How Finland Approaches Land Value Taxation: An experiment to cost-effectively value land in a system where land and structures are valued separately

Risto PELTOLA, Finland

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SUMMARY

Finland is among those rather few countries where higher rates are applied to land than structures in property taxation. As the valuation methods used in our country are more than 20 years old, and the valuation itself almost as old, the methods and the valuation itself are in urgent need of updating. A new system of valuation was ordered by the Ministry of Finance, and it has now been developed.

Based on the availability of data and how valuable the location is, a toolbox of three valuation methods is introduced:
1) for most invaluable land zip-code medians are recommended,
2) for more expensive land a spatial moving average of nearest comparable land sales is recommended, and
3) for most expensive land a spatial moving average of nearest comparable apartment sales is recommended as a second method.

In this paper those methods are explained and evaluated. The paper also includes results of an extensive analysis of effective property tax rates.

How Finland Approaches Land Value Taxation: An experiment to cost-effectively value land in a system where land and structures are valued separately[1]

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BACKGROUND AND PURPOSE OF THE STUDY

Finland used to have all these types of property taxes: (1) recurrent (annual) taxes on real (*immovable*) property, (2) recurrent taxes on net wealth, (3) taxes on estates, inheritances, and gifts, (4) taxes on financial and capital transactions (including real property transfers). The tax on net wealth was recently abolished. Taxes on inheritances have recently been lowered and there was a debate about abolishing them altogether (it didn't happen). Taxes on real property transfers, on the other hand, have been recently raised, in spite of a consensus view among economists about harmful effect of those taxes on housing markets and other economic activity.

As annual property tax is a local tax the revenue of all other taxes on wealth and property go to the coffers of central government. Arable and forest land is exempt from property tax.

It has been stated over and over again by experts and many politicians that the importance of annual property tax will grow in my country. Indeed the revenue now on property taxes is many times what it used to be when it was introduced in 1993. The maximum nominal rate was recently raised to 1,8 %, apart from for residential buildings 0,9 %. Maximum nominal rate for vacant building sites is as high as 6 %. Another trend is expected to take place: the land portion of property tax will grow in importance vis a vi the building portion.

As the revaluation will bring assessment values closer to market values the effective rates may sometimes exceed 1 %. As to vacant building sites it will be sometimes much higher. All these trends make a case for a good quality valuation system with uniform treatment of properties and taxpayers. On the other hand, the system should be cost effective.

In most systems the taxable value of the property is the combined value of land and structures. It may be seen more convinient to value the functional property as a whole. Indeeed, in the literature a separate valuation of land and buildings is seen as a cause of complications:

> Other complications can arise, especially in market value-based taxes. When land or buildings is taxed separately, it is difficult to estimate the market value of each component accurately. This difficulty also occurs under unified property taxes when the assessor is required to divide total value into its land and buildings components.

[1] An earlier version of this presentation was given at "2016 WORLD BANK CONFERENCE ON LAND AND POVERTY", The World Bank - Washington DC, March 14-18, 2016

> This makes it difficult to implement a pure site value tax—a land tax based only on the location value of the property. When a building or a unit in a building is sold, its price will reflect the value of its location (also an element of land value). (Property Tax Regimes in Europe. p. 24)

As to land for housing, Finland is one of those rather few countries, where separate rates are applied to land and structures, higher rates to land, especially vacant land. In this sense there is certain georgist spirit of land value taxation in the finnish system, although it has not been defended in these terms. Rather the higher rates on land have been seen pragmatic land policy. Obviously land and structures must be valued separatively. Indeed the valuation systems for land and structures are separeted altogether and are executed in different offices, for reasons partly unknown to me. At may continue that way even if new bodies of government take responsibility in these tasks.

The valuation of buildings is outside the scope of this paper. The scope and focus of this paper is to offer a method to value land in all locations. Land is to be valued in areas with plenty of land sales data as well as in areas with scarcity of sales data, and even in locations where most land is built and there is not much vacant land to be sold to start with, and the land may be of highest value in the country.

The ministry of finance ordered the National Land Survey of Finland to calculate land values for property taxation for all properties in the tax base, more some two million units. The project was started in January 2017 and is due to be completed by the end of 2019.

The structure of my presentation is following: An extensive performance analysis on property taxes was carried out in Finland, namely analysis of effective property tax rates and ratios between assessment values and market values, based on a large database on market data. The results of that analysis are presented (part I). Based on that analysis a new system for property valuation for taxation purposes was developed. The prototype of that valuation system is presented (part II).

PART I: CURRENT PROPERTY TAXATION IN FINLAND THE INSTITUIONAL SETTING

As to land for housing, Finland is one of those few countries, where separate rates are applied to land and structures. Housing land is taxed more heavily than housing structures. The nominal rate for housing land varies between 0,93 - 1,8 % and the nominal rate for housing structures varies between 0,41 -0,9 %. As for all other land and structures, the nominal rate variation is 0,93 - 1,8 %, the same as for housing land. [2] As to vacant lots in some growing areas the nominal rate variation is as high as 2-6 %.

The law on property taxation was introduced in 1993. In all property classes land and buildings must be valued separately, land based on market value and structures based on reproduction costs. Mass valuation was carries out first time in mid 1990-ies. The manpower used for valuing market value of land has never been more than three persons annually for the whole country, small amount concerning the vast task. The people involved did a decent job given the data and tools available in those times, but the results were far from perfect in terms of taxpayer equity. More of that in the next section.

Property tax is a local tax, towns and cities are receivers of the tax. Property tax income is 1,7 billion euros, or 1 % GDP and 4 % of total local taxes. The administration is carried out by state taxation authorities, including collection of tax, and the current development work was carried out by Ministry of Finance and National Land Survey.

