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Unravelling the Effects of Municipal Property Taxes on Dutch Housing Prices

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Abstract

This thesis examines how property tax rates influence housing prices across 478 Dutch municipalities from 2008 to 2022, capturing 4497 shifts in property tax rates. It utilises an asset pricing model adapted from Yinger (2020) and employs two-way fixed effects regression with added controls for municipal spending, local economic cycles and supply constraints. The baseline model findings indicate a partial capitalization of property taxes into housing prices, ranging from 35% to 41% depending on the assumed discount rate. This result is robust to alternative specifications, sample periods and exclusion of reclassified municipalities Sub-period analysis reveals a higher capitalization rate of around 73% for the years 2014-2022, likely due to rising housing prices. Further investigations into the heterogenous effect of supply constraints point towards capitalisation rates being higher in constrained municipalities. The results of this study ought to be interpreted with a degree of scepticism due to several limitations, chiefly the potential for reverse causality affecting the relationship between real estate prices and property tax rates as well as constraints of the available dataset. The study proposes possible solutions to those issues, providing a foundation for future research to refine the understanding of property tax capitalization in the Dutch housing market.

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Explanation of abbreviations

CBS - Centraal Bureau voor de Statistiek - Central Bureau of Statistics

COELO - Centrum voor Onderzoek van de Economie van de Lagere Overheden - Centre for Research on the Economics of Local Government

OZB - Onroerendezaakbelasting - Real Estate Property Tax

VVD - Volkspartij voor Vrijheid en Democratie - People's Party for Freedom and Democracy

WOZ - Waardering Onroerende Zaken - Valuation of Immovable Property

1. Introduction

An increasing share of housing market observers points to lowering the affordability of housing in urban areas. Some authors are going as far as to describe these recent developments as a housing affordability crisis in the making (The Economist, 2020). In general, the term refers to the hastening trend of housing-related household expenses rising more rapidly than incomes in a significant number of urban centres throughout the developed world (Wetzstein, 2017).

Similar statements are also made in the Dutch-specific context (Doorn et al., 2019; Verwaaij, 2020). There are two ways through which the dynamic of lowering housing affordability is apparent in the Netherlands:

- Firstly, nominal rent prices increased by almost 50% over the 2011-2021 period (Statista, 2022) while in the same period, nominal salaries increased by just 17% (OECD, 2022). As of 2022 country's urban areas exhibit the 3rd highest housing cost overburden rate[1] in the EU at 24.9%. It is the highest value for the country since the beginning of available data in 2005 (Eurostat, 2022) and may indicate the proliferation of so-called "housing poverty"[2] (Haffner & Boumeester, 2015).
- Secondly, nominal house prices are experiencing a similar ca. 50% growth dynamic in the 2011-2021 timeframe, especially pronounced in the post-2015 period (Eurostat, 2022). This may make homeownership unattainable for some, or at least distort individual decisions to buy a house, as can be showcased by the rising age of home buyers. It also cannot be fully explained by the ageing of Dutch society and is therefore likely influenced by rising prices (Kadaster, 2021).

Consequently, increasing costs and lowering the availability of housing could potentially contribute towards raising inequalities both in the Dutch context, as well as world-wide. Real-estate investors and already existing homeowners have in general benefited from raising asset values as reflected in a rapidly growing share of housing in national wealth measures among most developed economies (Piketty & Zucman, 2014). By some measures, this renders housing the largest asset class by value.

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[1] Percentages of the population living in households in which the total housing costs (after housing allowances) represent more than 40 % of disposable income (Eurostat, 2022)

[2] The authors don't formally define the term "housing poverty" but rather pertain to a broad concept of housing costs reducing households disposable after-housing income to level making participation in society according to specific norms impossible (Haffner & Boumeester, 2015)

Others point to the direct impact of lacking availability of housing on a wide array of social disturbances including effects on homelessness, fertility and crime, to name a few (Wetzstein, 2017), some of which may have already translated into political outcomes (Adler & Ansell, 2020).

Scholars familiar with the Dutch housing market also acknowledge the link between current trends for lowering affordability and increasing social inequalities (Boelhouwer, 2020). An aspect commonly described in literature revolves around the homeownership gap, defined as the heterogeneity of outcomes between those who own their home and those who live in a rented property. Haffner & Boumeester (2010) point to recent asymmetric changes in expenditure-to-income ratios among those two groups widening this gap. Literature suggests several reasons for widening the gap between tenants and owner-occupiers.

Rele & Steen (2001) suggest the existence of an implicit subsidy to homeownership stemming from low effective tax on residential property rendering the user-cost of owning property to be comparably lower than the one of renting. In other words, as far as tax perspective is concerned, real estate ownership in the Netherlands may appear to be an attractive way of living as well as storing and investing wealth, to some part thanks to the preferential tax treatment.

There exists a broad range of literature, both theoretical and empirical, describing mechanisms of taxes influencing property values through the mechanism of property tax capitalisation. However, to date, no published paper examined empirical evidence for Dutch property prices being affected by taxation. This thesis aims to contribute to filling this gap, by focusing on Dutch taxes on real estate value, known as the Valuation of Immovable Property (*Waardering Onroerende Zaken* - *WOZ*). It attempts to answer the following research question:

How do property tax rates affect housing prices in the Netherlands?

Overall this paper is divided into the following chapters:

The second chapter gives an overview of Dutch property taxes, summarising all taxes borne from real estate ownership with emphasis on the Real Estate Property Tax (*Onroerendezaakbelasting – OZB*).

The third chapter delves into the theory of tax capitalisation. It opens by defining the hypothesis formed by Tiebout (1956) and follows with its implications for the real estate market as well as introduces property tax capitalisation in the context of cross-sectional models.

The fourth chapter describes the methodology and data used in the study. Following Yinger (2020) it contains a derivation and outline of a baseline fixed effects model which I subject to further robustness tests to determine model validity. It also follows the analysis by Stadelmann & Billon (2012) in specifying a model for determining the impact of supply constraint on property tax capitalisation.

Chapter five reports the results of the baseline model, its associated robustness checks and models with supply constraints, and its associated robustness checks, respectively.

Chapter six provides a discussion of the results, putting them in the context of existing research and considering their implications as well as discussing limitations of the study, with the recommendations for further academic research.

Finally, chapter seven concludes.

2. Setting

The Dutch term of WOZ tax refers not to any singular tax, but a nationwide system of calculating various taxes and levies based on the imputed value of a residential property. Initially, an assessment of property values was done by various authorities utilising different methodologies and definitions. This was changed in 1995 with the passing of the Special Act for Real Estate Assessment (*Wet Waardering Onroerende Zaken*) (MvF, 1995) which established a common definition of property value to be used for tax calculations irrespective of which governmental entity levies them. At first, this calculation was conducted every four years, however, since 2007 property values have been assessed annually (Kuiiper & Kaathman, 2015).

In its current form, the WOZ-value is an annual estimate of the market value of the property as of 1 January of the previous year. It is calculated based on the transaction prices of properties sold in proximity collected and administered by the Cadastral Service (Government of the Netherlands, 2022) which is then intersected with property characteristics by municipalities to determine the market value of a given property. The value is calculated irrespective of whether a given home is leased or not. This value then serves as a base for several taxes and fees levied by different levels of government:

The levels of government entities collect taxes off the WOZ-value of the property: municipalities, water authorities and central government. Property taxes are particularly relevant to the finances of municipalities. In particular, Real Estate Property Tax is by far the most relevant source of financing for local governments in the Netherlands, comprising 41% of their revenues. In 2022 municipalities raised a total of EUR 4.8 bln through the means of OZB-tax (CBS, 2023b). Each municipality is free to set its rate of OZB-tax, which they adjust frequently enabling a high degree of cross-sectional and time variation. Frequent adjustment of the property tax rate is unique to the Dutch setting and has no close analogues in other developed countries (Kuiper & Kaathman, 2015). This makes the Netherlands an optimal environment to assess the impact of property tax shifts on real estate value.

Administering body	**Tax/fee**	**Description**
Municipality *[Gemeente]*	Real Estate Property tax *[OZB - Onroerendezaakbelasting]*	Property tax levied on residential and non-residential properties. In the case of rental properties to be paid fully by the owners. Tax rates vary by municipality and are not constrained (Kuiper & Kaathman, 2015).
	Waste Collection fee *[Afvalstoffenheffing]*	Non-discretionary fees are levied on property owners to cover the costs of waste collection and disposal services. *Notes:* not all municipalities utilise WOZ-values in the calculation of those fees; the maximum height of the fees is constrained by costs borne by municipalities (Kuiper & Kaathman, 2015).
	Sewerage fee *[Rioolheffing]*	
Regional Water Authority *[Waterschap]*	Water System fee *[Watersysteemheffing]*	Tax levied to finance the management of water resources, such as maintaining dykes and waterways (RVO, 2023).
Central Government	Income Tax *[Inkomstenbelasting]*	Tax levied on individuals' income; the WOZ value is used to calculate the imputed rental income. As of 2023, it was set as 0.5 per cent of its value (Klemm, Hebous, & Waerzeggers, 2021).
	Inheritance Tax *[Erfbelasting]*	Tax levied on the value of inherited assets, including property; the WOZ value minus liabilities associated with the property is used as the tax base (Belastingdienst, 2022).
	Gift Tax *[Schenkbelasting]*	

Table 1. Summary of levies and fees levied on the assessed WOZ-value of the property, it should be noted that this study focuses on examining the OZB taxes only

3. Background Literature

3.1. Conceptual framework

This thesis, similar to the majority of other studies investigating the relationship between property tax and house prices adheres to the principle that the value of a house, akin to any other asset, equals the present (discounted) value of the after-tax cash flow. This principle closely aligns with the housing-specific discounted cash flow model proposed by Poterba (1984). In his seminal paper, Poterba identifies six components that represent the costs and benefits of home ownership: the forgone risk-free interest, property taxes, tax-deductibility of mortgages and property taxes, maintenance costs, capital gains, and the risk premium. The annual cost of ownership, often referred to as the “user cost”, is then compared to the annual cost of renting, which represents the opportunity cost of renting versus buying a home. The mechanism influencing housing prices operates in the following way: as the user cost of housing rises, it reduces future expected returns on housing assets, thereby depreciating its valuation. This suggests a negative relationship between property tax rates and housing prices, all else being equal. This ties into the concept of “housing services”, being consumed both by the renters and owner-occupiers (with the latter “buying” the services from themselves) and corresponding to the value of the rent (actual or imputed).

