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The Distributional Effects of Imputed Rent Taxation: A Case Study of The Netherlands

Thesis for the BSc in International Business Administration — Public Economics track

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Abstract

Imputed rent is an approximation of the value of the housing services that an owner-occupied dwelling provides its owner. Although its taxation is becoming increasingly rare, taxing imputed rent can generate a substantial tax revenue and has been shown to be an important measure in promoting homeownership. However, even in the Netherlands, one of the few countries where imputed rent taxation is still in place, the government has been gradually decreasing the imputed rent rate from 0.75% to 0.35% of a home's value between 2017 and 2023.

This thesis explores the distributional effects of this decrease in imputed rent taxation in the Netherlands. We examine both the distribution of paid taxes and the effect of the policy change on the monthly housing expenses per income quintile. For this, we developed a simple simulation model of the housing market using three different approaches.

In our baseline model, which assumes no changes in the housing market, we find that the decrease in imputed rent taxation results in a tax revenue decrease of over €2 billion per year. Notably, only around 11% of these tax savings benefit the lowest-earning 40% of households, whereas 44% of these savings benefit the highest-earning 20%.

Furthermore, we have also simulated the effects of this change in imputed rent percentage on the housing market, accounting for the low supply elasticity in the Dutch housing market. We find that the policy change has lead to a house price increase of approximately 3.7% and a rise in the equilibrium quantity of owner-occupied houses of 0.68%. In our second model, we account for these housing market changes when calculating the imputed rent tax paid per quintile. In this model, we observe the effect on the tax revenue to be approximately 4.5% smaller than in our baseline model.

Lastly, in our third model we assume that the house price change impacts all housing costs for owner-occupiers. In this scenari, we find that almost two-thirds of the tax decrease is offset by an increase in annual housing expenses of €286 on average.

We recommend policymakers to carefully reconsider the desirability of lowering or eliminating taxes on imputed rent. Our findings indicate that such policies significantly increase house prices and lower tax revenue, all while most of this tax benefit is offset by increased housing expenses in other areas. Furthermore, the vast majority of the tax benefit goes to the highest-earning households, and the increased house prices presumably make homeownership more difficult for new buyers.

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1 Introduction

Globally, the taxation of imputed rent on residential properties is becoming an increasingly rare yet highly impactful income taxation policy. Nearly all countries in the world tax the income generated by individuals' assets in at least some form, but very few tax the income from most people's largest asset: their house. The Netherlands, the case study subject for this thesis, stands out as one of the few countries worldwide where imputed rents from houses are still taxed. Even there, however, the percentage of a home's value included in its owner's taxable income has been gradually decreasing in recent years, making full imputed rent taxation an increasingly rare policy.

Imputed rent is an estimate of the value of the housing services a homeowner obtains from their house, and its taxation is a central topic in discussions surrounding homeownership taxation and homeownership promotion. Tax policies concerning the housing market significantly impact government budgets. Even in the Netherlands, imputed rent taxation still generated a tax revenue of around €2.8 billion in 2023 (Ministerie van Financiën, 2022), accounting for 3% of the total annual income tax revenue. This substantial tax contribution persists despite the government's recent reduction in imputed rent, decreasing the taxable percentage of most home values to decrease from 0.75% in 2017 to 0.35% in 2023.

However, the actual imputed rent homeowners obtain from their homes is significantly higher than 0.35% of its value. Eichholtz et al. (2021) estimated that the average real rate of return on rental housing in Amsterdam is around 4.8%. Therefore, full imputed rent inclusion in income taxation would yield substantial tax revenues, which could be used to relieve tax burdens on labor, for example.

Over the past few decades, imputed rent taxation has become much less commonplace. In 1993, still 9 out of 24 OECD countries taxed imputed rents (Gervais, 2002), but this number dropped to only 4 out of 38 OECD countries in 2022 (OECD, 2022). Simultaneously, housing affordability has become an increasing concern in almost any country, with government interventions playing an ever more important role in politics and the housing market itself (Coupe, 2021).

In the Netherlands in particular, housing policy was considered one of the most important election topics in the 2023 general election. Despite this, imputed rent taxation was not mentioned in any of the election manifestos of the five largest parties (D66, 2023; GroenLinks-PvdA, 2023; Nieuw Sociaal Contract, 2023; PVV, 2023; VVD, 2023). In fact, the only proposed changes parties are advocating for are further decreases or complete abolishment of imputed rent taxation. These changes are suggested both by conservative parties like ChristenUnie as well as progressive, left-wing parties such as PvdA and Volt, despite their typical focus on equitable housing policies (Christenunie, 2024; Partij van de Arbeid, 2020; Volt Nederland, 2023).

The reasons Dutch political parties prioritize housing market reforms are pressing. Compared to 2013, the Dutch housing market has experienced a significant increase in supply shortages and a doubling of prices (Mouissie & Kraniotis, 2023). Simultaneously, housing expenses for homeowners have decreased both relative to incomes and in absolute amounts (Mouissie & Kraniotis, 2023). This has made homeownership a financially very attractive form of living, for those who can attain it. However, the Netherlands has the largest inequality in homeownership rates between income quartiles of all OECD countries: among the wealthiest 25 percent of individuals, 93 percent own a house, compared to only 30 percent in the lowest income quartile (OECD, 2022).

The relevance of imputed rent taxation extends beyond just the Netherlands. Homeownership rates have been falling globally (OECD, 2022), amid an intensifying global debate surrounding the increasing wealth inequality. This discourse has been significantly influenced by works such as Piketty's "Capital in the Twenty-First Century" (2014), in which he argues that wealth inequality tends to worsen over time due to the fact that the return on assets has historically been consistently exceeding economic growth rates. Piketty's work highlights the crucial role of assets, including in housing, in sustaining and worsening inequality, especially in a time where the wealth and inheritance tax have been decreasing since the mid-20th century in many countries. Rognlie (2016) further emphasizes that a large majority of this widening inequality after World War II stems from the appreciation of house and land value. These works underscore the important role of housing taxation in contemporary policy discussions. Therefore, given the current economic conditions and the intensified debate on wealth inequality, a renewed analysis of imputed rent taxation is essential.

1.1 Research Objectives

The Netherlands' recent increase in house prices and homeownership rate inequality, together with their societal dissatisfaction with government housing policy and their recent decrease in imputed rent taxation, make them a particularly interesting case study subject for this thesis.

Therefore, this thesis is a case study in which we build a microsimulation of the housing market. We then calibrate this model with empirical data, in an effort to examine the impact of the reduction in imputed rent taxation in the Netherlands. The main research question this thesis tries to answer is:

What were the distributional effects of the lowering of the imputed rent percentage included in individuals' taxable incomes in the Netherlands between 2018 and 2023?

To answer this central question, we divide the research goal into three research subquestions:

1. *What is the effect of reducing the imputed rent percentage from 0.70% to 0.35% on after-tax housing expenses for homeowners across different income quintiles in the Netherlands?*
2. *How does this tax reduction affect house prices in the Netherlands, and to what extent does this moderate the effect on after-tax housing expenses for different income quintiles?*
3. *What are the consequences of this reduction on tax revenues, and which income quintiles derive the largest tax relief from this change?*

By answering these subquestions, we aim to gain a better understanding of the implications of decreasing imputed rent taxation. As prior research on the isolated effects of changing the imputed rent tax on the housing market is limited, we specifically seek to determine its effects on housing expenses across different income groups and on government tax revenues.