Income of property tax on buildings is ca 1.2 billion euros, and income on property tax on land is 473 million euros. Table 1 illustrates the structure of property tax on land. For most properties and most areas of the country, property tax on buildings is much larger than property tax on land. However, as for housing in capital region and other high prices area, property tax on land may be higher than property tax on buildings.

The importance of property tax revenue in local finance is expected to rise in the near future.

PERFORMANCE ANALYSIS: EFFECTIVE PROPERTY TAX RATE AND RATIO STUDY

The importance of perfomance analysis (source: Property Tax Regimes in Europe)

> Comparatively few countries do much more than report basic revenue statistics. At the policy level, there is a need for greater information on such things as the composition of the property tax base and how the composition changes over time. That is, how much property tax is paid by each type of property relative to its share of total value?

[2] Before increases made last year, the nominal rate for housing land varied between 0,6 - 1,35 % and the nominal rate for housing structures varied between 0,39 -0,9 %. As for all other land and structures, the nominal rate variation was 0,6 - 1,35 %, the same as for housing land.

> This addresses the interplay of such factors as differential tax rates, differing bases of assessments, and differing exemption amounts. (Property Tax Regimes in Europe. p. 61)
>
> In a valued-based property tax, valuation accuracy is—or should be—an important concern. The chief tool used to gauge valuation accuracy in mass appraisal for property tax purposes is a "ratio study" (Gloudemans and Almy, 2011). Such a study is an investigation of how closely the valuations that property taxes are based on compare to market values (either current market values or the values on the valuation date). Actual prices from transactions deemed to be open-market, arm's length sales are used as evidence of market values, and the "ratio" in a ratio study simply is the ratio of the valuation to the sale price. (Property Tax Regimes in Europe. p. 62)
>
> In a ratio study, sales ratios would be calculated for all the sales that were deemed usable and patterns in the ratios would be examined. The statistics calculated in ratio studies mainly deal with the *level of value* and the *uniformity* of values. Level of value is measured by a measure of central tendency, such as the median, the common arithmetic mean, and the weighted mean. There are several aspects to uniformity. If the question is whether two or more groups of property are valued uniformly, measures of central tendency are compared. If the question is whether all the properties in a group are valued uniformly, a measure of variability is calculated. (Property Tax Regimes in Europe. p. 62)
>
> The *coefficient of dispersion* is the chief measure used. Sometimes, the concern is whether high-value properties and low-value properties are valued uniformly, other tests are used here. (The same concepts can be applied in studies of annual rental value assessments.) Denmark, Iceland, Lithuania, Northern Ireland, and Sweden are among the countries that routinely evaluate valuation performance using ratio studies. (Property Tax Regimes in Europe. p. 62)

The execution of perfomance analysis

Effective property tax rates were analyzed in all property classes where sufficient market data is available, namely housing properties and property for commercial and industrial purposes. Sales of built and unbuilt properties were analyzed. The relevant assessment value for built properties was the sum of assessment value of land and structures. As for unbuilt properties, the relevant assessment value was the assessment value of land only, of course.

Units of comparison were total price of the property and unit price of the property, depending on type of property. The market data covered 28 years. Table 2 shows the calculation system of the ratio of assessment value to market value.

The results were published in 2014. They reveal that in all jurisdictions the assessments values were quite low compared to market prices. Housing properties had the lowest relative assessments values. The median of relative assessment values (ratio of assessment value to market value) were 20-40 % for multifamily housing, 20-50 % for single family houses, 20-60 % for housing lots and 30-70 % for non-housing properties. The lowest ratios very usually in expensive locations.

The median effective tax rates were 0,08 - 0,2 % for multifamily housing, 0,1 - 0,3 % for single family houses, 0,1 - 0,4 % for housing lots and 0,1 - 0,5 for non-housing lots. Again, the lowest levels very usually in expensive locations. Table 3 shows ratio and equity statistics in the Finnish property taxation.
The variation between jurisdictions, as well as within a jurisdiction, is large. The analysis revealed large problems in equal treatment of tax payers. Inequity is a problem in its own right. However, it is an even larger problems if it is an obstacle for a property tax to be a more important source of local finance.

PART II: INTRODUCING A NEW SET OF METHODS FOR VALUATION KEY SKILLS NEEDED AND METHODS USED

Skills in valuation, statistics, econometrics, geomatics, and computing are needed and have been used to develop state-of-the-art mass valuation models. The databases on which they depend where taken mostly from public databases, and in some cases non-public databases kept by taxation authorities.

The key methods are intensive use of market information, simple hedonic models and spatial analysis. The main innovation is a mix of standard hedonic regression and spatial analysis, mainly indentyfying nearest property sales and calculating spatial moving average.

DATA AVAILABILITY

Data has been gathered from these sources:

1) property tax records of 2011 and 2014 taxation (source: Taxation authorities).
2) condominium sales 1987 - 2014 (october), which are collected for tranfer and sales profit taxation purposes (source: Taxation authorities).
3) land and other real property sales 1986 - 2015 (Official real property sales price register, kept by National Land Survey)
4) cadastre
5) zip code area subdivision
6) grid data 250x250 m2 (major cities only)

Land price data includes 254.000 million of urban land sales made in 1985-2015. Apartment price data includes 942.000 apartment sales made in 1987-2014.

Lot ratios are from taxation authorities. No other planning data was used. However, zoning maps and other data is available in electric format in most cities nowadays (180 cities and towns).

THE ADEQUACY OF MARKET INFORMATION

The adequacy or market information is examined in figure 1, which shows the number of housing lot sales in every zip code area, and the number of condominium sales in the same area. The number of sales comprises all sales made during the last 28 years, so most of the sales are of inferior value for valuation purposes. Most zip areas have more than 100 lot sales, so there must be more than enough recent sales also to determine not only the median land value in the area, but also some variation in land values within the area.