Finally, this paper discusses the notions of supply and demand in the housing market. These terms, albeit generally considered simple, may be subject to differing interpretations when referring to the property market. Unless stated otherwise, this thesis defines housing demand as a volume of housing services sought by the buyers present on the market at any given time. Correspondingly, housing demand is defined as a volume of housing services offered by the sellers on the market at any given time. Defining housing services as referring to both renting and purchasing is useful, as it defines a distinction between sellers and buyers as between those who own housing, landlords or owner-occupiers alike and those who seek to benefit from housing services, be it by renting or buying.

3.2. Property tax capitalisation

Property tax capitalization implies that changes in property taxes are absorbed into the market value of real estate properties. In simpler terms, property tax capitalization happens when an increase in the property tax rate results in a decrease in property value, all else being constant.

When describing a theory of property tax capitalisation, a fundamental reference can be made to the “Pure theory of local expenditures” introduced by Tiebout (1956). He argued, that since much of public services are levies handled on the localised level, and assuming households may have differing preferences for revenue-expenditure patterns of local as well as are mobile, then the individuals may self-select into municipalities with taxation and local expenditures combination best suited to their preferences. Municipalities levy local property taxes, the raising of which reduces their attractiveness in the eyes of the movers. However, with the resulting revenue they finance public goods, such as education, public spaces etc., thus increasing their attractiveness. In other words, rational and informed individuals may “shop” for the most optimal combination of local taxes and public services, which creates competitive pressure among jurisdictions wishing to attract households. This notion constitutes the so-called “Tiebout theorem”.

Its implications were later tested by Oates (1969). He inferred from Tiebout theorem, that, if households indeed sought to maximise their utility by moving based on the mix of public services and local taxation, then changes in demand for local housing in municipalities would affect local property prices. He examined the US setting, in which a significant portion of local municipality income stems from the property tax and a major spending item is schooling. According to his hypothesis, an increase in local property taxes without a corresponding increase in local public services, much of the tax increase would result in decreasing property prices, thus being capitalised. In the simplest terms, the question that Oates (1969) postulates inferring from the Tiebout theorem could be: *If we have two similar properties located in two different municipalities, what happens to their market prices if the property tax rate in one municipality increases, while everything else remains the same?*

Alternatively, if the municipality raises its taxes but also funds an increase in public spending (schooling) with additional receipts, then the effect of improved services should roughly offset the effect of a higher tax burden.

The seminal paper by Oates (1969) concerns a simple setting, with only homogenous jurisdictions and not accounting for the government interventions in the housing market. This is expanded by Epple & Zelenitz (1981) who agree with Oates on the basic confirmation of Tiebout's hypothesis that households have preferences for the tax-expenditure mix. They also argue that this result does not depend on differing objectives pursued by local governments or their number.

Oates's argument was rejected by Edel & Sclar (1974), who suggested that in long-run equilibrium, no capitalisation of fiscal variables should occur. Firstly, they criticize Oates for basing conclusions about household preferences on strong assumptions of individuals' preferences for services and taxes as well as being perfectly informed about respective tax-expenditure mixes in various jurisdictions. Secondly, they postulate, that Oates's interpretation of the Tiebout theorem is limited to just a statement about household demand and does not explicitly handle the supply side of the housing market. In their proposed model, over the long term, any distortions in house prices caused by shifts in the tax-expenditure mix are mitigated as supply responses return the local markets to equilibrium.

3.3. Property tax incidence

So far, the literature discussed in this paper treated property tax capitalisation in no more than zero-one terms. However, property tax may be capitalised into house prices only to some extent. Therefore we should differentiate between full capitalisation where the entire value of future property tax liability is reflected in the changed house value and partial capitalisation, where only part of it is.

Ultimately, this issue concerns the ultimate bearer of the taxes, otherwise known as economic tax incidence. In the case of full capitalisation, the entire value of property tax liability gets capitalised in the property price meaning the current owner bears the entire weight of the tax being unable to pass it on to tenants (or future buyers). In the extreme case of no capitalisation, the entire tax burden is either passed through onto tenants who experience it through escalated rents (for owners: increased outflows stemming from property tax are offset by increased inflows from rent, thus keeping the discounted cash flows-derived property value constant) or future buyers, who purchase the property by paying price undiscounted by attached "fiscal differential".

Following the review of property tax incidence by Zodrow (2001), there are three prevailing views on property tax incidence: the traditional view, the benefit view and the capital tax "new" view.

The traditional view developed by Simon (1943) predates the Tiebout theorem. It views property tax as a form of excise tax. In it, local property taxes primarily affect consumers of housing services. In an "open economy" setting the capital will naturally flow out of the taxed jurisdiction leading to a restriction in housing supply. This leads to an escalation in housing prices, leading to consumers ultimately bearing the burden of taxation, largely related to how elastic is the local housing supply.

A stylized link between capitalisation and supply elasticity under the traditional view can be made by adapting the model from the textbook by Rosen & Gayer (2008):

If the housing supply is perfectly elastic (i.e., the supply curve is horizontal), any changes in demand will be immediately met with corresponding shifts in supply, thereby preventing any price changes. In this scenario, current homeowners may be able to shift a portion of the tax burden onto future buyers. It would also suggest that communities can effortlessly expand in response to enhancements in the tax-services mix. Conversely, if the supply curve is vertical, indicating a perfectly inelastic supply, changes in demand instigated by property taxes will become fully capitalised. It means that sellers of housing services bear the entirety of the tax burden.

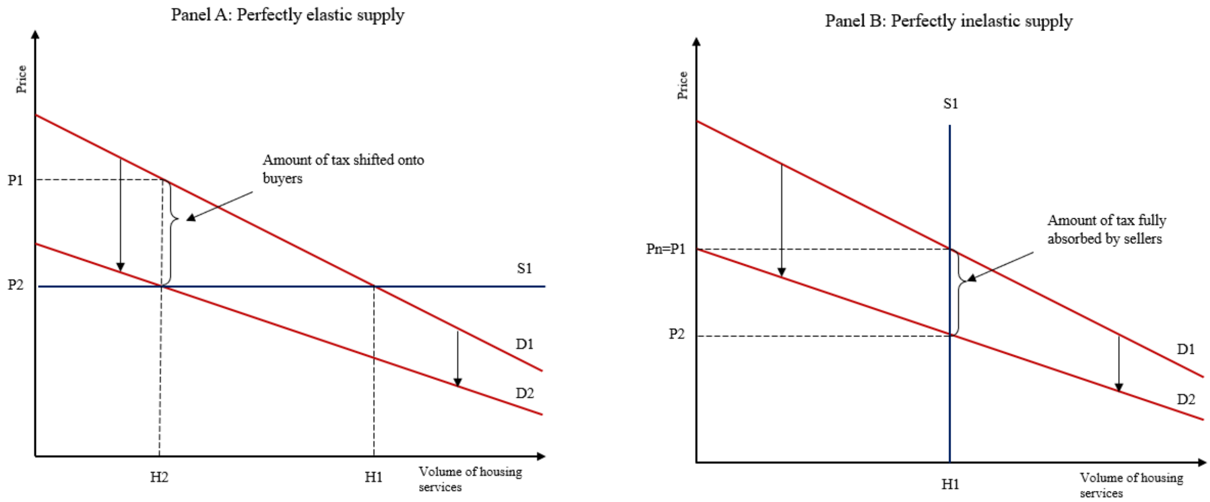

Figure 1. No capitalisation under perfectly elastic and inelastic supply as theorised by Rosen & Gayer (2008)

Under the setting with a perfectly elastic housing supply (panel A), where the introduction of a tax on property shifts the demand curve down from D1 to D2. Given the supply curve S is horizontal, the price (Pn=P1) received by suppliers stays the same, but the quantity of housing services exchanged falls from H1 to H2. The user cost paid for housing services includes the tax burden and equals P2. No capitalisation of property tax occurred as current homeowners were able to shift the entire burden to future homeowners.

Under a different setting (panel B), this time with the supply of housing being perfectly inelastic, the demand curve again gets shifted down from D1 to D2. This time, however, the shift produces a new equilibrium price P2 lower then Pn=P1, while the quantity of property exchanged H1 remains the same. Current property owners can either absorb the tax burden directly while retaining their house ownership or indirectly by accepting lowered market prices resulting in capital loss. Full capitalisation of property tax occurred as current homeowners were not able to shift the burden either way.

The benefit view was originally developed by Hamilton (1976) as an extension of the Tiebout theorem. He argued that property taxes could be viewed as benefit taxes, essentially fees for local services. This stems from two assumptions: firstly, housing units are heterogeneous, implying the existence of more expensive and less expensive housing units in the community. Secondly, households occupying housing units all have the same access to services provided locally. This means that should no capitalisation occur, occupants of the more inexpensive houses would benefit from the same services while paying less than those living in expensive homes. This would mean that such taxation be both distortionary and redistributive as households from more expensive homes effectively subsidize public services consumption of those living in less expensive homes. Hamilton, however, argued that though what he described as "perfect capitalisation" property tax may become benefit taxes, as more expensive houses may sell at discount accounting for fiscal differential stemming from excess taxes, while inexpensive homes sell as the premium stemming from future net benefits. Consequently, the benefit view asserts that property tax is a user charge exchanged for local services, making it non-distortionary and non-redistributive (in reference to annual income), provided full capitalisation occurs.

The third view, the capital tax view, also called the "new view", developed by Mieszkowski (1972) and expanded by Zodrow & Mieszkowski (1986) argues that property tax is a distortionary tax on the use of local housing capital. By utilising a general equilibrium model of the property tax and assuming the national capital stock to be fixed, he modelled the outflow of housing capital from hight-tax to low-tax jurisdictions, not much unlike those discussed in the traditional view. Where the capital tax view is different to the two previously discussed views is in implying that the property tax is a relatively progressive (in reference to annual income) segment of the national tax system.