1.2 Thesis Overview

In the remainder of this paper, we first lay out the relevant literature related to imputed rent taxation in Section 2. In Section 3, we outline the economic model that we use to develop our findings, which we present in Section 4. Lastly, the discussion, our final conclusions, and their policy implications are outlined in Section 5.

2 Background

This section will outline the theoretical background relevant to this thesis, through detailing the historic and current regulations surrounding imputed rent taxation in the Netherlands in Section 2.1, as well as the relevant literature from comparable studies in Section 2.2.

2.1 Imputed Rent and the Dutch Housing Market

Imputed rent taxation has existed in the Netherlands for over a century, but in various forms. It was first introduced in 1892, when the *Wet op de Vermogensbelasting* was ratified (Tweede Kamer der Staten Generaal, 1981). This wealth tax law introduced a 4% imputed rate of return on all forms of wealth, including houses, to ease the process of levying taxes. However, this tax rate initially only applied to individuals whose wealth exceeded 14 thousand Dutch guilders, a threshold most households did not meet. In 1914, the imputed rate of return on housing was first formally defined as an imputed *rent* and integrated into the income tax domain. Simultaneously, they introduced a tax deduction for the maintenance costs and the mortgage interest paid by homeowners. Throughout the twentieth century, the imputed rent taxation policy changed numerous times. The imputed rent percentage of the home value varied substantially, reaching its peak in 1994 at 2.9%.

In 2001, the current imputed rent taxation system was introduced, removing all forms of wealth taxation on owner-occupied housing and fully integrating imputed rent into the newly-established *box 1* tax regime, which encompasses income from both labor and housing. This new legislation required a large majority of homeowners to declare 0.80% of their home value as taxable income.

Additionally, a bracketed system was introduced. The few homes valued below € 75,000 were subject to a lower imputed rent rate, while the value of a house exceeding the 'villa threshold' of € 975,000 had a 0% imputed rent rate, effectively introducing an imputed rent ceiling. However, in 2008, the Dutch government decided that this ceiling should be removed, because they reasoned that the part of the home value that exceeds the villa threshold is used more often for investment rather than pure consumption (Tweede Kamer der Staten-Generaal, 2007). Therefore, the imputed rent rate in the top bracket was increased between 2009 and 2016, since when it has been consistent at 2.35%.

In 2016, the 2.35% imputed rent above the villa threshold was then taxed at 52% if it fell into the top income tax bracket, resulting in an effective tax rate of approximately 1.18% on the value above the villa threshold. This imputed rent tax rate was likely intentionally aligned with the wealth tax rate in box 3 at the time, which was 1.2%.

The value of the villa threshold is irregularly indexed, although in most years, it increased less than the increase in home values, causing the share of homeowners that fall into this top bracket to have increased significantly since it was first introduced (Belasting-schijven.nl, 2016; CBS, 2024). The imputed rent percentage for the housing value below the villa threshold as well as the value above the villa threshold are shown in Table 1.

	'01	**'02**	**'03**	**'04**	**'05**	**'06**	**'07**	**'08**	**'09**	**'10**	**'11**	**'12**
IR% below threshold	0.80	0.80	0.80	0.85	0.60	0.55	0.55	0.55	0.55	0.55	0.55	0.60
IR% above threshold	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.80	1.05	1.30
	'13	**'14**	**'15**	**'16**	**'17**	**'18**	**'19**	**'20**	**'21**	**'22**	**'23**	**'24**
IR% below threshold	0.60	0.70	0.75	0.75	0.75	0.70	0.65	0.60	0.50	0.45	0.35	0.35
IR% above threshold	1.55	1.80	2.05	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35

Table 1: Historical imputed rent percentages included in homeowners' taxable incomes in the Netherlands, 2001-2024. The 'IR% below threshold' rows show the imputed rent percentages for houses valued between €75,000 and the villa threshold, whereas the other rows show the imputed rent percentage above this threshold. Source: Belasting-schijven.nl (2016)

Before 1994, homeowners in the Netherlands were asked to indicate their own estimate of their home value when filing their taxes. This changed with the *Wet waardering onroerende zaken* in 1995 (CBS, 2020b), when the WOZ value was introduced. The WOZ value is an annual estimation of a home value, calculated by municipalities according to a standardized computerized house price model. It is important to note that the government always uses the WOZ value from last year when performing their tax calculations. For example, when calculating the imputed rent for the purpose of determining the owed income tax in 2024, the government considers the WOZ value as of January 1, 2023.

Particularly in the Netherlands, imputed rent taxation cannot be viewed separately from mortgage interest deduction. Whereas imputed rent has to be added to an individual's taxable income, the interest paid over their mortgage may be deducted from their taxable income, providing considerable tax relief for homeowners (Belastingdienst, 2024a). Together, they comprise the two most important tax measures related to housing in the Netherlands, although the impact of the mortgage interest deduction is much larger. CBS (2022a) calculated that the annual deduction of home expenses amounted to 26.5 billion euros in 2020, whereas the imputed rent that was taxed amounted to only 8.8 billion euros.

After the introduction of *Wet Hillen* in 2005, imputed rent taxation and mortgage interest deduction became even more intertwined. This law introduced a tax deduction for homeowners for whom the imputed rent was higher than their mortgage interest deduction. For these homeowners, the Wet Hillen deduction was determined to be exactly this difference, such that from then on, imputed rent was no longer an income that was taxed, but it now acts solely as a reduction in deductible housing expenses. The law came in place to stimulate homeowners to pay off a larger portion of their mortgages (Belastingdienst, 2024b). Twelve years later, however, the government decided to phase out the Wet Hillen deduction over a period of 30 years, starting in 2019 (Tweede Kamer der Staten-Generaal, 2017).

Important financial institutions and economists in the Netherlands have pleaded for government reforms regarding the tax benefits of owner-occupied housing for years now. The Dutch central bank (2021) claims that the current distinction in tax treatment between houses and other forms of wealth creates an undesirable, significant tax incentive to buy instead of rent a house. Furthermore, they state that these tax incentives are one of the causes of the strongly underdeveloped private rental sector and of the recent sharp increase in house prices.

Therefore, they advocate for the removal of mortgage interest deductions and the introduction of a tax on net wealth in housing. They suggest performing this by shifting owner-occupied homes from box 1 to box 3, where income from wealth is taxed. In box 3, they would tax housing wealth at the imputed rate of return of houses, which would likely be at a similar rate to an imputed rent tax. The Netherlands Bureau for Economic Policy Analysis (2020) projected this hypothetical reform to moderate the price increase of houses by two-thirds between 2021 and 2025. They projected that without a tax reform, home prices would increase by 15%, but when shifting owner-occupied homes to box 3, this increase decreased to 5%.

Cnossen and Jacobs (2019) similarly call for an equalization of the taxation of wealth in owner-occupied housing and in other forms of wealth. They argue that this can be done by gradually increasing the imputed rent percentage until its taxation has reached the same level that other forms of capital are taxed at. In box 1, where income is taxed at a top rate of 49.5%, this means that the imputed rent percentage would have to be between 1.8% and 2.4% to match the wealth tax rate. Furthermore, they argue that the tax benefit from mortgage interest deduction should be capped at 30% of the paid interest, in order to match the wealth tax rate of around 30%. Then, taxation on houses can be moved to box 3.