Some areas only have less than 10 lot sales made during a long period of 28 years, and in some cases the number of lot sales is only one or two. In the upper left corner of figure 1 is shown some one hundred zip areas with only a few land sales but more than a hundred-fold number of condominium sales. As it happens, these areas are those with most expensive land in the country. The more expensive land, the fewer vacant lots, and the fewer sales of them. On top of that there is often something unique about those sales, so the sales prices of most expensive locations are not always representative or at least need a closer inspection.

Some of these expensive areas are in CBD of course. However most of it is residential and there is vast amount of condominium sales, where a share of residential property aka “housing association” (comprising land and structures) is sold, so there is an implicit land price, or the price of location, included in these condominium prices. The connection between land prices and condominium prices cannot be analyzed in a property level, because there seldom is a land sale where condominiums later sell, and even if there is that land sale may be very old. However, the connection between land prices and condominium prices can be analyzed in a city level, and more importantly in a zip code level and a grid level.

OVERVIEW OF THE PRICE LANDSCAPE

To approach the price landscape, three levels of accuracy are used: The crudest level is a zip area comprising up to 10.000 properties. The intermediate levels are grids of 100 ha or 6.25 ha, comprising usually 20-100 properties. The most accurate level is the property subdivision itself. Mean property values are calculated for each level. As to the property level, standardized housing prices are used as a proxy to land prices.

The overview of the price landscape helps determine the most cost-effective way of valuation, and may in some cases be the valuation itself. Figure 3 gives a macro view of price landscape using zip area subdivision. Figure 4 gives a more detailed view of price landscape using grids in Helsinki MPA. Figure 5 gives a micro view of price landscape using property subdivision and constant quality apartment prices.

There are 2 million property units subject to property taxation in Finland. There are 5 million 250x250 m2 grids in Finnish land area, but an urban grid usually consists more than 10 properties. There are 3016 zip codes and 300 communities. All those subdivisions are relevant in property taxation: as the object of valuation, as a receiver of the tax revenue and as a setter of the tax rate, or as a methodological unit.

From a mass valuation point of view grids and zip code areas are very useful units of subdivision: there is enough data, preliminary property values can be calculated with small effort, and land values can be systematically compared to housing values.

MODELLING LAND PRICES

The impact of location on land prices is the purpose of the analysis, so all the other variables apart from spatial are control variables, and spatial variables are excluded from the model to be analyzed later by GIS tools. As the location is the single most important argument factor, only a small number of control variables are needed. Time is controlled firstly by deflating all prices by house price index, and secondly by a trend correction term. Zoning of land and size of lot are also controlled. An example of model specification is given in table 4.

A grid (250x250 m2) map of average values are made to help determine which method to use, and to give a second look at the price landscape. Only urban land is subject to property taxation in Finland, and the number of urban grids is ca 200.000 in urban areas.

THE TOOLBOX FOR PRACTICAL USE: A SET OF 3 VALUATION METHODS TO CHOOSE FROM

In search of a scalable, cost-effective way to calculate more than 2 million land values, a multiple method approach is proposed. There are three methods that are very different from each other in terms of accuracy, effort, costs and ease of use. The methods are, from less accurate to most accurate:

A. Zip code area median price. This method is less accurate, very easy to use, very cheap.
B. Nearest lot sales. This is the main method, quite accurate, quite costly.
C. Nearest condo sales. This is most difficult to use, quite accurate even when land price data is scarce.

The methods are recommended in these property type / price level mixes:

	expensive location	average location	inexpensive location
high rise housing lots	nearest condo sales	nearest lot sales	nearest lot sales
single family housing lots	nearest lot sales	nearest lot sales	zip code area median price
recreational housing lots	nearest lot sales	nearest lot sales	zip code area median price
office and commercial lot	nearest lot sales	zip code area median price	zip code area median price
industrial lots	zip code area median price	zip code area median price	zip code area median price
tax base share (%)	40	40	20
land area share (%)	3	27	70

I will next comment all those three methods in the next three sections, one by one.

A. ZONE PRICE BASED ON ZIP CODE AVERAGE

Zone price based on zip code average values are calculated as a trivial routine. This method is recommended to 70 % of land area representing 20 % of tax base. This is a "quick and dirty" way to produce something very fast. It's useful to have a method like this in the toolbox, in areas where land prices do not play a significant role and main part or property tax revenue is generated by structures. This is also a useful first step to get an overview of price landscape in more expensive locations. It can help to specify some hypothesis for further analysis.

A. ZONE PRICE BASED ON A SPATIAL MOVING AVERAGE OF NEAREST COMPARABLE LAND SALE

This is the most important and most effective method to value medium or high price land. This method is recommended to 20 % of land area representing 60 % tax base.

Identifying an area of homogenic land values involves five steps:

1. Based on high price level, high variation on prices, or a vision of price landscape produced by grid data, a method of nearest land sales is chosen

2. Constant quality, deflated unit land prices are calculated by hedonic regression. Only spatial factors are left out of regression.
3. Nearest land sales are automatically identified and a suitable number, between three and nine of them, is chosen
4. Spatial moving average of land prices is calculated automatically
5. Price zones are finished by manual interpretation

Figures 9 and 10 illustrate the method of nearest land sales. Figure 9 shows the property tax base in a medium sized city. Figure 10 shows, how based on three nearest neighbors a spatial moving average of land values is generated automatically. In a sense, this is also the first version of property tax zones. This first version can be generated automatically and effortlessly, when transaction data has been collected, corrected and filtered. However the machine time needed can be considerable.

Challenges for further development are twofold: 1) to produce more efficient, less time consuming calculation routines, and 2) to produce automatically more logical, intuitively more appealing zoning by incorporating more GIS data on roads, water bodies etc.