In addition, this view postulates that property tax differentials in reference to national tax increases result in offsetting “excise tax effects” comprising housing and commodity price increases (decreases) and wage and land price declines (increases) in relatively high (low) tax jurisdictions. As those effects tend to cancel out on the national level, the progressive effect on incomes appears to be the primary element affecting the incidence of tax liability under the capital tax view.

These views are relevant from the perspective of analysing the above-mentioned views when deriving conclusions from this study. Some municipalities, driven by the redistribution motive may intend to raise property tax to finance services or transfers to poorer households. Which, in the light of the above views may have no or regressive effects. It should be also noted, that in case of less than full capitalisation, this paper remains agnostic in regards to housing services providers (property owners) transferring the burden of property taxed onto renters, as rents remain unobservable in the examined setting.

3.4. Empirical evaluation

As outlined in the previous section, implications of Tiebout’s (1956) theorem for the real estate market were acknowledged by Oates (1969) who was the first to formally develop and test the notion of property tax capitalisation. He inferred that changes in local attractiveness as driven by the tax-expenditure mix would exert heterogeneous pressures on local housing markets, thus contributing towards cross-sectional variance in prices of properties. His simple cross-sectional 2SLS model, based on hedonic pricing models, can be written in a generalised form as follows:

$$V = f(T, G, M, H, Y)$$

Where:

V = Median home value by the municipality;

T = The effective percentage tax rate;

G = School spending per pupil

M = Geospatial variable of the proximity to the core of urban area;

H = Vector of hedonic variables relating to house properties such as size or age;

Y = Vector of “ability-to-pay” variables relating to household income.

Worth pointing out is that both property taxes and public education expenditures are present, as counteracting variables off-setting each-other's effects. It creates two kinds of problems. Firstly, tax rates and public expenditures are theorised to be correlated, and separating the effects of the two.

Secondly, other forms of public service spending may be at play. If omitted variables for different spending categories are positively correlated to the used proxy, then the estimation of the coefficient for the said proxy is likely to be upwardly biased. This was pointed out in criticism by Pollakowski (1973), who, upon inclusion of interaction with other forms of public services, finds no capitalisation.

A further improved version of a model (Oates, 1973), this time including other services, finds almost full capitalisation of property taxes. The difference stems from the dataset used, as both studies by Oates were based on New Jersey data, while Pollakowski utilized Bay Area data, thus indirectly validating other criticism regarding the limited external validity of the model.

Further counterpoints followed as showcased. King (1977) argued that the Oates model induces an upward bias of capitalisation for high-value homes and a downward bias for low-value homes. By utilizing data used originally by Oates (1973) in an improved model including neighbourhood and amenity quality he showed the estimates from the second study were biased upwards by 40% thus placing his revised estimate closer to the original study by Oates (1969). He also introduced two important points to the discussion about capitalisation. Firstly, Oates's hypothesis suggests capitalisation based on tax liability, but the model examines tax rates. Secondly, he suggests a control for tax cost should be included to avoid possible bias.

Rosen & Fullerton (1977) point to the issue of unobservability of public service quality. They argue, that the original model by Oates (1969) may be flawed, as it proxies public services level with per pupil spending, an input variable, while it would be more appropriate to utilise an output variable. The re-estimate original model utilising school achievement scores instead, resulting in capitalisation estimation close to 90%. Lewis & McNutt (1979) add to the previous point regarding public service quality by criticizing the use of aggregate census data for some studies, thus ignoring the hedonic properties of examined houses and within-variance in municipalities. They also raise concern with the use of assessed value as a reflection of market prices, as those are not verified in actual market conditions, and may misrepresent them. They estimate their model utilising individual data from actual house sales and find evidence of partial capitalisation of fiscal variables.

The overall discussion of concerns with empirical studies derived from the original Oates (1969) model has been summarized by Palmon & Smith (1998) who classify the issues with empirical models into five major categories:

- The need to assume a discount rate in DCF-based models creates problems in estimating the long-term present value of tax payments;
- The failure to adequately control for quality of public services leads to an under-identification problem;
- Variations in assessment practices across jurisdictions, leading to potential errors in variables;
- Lack of measures to mitigate the simultaneity between tax rates and property values, resulting in a simultaneity bias;
- The misspecification of the estimating equation, including choice of public services to include.

They estimate their model on the sample of Houston communities characterized by large variance in property prices, but close to no variance in public services, thus partially addressing issues related to spurious correlation between public services and taxes. They find evidence for partial capitalisation but only refer to unexpected changes in taxation. Ross and Yinger (1999) further add to the list above, stating that previous research often conflates the immediate impact of current tax rate differences on house prices with the long-term effects based on the shifts of expected future stream of property taxes. As defined by most studies, the degree of property tax capitalization represents how much current tax differences are absorbed into house values, under the assumption that these differences will persist indefinitely. However, this might not always be the case.

Overall, multiple studies have been conducted in the area, providing a great variance of results. Sirmans, Gatzlaff & Macpherson (2008) have counted at least 28 US-based empirical studies conducted until 2007, utilising varied methodologies (mainly 2SLS, as based on the original Oates model), and various definitions of tax (ex. effective tax rate, tax rate, dollar amount of taxes paid etc.). 7 of these found no capitalisation to be present, 10 found partial capitalisation, and 8 reported full capitalisation. Three studies stand out having reported results greatly diverging from other authors:

- Church (1974), as well as to a lesser extent Reinhard (1981), report overcapitalisation of property tax (ie. increases in tax rates result in a decrease in house prices larger than the present value of property taxes after an increase). They argue this might be driven by homeowners' expectations of a persistent upward trend in property taxes, though do not rule out a degree of methodological and measurement error.

- Brasington (2001) finds evidence for positive capitalisation (ie. increases in tax rates resulting in house prices increasing as well). He attributes this unusual result to characteristics specific to the US state of Ohio, primarily very low property tax rates.

All of the studies discussed previously exhibit a rather limited external validity, with idiosyncratic characteristics driving the seeming variance in results across the US. To better formulate expectations of potential results from studies in other European regions. The table below provides a selection of relevant studies, both previously mentioned US-ones as well as those based in Europe, a discussion of which takes place below the table:

Study	**Data**	**Methodology description**	**Results overview**
(Oates, 1969)	New Jersey, US	2SLS (Two-stage least-squares) estimation	Partial capitalisation (66%), significant (negative) relation with tax rates and (positive) with public expenditures
(Pollakowski, 1973)	San Francisco, US	2SLS, same as Oates	No significant capitalisation
(Oates, 1973)	New Jersey, US	2SLS. included total non-school expenditure per capita	Full capitalisation (92%) - significant effect of non-school expenditures
Church (1974)	California, US	2SLS	Overcapitalisation (120-240%)
(King, 1977)	New Jersey, US	2SLS, adjusted identification equation	Partial capitalisation (63-67%)

Study	Data	Methodology description	Results overview
Rosen & Fullerton (1977)	New Jersey, US	2SLS, school achievement used instead of per pupil spending	Full capitalisation (90%)
Lewis & McNutt (1979)	Utah, US	OLS (Ordinary-least-squares)	Partial capitalisation (22-25%)
(Reinhard, 1981)	US	2SLS, adjusted identification equation	Overcapitalisation (100-140%)
(Palmon & Smith, 1998)	Houston, US	OLS, no variation in public services	Partial capitalisation (62-64%) - only unexpected changes to tax rates can be shifted to property buyers
(Rosenthal, 1999)	England, UK	IV – natural experiment of the effects of poll tax introduction	Partial capitalisation (26-38%),
(Brasington, 2001)	Ohio, US	OLS and IV (Instrumental Variables) estimation	Positive capitalisation (-3%)
(Hilber, Lyytikäinen, & Vermeulen, 2011)	England, UK	FE (Fixed Effects) and IV regression of the effects of grants for local government	Full capitalisation (62%-107%)
(Stadelmann & Billon, 2012)	Zurich, Switzerland	Pooled OLS with time and county FE of the sample of tax-variant Swiss municipalities	Full tax capitalisation regardless of land constraints and housing supply

Study	Data	Methodology description	Results overview
(Hardt, Lehmann, & Wirth, 2016) (working paper)	Bavaria, Germany	Pooled OLS with time and county FE	Full capitalisation of tax, no persistent effect
(Elinder & Persson, 2017)	Sweden	DiD (Difference-in-difference) estimation of the effects of the national tax reform	No significant capitalisation except for the top 1% of most valuable properties

Table 2. Selection of empirical studies concerning property tax capitalisation

Rosenthal (1999) developed an asset pricing model to examine the impact of the shift of the tax base from housing consumption to individual residency (introduction of the so-called "Poll tax") and the effective lowering of the tax burden on housing. The study reports a significant impact of the reform on the subsequent house price inflation, estimating capitalisation to be between 26% (in West Yorkshire) and 38% (in Inner London) this result would also confirm earlier theoretical proposals that supply constraint would increase the degree to which capitalisation occurs. Similar conclusions were also driven from another UK-based study by Hilber, Lyytikäinen, & Vermeulen (2011) who examined the effects of electoral targeting of central government grants to local authorities and reported slight overcapitalisation of 107% in more constrained areas.

However, an examination of the sample of houses located in Swiss municipalities by Stadelmann & Billon (2012) shows full capitalisation regardless of land scarcity. The researchers found the land constraint, defined as lower-than-average unused land available for construction per capita, had no statistically significant effects on the reported degree of capitalisation. The authors explain this by Swiss-specific topography, zoning laws and local community resistance towards new constructions, once again pointing towards the importance of unobservable factors.

These results seem to be troubled by limited external validity. Hardt, Lehmann, & Wirth (2016) who mimicked the model by Stadelmann & Billon (2012) utilised it to examine panel data on Bavarian municipalities, finding evidence for capitalisation of property tax and some (but not all) local expenditures. Additionally, they do not find any of these capitalisations persistent. It is however worth noting that their study is still ongoing, and final results may yield more detailed conclusions.

Another study from Sweden (Elinder & Persson, 2017) finds zero effect of property tax reduction on the nationwide scale on property values, except for the highest-valued real estate. The authors propose three possible explanations for such: the most exclusive property market segment, where they observe positive tax capitalization, is characterised by physical land scarcity, substantial tax reductions for owners, and financially literate buyers. They also argue that no significant effect on the rest of the market may be driven by the fact that, as stated in the model by Yinger et al. (1988), prices tend to respond much more strongly to localised tax changes, as national tax reforms hardly provide opportunities for households to perform "tax arbitrage" on properties.