In another article, Jacobs (2023) calls for the same change, and claims that these tax changes could be used to severely lower tax rates on labor and profit. Removing the tax subsidies on housing would be a budget advantage of tens of billions of euros annually, which could be used to lower tax rates on labor and business. He reasons that this would make the tax system less harmful to the economy, which currently subsidizes living off investments (such as in housing), while punishing labor and entrepreneurship.

2.2 Relevant Literature

Already in 1943, one of the first influential works on imputed rent taxation was written by Marsh (1943). In this paper, Marsh states that imputed rent taxation would cause a significant shift from homeowning to renting, as 'marginal homeowners' (homeowners for whom paying their house is financially challenging) would choose to sell their house, and start renting instead. Moreover, he reasons that the removal of the favorable tax treatment of imputed rent increases the economic efficiency, because an optimal allocation of resources (or in this case of investment types) is the allocation that is chosen when there is no interference through taxes. Therefore, he argues that an introduction of an imputed rent tax would increase society's overall welfare.

Decades later, Gervais (2002) had similar findings from the economic simulation he performed. In this simulation, he modeled household behavior by presenting them with the choice to either save or consume the money they earned through labor or asset holdings in each period. Their consumption can either go to housing services or other goods, and asset holdings are either in housing, business capital or deposits at financial institutions. In case households choose to spend money on housing services, they have to choose whether to rent or buy when spending money on housing services, and when houses are bought, households face both an imputed rent taxation as well as a mortgage interest deduction.

Then, after modeling these decision problems, he defined the budget constraints and the optimization problem that households fase during each time period. Through this, he found that implementing imputed rent taxation caused households to strictly prefer renting over homeowning if the tax on imputed rents is lower than the tax rate on other types of wealth. Moreover, he observed that individuals' diverged a large portion of their investments from housing to business capital, suggesting that the current preferential tax treatment of housing is crowding out business capital.

Lastly, by estimating the welfare effects these changes had through measuring the utilities derived from lifetime consumption, he found that introducing imputed rent taxation increased welfare for all income quintiles, but most strongly so for the poorest quintile. The latter is due to the fact that in his model, the bottom quintile has no homeowners and thus only benefits from a tax increase because imputed rent taxation allows for a decrease in income taxes of over 14 percent. The general positive welfare effect, they claim, is due to the fact that the wedge between the return on housing capital and other assets is now removed. This leads to a reduction in over-investment in housing, which in turn results in a flatter consumption pattern across individuals' lifetimes, which increases their welfare.

On the other hand, Rotberg and Steinberg (2024) found through their simulations that when subsidizing homeownership, the effectiveness of the measures applied heavily depends on the conditions of the rental market. They found these conditions to be a deciding factor in determining whether imputed rent taxation is welfare-improving or not. Their modeling approach was (intentionally) very similar to Gervais', but contrary to his, they developed an additional model in which there was a limited supply elasticity of rental properties, and a high share of cost-burdened renters (i.e., renters who spend the majority of their income on rent).

They considered the limited supply elasticity to be a particularly interesting feature due to the high likelihood of this being the case in urban areas. Furthermore, they regarded a high share of cost-burdened renters to also be an important consideration due to the large welfare effects that a rent increase has on them. They then calibrated this model and their baseline model (without cost-burdened renters and with an infinite supply elasticity) mostly using data from the 2019 Survey of Consumer Finances.

Firstly, in their baseline model, their results show that the introduction of imputed rent taxation causes a house price decrease of 8.0%, and has a positive effect on aggregate welfare (measured as the ex-ante expected lifetime utility derived from consumption). The largest benefit goes to the lowest income groups, similar to other researchers' findings.

Then, they included a much lower, more realistic supply elasticity of 1.4 and a share of cost-burdened renters of 15.1%. This extended model found that the inclusion of imputed rent taxation actually had a *negative* impact on aggregate welfare, contrary to what other studies had found. They claim that the difference between their findings and those of others can be explained by the increased impact of imputed rent taxation on the welfare of renters, which is caused by two factors. First, the lower supply elasticity causes the increased demand on the rental market (due to the decreased attractiveness of homeownership) to have a bigger impact on rents than in a scenario with an infinite supply elasticity. In this model, rents increased by 16.5% due to the introduction of imputed rent taxation. Second, a price increase on the rental market has a stronger impact on aggregate welfare when including a higher share of cost-burdened renters, as the impact on their welfare of a rent increase is much stronger.

Poterba (1984) also finds through theoretical models of U.S. capital markets that the American failure to tax imputed rents has a significant impact on the housing market. His model uses an asset-market framework where he modeled the interaction between housing and other forms of capital when accounting for factors such as interest rates, tax rates, and house prices. He found that when imputed rent is taxed at 25%, this would lower house prices by 13% in the short run. Furthermore, he found that it would decrease the number of owner-occupied houses by one-sixth, thereby also strongly increasing the supply on the private rental market.

Finally, the Netherlands Institute for Social Research (SCP, 2017) frequently researches the distributional impact of various tax policies in the Netherlands. They analyzed the annual costs associated with the Dutch government's undervaluation of the imputed rent, using data from the triannual WOoN research and CBS data on household expenditure categories. With the latter, they calculated that the net market rental value of an owner-occupied home is 3.35% of the WOZ value.

Using this valuation and the data from the WOoN research, they found that in 2014, the government's underestimation of imputed rent taxation cost the Dutch government more than €10 billion. Of this tax subsidy, more than 40% benefited the highest-earning decile, while less than 15% went to the bottom five deciles. This serves as an early indicator of the distribution of the monetary benefit from not taxing imputed rent (and conversely, the burden of taxing it). However, unlike our study, they did not include the effects of imputed rent on house prices and, consequently, on housing expenses.

3 Methodology

This thesis is a microsimulation based on empirical data in which we estimate the distributional effects of the decrease in imputed rent from 0.70% to 0.35% in the Netherlands. Besides considering the ceteris paribus effects of this decrease, we also implement two models that take into account the effect that imputed rent taxation has on housing demand and house prices. For this, we have developed an economic model to predict changes in housing expenses, house prices and tax revenue per standardised income quintile. We then calibrated this model using data from CBS. This section first outlines the assumptions made and the terminology used in our model in Sections 3.1 and 3.2, respectively. Then, our model of the housing market is detailed in Section 3.4. In Section 3.3, we specify the three modeling approaches we used to model the effect of a change in the housing market due to a change in imputed rent taxation on housing expenditure. Lastly, our implementation and calibration of the model is explained in Section 3.5.

3.1 Assumptions

Our work rests on several assumptions and simplifications, which are described and substantiated in this section. The assumptions made are as follows:

1. *Demand elasticities are equal for all income quintiles, and relative changes in house prices are equal among all segments of the housing market.*

2. *The average amount of wealth in owned homes for each income quintile is equal to the average WOZ value of that quintile's houses.*

3. *The average housing expense of the ith* ***disposable*** *income quintile is equal to the average housing expense of the ith* ***standardized*** *income quintile.* This assumption is necessary because of limited data availability.

