No taxation without capitalization*

Quantile treatment effects of land tax reform on house prices

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Abstract

In this paper, I investigate the role of land value taxation on Danish house prices using quasi-experimental evidence from the 2007 reform of the Danish municipalities. To this end, I webscrape the Danish aggregate house price portal `Boliga` for prices and individual characteristics of all Danish houses sold on the free market from 2000-2008. As I believe the effects of changes to land property taxation to be heterogenous, I resort to quantile regression. I find a striking pattern: Land property taxes are capitalized into house prices, but the effect is stronger at the top of the market segment than it is the at the bottom.

*[*] **Statement**: I hereby state that the data used in this paper is used for academic purposes only. As the data contains personal identifiable information, I cannot make it publicly available. All codes used in this paper are available here. The webscraper used in this paper takes inspiration from Lassen and Høst (2022).

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Contents

1 Introduction

Land value taxation is said to be the "perfect tax" as it generates revenue without distorting economic decisions, such as conventional income taxes (Dye and England (2010)). For this reason, it is strongly advocated by prominent economists, including Piketty (2014) and Stiglitz (2015). Despite this, Denmark is one of only a handful of countries to use land value taxation. This makes empirical evidence of the role of land value taxation, in particular to house prices and housing wealth, hard to come by. To this end, I exploit quasi-experimental evidence of changes to land value taxation from the Danish 'Strukturreform' in 2007.[1] Of several key elements of the reform, land value taxes were substantially changed. Of 271 municipalities, 132 raised land value taxes while 110 lowered property land taxes (KL (2007)). With this variation in mind, I seek to answer the following research question: *Do these changes to land taxes capitalize into house prices and if so, is this capitalization heterogeneous across house prices?*

To investigate this proposition, I scrape the Danish aggregate housing price portal `Boliga` to fetch information on all single-family homes sold on the free market between 2000 and 2008. I combine this with rich data on housing characteristics for each dwelling and with geospatial data to identify how much each individual house experienced changes to (effective) property land taxes.

My results show a striking pattern: Quantile treatment effects of changes to property land taxes are stronger at the top than it is at the bottom. That is, the capitalization effect of changes to (effective) property land taxes are stronger, the more expensive the houses is.

This paper is structured as follows: Section 2 outlines the institutional setting surrounding the reform. Section 3 describes the data collection process along with descriptive statistics. I define my empirical strategy Section 4 and present my results in Section 5. In Section 6, I summarize and conclude.

1.1 Literature

My study adds to the relatively limited literature on land value taxation. First and foremost, I add to the evidence of capitalization of changes to land value taxation in a Danish context found in Høj et al. (2018), who investigate the same 2007 reform in Den-

[1] The Danish term for land value taxation is 'grundskyldspromille'.

mark like I do. Methodologically, my study differs from Høj et al. (2018) as I use quantile regression instead of standard OLS to investigate the (potentially) heterogeneous effects across house prices.

Elinder and Persson (2017) find evidence of limited capitalization of a (national) property tax reform in Sweden, but, similar to me, that the effect is stronger at the very top of the market segment.

Borge and Rattsø (2014) examine the relationship between property land taxes and housing prices in Norway between 1997-1999. They also find capitalization effects on house prices. As local governments can decide whether or not to impose property taxes in Norway, the authors resort to an instrumental variable approach to isolate the effect of difference in property taxation. This is not a concern for me given that changes to property taxation were exogenously imposed on Danish house owners.

In a setting akin to the Danish 2007 'Strukturreform', Oliviero and Scognamiglio (2019) investigate a 2012 reform to the Italian municipal tax system and its influence on house valuations. These valuations are based on both transaction data and surveys of local housing market conditions conducted among Italian real state agents. They find some effects of capitalization effects. Keep in mind, my data is fully based on transactions, so my results may not be directly translatable.

2 Institutional setting

Since 2007, land taxes have been imposed by municipalities and is levied on the land value of the plot on which a property is built (Høj et al. (2018)). Prior to this, both counties and municipalities levied taxes on house owners. A flat tax rate of 10 per mille (1 percent) of house land values were collected by the counties in addition to differing levels of land taxes collected by the municipalities. The 2007 reform removed counties altogether, merged 270 municipalities into 98 and put the sole legal responsibility of property land taxes to these 'new' jurisdictional entities, which could now set land taxes between 16 and 34 per mille of land valuations (Jepsen and Dietrich (2022)).

Except for a few old municipalities, the reform essentially lowered the amount of municipalities by merging them one-by-one into larger entities. However, a few old municipalities were first split up and then merged into new jurisdictional areas. I ignore these as they provide considerable complexity in assigning the correct changes to land taxes.

Naturally, the reform of 2007 did not come as a complete (exogenous) shock. For years, there had been ongoing debate to merge municipalities. One example of the motivation behind the reform was the difficulty of managing complex administrative tasks, such as highly-specialised youth care, for the smallest municipalities, see Klitgaard (2017). The Venstre/Konservative government set up a formal commission to investigate the needs for an administrative reform as early as 2002 (Internal Affairs (2004)). By the summer of 2004, it was public knowledge that land taxes were subject to change and in the fall of 2006, the level of the new property land taxes were established. It is therefore likely that people shaped their expectations in response to this information.