In summary, both US and Europe-based studies provide a rather limited external validity that could be superimposed on the Dutch setting. However, a few key areas of interest may still be discerned:

- Land and supply scarcity seems to play a role in the degree of capitalisation, with areas with more land and/or housing scarcity generally exhibiting higher capitalisation. Appropriate specification of this issue is crucial, which will be discussed in the latter sections of this thesis.
- Value of the house may also be of importance, with higher valued properties possibly reacting stronger to tax changes, while lower valued properties reacting stronger to expenditure changes, as postulated with amenity view of incidence.
- Zoning and construction law are highly relevant, although their exact impact is highly idiosyncratic. Other unobservable factors, not mentioned in the above review may also be at play, constituting possible omitted variable bias.

4. Empirical strategy

4.1. Sample Selection

The natural starting point of the studied period is the year 2007 when the annual estimation of WOZ-values was introduced (Kuiiper & Kaathman, 2015) providing a hard barrier on the scope of this study. However, due to limitations on the data for municipal spending, the study's starting point is 2008. Data from 478 Dutch municipalities that existed in the period between 2008 and 2022 is used. It should be noted that during this period 35 new municipalities were created, 134 municipalities were dissolved as well and many more were amended by absorbing parts of dissolved municipalities.

The dependent variable is the average house selling price while nominal property tax rates and per capita public expenditures are primary independent variables, a vector of control variables is also introduced. For robustness, the sample is further divided into two sub-periods: 2008-2013 and 2014-2022 in order to examine whether estimates of capitalisation for the full sample hold when subjected to variable economic environments. Due to the subsiding effect of the housing bubble since the peak of 2008 (avg. EUR 255k) house prices in the Netherlands exhibited a general downward trend, reaching a low point in 2013 (avg. EUR 213k). Since this point, the effects of the housing bubble visibly subsided, and housing prices began their recovery (the reasons for which are multiple) reaching an average selling price of EUR 387k in 2022 (as showcased in Figure 2.) It is therefore reasonable to divide the sample into periods of contradicting price trends in the market at large.

4.2. Dependent variable

The dependent variable for this paper is average annual property prices. *Centraal Bureau vor de Statistiek* (CBS) publishes annual data on the average property prices for each municipality (CBS, 2022b) based on transaction data compiled by Kadaster. Between 2008 and 2022 the median average residential property price in municipalities has increased from EUR 257k to EUR 411k, that is despite the fact that the year 2008 was characterised by a peak property bubble, which burst and led to the Global Financial Crisis. As showcased in Figures 3. and 4. The distribution of average property prices in municipalities has shifted upwards significantly between 2008 and 2022.

In 2022, three municipalities recorded average property purchase prices larger than EUR 1m: Bloemendaal, Blaricum and Laren – all of these are small communities in proximity to

Amsterdam, popular with the well-off. The lowest average house price of EUR 231k was reported in Pekela, a small rural community in Groningen province.

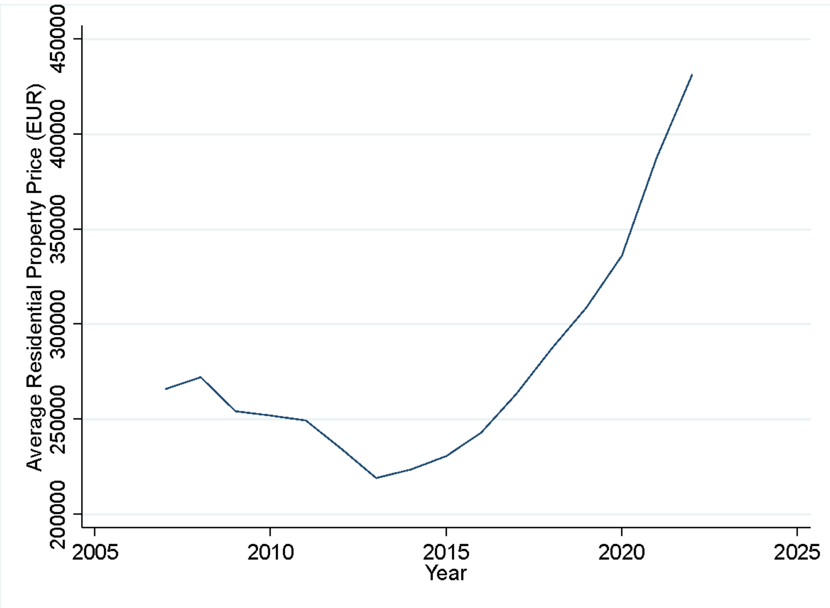

Figure 2. Average residential property prices (EUR) in municipalities in 2007-2022 period

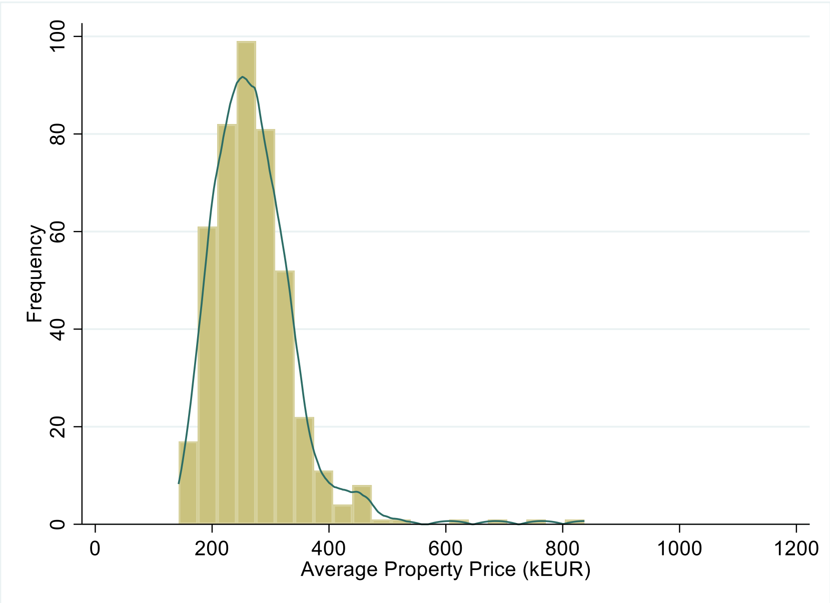

Figure 3. Distribution of average residential property prices (EUR) in municipalities in 2008

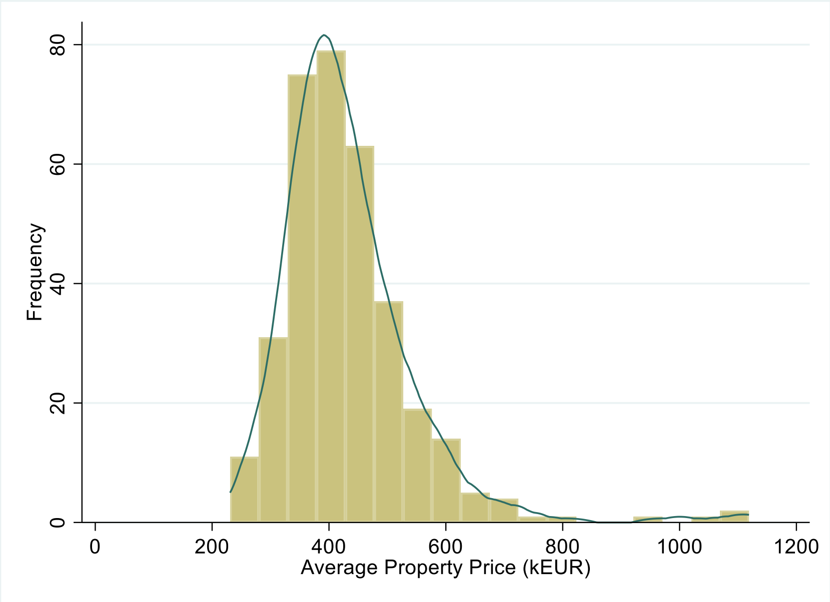

Figure 5. Distribution of average residential property prices (EUR) in municipalities in 2022

It should be noted that such a defined dependent variable does not control for hedonic characteristics of properties, such as size, condition, age, number of rooms etc. Micro-level data were requested from Kadaster directly, however, such a dataset of all sales transactions throughout 2007-2022 would far exceed the maximum dataset the agency can share for research purposes. This constitutes a clear limitation of the study, a property composition varies between municipalities, which might explain part of the cross-municipality property value variance. For example, a significant share of houses in Bloemendaal are historical detached villas – the type of property typically achieving higher market valuations. However, much of this variation would be captured by municipality-fixed effects in the model.

4.3. Independent variables

	Variable	Description	Source
BASELINE MODEL	HOUSE_PRICE	Average residential property selling price per municipality in a year (EUR)	(CBS, 2023b)
	OZB_VALUE	OZB tax rate in a municipality at a given year (%)	(COELO, 2023)
	SPEND_PC	Municipality expenditures per capita (%)	(Rijksoverheid, 2023)
ECONOMC CYCLE	UNEM_RATE	Unemployment rate (%)	(CBS, 2023a)
	DISP_INCOME	Average disposable household income (EUR)	
	POP_CHANGE	Population change y/y	
SUPPLY CONSTRAINT	POP_DENSITY	Population density (ppl/km2)	
	SUPPLY_RATE	Rate of new housing units as a fraction of total housing stock	
	DEV_LAND	Developed land as a fraction of total land (%)	

Table 3. Overview of variables in the study, all variables reported at the municipality level

4.3.1. Property tax rate

Primary independent variables follow from the model laid down by Tiebout (1956). Firstly, Property tax (OZB) rates are obtained from the database of *Centrum voor Onderzoek van de Economie van de Lagere Overheden* (COELO), which annually publishes these for each municipality (COELO, 2023) for the 2014-2022 period. Additional data for 2007-2013 is also provided by COELO on request and is converted into percentage rates (as until 2013 the OZB rate was reported as liability per 1000 EUR of property value). The evolution of the OZB rates between 2007 and 2022 is showcased in Figure 5. Over the observed period the rates followed a "hump-shaped" path, reaching the peak in 2016 and subsequently declining.

