b>	<b>t-value</b>
Constant	No	14.478	Irrelevant
<i>Structural attributes</i>			
<b>AREA</b>	Natural logarithm	.072	6.041*
<b>ROOMS</b>	Natural logarithm	.391	18.956*
<b>AGE</b>	Natural logarithm	-.112	-18.569*
<b>COOP</b>	No (dummy variable)	-.801	-31.040*
<b>VIEW</b>	No (dummy variable)	.535	9.116*
<i>Neighbourhood attributes</i>			
<b>EDU</b>	Natural logarithm	.514	8.862*
<b>INC</b>	Natural logarithm	-.004	-.166
<b>FOR</b>	Natural logarithm	-.107	-3.087*
<b>SCC</b>	Natural logarithm	.023	.355
<b>TAX</b>	Natural logarithm	-.050	-3.401*
<i>Accessibility attributes</i>			
<i>Distance to:</i>			
<b>TRI</b>	Natural logarithm	-.266	-11.712*
<b>HBG</b>	Natural logarithm	-.186	-10.591*

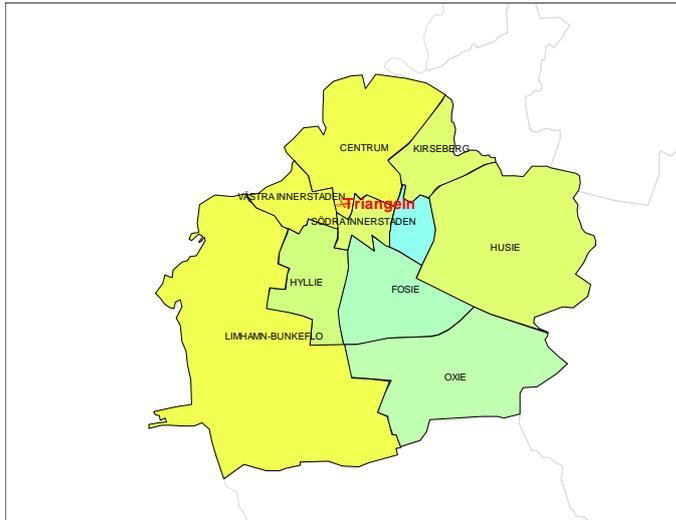
$N=2995$ ;  $R^2=0.552$ ; \*:  $p<.01$

Since the share of college-educated residents is the most important neighborhood attribute, it should be interesting to look at how it varies between municipalities in Scania and between districts of Malmö (Map 2 and Map 3). The highest education

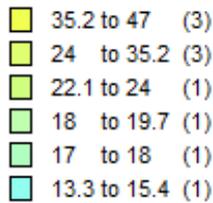
levels are encountered in south-western Scania: in Lund, Lomma and the western districts of Malmö.



*Map 2: Percentage share of college-educated in Scania's municipalities, 2009*



Note: The blue-colored district is Rosengård



Map 3: Percentage share of college-educated in Malmö's districts

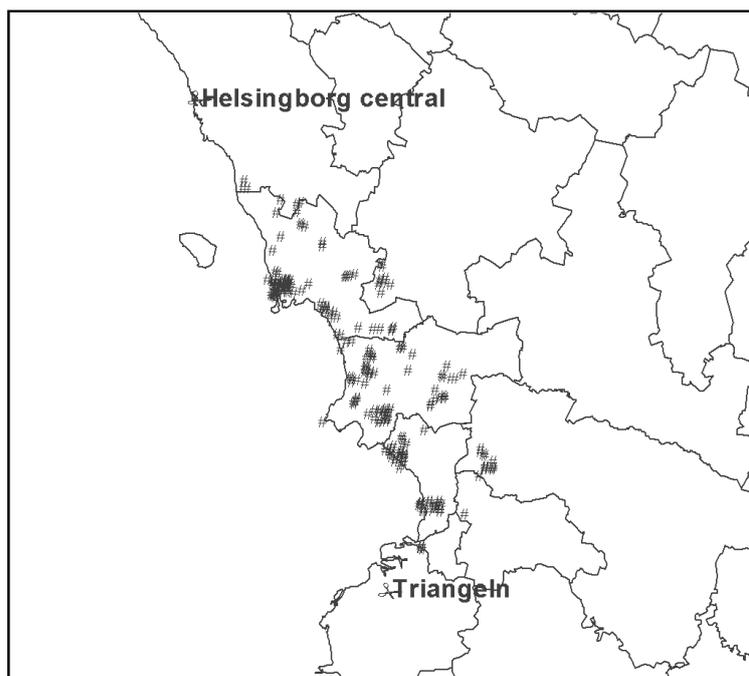
Lund is the municipality with the highest share of college-educated. Its share of 47 per cent is not only the highest in Scania; it is the highest in Sweden. The northwestern part of the region is also relatively highly educated. Malmö is interesting in that there is a pronounced boundary between the highly educated western districts and the much less educated eastern ones. Rosengård, in particular, has one of the lowest percentage shares of college-educated in Sweden (this is an area with over 90 per cent immigrants and high unemployment and crime rates).