4. *All housing costs for owner-occupied houses other than imputed rent are a constant share of the WOZ value of the house. In other words, α, as specified in Section 3.2, remains constant over time, even as house prices change.*

5. *In 2018, the marginal tax rate was 40.85% for every household in the first three quintiles and 52.0% for every household in the fourth and fifth quintiles.*

   We make this assumption because, given that the average tax credit is approximately 10.5% of a household's gross income (CBS, 2020a), a taxable income of €68.508 (the threshold to fall into the 52% tax bracket) yields a net income of approximately $Y_{\text{net}} \approx 68{,}508 - (0.4085 \cdot 68{,}508 - 0.10 \cdot 68{,}508) =$

€47,373.28 (Belastingdienst, 2023). CBS (2023a) reports that from the decile fourth quintile onwards, the average disposable household income is above this threshold.

6. *All households have an equal imputed rent percentage.*

   We make this assumption because the average home values for all quintiles fall in the same imputed rent bracket. While there are of course houses worth more and less than these averages, houses worth under € 75,000 are extremely rare in practice, and less than 40.000 houses were worth over €1 million in 2017, suggesting that the share of homes in the higher imputed rent bracket is small (Calcasa, 2023). Nonetheless, this could cause our model to substantially underestimate imputed rent for higher income quintiles.

7. *Wet Hillen does not apply.*

   Even though this simplification causes our model to overestimate the taxed imputed rent for many households, CBS (2018) found that the average household that uses a Wet Hillen deduction does not have a particularly higher income than the average household that does not use the deduction, suggesting that the difference in relative impact of the measure between quintiles could be relatively small.

3.2 Terminology

Before we can provide the mathematical specification of our models, certain terminology needs to be defined. In general, we wish to establish two formulas, $\text{irt}_i(\pi)$ and $m_i(\pi)$, where irt_i yields the average imputed rent tax of a household in quintile i, and m_i yields the average monthly net housing expenses for households in quintile i. Both of these formulas are expressed in terms of the imputed rent percentage π. Here, quintile i refers to the 20%-groups of households when divided into equal-sized quintiles based on disposable household income.

Besides having the imputed rent percentage as a variable, the model is also dependent on several other *constant* inputs, that should all be defined for the starting period of the model, which are:

- $\overline{P_i}$, the average last-year WOZ value of home-owning households in quintile i,
- h_i, the number of homeowners in quintile i,
- τ_i, the marginal tax rate for households in quintile i.

With this, we can model the average imputed rent taxation $\text{irt}_i(\pi)$ of a household in quintile i based on the current imputed rent percentage π as

$$\mathrm{irt}_i(\pi) = \pi \cdot \overline{P_i} \cdot \tau_i. \tag{1}$$

Lastly, to better express our equations for house prices, we divide the housing costs incurred over time by owners into two components for each quintile i: the imputed rent tax I and all other costs. These costs include all upfront and periodic costs such as the purchase, mortgage, maintenance costs, taxes and tax benefits associated with the purchase of a house. Both α and I are defined as shares of the purchase price of the house, and averaged across all homeowners.

3.3 Housing Market Model

For the purpose of our second and third modeling approaches (as specified in Section 3.4), we have developed a simulation of the market for owner-occupied houses. With this, we aim to model the difference in house prices as a function of the new imputed rent percentage. This section specifies this model's construction.

If we define Q_s to be the aggregate supply of houses, we have $Q_s(P_s)$, i.e., Q_s is a function of the 'producer' prices P_s. Here, producer prices are simply the prices received by the seller of a house. Similarly, the aggregate demand Q_d is a function of the consumer prices P_d, which depend on the producer prices of houses themselves, as well as on all additional upfront and periodic net costs faced by the consumer. Given the definitions of I and α from before, this means we can write $P_d = P_s \cdot (I + \alpha)$.

Writing $q_d^i(P_d)$ for the total demand from quintile i, we can then define the aggregate demand Q_d as $Q_d(P_d) \equiv \sum_{i=1}^{5} q^i(P_d)$. In equilibrium, the aggregate demand must be equal to the aggregate supply, i.e.,

$$Q_d(P_d) = Q_s(P_s) = Q_s\left(\frac{P_d}{\alpha + I}\right). \tag{2}$$

Then, if we want to determine the change in equilibrium quantity, we take the derivatives of both sides, and get:

$$\mathrm{d}Q_d = \frac{\partial Q_d(P_d)}{\partial P_d} \cdot \mathrm{d}P_d = \mathrm{d}Q_s = \frac{\partial Q_s(P_s)}{\partial P_s} \cdot \mathrm{d}P_s. \tag{3}$$

Given that the demand and supply elasticities ε_d and ε_s are defined as $\varepsilon_s \equiv \frac{\partial Q_s(P_s)}{\partial P_s} \cdot \frac{P_s}{Q_s}$ and

$\varepsilon_d \equiv -\dfrac{\partial Q_d(P_d)}{\partial P_d} \cdot \dfrac{P_d}{Q_d}$, we can rewrite this change in quantity in terms of the elasticities as follows:

$$\mathrm{d}Q_d = \left(\frac{Q_d}{Q_d} \cdot \frac{P_d}{P_d}\right) \frac{\partial Q_d(P_d)}{\partial P_d} \cdot \mathrm{d}P_d = \mathrm{d}Q_s = \left(\frac{Q_s}{Q_s} \cdot \frac{P_s}{P_s}\right) \cdot \frac{\partial Q_s(P_s)}{\partial P_s} \cdot \mathrm{d}P_s, \tag{4}$$

$$\frac{Q_d}{P_d} \cdot \frac{P_d}{Q_d} \cdot \frac{\partial Q_d(P_d)}{\partial P_d} \cdot \mathrm{d}P_d = \frac{Q_s}{P_s} \cdot \frac{P_s}{Q_s} \cdot \frac{\partial Q_s(P_s)}{\partial P_s} \cdot \mathrm{d}P_s, \tag{5}$$

$$-Q_d\left(P_d\right) \cdot \varepsilon_d \cdot \frac{\mathrm{d}P_d}{P_d} = Q_s\left(P_s\right) \cdot \varepsilon_s \cdot \frac{\mathrm{d}P_s}{P_s}. \tag{6}$$

Furthermore, given the fact that α is constant using Assumption 4, observe that

$$\frac{\mathrm{d}P_d}{P_d} = \frac{\mathrm{d}P_s}{P_s} + \frac{\mathrm{d}I}{\alpha + I} + \frac{\mathrm{d}\alpha}{\alpha + I} = \frac{\mathrm{d}P_s}{P_s} + \frac{dI}{\alpha + I}. \tag{7}$$

Plugging in this equation for the relative change in price and using the fact that $Q_s = Q_d$ in equilibrium, we conclude that:

$$-Q_d\left(P_d\right) \cdot \varepsilon_d \cdot \left(\frac{\mathrm{d}P_s}{P_s} + \frac{dI}{\alpha + I}\right) = Q_s\left(P_s\right) \cdot \varepsilon_s \cdot \frac{\mathrm{d}P_s}{P_s}, \tag{8}$$

$$-\varepsilon_d \cdot \frac{\mathrm{d}P_s}{P_s} - \varepsilon_d \cdot \frac{dI}{\alpha + I} = \varepsilon_s \cdot \frac{\mathrm{d}P_s}{P_s}, \tag{9}$$

$$-\left(\varepsilon_d + \varepsilon_s\right) \cdot \frac{\mathrm{d}P_s}{P_s} = \varepsilon_d \cdot \frac{dI}{\alpha + I}, \tag{10}$$

$$\frac{\mathrm{d}P_s}{P_s} = -\frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} \cdot \frac{dI}{\alpha + I}. \tag{11}$$

Now, finally, by defining the tax-shifting coefficient Δ as $\Delta \equiv \frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s}$ and the share of imputed rent tax in the total housing costs ω as $\omega \equiv \frac{I}{\alpha + I}$, we can write for the relative change in equilibrium price and quantity:

$$\frac{\mathrm{d}P_s}{P_s} = -\Delta \cdot \omega \cdot \frac{\mathrm{d}I}{I} \tag{12}$$

$$\frac{\mathrm{d}Q_s}{Q_s} = -\Delta \cdot \omega \cdot \frac{\mathrm{d}I}{I} \cdot \varepsilon_s \tag{13}$$

In other words, assuming that the share of all other homeownership costs remains constant, the relative change in house prices is equal to the product of the tax-shifting coefficient, the share of imputed rent tax in the total housing costs, and the relative change in imputed rent.