Curiously, OZB tax rates appear to move in the opposite direction to house price (as showcased more closely in Figure 6.) though the timing varies (with no lag during the 2008 price peak and a three-year delay after the 2013. At first glance, this movement may seem in line with the theory of capitalisation. However, an alternative explanation may seem more probable as the OZB rate reaches its' turnaround point 3 years after property prices. This might mean, that faced with rapidly increasing property values, and raising the tax base for OZB tax, municipalities might have opted to reduce the rates in order to keep the tax liabilities "under control". This raises questions about potential reverse causality which will be addressed in subsequent sections.

It should also be noted, that the inclusion of property tax rates instead of property tax liability may be at odds with a critique of Oates's model by King (1977), however, in the later section I show a derivation of the tax-rate-based model consistent with the theoretical framework outlined in the previous sections.

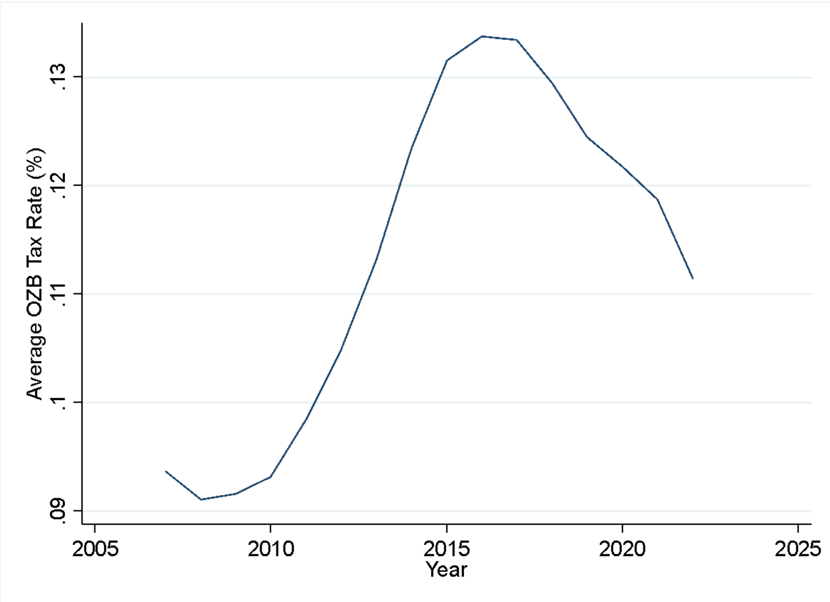

Figure 5. Average OZB tax rate (%) in municipalities in 2007-2022 period

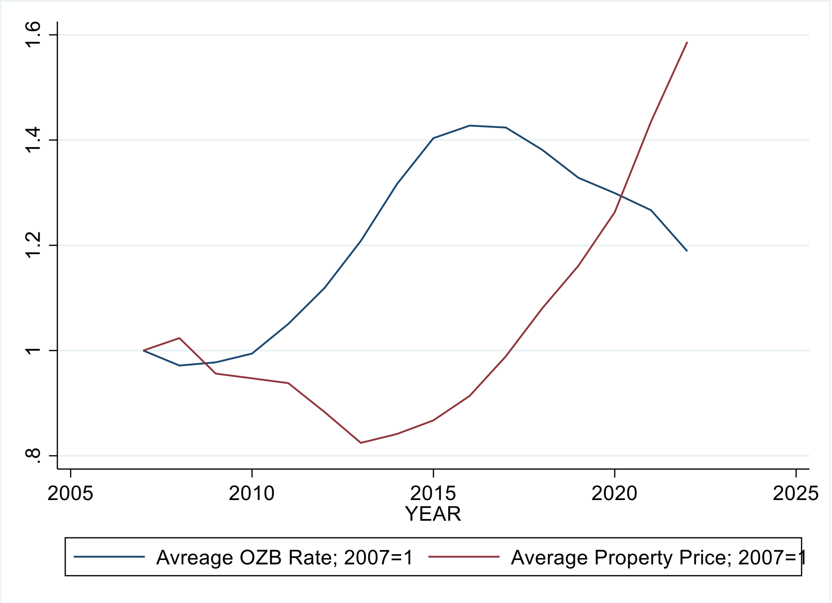

Figure 6. Juxtaposition of the evolutions of average OZB-rates and average property prices in reference to 2007

4.3.2. Municipality spending

Per capita municipality expenditures serve as a suitable proxy for local spending levels. As it covers broadly defined municipality service it could be posited that it is consistent with points raised by Pollakowski (1973). However, it should be noted, that contrary to the US setting, in the Netherlands, the majority of crucial public services (such as education and healthcare) are administered and regulated centrally, thus leaving less space for possible variance in their provision on the municipality level.

It is also crucial to highlight that such a defined variable doesn't adequately account for the quality of public services, which is an issue as pointed out by Rosen & Fullerton (1977). Here a difference between the US and Dutch setting may be relevant, as more central supervision of services renders variance in quality likely less pronounced, thus rendering this issue somewhat less concerning when examining the Netherlands.

Data regarding per capita expenditures by municipalities can be sourced from the FINDO database, shared by Rijksoverheid (2023). A notable limitation of this dataset is its focus on municipalities existing as of 2023, neglecting the numerous rearrangements that occurred during the sample period.

4.3.3. Local economic cycle

Kuiiper & Kaathman (2015) suggest that municipal decisions regarding property tax might be influenced by the local economic climate. Consequently, indicators of local economic conditions have been incorporated:

- The unemployment rate, is calculated by dividing the number of unemployment benefit recipients by the total number of employed individuals in a municipality.
- Average disposable household income, also pinpointed by Sutton (2002) as well as McQuinn and O'Reilly (2008). as a principal driver of house prices in the Netherlands. Stutton further contends that interest rates significantly impact house prices and should be factored in. However, this is accounted for by the year-fixed effect in our analysis. Due to the limited availability of this variable (covering only the 2011-2021 period), I opt to exclude it from the baseline model instead of making it part of the comprehensive model as a robustness check.

Gyourko, Mayer, & Sinai (2013) also argue that migration patterns can influence local property values, as they reflect both the allure of a municipality and its economic vitality. To account for this, changes in the population are controlled by determining the first difference in municipal population data. It should also be noted, that population changes may also be driven by births and deaths, influencing the age composition of the municipality, this would have a minor effect compared to migrations, through could still serve as a biasing factor for the study.

4.3.4. Supply constraint

A number of previous empirical studies, starting with Rosenthal (1999), through Hilber, Lyytikäinen, & Vermeulen (2011), and Hardt, Lehmann, & Wirth (2016) find that supply constraint would increase the degree to which capitalisation occurs.

This study takes inspiration from the design utilised by Stadelmann & Billon (2012) in which the authors examine the effects of land scarcity on the degree of capitalisation. Similar to their study this thesis includes variables of population density as well as incorporates information on the share of developed land in total municipal area. However, it should be noted that supply constraint is not purely defined by land constraint, but also by zoning and regulatory environment. These aspects are qualitative in nature and thus challenging to model quantitatively. However, the rate of new housing supply (defined as new housing units built as a % of total housing stock), which is derived by dividing new housing units by the total housing count in a municipality, can act as a suitable proxy for comprehending these supply constraints. The authors do not deem inclusion of variables for regulatory constraint necessary, so I omit it from the baseline model, to include the new housing supply rate in the comprehensive model. It should be noted, that even the inclusion of the new housing supply rate does not fully reflect the housing supply as defined in the earlier sections of the study, as I cannot observe by the volume of housing services offered at the market at any given time.

4.4. Baseline model

I base the workhorse model utilised in this thesis on one developed by Yinger et al. (1988) and further improved upon by Yinger (2020). In its essence, the model is an asset pricing model in which house value equals the present value of the net benefits from owning it.

In this case, full capitalization means that the differences in house prices, after considering all other price-influencing variables, perfectly match the present value of expected tax obligations. It also implies that the full extent of changes in tax liability is absorbed by current real estate owners, while partial capitalisation means that some part of the burden can be passed onto future owners.

Starting with a model without property taxes - this value amounts to the present value V of expected rental benefits (actual or imputed) over the expected lifetime L of the house:

$$V = \sum_{y=1}^{L} \frac{\hat{P}H}{(1+r)^y} \tag{1}$$

Where $\hat{P}$ is the pre-tax price of housing services, H is the volume of housing services associated with the property. I further refer to the expression $\hat{P}H$ as rental benefits and r as the discount rate, y denotes the year. Assuming the expected lifetime of the house is very large (precisely, exceeding the economic horizon of a human lifetime) the model can be simplified (proof in the appendix):

$$V = \frac{\hat{P}H}{r} \quad (2)$$

In essence, in equation (2) the (current) value of the house equals its annual rental benefits divided by a discount rate. The model can be further expanded, adding property tax payment T yields the following equation:

$$T = tV \quad (3)$$

Where tax payment is the product nominal tax rate t and market value V which should be reflected in the property's WOZ-assessment. Keeping in simplified convention from equation (2) yields the following:

$$V = \frac{\hat{P}H}{r} - \frac{tV}{r} \quad (4)$$

In expression (4), the value of the house equals the annual discounted rental value minus annual tax value; this, however, assumes full capitalisation. A degree of tax capitalisation β can be introduced:

$$V = \frac{\hat{P}H}{r} - \frac{\beta tV}{r} \quad (5)$$

A value of β equal to 1 means full capitalisation while a value of 0 corresponds to no capitalisation. This expression can be solved for V yielding the following:

$$V = \frac{\hat{P}H}{(r + \beta t)} \quad (6)$$

Finally, taking logs of both sides yields a form that is suitable for empirical estimation:

$$\ln(V) = \ln(\hat{P}\,H) - \ln(r) - \ln\left(1 + \frac{\beta}{r}t\right) \quad (7)$$

The value of discount rate r is unobservable, most studies estimate the value of $\frac{\beta}{r}$, then assume the value of r and thus calculate the implied value of β. Yinger et al. (1988) argue that by usually assuming the discount rate to be between 5-6%, most studies in fact overestimate the degree of capitalisation and argue for utilising a 3% discount rate as in their view, it is closer to actual risk-free interest rates present in the economy.

This can serve as a starting point for the baseline model, however, given that throughout the majority of the sample period the interest rates in Europe remained at unprecedentedly low levels, entertaining even lower discount rates of 1% and 2% may be appropriate.