A. ZONE PRICE BASED ON A SPATIAL MOVING AVERAGE OF NEAREST COMPARABLE APARTMENT SALE

This is the most important and most effective method in most expensive locations where land sales are scarce or do not exist at all. This method is recommended to less than 1 % of land area representing 10 -20 % of tax base.
The method involves four steps:

1. Calculating constant quality condominium price
2. Identifying an area of homogenic condo values in methods described in the previous section, including manual work
3. Calculating the land price as a function of condo price
4. Calculating the median price of land in a price zone based on land prices, condo prices, or both.

Constant quality condominium price: The standard apartment is in a 40 year old building and has at least 60 m2 floor area. The lot must be freehold, not leasehold. The spatial factors are excluded from the regression model. However, as the age of the building correlates with the price of land, the explainable variable must be the price compared to the zip area average price. The model produces an estimate of annual depreciation of ca. 1 % during the first 40 years in the life of the building. If the correlation is not taken into account, multicolleniarity would occur, and the model would produce a biased estimate of a very low annual depreciation.

Land values are derived from standardized apartment values by a simple regression, where the average price of housing, in a grid, is the only regressor, and the average land price in a grid is explained. This simple routine is repeated in every city. However, for the country as a whole this simple procedure is far too crude, as price of land not only depends on the price of housing, but on the supply constraints of land for housing, which varies across the country.

Figure 8 and tables 5 illustrate the relationship of high rise residential land price and condominium price.

Table 6 gives a model of high rise residential lot sales price (€/floor-m2) as a function of constant quality condominium sale price. Table 7 gives a model of high rise residential lot sales price with a different explainable variable (€/land-m2) as a function of constant quality condominium sale price. In the first model parameters are around unity (one), in the second model parameters are around two. When lot ratios are modelled as a function of constant quality condominium sale price, the parameters are again around one. The conclusion is simple: the most expensive land is so expensive because unit prices for floor-m2 are high, and because the land is built more efficiently.

Zone price based on a spatial moving average of nearest comparable apartment sales follows the procedure presented with land sales. A land share of an apartment prices ratio is useful and it is calculated.

The land price can also be calculated using sales prices of single family homes. As there is usually data on vacant lot sales in areas zoned for single family housing, using single family homes sales data is not essential. However using that data gives a valuable extra view in the price landscape, and coupled with lot sales data, produces a rich view on prices.

PART III: CONCLUSIONS

According to literature the best practice shows that all four steps in property tax administration (identification of properties, valuation, recordkeeping, and collection) should be part of any administrative reform program. To leave out even one of the basic pillars of administration may jeopardize the success of a property tax reform, whether in terms of revenue mobilization or any other objectives the reform was designed to achieve (Property Tax Regimes in Europe. p. 61). In Finland the property tax base is rather well identified with the help of local governments, the recipients of the tax. The fiscal cadaster is in a rather good shape, although it requires far too much manual work in the update process. Collection performance is among the best in the world. Valuation and recordkeeping are clearly the weakest pillars.

The aim is to derive the land part of the property value for all the property tax base. In most cases comparable prices of land sales are enough. In most valuable locations land sales are scarce, but home sales are abundant. It's possible to derive the land share of house prices.

The relevant techniques are:

1. Extensive use of standard regression analysis
2. Calculating constant quality home prices
3. Indentifying nearest comparable sales and calculating spatial moving average

Based on the availability of data and how valuable the location is, a toolbox of three valuation methods is introduced:

1. for most invaluable land zip-code medians are recommended,

2. for more expensive land a spatial moving average of nearest comparable land sales is recommended, and
3. for most expensive land a spatial moving average of nearest comparable apartment sales is recommended as a second method.

The project has just started and it is too early to draw conclusions. In three years the new property taxation tool is in use and experience will tell how accurate and cost-effective it will be.

The finnish approach with spatial analysis, standard statitical models and intensive use of all possible price data offers a potential to produce rather accurate land price estimates at low cost, even in the absense of actual land price data in some locations.

As to future revaluation cycles "Property Tax Regimes in Europe" offers this insight:

> Changing from intermittent revaluation projects to an annual reassessment program can offer major benefits. The most important is that property tax burdens are more equitably distributed. Changes in the composition of the tax base are more gradual, which reduces popular and political opposition to revaluations. Property owners can more easily predict what their property taxes will be, and taxing districts can better judge their property tax capacity. Lastly, the annual costs of an ongoing revaluation program often compare favorably with the annualized costs of periodic revaluations. To argue for frequent revaluations is not to argue that all recurrent taxes on immovable property should be value-based. As previously noted, there are situations in which area based property taxes are appropriate, and a well-administered area-base tax likely is more acceptable than a badly neglected value-based property tax. (Property Tax Regimes in Europe. p. 62)

After the revaluation is ready in 2019, the next revaluation should be in 3-6 years. The goal in Finland should be an annual reassessment program. It should not be too unrealistic.

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CONTACTS

Risto Peltola
Senior advisor
National Land Survey
POBox 84, 00521 Helsinki
tel: ++358 40 801 7674

Table 1. The amount and structure of property tax on land, 2014

	number	assessment value (mill.€)	property tax on land (mill.€)
all properties	2175817	57475	473
	shares (%) 2013		
type of property	number	assessment value (mill.€)	property tax on land (mill.€)
residential	69 %	62 %	64 %
office/retail	1 %	14 %	13 %
logistics	1 %	1 %	1 %
recreation	26 %	11 %	13 %
industrial	2 %	4 %	4 %
public	1 %	6 %	4 %

Table 2. System of comparing assessment value and market value

	assesment value	unit	market value	remarks
land				
housing lot	of land	€/land-m2	real estate sale	most recent sale after 1985
vacation housing lot				
commercial/industrial lot				
built property				
multifamily building	of land and building together	€/floor area-m2	comdomi-nium sale	all sales in 1987-2011
single family building		€	real estate sale	most recent sale after 1985
vacation building				
commercial/industrial building				