## Results II: The two-centered nature of western Scania

A special iterative procedure was used to identify the land price-based delimitation of western Scania. The procedure was based on the successive elimination of observations from the hedonic price analysis with increasing distances from each of the two centers. In both cases, the conclusion was that the price-distance gradient ends

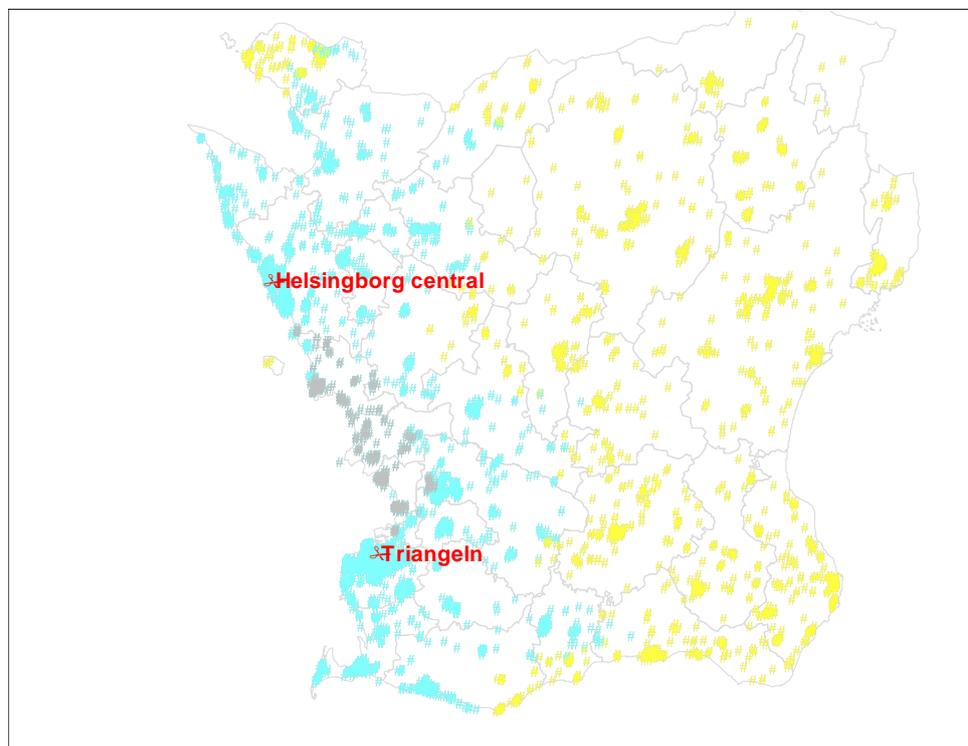
at a time distance of about 42 minutes from the local accessibility-maximizing node. This implies that the gradient that originates from Triangeln in Malmö ceases to affect house prices at a point that is located roughly 7 minutes to the south of Helsingborg Central Station, while the distance gradient centered on Helsingborg extends to a point that is 7 minutes to the north of Triangeln. Another way of expressing the same result is to state that Helsingborg's southern suburbs are more attractive than its northern suburbs due to the greater proximity to Malmö in the south. Analogously, Malmö's northern suburbs are more attractive than its southern ones.

A detailed analysis dwellings within 42 minutes of both Triangeln and Helsingborg Central Station shows that there are no accessibility-related regional price differences within this area. Within this area, greater distances to Helsingborg are counteracted by shorter distances to Malmö and vice versa. The implication is that a corridor that starts in central Malmö and ends in central Helsingborg offers extraordinarily good accessibility as compared with the rest of western Scania. Map 4 shows the extent of this area.



*Map 4: Observations without significant variations in general accessibility*

Looking at western Scania, one conclusion of the analysis is that the delimitation of the two distance gradients encompasses all of Scania except for northern Båstad and the island of Ven. The north-south extent of the housing market is therefore almost exactly the same as the commuting-based delimitation of the Malmö labour market area. The eastern delimitation of the housing market is however significantly further west than the commuting-based labor market delimitation. Map 5 shows the delimitation of the housing market, using the extent of both the Malmö and Helsingborg distance gradients simultaneously.



- 43-114 minutes to Triangeln and Helsingborg C (1417 observations)
- 0-42 minutes to Triangeln or Helsingborg C (3502 observations)
- Grey observations: 0-42 minutes to Triangeln and Helsingborg C

*Map 5: The two-centered housing market region in western Scania*

The result indicates that the integrated housing market in western Scania has a clear

north-south corridor shape. The main reason is probably that the road and rail infrastructure between Båstad and Malmö is of much higher quality than the corresponding east-west infrastructures. It is therefore likely that most of the new housing supply will be forthcoming within the north-south corridor, at least in the short or medium term.

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