For the baseline model, I include the variables discussed above, as well as controls for the economic cycle (unemployment rate and population growth) as well as for supply constraint (population density and developed land), as argued in previous sections. I omit the variables for disposable income and supply rate, as they are limited in the available time scope. Those are later included in the comprehensive version of the model, to be discussed under robustness check.

All the above considered this yields the following baseline model specification:

$$\begin{aligned} \ln({HOUSE_{PRICE}}_{m,t}) &= \beta_1 \ln\left(1 + \frac{{OZB_{RATE}}_{m,t}}{r}\right) + \beta_2 \ln\left({SPEND_{PC}}_{m,t}\right) \\ &+ \beta_3 \ln\left({DISP_{INCOME}}_{m,t}\right) + \beta_4 {UNEM_{RATE}}_{m,t} + \beta_5 {POP_{GROWTH}}_{m,t} \\ &+ \beta_6 {POP_{DENSITY}}_{m,t} + \beta_7 {DEV_{LAND}}_{m,t} + \theta_m + \eta_t + \varepsilon_{m,t} \end{aligned} \tag{9}$$

Where θ_m is a municipality fixed effect, η_t is a year-fixed effect and ε_{mt} denotes error term. β_1 denotes the degree of capitalisation, for a given discount rate r.

The term $\ln(V)$ in the equation (8) corresponds to $\ln({HOUSE_{PRICE}}_{m,t})$ in the equation (9), term $\ln(r)$ is constant, therefore it is not included in the model specification. Term $\ln\,(1 + \frac{\beta}{r} t)$ in the equation (8) corresponds to the term $\beta_1 \ln\left(1 + \frac{{OZB_{RATE}}_{m,t}}{r}\right)$ in the model specification. The remaining model term in the specification (9) corresponds to the inclusion of control variables. Notably, I choose to omit the term $\ln(\hat{P}\,H)$ from equation (8) as it refers to housing services, which cannot be observed in the examined setting.

In the baseline specification, the model tests the following hypotheses:

$$H_1\colon \beta_1 = 0 \tag{10}$$

$$H_2: \beta_1 \in (0; -1) \tag{11}$$

$$H_3: \beta_1 = -1 \tag{12}$$

Hypothesis 1 corresponds to no capitalisation, which would imply property taxes are completely passed on by current homeowners. Hypothesis 2 corresponds to the case of partial capitalisation, where current homeowners can pass on only part of their tax liability. Hypothesis 3 corresponds to the case of full capitalisation, in which current homeowners fully absorb expected property tax liabilities.

4.5. Robustness

4.5.1. Comprehensive model

In the comprehensive model, the two control variables previously excluded in order to preserve the length of the sample period, are included in the comprehensive model. This entails disposable income as suggested by Sutton (2002), as well as the rate of housing supply proxying for regulatory constraints.

4.5.2. Alternative sample period

In the baseline model, the sample spans from 2007 to 2022, capturing a key trend shift in 2013, when the housing market began to recover post-financial crisis. This change could have had an effect on the degree of tax capitalization in the Dutch property market. It is not unreasonable to assume that different forces pertaining to the degree of market tension likely impacted the sector before and after 2013. Another consideration is the presence of non-binding limitations on property tax increases, agreed upon annually until 2014 between municipalities and the central government, which constitute a possible mechanism for simultaneity bias. Interestingly, even after these officially sanctioned limitations ceased to exist post-2014, many municipalities continued the practice of self-imposing limits on tax increases. It was particularly evident in scenarios where the tax base, represented by WOZ-values, was rapidly increasing. In such cases, municipalities often lowered the tax rates to offset the increase in the tax base (Sandee, 2023). This behaviour adds another layer of complexity to the study, as it suggests a form of endogeneity that could raise concerns about reverse causality between property taxes and property values.

4.5.3. Municipality reclassification

Certainly, addressing the geographical and administrative changes in municipalities over the sample period adds a layer of complexity to the study. With 134 dissolutions, 35 creations, and 22 amendments to municipalities during the sample period. Epple, Zelenitz & Visscher (1978) argue that if the boundaries of jurisdictions can be redrawn, then house prices across the municipality borders must be equal. This presents a valid concern these municipality changes could distort the results of the analysis by introducing a downward bias into the coefficients for the entire sample.

To mitigate this issue, a dummy variable is introduced to exclude all reclassified municipalities from the sample. This allows for a more stable and consistent dataset, reducing the noise generated by these administrative alterations. By doing so, this study aims to isolate the effect of property tax rates and other variables of interest on housing prices without the confounding influence of municipal restructuring.

4.6. Supply constraint

Theoretical models show that the degree to which property taxes get capitalised declines when supply elasticity increases (Rosen & Gayer, 2008). This is further explored in several empirical works, some of which confirm this theoretical inference (Rosenthal, 1999; Hilber, Lyytikäinen, & Vermeulen, 2011) while others do not find statistically significant results (Stadelmann & Billon, 2012; Hardt, Lehmann, & Wirth, 2016).

I choose to follow Hilber & Vermeulen (2010) who, in their UK study, find regulatory constraints to be endogenously determined, as local governments may adjust their zoning to economic conditions as well as other political factors that cannot be observed. Therefore the supply constraint in the model is defined purely as a physical constraint on land available for construction. This is choice is far from perfect, however, it seems to the second-best choice as I cannot directly observe the elasticity of housing markets for municipalities or the volume of housing services being offered on the market at any given time.

To do this, I introduce a binary variable to account for land availability defined by land available for construction per capita. I choose this variable, as it reflects the possible demand for housing in a given area (expressed through a population size), juxtaposed to the area’s capacity to satisfy the demand through means of housing stock expansion. To ascertain to which degree the land scarcity impacts the degree of capitalisation I follow two approaches used by Stadelmann & Billon (2012): split sample and linear interaction model.

In the first approach, I separate the dataset into two distinct subsamples: those which have more available land per capita than the national average of 3,195.2 square meters, and those which do not. I refer to the latter group as land-constrained. The hypothesis is that, if the availability of housing supply influences the degree to which fiscal variables are capitalized into property values, then land-constrained municipalities characterized should display a significantly higher degree of capitalization. To ensure the robustness of the findings, the threshold for land scarcity is adjusted by plus or minus 15%. This adjustment serves to verify that the observed relationship is not an artefact of the specific threshold chosen.

The second methodology employs a linear interaction model, incorporating fiscal variables and a (1) previously discussed dummy for land scarcity, and (2) a standardized measure of available land. The latter is derived by computing the deviation of land availability in a given municipality i from the overall mean of land available per capita. This means that municipalities with larger-than-average amounts of land available per capita are assigned positive values of this standardised measure, while those with lower-than-average amounts ie. land-constrained municipalities are assigned negative values of standardised measure. Fiscal variables are then interacted with this standardized measure to evaluate its moderating effect on the relationship between taxes, municipal expenditures, and housing prices. If a higher-than-average supply of unused land reduces responsiveness to fiscal variables, then the interaction between tax variables and available construction space should yield a positive coefficient, while the interaction with public expenditure should produce a negative one. In other words, the degree of tax capitalization would inversely correlate with the extent of available construction land within municipalities.

5. Results

5.1. Baseline model

The results of the baseline model are presented in columns (1) – (3) of Table 4. The results can be interpreted as follows: all else equal, a 1% increase in the OZB rate is correlated with a 0.378%-0.438% decrease in house prices, on average. This coefficient is different from 0 at a 1% significance level. The hypotheses of no capitalisation $H_1\colon \beta_1 = 0$ and full capitalisation $H_3\colon \beta_1 = -1$ can both be rejected with over 99% certainty. The hypothesis of partial capitalisation $H_2\colon \beta_1 \in (0; 1)$ cannot be rejected regardless of the chosen discount rate. The

95% confidence intervals of the coefficient for all discount rate levels show that the magnitude effect falls confidently under 50% capitalisation. In other words, in the baseline model, the degree of capitalisation is estimated to be within the 37.8%-43.8% band, corresponding to the percentage of burden borne by property tax shift getting capitalised into property prices.

There is also a significant positive relationship between municipal spending per capita and house prices, as well as disposable income and a negative relationship between the unemployment rate and house prices, which is in line with previously formulated expectations. The coefficients of other control variables do not significantly differ from zero. The within R-squared corresponds to 44.6% of house price variation being explained by the model.

5.2. Robustness

The results of the comprehensive model including variables of disposable income and supply rate at the discount rate of 2% are presented in column (4), the changes in the magnitude of property tax capitalisation are negligible.

Results of regressions of the baseline model with the sample period divided into 2008-2013 and 2014-2022 periods are presented in columns (5) and (6), respectively. Interestingly, there is a great deal of heterogeneity in the results with the capitalisation rate for the 2008-2013 period estimated at 33.7%, and the capitalisation rate for the 2014-2022 period estimated at 72.7%. This may suggest a conclusion that the degree of capitalisation can vary according to shifts in the economic environment, indicating that it is much greater for a market with increasing property prices. Nonetheless, no strong conclusions may be drawn from this specification, intended purely as a robustness check.

This also corresponds to the dramatic fall in housing supply recorded in the country following 2013, significantly tightening the market (Boelhouwer, 2020). Throughout the latter period, a series of legal developments further restricted supply elasticity, with the 2019 Supreme Court (*Hoge Raad*) ruling regarding the execution of nitrogen emissions limits effectively thwarting new housing supply ever since (The Economist, 2023).

Finally, re-estimation of the model after excluding all municipalities which have been reclassified during the sample period. The results of this are showcased in column (7) showing only minimal reduction in capitalisation rate by 3.5pp. This is likely an artefact of the procedure for exclusion of amended municipalities, where the exclusions were made post-amendment, inadvertently biassing the mean year of the sample downwards, towards a period which is now known, was characterised by a lower degree of capitalisation.