Table 3. Ratio and equity statistics in Finnish property taxation, 2011

	the ratio of assessment value to market value (%)			effective property tax rate (0,01 %)
	Median	standard deviation (log)		
		all country	within a jurisdiction	Median
housing, several apartments	25	0,49	0,32	12
single family house	32	0,70	0,67	15
lot for housing	34	0,94	1,00	25
second home, recreation	29	0,72	0,69	27
lot for second home, recreation	32	0,97	0,97	22
commercial-industrial, built	42	1,14	1,07	34
commercial-industrial lot	47	1,17	1,12	32

Table 4. Housing lot price model specification

LBRPRICE = $\alpha + \beta_t$ * TIME + β_a * LLOTAREA + β_r * ADJACENTTOSEE + ε, where
LBRPRICE = ln (price of building right €/floor-m2)
TIME = time of sale = year - 2000 + month /12
LLOTAREA = ln (LOTAREA)
LOTAREA = lot area m2, max 1000 m2 in cities and towns , max 3000 m2 elsewhere
ADJACENTTOSEE = 1, when the sale is adjacent to see, otherwise = 0
A = constant
β_t, β_a , β_r = parameter values
ε = error term
ln =natural log

Table 5. Price statistics of high rise residential lot sales and condominium sales. Seven largest cities.

	number			price statistics (median)		
city	**grids**	**condo sales**	**lot sales**	**condo sales price €/m2**	**land price €/floor-m2**	**land price €/m2**
Espoo	159	21488	329	3321	609	494
Helsinki	128	25129	223	3960	888	1069
Vantaa	95	13078	171	2880	395	272
Jyväskylä	79	7881	201	2311	207	180
Oulu	35	3111	61	2311	304	338
Tampere	92	14357	148	2426	452	502
Turku	90	13311	167	2301	308	326

Table 6. Model of high rise residential lot sales price (€/land-m2) as a function of constant quality condominium sale price. Seven largest cities. Natural logarithms on both sides of equation.

model of land price €/land-m2		
city	impact of condo prices	constant
Espoo	1,40	-5,39
Helsinki	2,02	-10,10
Vantaa	1,14	-3,68
Jyväskylä	2,23	-12,57
Oulu	2,77	-16,07
Tampere	2,35	-12,65
Turku	1,79	-8,43

Table 7. Model of high rise residential lot sales price (€/floor-m2) as a function of constant quality condominium sale price. Seven largest cities. Natural logarithms on both sides of equation.

model of land price €/floor-m2		
city	impact of condo prices	constant
Espoo	0,61	1,39
Helsinki	1,02	-1,73
Vantaa	0,98	-1,94
Jyväskylä	0,83	-1,29
Oulu	0,96	-1,83
Tampere	1,10	-2,66
Turku	1,11	-3,03