3.4 Modeling Approaches

To model the impact of a changed imputed rent taxation policy on household expenses and tax revenues, we use three different models, implementing three degrees at which the impact of the imputed rent tax on the housing market influences our dependent variables.

First, for our baseline model, we compute the effects of the change in imputed rent percentage for households across different standardized income quintiles before and after the reduction, without taking into account the potential effects the measure might have on the housing market. In other words, we assume the change in housing expenses is equal to the change in imputed rent taxation, and the change in tax revenue is simply the sum of these imputed rent changes.

Then, for our second model, we also consider the effect of the decrease in the imputed rent on house prices, and the effect of this house price change on the imputed rent taxation. For this, we will first compute the effect that the change in imputed rent percentage has on house prices and housing supply (as per our housing market model in Section 3.3), and then re-calculate the imputed rent paid by each quintile.

Lastly, in our third model, we not only consider the effect that this house price change has on imputed rent taxation, but also its effect on monthly home expenses in general. This model assumes that all home expenses grow proportionally to the home value in the long term. CBS defines net housing expenses, as net mortgage expenses, real estate taxes, homeowner's insurance, imputed rent taxes, and maintenance costs. These taxes and the insurance by definition grow proportionally to the house price (CBS, 2022b). Then, in the long term, as houses get refinanced and new first-time homebuyers enter the housing market, mortgage payments should also go up proportionally to house prices. This only leaves the maintenance costs that potentially do not increase proportionally to real estate prices, but given the large share of the costs that the other elements comprise, our third model could still be very close to reality given enough time.

Lastly, for all three models, we can now define the changes in imputed rent tax revenue for each quintile, $\mathrm{d}T_i$, the change in total imputed rent tax revenue, $\mathrm{d}T$, and the change in average monthly housing expenses per quintile i, $\mathrm{d}m_i$, in terms of an old and new imputed rent tax rate π_0 and π_1.

The government's imputed rent tax revenue $T(\pi)$ is simply the product of the imputed rent tax per household and the number of home-owning households, summed over each quintile, i.e., $T(\pi) = \sum_{i=1}^{5} h_i \cdot \mathrm{irt}_i(\pi)$. For the baseline model, this means that the change in taxes caused by the imputed rent change, is simply the per-household tax difference multiplied by the number of households. For the second and third model, however, the amount of households h_i and the new imputed rent tax $\mathrm{irt}(\pi_1)$ need to be incremented by the change in quantity and price on the housing market, respectively. This gives:

$$\mathrm{d}T = \sum_{i=1}^{5} dT_i(\pi_0, \pi_1), \text{ where} \tag{14}$$

$$\mathrm{d}T_i = \begin{cases} h_i \cdot \mathrm{irt}_i(\pi_1) - h_i \cdot \mathrm{irt}_i(\pi_0) & \text{in the baseline model,} \\ \Big(h_i \cdot (1 + \frac{\mathrm{d}Q_s}{Q_s})\Big) \cdot \Big(\mathrm{irt}_i(\pi_1) \cdot (1 + \frac{\mathrm{d}P_s}{P_s})\Big) - h_i \cdot \mathrm{irt}_i(\pi_0) & \text{in the second and third model.} \end{cases} \tag{15}$$

The change in monthly housing expenses per household in quintile i, m_i, also depends on which model is chosen. In the baseline model, the only change in housing expenses is given by the change in imputed rent tax. In the second model, however, the imputed rent tax that households pay not only changes due to the increase in imputed rent percentage, but also because of the increase in house price. Finally, in the third model, the new housing expenses are given by the housing expenses when recomputed with the new imputed rent tax, and then incrementing this amount by the house price change rate. For this model, the change in monthly expenses is given by subtracting this new amount by the old amount m_i.

$$\mathrm{d}m_i = \begin{cases} \frac{1}{12} \cdot (\mathrm{irt}_i(\pi_1) - \mathrm{irt}_i(\pi_0)) & \text{in the baseline model,} \\ \frac{1}{12} \cdot \Big(\mathrm{irt}_i(\pi_1) \cdot (1 + \frac{\mathrm{d}P_s}{P_s}) - \mathrm{irt}_i(\pi_0)\Big) & \text{in the second model.} \\ (m_i - \frac{1}{12}\mathrm{irt}_i(\pi_0) + \frac{1}{12}\mathrm{irt}_i(\pi_1)) \cdot (1 + \frac{\mathrm{d}P_s}{P_s}) - m_i & \text{in the third model.} \end{cases} \tag{16}$$

3.5 Model Implementation and Data Collection

With this model of housing expenses and tax revenue, we now need to find the inputs for this model using reliable data sources. We chose to source our data from CBS (Centraal Bureau voor de Statistiek, or Statistics Netherlands), the national statistics office of the Netherlands.

First, we determine the base year for our data collection based on the most infrequent data source used, which is the data on net monthly housing expenses for homeowners. These data stem from CBS (2022c), who perform the triennial WoON research together with the Dutch Ministry of the Interior. We would have preferred to measure the effect of the imputed rent change in 2017, as this was the year with the highest imputed rent percentage since 2004, and after 2017 the imputed rent percentage has only decreased. However, there were no data available on housing expenses in this year. Therefore, we chose 2018 as the base year for our model's implementation, and analyzed the change in imputed rent from 0.70% (in 2018) to 0.35% (in 2023).

Then, for each quintile, we can obtain our data on the number of homeownersand the average WOZ value per household from CBS (2023b). This CBS table provides data on the wealth components of each standardized income quintile's wealth. The first property can be obtained directly from the 2018 data in this table and, given Assumption 2, we can obtain the average WOZ values per household using the housing wealth from the 2017 data in this table. We can use these data to compute $\text{irt}_{\text{i}}(\pi)$ for each quintile.

From the WOoN research data we can derive the value of ω for our housing market model. For this, we divide $\text{irt}_i(\pi)$ by the annual housing expenses from the data for each quintile. Then, we take the weighted average of this value, by weighing the outcomes by the amount of homeowners in each quintile.

Finally, the last necessary values are those of ε_d and ε_s. Öztürk et al. (2018) found that the Dutch housing market can be characterized by having a very low supply elasticity, mostly in its major cities. This is caused both by geography-related supply constraints as well as strict building regulations impairing the construction of new houses. They refer to the work of Caldera and Johansson (2013), who investigated the price elasticities of housing supply in all OECD countries. For the Netherlands, Caldera and Johansson found that $\varepsilon_s = 0.186$. Vermeulen and Rouwendal (2007) claim that few studies have been done on housing supply elasticities outside of the United States. They themselves find that housing supply is almost fully inelastic in the short run, with a supply elasticity between 0.037 and 0.046.