Also relevant in the context of the 2007 reform, Denmark introduced a nominal "stop" to property value taxation in 2002. This meant that taxes paid on the valuation of the property itself has been nominally unchanged since 2002. A number of high-ranking scholars, including those affiliated with the Danish Economic Council, have suggested that this has amplified the regional disparities in the Danish housing market (Svarer et al. (2016)).

To avoid confusion of referring to different 'sets' of municipalities (before and after 2007), I simply refer to the geographical entities as 'areas' henceforth.

3 Data

Having set the scene in the previous section, I turn to describe my data in this section. First, I provide a few descriptive statistics and briefly go over how I have acquired the data. I focus only on single-family homes, as the rules for apartments are more complex. Second, I transform the changes to land value tax rates into *effective* land tax rates, that varies across individual houses.

3.1 Data collection

A summary of my data sources can be found in Table 1. My main data source is `Boliga`, which is a Danish aggregate house price portal. I specifically make use of their API by webscraping all single-family homes sold on the free market between 2000 and 2008. In total, I get 374,895 properties by doing this. This process is fairly straightforward given that I can make requests to the API fetching around 2,000 homes with unique IDs wrapped in a JSON file with each call. This gives me information on house size, address, price, size, number of rooms and, crucially, GPS coordinates of this specific address. I will come back to why this is important.

I supplement this data with information from the Danish Building and Dwelling Register ("BBR") of each home. This is also done via `Boliga`. The BBR has extremely detailed info on practically every housing characteristics, you can think of, and as a result has been heralded as one of the leading property valuation systems in the world (Almy (2014); Milan et al. (2016)). The property valuation takes into account three main characteristics: i) The building itself, such as number of rooms, bathrooms, garage etc, ii) The plot of land of which the building reside on and iii) Amenities and proximity to infrastructure (Vurderingsstyrelsen (2023)). In conclusion, this data is arguably the best proxy for any differences in quality between individual houses. Please note here that this register relies on self-reported housing characteristics that affect the property assessments and so may contain errors, which I cannot account for.

In addition, I have acquired data on regional house price index from Statistics Denmark, table EJ55 and shapefiles of the 'old' Danish municipalities and regions from Dataforsyningen. Using the GPS coordinates from `Boliga`, I can link each house to the 'old' municipalities with GeoPandas (Jordahl et al. (2020)), as this information is not readily available elsewhere. Finally, data of changes to the area/municipal land property land taxes are taken from KL (2007).

Because it is difficult to infer a causal interpretation of changes to the land tax rate itself, which only varies between municipalities, I take inspiration from Høj et al. (2018) and focus on *effective* land tax rates that varies across individual houses. Consider the following equation:

$$\Delta ELTR_{h,a} = \Delta LTR_a \frac{L_{h,a}}{V_{h,a}} \tag{1}$$

For any property h in area a, equation (1) states that the difference of the effective land tax rate following the 2007 reform is the fraction of the total property value paid in land tax in area a. If land taxes are capitalized into house prices, it must be that house prices are inversely related to changes to land taxes.

Table 1: Summary of data sources

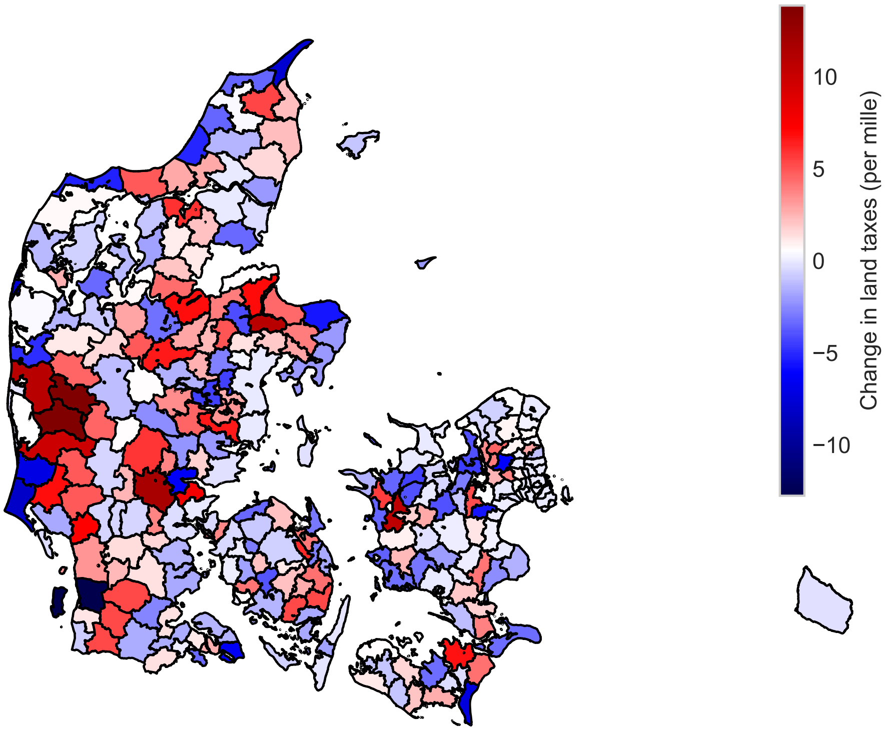
Data source	Description
Boliga	Used for data on individual house characteristics, including size, address, price, GPS coordinates and (historic) property evaluations from the Danish Buiding Register ("BBR").
Statistics Denmark	Table EJ55 for regional house price index to deflate house prices (index year 2006).
Dataforsyningen	Shapefiles of 'old' municipal borders prior to the 2007 reform. This is used to assign each house to the correct area.
Kommunernes Landsforening	Data on changes to area/municipal property land taxes following the 2007 reform.