Figure 1. Number of lot sales and condominium sales in 30 years by zip code area

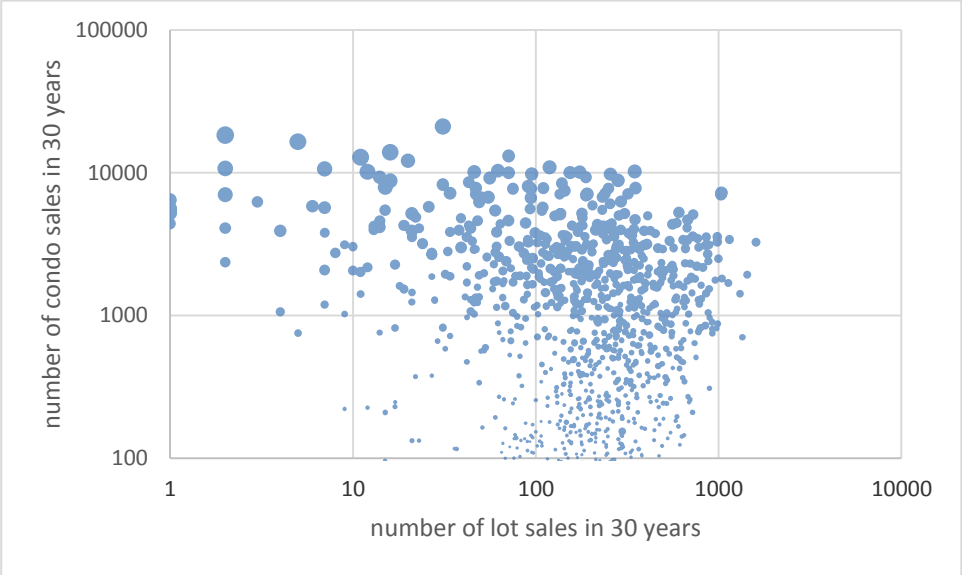


Figure 2. Price of housing lot and condominium in 2014 by zip code area

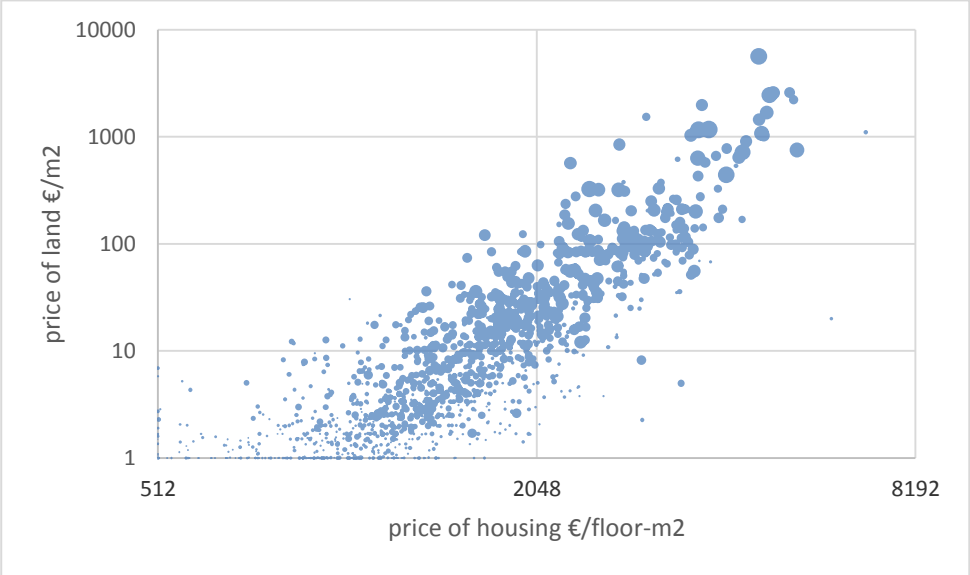


Figure 3. Price of single family home by zip code area, Southern Finland

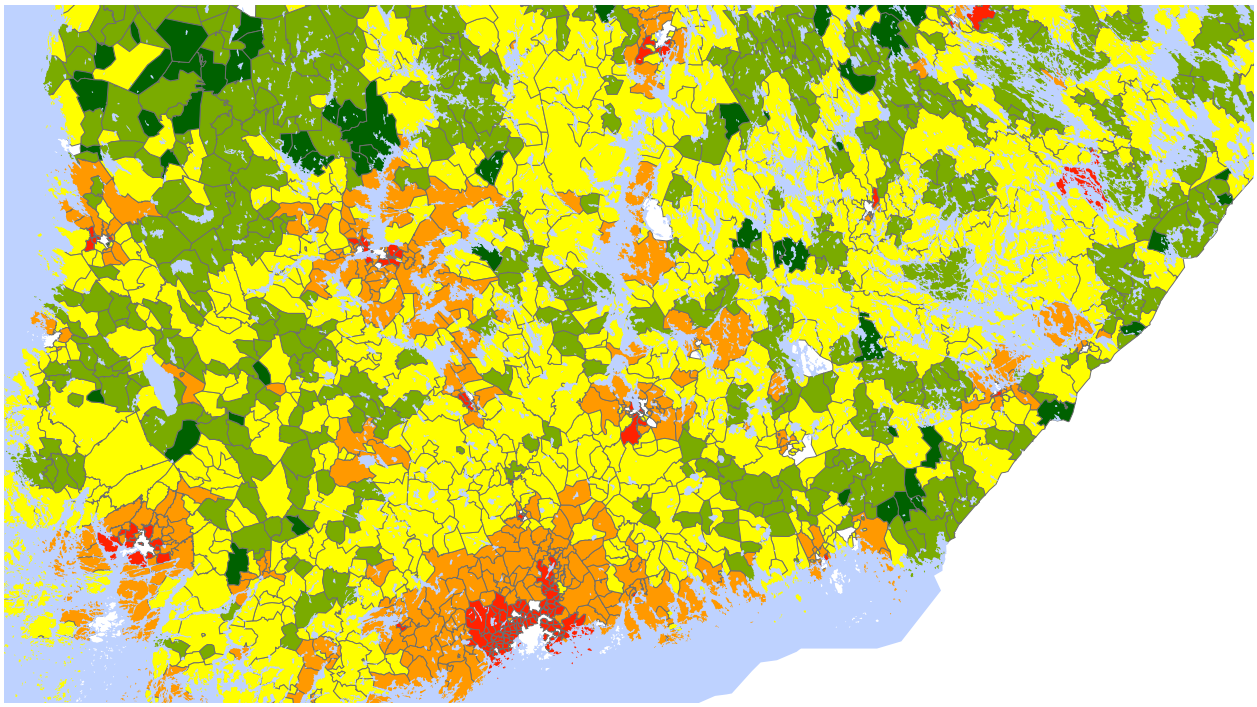


Figure 4. Constant quality price of condominium by grid, Helsinki MPA

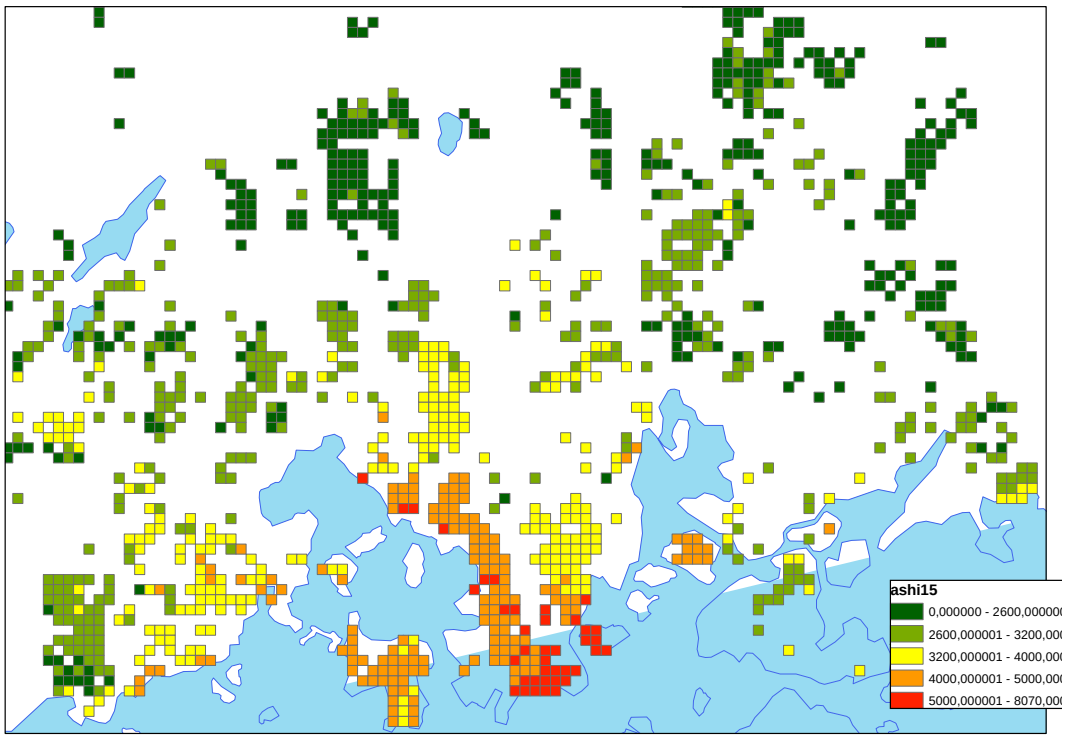


Figure 5. Constant quality price of condominium by property, Southern inner Helsinki