Koning, Saitua Nistal, and Ebregt (2006) approximated the supply elasticity to be significantly higher, however, at 0.65, based on what best fit their housing market model data. Most researchers seem to agree, though, that the price elasticity of Dutch housing supply is very low and much lower than in for example the United States. The elasticity in the Netherlands most probably lies anywhere between 0 and 0.6. For our base model, we will assume Caldera and Johansson's estimate of 0.186.

Housing demand in the Netherlands appears to be more elastic on the other hand, although it has been studied even less extensively than housing supply. The two most relevant estimates of demand elasticity in terms of geographical proximity and recency stem from Ras et al. and Ermisch et al. Ras, van Gameren, and Eggink (2005) estimated the price elasticity of demand for owner-occupied housing in the Netherlands to be 0.44. Similarly, Ermisch, Findlay, and Gibb (1996) found that in the United Kingdom, $\varepsilon_d = 0.4$. For our model implementation, we will use the value found by Ras et al., i.e., assume that $\varepsilon_d = 0.44$. Because our results strongly depend on our assumptions for the supply and demand elasticities of the housing market, we have analyzed the sensitivity of our results to these elasticity estimates, as described in Section 4.3.

4 Results

After developing our economic model for the housing market, specifying the three scenarios to test this model on, and determining our data sources, we were able to estimate the effects of the imputed rent percentage decrease. This section outlines all of our findings regarding our model's input data, output results, and validity in Sections 4.1, 4.2, and 4.3, respectively.

4.1 Input data

First of all, the input data we obtained for our model, as per the methods described in Section 3.5, are shown in Table 2. From these data, we observe that it does not necessarily hold that people from a higher income quintile own higher-valued houses. In fact, the first quintile's average home value is higher than both the second and third quintile's home values. This is caused by people who have reached retirement age and thus have a low income, but potentially still have a high wealth. While this causes the average imputed rent tax for the lowest income quintile to be disproportionately high, the effect of this on tax revenues is strongly moderated by their significantly lower homeownership rate.

Quintile	WOZ value	Homeowners	Average monthly housing expense	
			Including IRT	Excluding IRT
1	€ 254,451	174,100	€ 357	€ 296
2	€ 219,184	497,300	€ 474	€ 422
3	€ 227,238	1,036,800	€ 579	€ 525
4	€ 254,099	1,274,700	€ 718	€ 641
5	€ 352,182	1,386,500	€ 952	€ 846

Table 2: The input data gathered from the aforementioned CBS sources (2022c; 2023b). The columns respectively indicate the estimated WOZ value on January 1, 2017, the number of homeowners in 2018, and the average monthly housing expense for homeowners in 2018, for each equal-sized standardized income quintile of approximately 1.5 million households. We computed the monthly housing expenses excluding imputed rent tax (IRT) ourselves by subtracting $\text{irt}_i(0.0070\%)$ from the expenses including IRT.

With these data, we can also easily use our model to deduce how the total paid imputed rent tax is divided over the quintiles. This is because this share is only dependent on the number of homeowners, the average WOZ value, and the marginal tax rate per quintile. Even though the absolute figures of the imputed rent tax revenue per quintile are dependent on all those factors as well as on the imputed rent percentage itself, the shares of imputed rent tax paid per quintile are independent of the imputed rent percentage. This holds even when considering the potential house price increase that an imputed rent percentage change can cause, because this house price increase has a proportional effect on the paid imputed rent tax for all quintiles. The distribution of the paid imputed rent tax is shown in Figure 1.

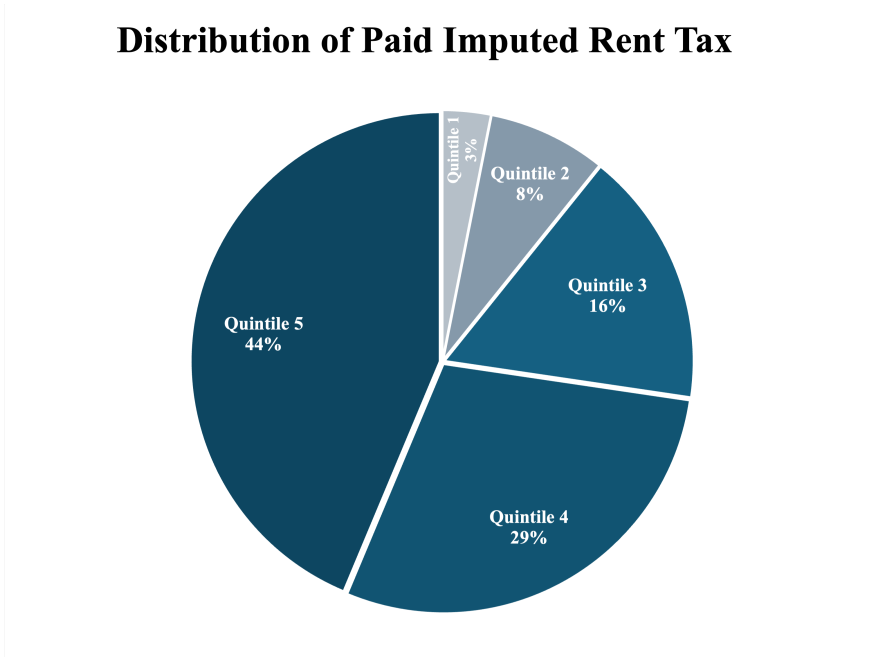

Figure 1: A pie chart showing the share of the total paid imputed rent tax per quintile, based on the data available for fiscal year 2018. Source: CBS (2023b) and own work.

4.2 Model output

This section outlines the results obtained using our models, given the above data. For all three models, we present their findings on the impacts of the decrease in imputed rent on housing expenses and tax revenues for all quintiles.

First, we consider the outcomes of our baseline model. Using the values from Table 2, we were able to estimate the monthly housing expenses if the imputed rent percentage had been 0.35% using Equation 3.4. The results of this are shown in Table 3.

Quintile	Monthly housing expense (IR=0.70%)	Monthly housing expense (IR=0.35%)
1	€357	€327 (-8.5%)
2	€474	€448 (-5.5%)
3	€579	€552 (-4.7%)
4	€718	€679 (-5.4%)
5	€952	€899 (-5.6%)

Table 3: The results of our baseline model: the average monthly total housing expenses per quintile in 2018, at the actual imputed rent of 0.70% and when the imputed rent had been 0.35% of the home value. The numbers in parentheses in each cell indicate the decrease in average monthly housing expenses caused by this decrease in imputed rent.

At first glance, it may appear as if this imputed rent decrease benefits lower-income households the most. However, since the homeownership rate in the first two quintiles is significantly lower than in the other three quintiles, the share of the total savings on housing expenses for these quintiles is significantly lower too (as discussed and shown in Figure 2 below). For all quintiles combined, the imputed rent tax revenue in our baseline model was halved, from approximately €4.05 billion per year to €2.03 billion per year.

For our second and third models, we first computed the relative change in house prices due to the decrease in imputed rent percentage. For this, we first compute $\frac{I}{\alpha+I}$, i.e., the weighted average of the imputed rent relative to the total housing cost, weighed by the amount of households per quintile. Given the inputs from Table 2, this gives $\frac{I}{\alpha+I} \approx 0.1084$.