3.2 Descriptive statistics

To provide a visual representation of my data, I make a few descriptive plots. A visual inspection of Figure 1 illustrates the national variation in changes to land taxes following the reform in 2007. It is these changes I treat as exogenous to identify its effect on house prices. Of 266 areas, 132 raised land taxes, another 110 lowered land taxes, while 24 left land taxes unchanged. I specifically turn my attention to the areas that experienced changes to land taxes, as I believe these will provide ample variation when identifying effects.

Table 2 shows the two areas with the biggest changes to land taxes in percentage points per mille, with Ørbæk on the Island of Funen and Augustenborg in South Jutland raising taxes by 13.86 and lowering taxes by 12.76 percentage points per mille, respectively. Table 3 illustrate the considerable national variation in changes to effective land taxes in 2007. The greatest variation of effective land taxes is found in the areas who saw an increase with an average change of 0.67 per mille points and a standard deviation of 0.73. Further, average change to effective property land taxes is slightly positive positive at around 0.07 per mille points, the standard deviation of 0.84 highlights how much this varies across houses.

Figure 1: Changes to land tax following 2007 reform



Source: KL (2007) with geospatial data from Dataforsyningen (2023). Please note that a few areas have been intentionally left out from the map due to complexity in assigning the correct change to land taxes, see section 2 for more details.

Table 2: Highest/lowest change to land taxes per mille points

	Municipality/area	Land tax change
Highest	Ørbæk	13.86
Lowest	Augustenborg	-12.76

Source: KL (2007)

Table 3: Average change to effective land taxes by area category

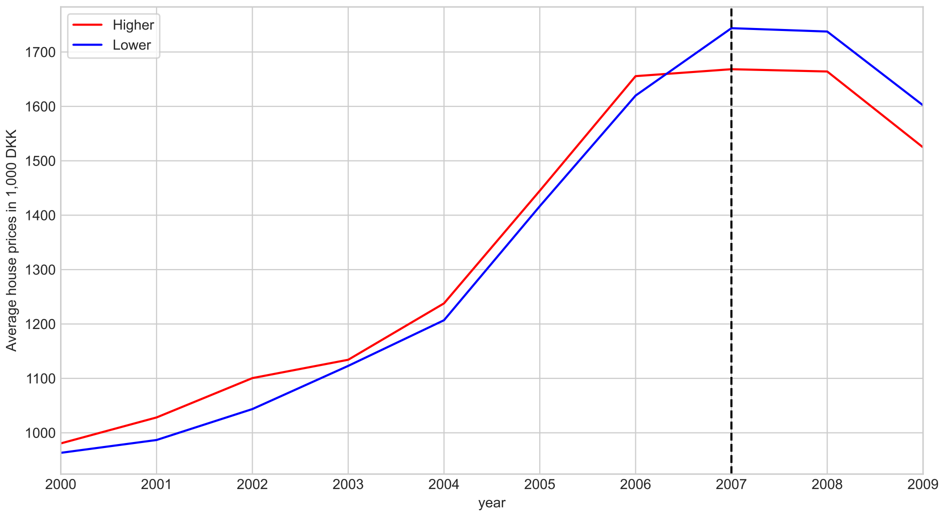
Category	Per mille points	Standard deviation
Raised land taxes	0.67	0.73
Lowered land taxes	-0.45	0.52
Average change	0.07	0.84

Source: KL (2007). This refers to houses sold after the reform was implemented.

Figure 2 in conjunction with Table 4 establishes the motivation for examining this particular reform. Graphically, it looks like as if changes to land taxes does in fact capitalize into house prices. In 2003, well before the reform was implemented, prices were on average 11,000 DKK higher in areas that experienced increasing land value taxes compared to those areas that later lowered taxes. When the reform was implemented in 2007, this price difference reversed. In 2007, houses sold in areas that raised land value taxation were on average 75,000 DKK cheaper compared to those sold in area where taxes were decreased, an estimated difference-in-difference of 86,000 DKK. Additionally, this effect is stronger in increasing quantiles of house prices. [2]

This, at least on the surface, indicate a capitalization effect. Obviously, there are a multitude of problems by drawing this conclusion. Are you simply buying larger/smaller houses between the two areas? Are there systematic differences to the 'quality' of houses bought after the reform? In the following section, I outline my empirical strategy to account for these potential issues.

Figure 2: Average single-family house prices, pre/post of the 2007 'Strukturreform'



Source: Own calculation with data from Boliga (2023). The lines are split between areas that raised (red) and lowered (blue) land taxes following the 2007 reform

[2]See Table 6 and 7 in Appendix A.1 for examples.

Table 4: Average single-family prices pre/post of the 2007 'Strukturreform'

	2003	2007	Difference
Higher	1134.22	1668.35	534.13
Lower	1122.99	1743.78	620.80
Difference	11.23	-75.43	-86.67

Source: Boliga (2023). Prices are nominal and denoted in 1,000 DKK.