Outcome variable: Ln(House Price)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(OZB_RATE)	-0.347***	-0.378***	-0.410***	-0.383***	-0.337***	-0.727***	-0.343***
	(0.0475)	(0.0514)	(0.0553)	(0.0629)	(0.0549)	(0.0842)	(0.0374)
Ln(SPEND_PC)	0.456***	0.457***	0.457***	0.122***	-0.167***	0.384***	0.410***
	(0.0293)	(0.0294)	(0.0294)	(0.0271)	(0.0321)	(0.0329)	(0.0203)
UNEM_RATE	-3.840***	-3.839***	-3.839***	-1.737***	-2.402***	-5.012***	-4.010***
	(0.262)	(0.261)	(0.260)	(0.253)	(0.333)	(0.362)	(0.271)
POP_GROWTH	-0.00131	-0.00199	-0.00255	-0.0248	-0.111***	0.196	-0.272
	(0.0816)	(0.0816)	(0.0816)	(0.0614)	(0.0399)	(0.206)	(0.255)
Ln(POP_DEN)	-0.0254	-0.0265	-0.0274	-0.101	-0.172***	-0.0670	0.545
	(0.0826)	(0.0825)	(0.0824)	(0.114)	(0.0503)	(0.186)	(0.628)
DEV_LAND	0.126	0.128	0.130	0.0984	-0.0948	-0.0277	0.721
	(0.274)	(0.275)	(0.276)	(0.119)	(0.376)	(0.182)	(0.471)
Constant	10.43***	10.27***	10.20***	-1.549	15.33***	11.83***	6.845*
	(0.586)	(0.601)	(0.609)	(1.206)	(0.440)	(1.181)	(3.778)
Discount rate	1%	2%	3%	2%	2%	2%	2%
Model	Baseline	Baseline	Baseline	Comprehensive	Baseline	Baseline	Baseline
Reclassified municipalities	Yes	Yes	Yes	Yes	Yes	Yes	No
Period	2008-2022	2008-2022	2008-2022	2012-2021	2008-2013	2014-2022	2008-2022
Observations	4,497	4,497	4,497	3,206	1,892	2,605	4,267
R-squared	0.410	0.410	0.410	0.491	0.577	0.392	0.514
Number of GEEM_ID	328	328	328	328	321	328	316

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Results of the baseline model with associated robustness checks

5.3. Supply constraint

The results of the split sample model with a threshold set at the average unused land value are reported in columns (1) and (2) of Table 5. There exists some heterogeneity in results between municipalities in which land is more widely available for construction, and the land-constrained ones with the former exhibiting a capitalisation rate of 29.2% and the latter a capitalisation rate of 39.0%. This, however, is still a fairly subtle difference which gets diminished when alternative thresholds are introduced in columns (3) – (6).

Outcome variable: Ln(House Price)	(1)	(2)	(3)	(4)	(5)	(6)
Ln(OZB_RATE)	-0.292***	-0.390***	-0.312***	-0.388***	-0.317***	-0.382***
	(0.0501)	(0.0620)	(0.0582)	(0.0587)	(0.0481)	(0.0656)
Ln(SPEND_PC)	0.363***	0.471***	0.382***	0.465***	0.383***	0.472***
	(0.0282)	(0.0363)	(0.0322)	(0.0345)	(0.0279)	(0.0381)
UNEM_RATE	-3.768***	-4.108***	-3.604***	-4.055***	-3.789***	-4.129***
	(0.302)	(0.401)	(0.348)	(0.355)	(0.283)	(0.435)
POP_GROWTH	-0.123	0.00261	-0.126	0.00660	-0.0434	-0.00182
	(0.0984)	(0.0861)	(0.0961)	(0.0863)	(0.155)	(0.0859)
Ln(POP_DEN)	1.517***	0.0204	1.558***	-0.00739	1.060***	0.0440
	(0.335)	(0.123)	(0.392)	(0.124)	(0.352)	(0.123)
AVAIL_LAND_PC	38.47***	63.49	38.81***	27.89	23.50	95.13
	(12.97)	(59.67)	(12.61)	(63.31)	(15.83)	(63.09)
Constant	2.595	9.851***	2.425	10.11***	4.868***	9.641***
	(1.724)	(1.001)	(1.978)	(1.006)	(1.824)	(1.011)
Discount rate	2%	2%	2%	2%	2%	2%
Threshold	3,195.2	3,195.2	3,674.4	3,674.4	2,715.9	2,715.9
Land Constraint	No	Yes	No	Yes	No	Yes
Period	2008-2022	2008-2022	2008-2022	2008-2022	2008-2022	2008-2022
Observations	1,409	3,088	1,146	3,351	1,629	2,868
R-squared	0.730	0.352	0.734	0.363	0.733	0.338
Number of GEEM_ID	103	225	84	244	119	209

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Results of the sample-split model at different thresholds of land scarcity

Results of the linear interaction model (Table 6.) provide somewhat of an ambiguous picture for the statistical significance of considered heterogeneous effects of land scarcity. Interaction terms of the dummy variable with the OZB rate reported in column (1) seem to be statistically significant at the 10% level. This suggests that there might indeed be some, albeit week effect of land constraint on the degree to which fiscal variables are capitalised into house prices. However, the model with a standardised measure of available land, reported in column (2) does not show any statistically significant effect. Therefore, one cannot conclusively say whether land scarcity is a valid factor influencing property tax capitalisation, while it also suggests that it is not exactly baseless to suggest it plays some role in the process.

Interestingly, the results for capitalisation of municipal spending per capita exhibit more heterogeneity between samples as seen in Table 5. Additionally, the interaction term of the dummy variable for land constraint with municipal spending per capita, reported in column (1) with a coefficient statistically significant at 5% level, meaning the effect of land constraint seems to impact the capitalisation of municipality spending more significantly than the property tax rate.

Outcome variable: Ln(House Price)	(1)	(2)
Ln(OZB_RATE)	-0.267***	-0.366***
	(0.0497)	(0.0457)
Int[ln(OZB_RATE)*Land Available	-0.133*	11.83
	(0.0689)	(9.361)
Ln(SPEND_PC)	0.376***	0.449***
	(0.0259)	(0.0263)
Int[ln(SPEND_PC)*Land Available	0.0994**	-6.717
	(0.0398)	(5.762)
UNEM_RATE	-3.953***	-3.874***
	(0.270)	(0.267)
POP_GROWTH	0.00615	0.00630
	(0.0821)	(0.0832)
Ln(POP_DEN)	-0.0327	-0.0217
	(0.0866)	(0.0921)
AVAIL_LAND_PC	-11.77	-1.308
	(19.04)	(22.61)
Constant	10.42***	10.29***
	(0.646)	(0.700)
Discount rate	2%	2%
Model	Dummy	Standardized measure
Period	2008-2022	2008-2022
Observations	4,497	4,497
R-squared	0.409	0.405
Number of GEEM_ID	328	328

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Results of the linear interaction model for land constraint

6. Discussion

6.1. Study limitations

6.1.1. Reverse causality and simultaneity bias

There are legitimate reasons to believe that estimated capitalisation coefficients may be impacted by the issue of reversed causality. The juxtaposition of the evolution of WOZ-rates and property prices (Figure 6.) suggests that municipalities might have engaged in reductions of WOZ rates to keep the EUR-denominated tax liabilities stable in an environment of raising property prices. This might bias the capitalisation estimates towards 100% as increasing property prices lead to lower property tax rates, thus resulting in an apparent strong negative estimate relationship between the two. In fact, until 2014, a mechanism of maximum WOZ-tax increase through which municipalities would negotiate a maximum increase in WOZ-tax (defined in terms of EUR tax liability, not rate) was possible for the year. This mechanism was voluntary, meaning that in some cases municipalities would violate those agreements and increase the property tax more than agreed (Volkskrant, 2014). Even after the cap was abolished in 2014, there were notable examples of municipalities adjusting the OZB rate downwards in order to keep the actual tax liability constant in light of WOZ-value increases.

Examples of mitigating reverse causality issues utilising (IVs) varying from the composition of local councils can by found in the study by Hilber, Lyytikäinen, & Vermeulen (2011) who used share of Labour Party representation as an instrument for the distribution of central government grants.

Using the share of municipal council seats held by the current ruling Dutch party - People's Party for Freedom and Democracy (*Volkspartij voor Vrijheid en Democratie - VVD*), as an instrumental variable could be a strategic approach. Such an instrument seems to adequately satisfy the four conditions of instrumental variables:

(i) The VVD has a consistent track record of implementing policies that benefit homeowners and promote homeownership (André et al., 2018), (Boelhouwer, 2020), therefore a variable reflecting its share of representatives in local councils may constitute a meaningful first stage.

(ii) Similar to all other political parties, VVD is particularly popular among certain demographic groups, which may constitute a violation of the independence criterion. This might be solved by introducing controls for the composition of municipalities' population.

(iii) Political parties are most likely to influence property prices through the taxation and municipality spending mix. Throughout the observed sample period, large variance in property prices was either induced through economic shocks exogenous to the Dutch real estate market or through legal rulings independent of political influence.

(iv) It can be considered unlikely that local representatives of a certain political party would drastically defy the party line, thus invalidating the monotonicity assumption in the model. If this was the case, singular municipalities experiencing such an issue could be eliminated from the sample.

All things considered, the party composition of municipal councils could serve as a viable instrument to isolate the impact of property tax changes on home values, helping to address the issue of reverse causality. This could be particularly effective if the party's policy stance is stable and widely recognized, making it a predictable influence on the property tax-municipal expenditures mix. Unfortunately, comprehensive data on municipal council representation is not available, rendering this strategy outside of the scope of this thesis. However, the above argumentation may serve as a basis for future research.

Alternatively, the simplest possible IV strategy is to instrument the explanatory variable by a lag of itself, in this case, the OZB-tax rate, which is a common practice in various empirical studies. This is far from a perfect solution, as outlined by Bellemare, Masaki, & Pepinsky (2017). They do, however, point out conditions under which it is still viable. The use of lagged explanatory variables as instrumental variables can be viable under certain conditions, particularly when dealing with the issue of reverse causality: (i) no unobserved confounding; (ii) no dynamics in the dependent variable; (iii) one-period lag-only.

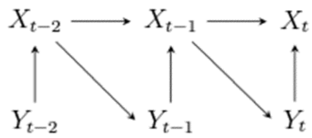

Figure 8. Representation of valid generating process for the lagged variable instrument, Bellemare, Masaki, & Pepinsky (2017)

6.1.2. Omitted variables

Due to the aggregate nature of the study, it does not control for the specific characteristics of houses sold at a given year, in a given municipality. This could be solved by basing the study on micro-level data and implementing hedonic variables in the model. It should be noted that such variation in housing composition between municipalities and years should be included in fixed effects terms, and therefore not bias the estimates in any significant way.