Then, using that $\frac{dI}{I}$ in our scenario is -0.5 and that the tax-shifting coefficient is $\frac{\varepsilon_d}{\varepsilon_d+\varepsilon_s} = \frac{0.44}{0.44+0.186} \approx 0.70$, we obtain a relative change in house prices of $\frac{\mathrm{d}P_s}{P_s} \approx -0.70 \cdot 0.1084 \cdot -0.5 \approx 0.0381$, i.e., a 3.81% increase in house prices caused by the decrease in imputed rent. The change in equilibrium quantity becomes $\frac{\mathrm{d}Q_s}{Q_s} \approx 0.0370 \cdot 0.186 \approx 0.0068$, i.e., a 0.68% change in the quantity of owner-occupied housing.

Using this house price change of 3.81% to implement models 2 and 3, we obtain the housing expenses per quintile as shown in Table 4.

Quintile	**Average monthly housing expenses**		
	IR=0.70%: 2018 data	**IR=0.35%: Model 2**	**IR=0.35%: Model 3**
1	€ 357	€ 328 (-8.2%)	€ 339 (-5.1%)
2	€ 474	€ 449 (-5.3%)	€ 464 (-2.1%)
3	€ 579	€ 553 (-4.5%)	€ 572 (-1.2%)
4	€ 718	€ 681 (-5.2%)	€ 704 (-1.9%)
5	€ 952	€ 901 (-5.4%)	€ 932 (-2.1%)

Table 4: The results of our second and third models: the average monthly total housing expenses per quintile in 2018, compared to the average expenses had the imputed rent been 0.35% as projected by our second and third models.

Here, we observe that in model 2, the house price increase does not lead to major differences in monthly expenses compared to our baseline model. This is easily explained by the fact that in model 2, only the imputed rent tax changes along with the house price change, causing only a (relatively insignificant) expense change in the imputed rent tax paid by households, of 3.81%.

In both the second and third model, the total imputed rent tax revenue is approximately 4.5% higher than in our baseline model, as the tax revenue increases by both the change in house prices as well in quantity. This brings the total tax revenue to € 2.12 billion, with the distribution of this tax revenue being the same as in the basline model, as shown in Figure 1.

However, with model 3, almost two-thirds of the benefit of the decrease in taxes is offset by an increase in other housing expenses, making the total decrease in annual housing expenses due to the tax relief only € 723 million. The first quintile is relatively least affected by this house price increase, again suggesting that the imputed rent decrease benefits them the most.

On the other hand, when taking into account that the lowest income quintiles have the lowest homeownership rates, we again observe that the total annual savings for the entire quintiles are significantly larger for the highest-earning households. A comparison of the total annual savings per quintile for each model is shown in Figure 2 below.

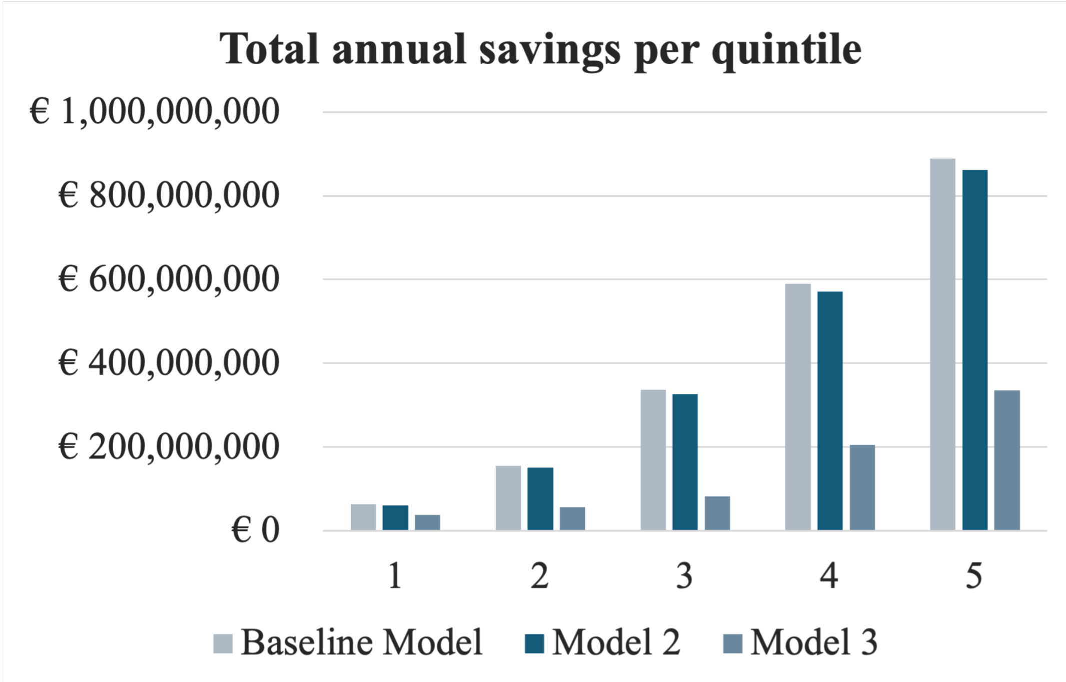

Figure 2: A graph showing the total benefit per quintile, when comparing the total annual housing expenses in 2017 from CBS (2022c) with the situation where the imputed rent had been 0.35% as estimated by our three models. The accompanying numerical data belonging to this chart are shown in Appendix A.

4.3 Model validation

Lastly, we validate our findings both through comparing our data with research from CBS and the Dutch Ministry of Finance, and by measuring the sensitivity of our results to our assumptions of supply and demand elasticity.

First of all, our model estimates the average monthly imputed rent to be €160.35, which is very much in line with CBS's (2020a) estimated average monthly imputed rent of €162.11 (CBS, 2020a). Second, our model's estimated total imputed rent tax revenue is €4.07 billion, which is almost 800 million euros higher compared to the Ministry of Finance's estimate of €3.283 billion (Ministerie van Financiën, 2017). However, this difference can largely be explained by our exclusion of Wet Hillen, given that, for the same year, CBS estimated the Wet Hillen deduction to be approximately €1.9 billion, which, at an average marginal tax rate (from our model) of 47.6%, would cause a tax credit of €905 million. Therefore, both of these differences seem to be within very reasonable margins, suggesting our model computes the imputed rent tax reasonably well.

Lastly, since our results are presumably very sensitive to our estimates of the supply and demand elasticities of owner-occupied housing in the Netherlands, we analyzed how strongly our results change based on the values of ε_d and ε_s. For this, we re-evaluated our housing market model for different values of ε_d and ε_s, by computing the new house price change and the new total annual savings in model 3. The results of this are shown in Table 5.

ε_d	ε_s	**House Price Change**	**Total Expenses Change**
	0	5.42%	€0.11 billion
0.2	0.186	2.81%	€1.04 billion
	0.5	1.55%	€1.49 billion
	0	5.42%	€0.11 billion
0.44	0.186	**3.81%**	**€0.68 billion**
	0.5	2.54%	€1.15 billion
	0	5.42%	€0.11 billion
1	0.186	4.57%	€0.41 billion
	0.5	3.61%	€0.76 billion

Table 5: The average house price increase and the total estimated annual expense change in model 3, for different values of the supply and demand elasticity of housing. The results belonging to the two elasticity values we assumed in our model are highlighted in bold.