4 Empirical framework

Up until now, I have showed indications of capitalization effects of changes to land tax rates in the context of the 2007 reform. In this section, I outline my empirical strategy to causally determine whether these changes did in fact capitalize into house prices and whether this effect is heterogenous across the distribution of house prices.

First, I define a quantile difference-in-difference model with area- and year-fixed effects. For computational simplicity, I assume these fixed effect to affect quantiles *equally*.

Second, I then expand the model to include within-quantile fixed effects. In addition, I also relax the assumption of parallel pre-trends.

4.1 Estimation strategy

More often than not, economists are interested in a conditional mean of some outcome y conditional on a number of covariates $\mathbf{x}$, that is $E[y|\mathbf{x}]$. In this context, I seek to answer whether changes to land property taxation following the 2007 'Strukturreform' captialized into house prices. This could be estimated using standard OLS methods using year and area fixed effects for example (Høj et al. (2018)). Assuming the estimates can be causally interpreted, they would only tell me of an average treatment effect and not whether the capitalization effect is heterogenous across the distribution of house prices.

To investigate this, consider the following quantile difference-in-difference regression inspired by Høj et al. (2018) as the starting point of my estimation strategy:

$$\ln P_{h,a,t}(\boldsymbol{\tau}) = \beta_0(\boldsymbol{\tau}) + \alpha_a + \gamma_t + \sum_{t=2005}^{2008} \phi_t(\boldsymbol{\tau})\Delta ELTR_{h,a} + \beta_1(\boldsymbol{\tau}) \ln V_{01h,a} + \epsilon_{h,a,t}(\boldsymbol{\tau}) \quad (2)$$

This specification, which I denote *across-(quantiles)-fixed effects*, is chosen in part for its computational simplicity. My outcome of interest is the logarithm of house prices P for house h in area a at time t, deflated by Statistics Denmark's regional house price index. I estimate my model for quantiles $\boldsymbol{\tau} = \{0.1, 0.2, ..., 0.9\}$. My main coefficient(s) of interest is $\phi_{2007}(\boldsymbol{\tau})$.

Fixed effects. I include area specific fixed affect α_a to condition on any unobserved area-specific time-invariant confounders, while the year fixed effects γ_t controls for, say, any unobservable shocks specific to that year. The computational simplicity comes from my "two-step" procedure: I first demean my dataset by area and year, an approach analogous to any OLS-estimation with fixed effects, as is suggested by Canay (2011). I then apply quantile regression on this transformed dataset. Crucially, this implies that the fixed effects affect quantiles *equally*.[3]

Year-dummies. Given the period between announcement and implementation, see section 2, I include a number of yearly dummies interacted with the change in (effective) land taxes of the 2007 reform starting from 2005 up until 2008 to capture any gradual effect on prices. Recall, that by mid-2004, it became public knowledge that property

[3]Canay (2011) calls these fixed effects 'location-shifters'. In my context, I find it more intuitive to think of them as affecting quantiles of house prices *equally*. More details can be found in their paper, but they essentially show the consistency of a quantile regression estimator for a data-generating process on the functional form found in equation (2).

land taxes were subject to change. This specification implies that the years 2000-2004 represent a pre-treatment period.

House quality. Further, I control for the logarithm of the public property assessment from the BBR register for house h in 2001 to capture any 'pure' difference in the quality of each house ($\ln V_{01,h,a}$). This is the last year before the nominal "stop" to property valuation taxes, see Section 2. Note that this assumes the quality of house and infrastructure is constant in the period between 2001 and 2007.

Standard errors. As my "true" variation in the data is between houses, I cluster the standard errors on the individual house level ("robust" standard errors).[4]

Assumptions. For my model to yield consistent estimates, it must be that i) the area- and year-fixed effects affect quantiles equally and ii) that pre-trends in the years 2000-2004 must have parallel trends in each quantile, as is standard in a difference-in-difference setup. For now, I investigate the effect of the reform under these assumptions, but I will return to this in the following section.

4.1.1 Results (I): Indications of heterogenous effects?

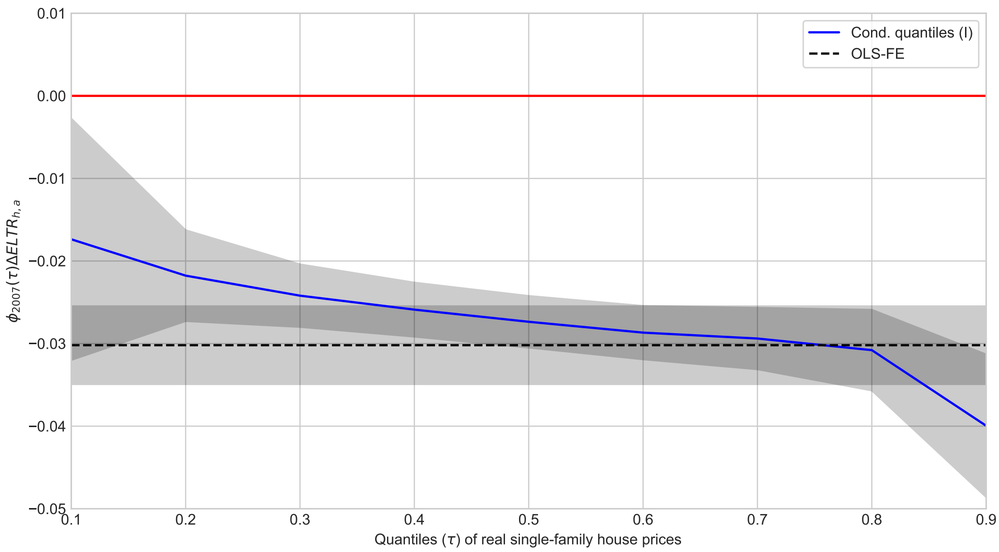
Figure 3 show the results of model specified in equation (2). A clear pattern emerges:

i) The treatment effect of changes to effective land taxes in 2007 are quite different across $\boldsymbol{\tau}$ quantiles of house prices ($\phi_{2007}(\boldsymbol{\tau})$). At the $\tau = 0.2$ quantile, a one per mille (0.1 percent) increase to effective land value tax rate decreased house prices by around 2 percent. At the $\tau = 0.9$ quantile, the capitalization effect is around double that at the $\tau = 0.2$ quantile.

ii) Table 8 in Appendix A.1 also indicate a gradual effect on prices, with year-coefficients decreasing over time in line with how the reform was communicated and implemented. I have included an OLS-estimate in exactly the same specification found in equation (2), except that I now of course model a conditional mean. This specification is identical to the found in Høj et al. (2018).

[4] I follow the advice from Leth-Pedersen and Maire (2022) and cluster on the level of my data variation.

Figure 3: Quantile treatment effects of land tax reform on house prices



Note: Estimates of the effect the 2007 'Strukturreform' ($\phi_{2007}(\boldsymbol{\tau})$) in quantiles of real house prices with 95 percent confidence bands. Standard errors are clustered at the individual house level ("robust" standard errors).

4.2 Extension

With the results found in Figure **??** in mind, I return to the relatively strong assumption which they rely on: i) that the area- and year-fixed affect quantiles equally and ii) that the pre-treatment years 2000-2003 for each quantiles $\boldsymbol{\tau} = \{0.1, 0.2, ..., 0.9\}$ follow a flat pre-trend.

First, to relax the assumption of the 'location-shifter' fixed effects, I rely on results by Machado and Silva (2019). In their paper, they derive a quantile regression estimator that allows for within-quantile fixed effects. In the context of my paper, this means that I allow the unobserved fixed effects to be different across the entire distribution of house prices, which I would argue is a more favorable modelling choice than the 'simple' approach outlined by Canay (2011).

Second, my assumption of parallel pre-trends implicitly means that I am restricting $K \times T$ parameters, with $K = 9$ quantile estimates in $T = 5$ pre-trend periods (2000-2004), to be equal to zero. To relax this assumption, I follow the key recommendation by Bilinski and Hatfield (2018), who advocates for a linear trend difference in DiD-setup.[5]

In light of this, I expand model 2 to include within-quantiles fixed effects and a full

[5]Consider the fact that the partial derivative is constant...

set of year dummies interacted with changes to effective land tax rates starting from 2000 up until 2008:

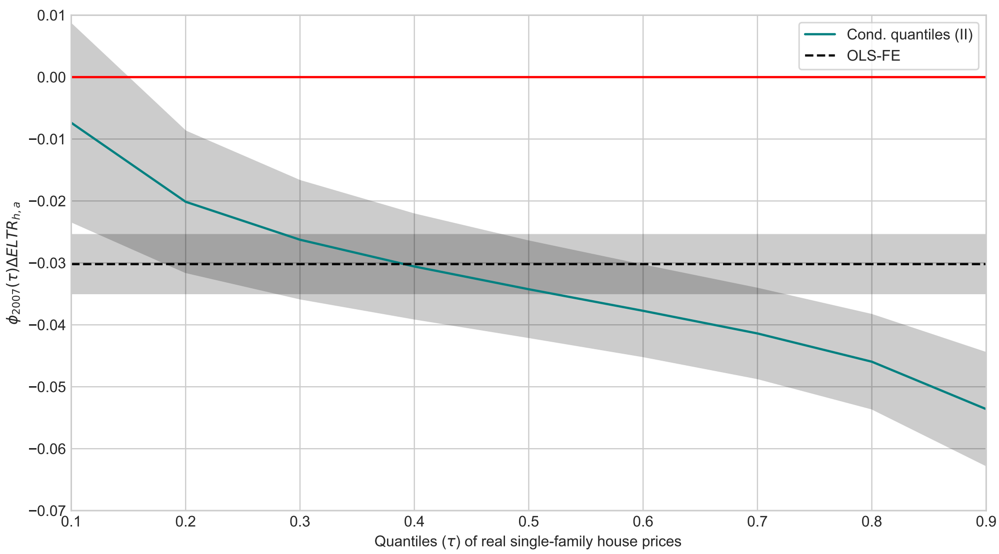
$$\ln P_{h,a,t}(\boldsymbol{\tau}) = \beta_0(\boldsymbol{\tau}) + \alpha_a(\boldsymbol{\tau}) + \gamma_t(\boldsymbol{\tau}) + \sum_{t=2000}^{2008} \phi_t(\boldsymbol{\tau})\Delta ELTR_{h,a} + \beta_1(\boldsymbol{\tau}) \ln V_{01h,a} + \epsilon_{h,a,t}(\boldsymbol{\tau}) \tag{3}$$

I restrict $\phi_{2004}(\boldsymbol{\tau}) = 0$ to normalize effects.