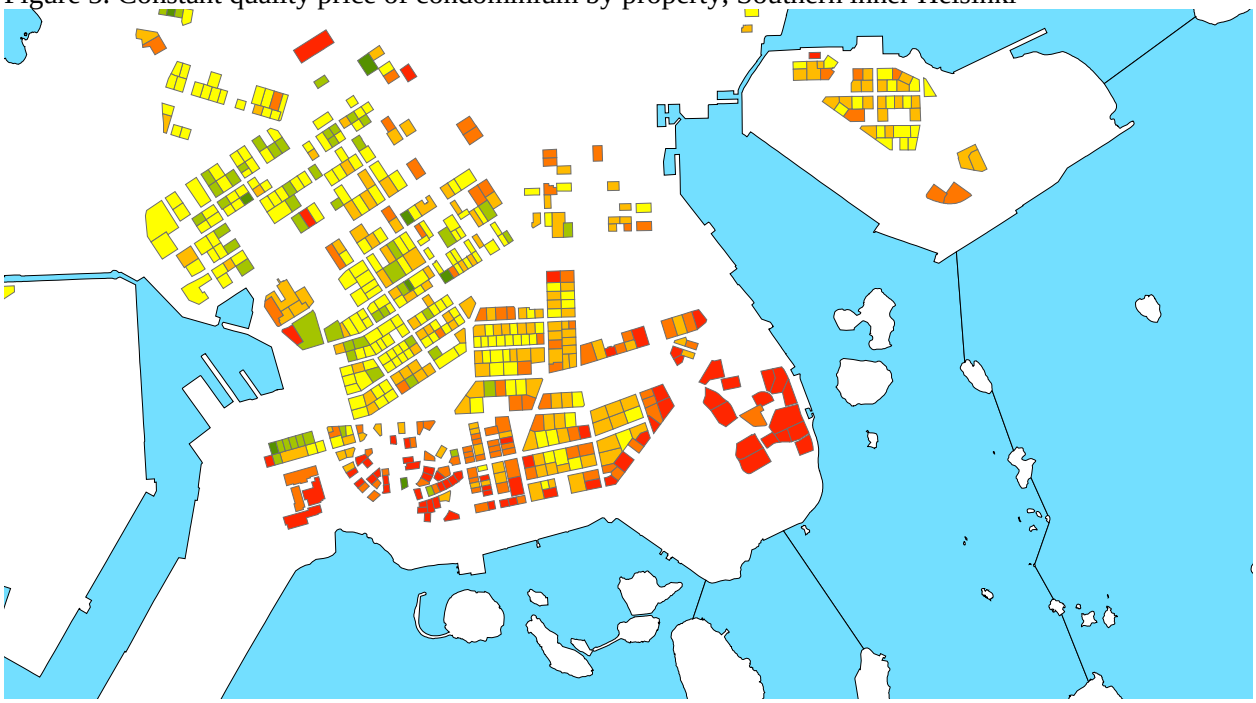


Figure 6. Multi-family housing lot price by grid, constant quality, Helsinki MPA

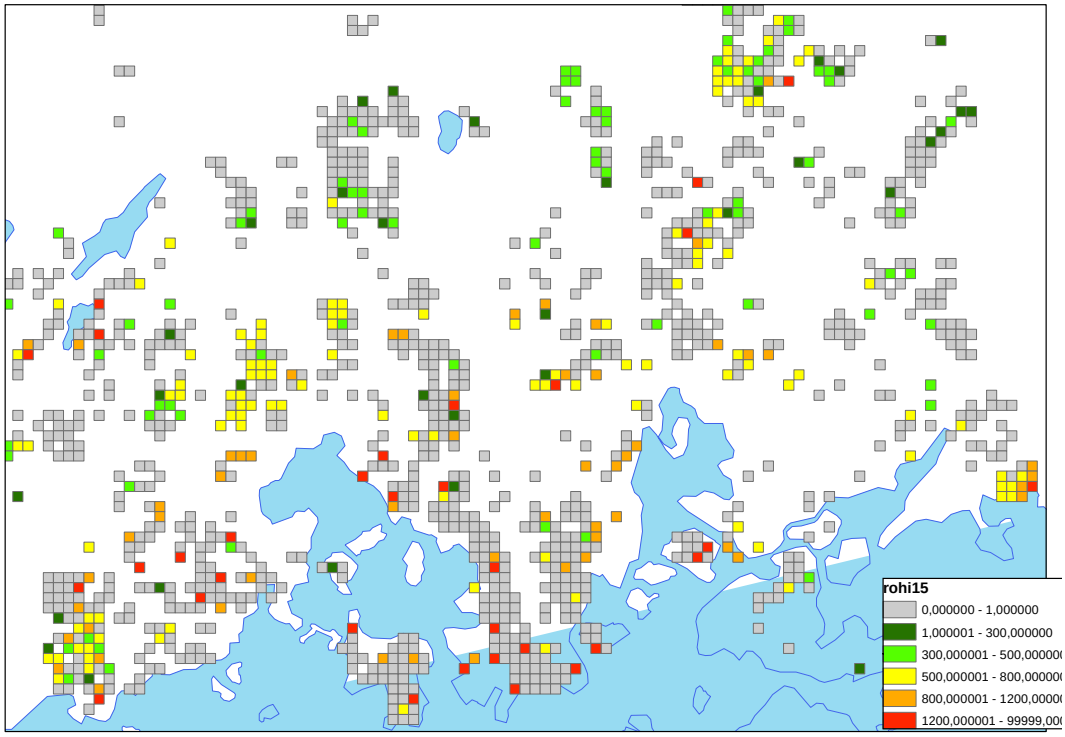
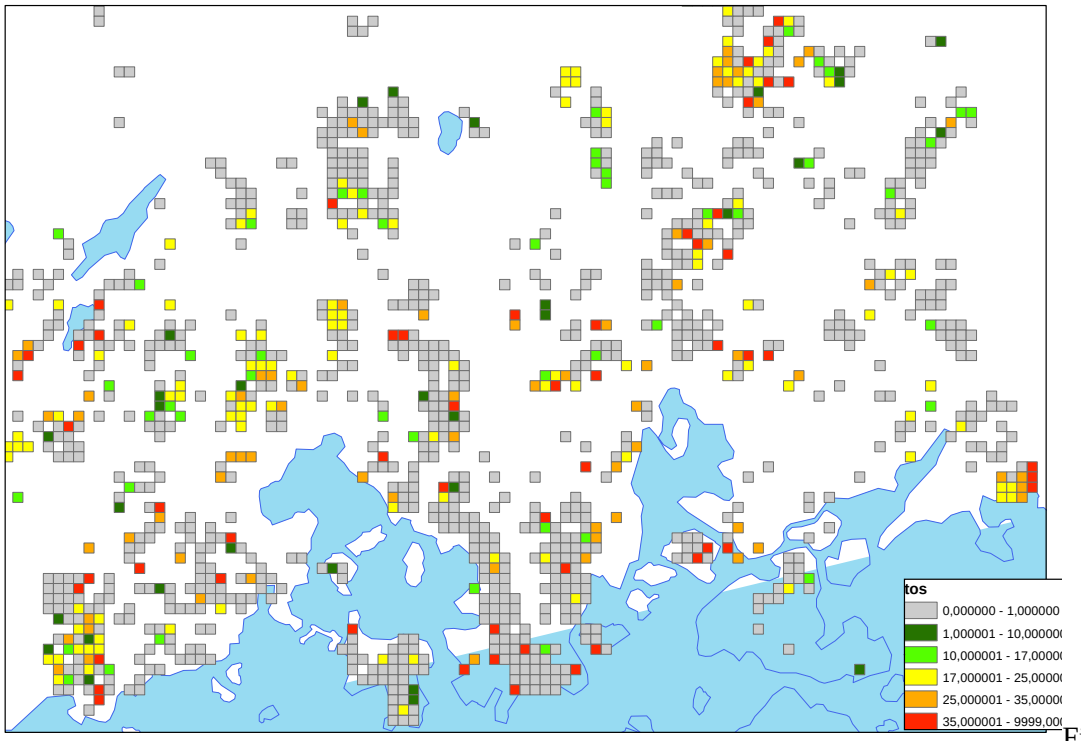


Figure 7. Land share of housing price by grid, Helsinki MPA



Figure

Figure 8. Housing land price (€/m2) as function of house price. 77 commuting areas in the country.