The results for the house price increase are as expected. The greater the supply elasticity relative to the demand elasticity, the lower the tax-shifting coefficient, resulting in a smaller home price increase. The situation where housing supply is fully inelastic is of particular interest. In theory, in a market with fully inelastic supply one would expect a tax decrease to be fully compensated by an increase in price. In our model, this is almost the case, where almost 95% of the tax decrease is compensated with an increase in housing expenses. This indicates that our model estimates relatively well a change in housing expenses relatively well.

Still, this table shows that our results are highly dependent on our estimate of the supply and demand elasticities. In particular, if it turns out that the demand is relatively inelastic and the supply is relatively elastic, this would mean that the decrease in imputed rent taxation has actually significantly benefited homeowners, contrary to what our current results indicate. As mentioned in Section 3.5, however, there is a consensus among economists that the Netherlands has a relatively inelastic supply of housing.

5 Discussion and Conclusion

In this section, we address the limitations of this research and present our suggestions for further research based on this. Furthermore, we use the results from Section 4 to answer our research questions as well as discuss the implications of our research for future tax policy.

5.1 Discussion and Further Research

Our findings should be viewed within the context of the Netherlands and given the assumptions we made. This calls for further research to explore several areas. First of all, as mentioned, the Dutch housing market has a particularly low price elasticity of supply, which causes a very large share of the tax benefits on the housing market to be reflected in increased house prices instead of benefiting households. In countries where supply elasticity is greater, tax benefits on housing will be more effective. We found that our results are strongly dependent on the values we assumed for the elasticities, indicating that our results should be interpreted cautiously when extended to other countries.

Second of all, given the data that is publicly available through CBS, we were unable to include Wet Hillen in our model. Although it appears that Wet Hillen has only marginal effects on the distributional impact of imputed rent taxation (see Section 3.1), this prompts further research to determine whether this holds empirically as well. This has become particularly relevant now that the Dutch government has started to phase out Wet Hillen.

Lastly, it is possible that a large portion of the decrease in imputed rent taxation is offset by the simultaneous decrease in the maximum mortgage interest deduction in the Netherlands that started in 2014. Therefore, further research is necessary to establish the effect that this simultaneous policy change has had on housing expenditure, whether it alleviated the decrease in tax revenue, and who were most strongly affected by this combination of changes.

5.2 Research Subquestions

Reflecting on our first research subquestion, we find that in all three of our models, the measure causes housing expenses to significantly decrease for households in all quintiles. We found that imputed rent tax forms a substantial share of housing expenses, accounting for 10.81% of the total costs in 2018, when the imputed rent percentage was still 0.70%. The significance of imputed rent tax in housing expenses explains why our model predicts the influence of a change in the imputed rent percentage to 0.35% to have a considerable effect on housing expenses as well.

We find the average decrease in monthly housing expenses to be 1.92%, 5.22% and 5.42% for the three models, respectively. Not only this, but it also holds that in all of our models, the relative decrease in housing expenses per household is the largest in the lowest quintile, with an average decrease of 5.1% to 8.5%. All in all, the results from our models suggest that the answer to our first research subquestion is that the decrease in imputed rent tax significantly decreased housing expenses, most strongly for the lowest-income households.

Considering our second subquestion, we conclude that the fact that imputed rent tax comprises such a substantial share of homeowners' household costs also causes a decrease in imputed rent taxation to have a significant positive influence on house prices, of approximately 3.81%. Our third model assumes that in the long term, all housing expenses will increase because of this house price increase. In this scenario, almost two-thirds of the effects of the tax decrease would be diminished by an increase in housing costs. Middle-class households from the third quintile would experience this moderating effect most strongly, with their housing expenses then only decreasing by 1.1%.

For our last research subquestion, we wanted to determine the effects of the Dutch government's reduction in imputed rent taxation on their tax revenue, as well as determine what income groups benefit the most from the reduction. We found that the reduction in imputed rent caused its tax revenue to decrease from €4.05 billion to €2.03 billion per year (before including the increase of the equilibrium price and quantity on the housing market). Almost half of this tax relief benefits the wealthiest 20% of households, as they pay more than 43% of the imputed rent tax. Contrarily, only 11% of the imputed rent tax is paid by the bottom 40% of households.

5.3 Central Research Question

All in all, we conclude that the Dutch government's decrease in imputed rent most strongly benefits the highest-income households, while also significantly increasing Dutch house prices. Furthermore, it is highly plausible that a large share of the tax relief is diminished by an increase in housing expenses. This makes imputed tax reliefs an ineffective and inequitable policy for relieving costs for homeowners, while it also impedes homeownership for individuals that do not yet own a house through a strong increase in house prices.

5.4 Policy Implications

Considering our results in the context of current societal conditions, where housing affordability is a growing concern worldwide and the intensifying debate on wealth inequality often centers around housing, our findings call for a renewed consideration of imputed rent taxation in many countries.

Given our observation that imputed rent tax plays a substantial role in home expenses, it is surprising that the largest political parties in the Netherlands do not mention it in their election manifestos. Our results indicate that a decrease in imputed rent tax leads to an increase in house prices, yet both conservative and progressive parties advocate for reducing this tax. This seems contradictory to the objectives of many political parties, especially left-wing parties, that aim to mitigate the recent surge in house prices.

In the growing debate on the increasing wealth inequality, Rognlie (2016) suggests that policymakers concerned with income equality should mostly focus on housing and closely monitor housing costs. Our research indicates that imputed rent taxation can play a crucial role in addressing both housing affordability and (thereby) wealth inequality. In this, it is particularly noteworthy that the far majority of imputed rent tax is paid by higher-income households.

Our findings support policy suggestions by the Dutch central bank and the Netherlands Bureau for Economic Policy Analysis (CPB, 2020; De Nederlandsche Bank, 2021), which advocate for phasing out the fiscal benefits of owner-occupied housing. Despite this evidence, imputed rent tax policies are becoming increasingly rare, suggesting that the political hesitancy to remove fiscal benefits of homeownership may stem more from political considerations rather than from economic rationale.

Therefore, a reintroduction or an increase in imputed rent taxation deserves reconsideration in countries worldwide, especially if political parties continue to prioritize promoting homeownership. Our findings suggest that imputed rent taxation could serve as an effective tool for addressing both housing market challenges and wealth inequality, while increasing tax revenues and likely without significantly impacting housing expenses.

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A Full Data: Annual Savings per Quintile

The purpose of this appendix is to show the numerical data corresponding to Figure 2, as well as the per-quintile share of the total annual savings.

Quintile	**Total annual housing cost savings**		
	IR=0.70%: 2018 data	**IR=0.35%: Model 2**	**IR=0.35%: Model 3**
1	€ 63.34 million (3.11%)	€ 61.41 million (3.11%)	€ 37.60 million (5.50%)
2	€ 155.84 million (7.66%)	€ 151.11 million (7.66%)	€ 54.38 million (7.95%)
3	€ 336.85 million (16.6%)	€ 326.62 million (16.6%)	€ 75.72 million (11.1%)
4	€ 589.50 million (29.0%)	€ 571.59 million (29.0%)	€ 194.83 million (28.5%)
5	€ 888.71 million (43.7%)	€ 861.71 million (43.7%)	€ 321.28 million (47.0%)

Table 6: The numerical data from Figure 2, showing the total annual housing cost savings per quintile in each of our three models. In parentheses, we show the share of each quintile's total annual savings as a share of the total savings in that model.