4.2.1 Results (II): Evidence of heterogenous effects?

Figure 4 in conjunction with Table 5 show the main results of this paper.

Figure 4: Quantile treatment effects of land tax reform on house prices



Note: Estimates of the effect the 2007 'Strukturreform' ($\phi_{2007}(\boldsymbol{\tau})$) in quantiles of real house prices with 95 percent confidence bands. Standard errors are clustered at the individual house level ("robust" standard errors).

Table 5: Quantile treatment effects of changes to land tax rates

	Quantile regressions (II)			
	20%	50%	80%	OLS-FE
	(1)	(2)	(3)	(4)
Intercept	4.833***	4.857***	4.877***	-4.834***
	(0.030)	(0.047)	(0.045)	(0.020)
$\ln V_{01}$	0.666***	0.681***	0.694***	0.680***
	(0.005)	(0.003)	(0.003)	(0.001)
$2000\Delta ELTR$	-0.007	-0.007**	-0.008**	-0.008**
	(0.006)	(0.004)	(0.003)	(0.006)
$2001\Delta ELTR$	0.002	-0.003	-0.008***	-0.003
	(0.004)	(0.003)	(0.003)	(0.003)
$2002\Delta ELTR$	0.003	0.001	0.000	0.001
	(0.006)	(0.004)	(0.004)	(0.003)
$2003\Delta ELTR$	0.003	-0.006*	-0.013***	-0.005
	(0.005)	(0.003)	(0.003)	(0.003)
$2005\Delta ELTR$	-0.004	-0.018***	-0.030***	-0.017***
	(0.005)	(0.004)	(0.003)	(0.003)
$2006\Delta ELTR$	-0.019***	-0.029***	-0.037***	-0.028***
	(0.005)	(0.004)	(0.003)	(0.003)
$2007\Delta ELTR$	-0.020***	-0.034***	-0.046***	-0.033***
	(0.006)	(0.004)	(0.004)	(0.003)
$2008\Delta ELTR$	-0.005	-0.020***	-0.031***	-0.018***
	(0.007)	(0.004)	(0.004)	(0.004)
Observations	374,895	374,895	374,895	374,895

Note: $^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$. Standard errors are clustered at the individual house level (”robust” standard errors).

4.3 Robustness checks

It could be inferred that the effect of any changes to the (effective) land tax rate may be partially absorbed by differences in the quality of the municipal services and differences hereof. Unfortunately, I do not have such temporal data at hand. Alternatively, I follow Høj et al. (2018) and include *income* tax changes following the 2007 reform in my robustness checks in Section 5.1. Naturally, this relies on the assumption that income taxes is a good proxy for services offered by the municipality. Since municipalities in Danish are required to run a balanced budget, higher tax revenues implies the potential for better services, ceteris paribus.

5 Results

Additionally, I have included an OLS estimate in Table **??** with area and time fixed effects in exactly the same specification as stated in equation 2, except that I now of course model a conditional mean and not conditional quantiles. The OLS-esitmate implies that 1 per mille (0.1) percent increase to effective land taxes decreased (increased) real house prices by around 3 percent on average. Crucially, this of course do not show full picture of the heterogenous treatment effects across the distribution of house prices illustrated in Figure **??**.

5.1 Robustness checks

First, as stated in Section **??**, it may be that the time and area fixed effects differ across quantiles of house prices $[\alpha_a(\tau))$ and $\gamma_t(\tau)]$. I refer to this as *within-(quantiles)-fixed effects* as opposed to my main specification called *across-(quantiles)-fixed effects*. I lean on the excellent work by Machado and Silva (2019), who has proposed an estimator that can account for this. Estimates using this specification exhibit the same heterogenous pattern with point estimates somewhat more "steep" across quantiles, see Figure **??** in Appendix A.1. This result is in line with what I alluded to in Section **??**. To clarify, I will reiterate the intuition. Consider an "expensive" and a "cheap" house sold in one area a. Using the estimator by Machado and Silva (2019), I no longer need to assume that, say, an unobserved shock in a year hit the cheap and expensive house *equally*.

Second, the lack of a proxy for the quality of municipal services may be a cause for concern in identifying the causal impact of changes to property land taxation. Still, even I include changes to income tax after the 2007 reform, point estimates remain stable and within the same range as my original specification in equation (2), see Table 9.

6 Conclusion

In this paper, I investigate the impact of changes to property land taxation on house prices. To do this, I use a unique dataset containing all single-family homes sold on the free market in Denmark between 2000-2008 enriched with detailed housing characteristics. I webscrape this from Boliga. The 2007 reform of Danish municipalities provide quasi-experimental variation in changes in to property land taxes. This reform did not come as a complete shock to the Danish population. By the summer of 2004, it was public knowledge that property land taxes were subject to change. It is therefore likely that people shaped their expectations in response to this. With inspiration from Høj et al. (2018), I model the potentially gradual price effect of the 2007 reform in a quantile regression setting.

Not only do my results clearly show an effect of capitalization into house prices, these results are heterogenous in nature. I find clear evidence of higher capitalization at the top of the market segment than at the bottom. These results are also robust to different model specifications, including modelling area and time fixed effects that vary within quantiles.