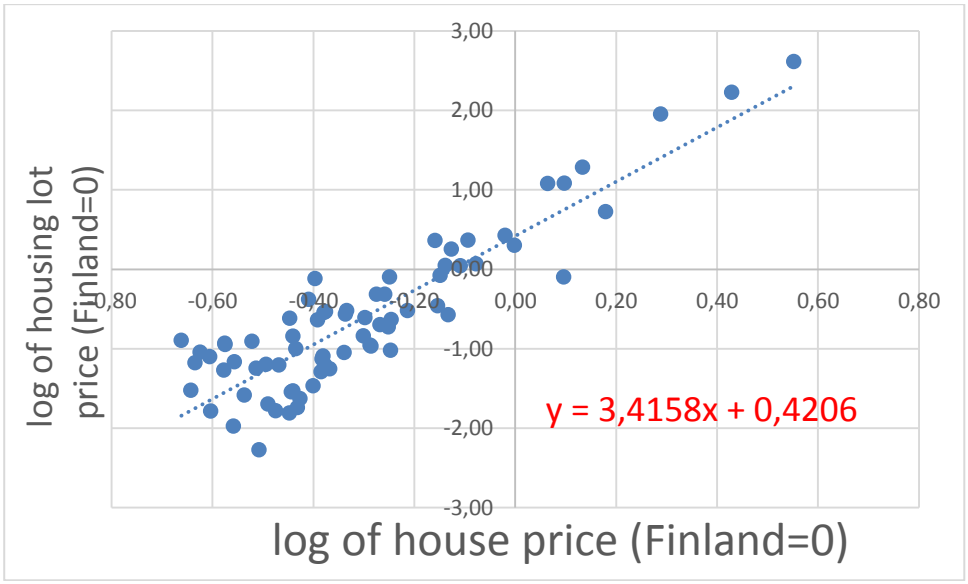


Figure 9. Property tax base in a medium sized city (Kouvola). Brown indicates lots owned by other than the city itself. Green indicates lots owned by the city itself that do not have to pay property tax on land. Lilac indicates housing lot sales.

Figure 10. Based on three nearest neighbors a spatial moving average of land values is generated automatically.