However, as theorized by Lewis & McNutt (1979) and later shown by Elinder & Persson (2017), the strength of capitalisation of fiscal variables may vary depending on the value of the property, therefore controlling for sub-segments of the real estate market could yield some heterogeneous effects. Unfortunately, the sample size needed to conduct this study far exceeded the maximum dataset that could be shared by the Kadaster service for research purposes. Additionally, not including micro-level data makes it impossible to include controls for rental benefits associated with a given property and expressed as $\ln(\hat{P}\,H)$ in the equation (8) of the baseline model, thus making the rendering of the model by Yinger (2020) utilised in this study incomplete.

In the study, public services are reflected by municipal expenditures per capita. This is far from perfect, as it ignores the quality of public service provision. There exists a reasonable argument for why this might be less of an issue in the Dutch setting, with centrally managed key public services, however, some variance in the quality of execution of other municipality tasks may still be present. There likely exist few good solutions for an issue of unobservable quality of public services, other than including socioeconomic variables about local population such as proposed by Rosen & Fullerton (1977).

6.1.3. Selection bias

Due to the lack of data for the municipality spending for municipalities that were not extant in the year 2022, which is 134 municipalities out of the total 478 that were present at any point throughout the sample period. It constitutes a non-trivial, non-random omission of observations shifting the composition of the sample forward. In other words, the further a certain period is from 2022, the larger portion of municipalities present at the time would be omitted from the sample, due to frequent reclassifications and mergers of Dutch municipalities throughout the observed period.

This issue can be solved by reversing the procedure used to arrive at the original municipality dataset. The current data shared by the Ministry of Interior utilises a population-weighted average of spending for municipalities in post-merger identity. It is unfortunately impossible without a full dataset, which was not shared by the Ministry upon inquiry. Alternatively, post-merger identities could also be applied to the pre-merger identities by averaging other variables in accordance with the same procedure as described above. This however would be a solution suboptimal in comparison to the first one proposed, as averaging out variables would lead to the omission of relevant inter-municipality heterogeneity.

6.2. Study implications

The results of the baseline model estimation show that both hypotheses of no and full capitalisation can be rejected in all estimated specifications, at all chosen discount rate levels. These results point towards partial capitalisation at an average 35-41% level being in action in the examined sample of Dutch municipalities. This result is robust to the inclusion of additional variables as well as the exclusion of reclassified municipalities. However, the division of the sample period into 2008-2013 and 2014-2022 shows a wide heterogeneity of results varying from partial capitalisation of 34% in the former period, and 73% in the latter period. This might lead to a conclusion that a tighter market may facilitate the degree of capitalisation to be larger, though no solid conclusion may be derived from the way it was examined in this study.

Further exploration of this aspect by examining the impact of land constraint on property tax capitalisation by implementing two alternative empirical approaches as based on the Swiss study by Stadelmann & Billon (2012) does not yield fully robust results. Nonetheless, it gives reasons to suspect that market tightness, expressed by either raising prices or present land constraints does influence the degree to which property taxes get capitalised into real estate prices, which may prove a tentative confirmation of the traditional and capital views of property tax incidence, though the latter cannot be fully examined in absence of micro-level-data which could shed more light on the capitalisation on different value levels.

The study also confirms that changes in municipality spending per capita are capitalised into property prices, though these results are not fully robust to the addition of variables and alternative sample periods. Nonetheless, the study does not provide enough evidence to provide conclusions regarding the validity of the benefit view of property tax incidence in the Dutch setting, again stemming from the absence of micro-level data. There are, however, some reasons to believe that land scarcity significantly increases the degree to which spending fiscal variables are capitalised into property prices as well.

Because I cannot fully conclude the validity of the benefit view and capital tax view of property tax incidence in the Dutch setting it is difficult to definitely conclude on whether property taxation in the Netherlands can be viewed as both distortionary and redistributive. However, some tentative conclusions may be made in the context of the benefit view. According to Hamilton (1976), the property tax can be viewed as a non-distortionary and non-redistributive user charge only in the case of "perfect capitalisation" occurrence of which was rejected in this study. This means that all others being constant, the property tax may indeed be viewed as somewhat distortionary and redistributive as poorer households (ie. those living in lower-value properties) benefit from the public services in the same way that wealthier households while paying comparably lower property taxes. Two additional points of caution ought to be raised in tandem with this statement. Firstly, the impact of a given tax should never be judged in isolation, therefore it is impossible to state whether property tax is a relatively progressive segment of the national tax system in the Netherlands without examining its relationship with other taxes, which this study does not perform. This also includes other fees and taxes in the Netherlands that are raised based on the assessed WOZ value of properties and many other motives. Secondly, this study remains agnostic in regards to the property tax heterogeneously impacting renters and owner-occupiers, as it broadly defines buyers of housing services as entailing both of those groups.

7. Conclusion

This thesis investigates the answer to the following research question "How do property tax rates affect housing prices in the Netherlands?". To achieve that, it examines a sample of 478 Dutch municipalities, over a period of years 2008-2022, with a combined 4497 OZB-tax rate shifts. The baseline model is an asset pricing model in which house value equals the present value of the net benefits from owning it, as derived from Yinger (2020). Estimation of coefficients is done with two-way fixed effects, with municipal and time-fixed effects. Additionally, controls for municipal spending per capita, local economic cycle and supply constraints are added. Results of the baseline model point towards rejection of both hypotheses of no capitalisation as well as full capitalisation, indicating only a partial capitalisation of the property tax rate at the 35-41% level, depending on the assumed discount rate. The results are robust to the addition of further variables, adjustments to the sample period as well and exclusion of reclassified municipalities. Additional analysis shows significant heterogeneous effects when splitting the sample period into 2008-2013 and 2014-2022 sub-periods, with the latter exhibiting partial capitalisation at around 73%, however, no strong conclusions can be inferred from this result. The study also examines the effects of land constraint on property tax capitalisation, following the design set up by Stadelmann & Billon (2012), it finds some results pointing towards supply constraint increasing the degree of capitalisation, though those results are not fully robust to alternative specifications.

The study is burdened by a series of limitations, the issue of possible reverse causality from real estate prices to OZB-tax rates being the primary of them. Future research may utilise possible solutions to this issue discussed in the thesis, but impossible to introduce due to the limited scope of data utilised. Additional issues include omitted variables for the hedonic properties of houses sold in the period, unobserved quality of public services in municipalities, as well as selection bias stemming from some municipalities having missing expenditure data. It renders some of the estimates and conclusions of this study to be taken with a degree of scepticism, further research may make further attempts to solve these issues and deliver more conclusive results about the full scope of variables impacting property tax capitalisation.

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Appendix A.

Derivation of the baseline model as based on Yinger (2020).

Starting point of the derivation is the model equating house value V to the sum of discounted rental benefits $\hat{P}H$ over the expected lifetime L.

$$V = \sum_{y=1}^{L} \frac{\hat{P}H}{(1+r)^y} \tag{1}$$

Assuming L is large, I can simplify this model by dropping the sum notation with the following steps:

$$V = \frac{\hat{P}H}{(1+r)} + \frac{\hat{P}H}{(1+r)^2} + - \cdots + \frac{\hat{P}H}{(1+r)^L} \tag{2}$$

$$V(1+r) = \hat{P}H + \frac{\hat{P}H}{(1+r)} + \frac{\hat{P}H}{(1+r)^2} + - \cdots + \frac{\hat{P}H}{(1+r)^{L-1}} \tag{3}$$

$$V - V(1+r) = \hat{P}H + \frac{\hat{P}H}{(1+r)^L} \tag{4}$$

$$V[1-(1+r)] = \hat{P}H[(1+r)^{-L} - 1] \tag{5}$$

$$V = \hat{P}H\left(\frac{1-(1+r)^{-L}}{r}\right) = \frac{\hat{P}H}{r'} \tag{6}$$

I then obtain r' under the assumption of L being very large, an therefore:

$$\lim_{L\to\infty}\left(\frac{r}{1-(1+r)^{-L}}\right) = r \tag{7}$$

Provided that:

$$r \in R \ \wedge \log(1+r) > 0$$

Which allows to make the following inference:

$$r' \equiv \left(\frac{r}{1-(1+r)^{-L}}\right) \tag{8}$$

This yields the following the following simplified equation:

$$V = \frac{\hat{P}H}{r} \tag{8}$$

I then introduce the property tax payment T which is the product of tax rate t:

$$T = tV \tag{9}$$

This allows me to produce the version of expression (1) accounting for tax outflows:

$$V = \sum_{y=1}^{L} \frac{\hat{P}H}{(1+r)^y} - \sum_{y=1}^{L} \frac{tV}{(1+r)^y} \tag{10}$$

Which can be then simplified to the form from expression (8):

$$V = \frac{\hat{P}H}{r} - \frac{tV}{r} \tag{11}$$

Expression (11) denotes fully capitalized property taxes. I can introduce the degree of capitalisation β:

$$V = \sum_{y=1}^{L} \frac{\hat{P}H}{(1+r)^y} - \sum_{y=1}^{L} \frac{\beta tV}{(1+r)^y} \tag{12}$$

Written in a simplified form which can be solved for V with the following steps:

$$V = \frac{\hat{P}H}{r} - \frac{\beta tV}{r} \tag{13}$$

$$V = \frac{\hat{P}H - \beta tV}{r} \tag{14}$$

$$Vr = \hat{P}H - \beta tV \tag{15}$$

$$Vr + \beta tV = \hat{P}H \tag{16}$$

$$V(r + \beta t) = \hat{P}H \tag{17}$$

This yields the following capitalisation equation:

$$V = \frac{\hat{P}H}{(r + \beta t)} \tag{18}$$

This can be rewritten as:

$$V = \frac{\hat{P}H}{r\left(1 + \frac{\beta}{r}t\right)} \tag{19}$$

I can take logs of both sides of the expression (19) yielding the following:

$$\ln(V) = \ln(\hat{P}) + \ln(H) - \ln(r) - \ln\,(1 + \frac{\beta}{r}t) \tag{20}$$

This expression is than suitable for empirical estimation.