These results are also likely to have broader policy implications. In a strictly Danish setting, the nominal stop to property value taxation in 2002 has created relatively large regional disparities in house equity, as suggested by prominent scholars. My results suggest that land value taxation can have redistributive effects in terms of house equity. Further, as the demographic transition puts modern welfare states under considerable financial stress, it calls for review of public finances. One way of solving this would be to move towards a more immobile, non-distortionary tax base, such as through land value and property value taxation.

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A Appendix

A.1 Additional results

Table 6: Single-family prices pre/post of the 2007 'Strukturreform', 25 pct. quantile

	2003	2007	Difference
Higher	614.0	850.0	236.0
Lower	650.0	950.0	300.0
Difference	-36.0	-100.0	-64.0

Source: Boliga (2023). Prices are nominal and denoted in 1,000 DKK.

Table 7: Single-family prices pre/post of the 2007 'Strukturreform', 75 pct. quantile

	2003	2007	Difference
Higher	1438.8	1965.0	526.2
Lower	1335.0	2075.0	740.0
Difference	103.8	-110.0	-213.8

Source: Boliga (2023). Prices are nominal and denoted in 1,000 DKK.

Table 8: Quantile treatment effects of land tax reform on house prices

	Quantile regressions (I)			
	20% (1)	50% (2)	80% (3)	OLS-FE (4)
Intercept	-2.219***	-2.241***	-2.742***	-4.834***
	(0.022)	(0.011)	(0.019)	(0.118)
$\ln V_{01}$	0.884***	0.868***	0.817***	0.680***
	(0.002)	(0.001)	(0.001)	(0.009)
$2005\Delta ELTR$	-0.009***	-0.018***	-0.022***	-0.014***
	(0.003)	(0.002)	(0.002)	(0.006)
$2006\Delta ELTR$	-0.021***	-0.024***	-0.031***	-0.025***
	(0.003)	(0.002)	(0.002)	(0.007)
$2007\Delta ELTR$	-0.022***	-0.027***	-0.031***	-0.030***
	(0.003)	(0.002)	(0.003)	(0.008)
$2008\Delta ELTR$	-0.010***	-0.019***	-0.019***	-0.015**
	(0.003)	(0.002)	(0.003)	(0.006)
Observations	374,895	374,895	374,895	374,895

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$. Standard errors are clustered at the individual house level (”robust” standard errors). These estimates are based on

$$\ln P_{h,a,t}(\tau) = \beta_0(\tau)+\alpha_a(\tau)+\gamma_t(\tau)+\sum_{t=2005}^{2008}\phi_t(\tau)\Delta ELTR_{h,a}+\beta_1(\tau)\ln V_{01h,a}+\epsilon_{h,a,t}(\tau) \quad (4)$$

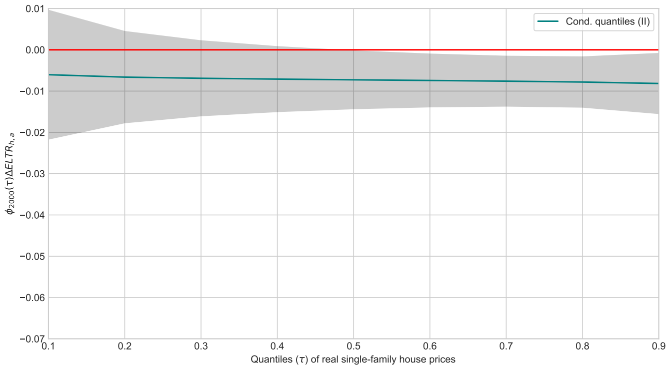
Table 9: Quantile treatment effects, incl. proxy for quality of services

	Quantile regressions			
	20%	50%	80%	OLS-FE
	(1)	(2)	(3)	(4)
Intercept	-2.218***	-2.240***	-2.750***	-4.834***
	(0.023)	(0.011)	(0.019)	(0.118)
$\ln propvalue_{01}$	0.884***	0.868***	0.817***	0.680***
	(0.002)	(0.001)	(0.001)	(0.009)
$2005\Delta ELTR$	-0.010***	-0.018***	-0.021***	-0.014***
	(0.003)	(0.002)	(0.002)	(0.006)
$2006\Delta ELTR$	-0.020***	-0.024***	-0.031***	-0.025***
	(0.003)	(0.002)	(0.002)	(0.007)
$2007\Delta ELTR$	-0.021***	-0.027***	-0.031***	-0.030***
	(0.003)	(0.002)	(0.002)	(0.008)
$2008\Delta ELTR$	-0.012***	-0.019***	-0.019***	-0.015**
	(0.003)	(0.002)	(0.003)	(0.006)
2005Δ service	-0.002	0.003*	0.009***	.
	(0.003)	(0.002)	(0.002)	(.)
2006Δ service	0.010***	0.016***	0.021***	.
	(0.003)	(0.002)	(0.003)	(.)
2007Δ service	0.008**	0.018***	0.023***	.
	(0.003)	(0.002)	(0.003)	(.)
2008Δ service	-0.006*	0.005***	0.010***	.
	(0.004)	(0.002)	(0.003)	(.)
Observations	374,895	374,895	374,895	374,895

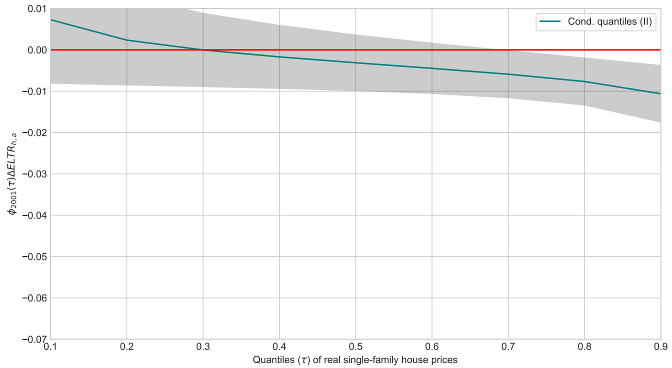
Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$. Standard errors are clustered at the individual house level ("robust" standard errors).

A.2 Quantile treatments effects by year

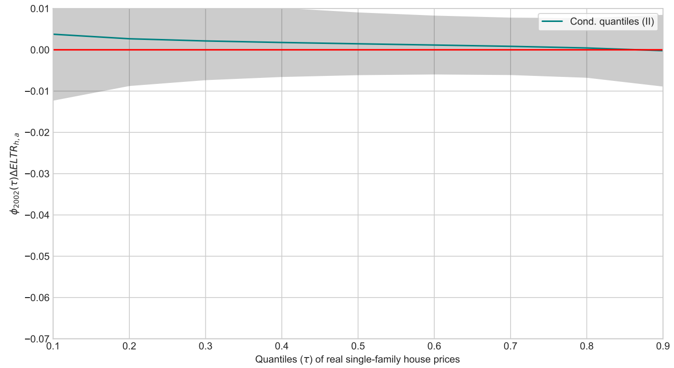
Figure 5: Quantile treatment effects by year-coefficient



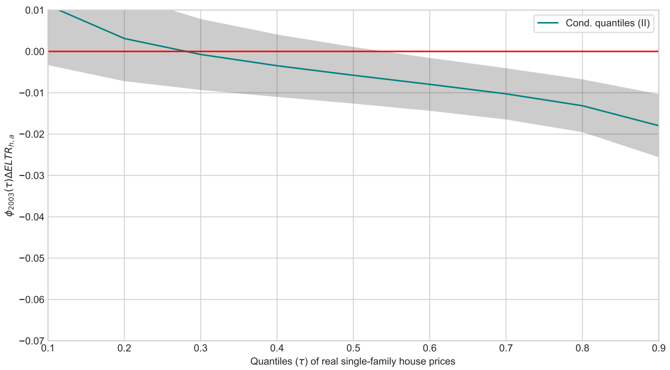
(a) 2000



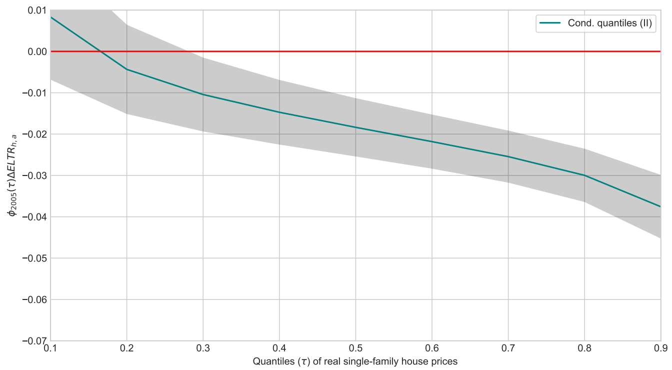
(b) 2001



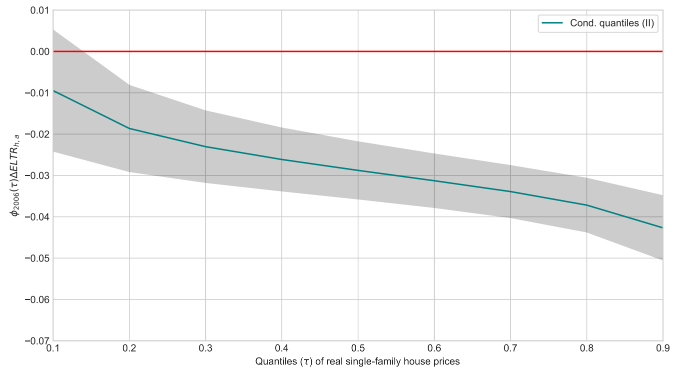
(c) 2002



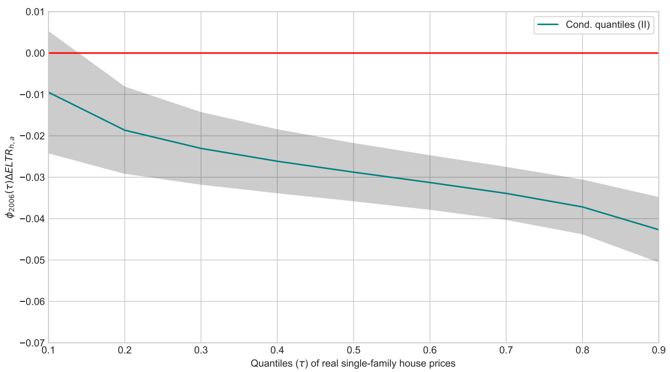
(d) 2003



(e) 2005



(f) 2006



(g) 2008