the review of income and wealth

Review of Income and Wealth
Series 66, Number 3, September 2020
DOI: 10.1111/roiw.12423

TAXATION OF HOUSING: KILLING SEVERAL BIRDS WITH ONE STONE

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High and sustained housing-price growth has been observed in many countries over recent decades. In Norway, real housing prices increased by 200 percent between 1990 and 2015, and many households have high debts. In addition, maintaining the welfare state as the population ages likely involves higher taxes in the coming years. Norway taxes housing leniently. Increased taxation of housing is a way of killing several birds with one stone: generating tax revenue, moderating housing prices, and increasing efficiency. In this paper, I use a microsimulation model to determine the effects on revenue and distribution of a hypothetical tax change where housing is taxed as other capital assets. I take into account the effect of taxation on housing demand, using a simple user-cost model. This housing tax would increase personal tax revenue by 11 percent and make the tax system more progressive. Housing prices would fall by 20 percent.

JEL Codes: D31, H24, R21

Keywords: housing policy, taxation, income distribution

1. INTRODUCTION

High and sustained housing-price growth has been observed in many countries over recent decades. Concerns about the existence and adverse affects of housing bubbles have increased following the 2008 financial crisis, particularly where household debt is also high (Jordá *et al.*, 2016). The reduction of housing prices and household debt are among several reasons to increase the taxation of housing. This paper deals with the distributional effects that would follow a change in housing taxation, as well as the effects on housing prices and tax revenue.

Housing prices in many developed countries have increased to historically high levels, as shown in Figure 1.[1] The financial crisis of 2008 led to housing-price busts, with serious consequences in some countries, although Norway was only lightly affected.[2] Several reasons have been suggested for this long-term increase in housing prices, such as income and population growth, low interest rates (Diamond

Note: I thank Elin Halvorsen, Torbjørn Hægeland, Kjetil Telle, Thor Olav Thoresen, the editor, and two anonymous referees for valuable comments, and Bård Lian for an introduction to LOTTE. This work has been supported by the Norwegian Research Council (grant no. 217423).

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[1]The housing-price indexes are from OECD (2016).

[2]On the other hand, some countries, such as Germany, have had relatively stable housing prices over a long period.

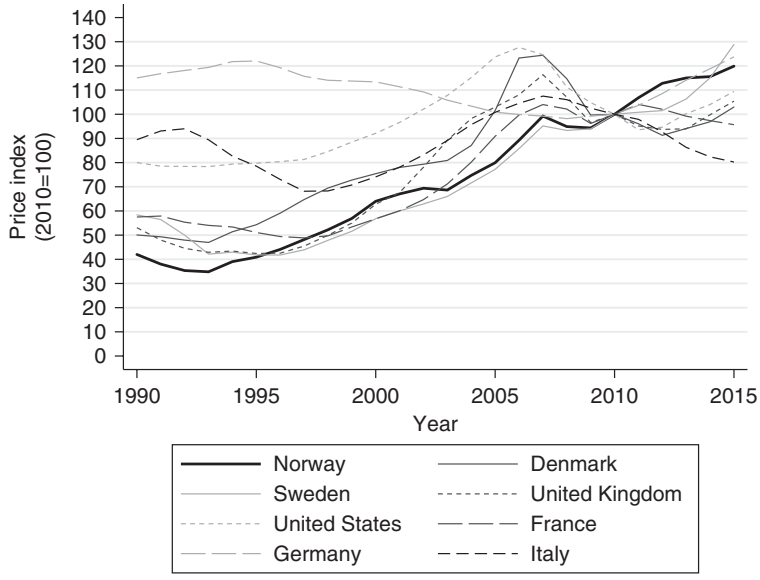

Figure 1. Housing Prices, Selected Countries, 1990–2015
Notes: Data from OECD (2016). Yearly real housing-price indexes.

and Rajan, 2009), and financial innovation (Duca *et al*., 2010; Jordá *et al*., 2016).[3] Household debt has also increased markedly in most countries over the same period (Figure 2), an increase that has often been associated with housing-price growth (André, 2016).

The reasons for the debt-fueled price increases are outside the scope of this paper. But high housing prices and highly leveraged households represent a macroeconomic risk. A drop in housing prices could strongly affect the wider economy, as highly leveraged housing owners reduce consumption (Mian *et al*., 2013).

Most developed countries tax owner-occupied housing leniently. I show, using data and tax rules from Norway, how an increase in housing taxes reduces housing prices and makes the (post-tax) income distribution of households more progressive. The estimates are based on Norwegian register data with household-level housing valuations for the whole population.

Norway is, as shown in Figures 1 and 2, one of the countries in which prices and debt have been rising most rapidly. However, it is not exceptional; Sweden, Denmark, and the United Kingdom (U.K.) have had similar patterns of growth. In Norway, real prices increased by 200 percent between 1990 and 2015, with only a small dip following the financial crisis of 2008. Correspondingly, international audits (i.e. OECD, 2012) and national policymakers (Norges Bank, 2014) are concerned by the high share of mortgage financed housing in the portfolio of

[3]Miles and Pillonca (2008) try to estimate the contributions of different factors to housing-price growth for a number of European countries and the United States (U.S.).

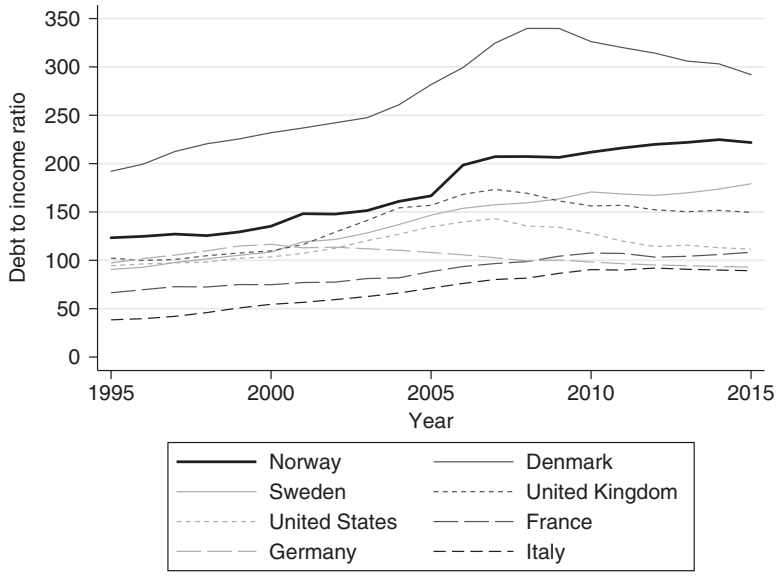

Figure 2. Household Debt to Income Ratio, Selected Countries, 1995–2015
Notes: Data from OECD (2017). Gross household debt to net disposable income.

Norwegian households. The lenient taxation of housing in Norway is mentioned as one of the reasons for the high demand for housing (OECD, 2012).[4]

The theoretical literature on housing taxation generally recommends neutrality of taxation (Mirrlees *et al*., 2011), out of consideration for both efficiency and fairness. Several papers document the efficiency cost of low housing taxation (Skinner, 1996; Gervais, 2002; Bye and Åvitsland, 2003; Van Ewijk *et al*., 2007; Sommer and Sullivan, 2018). The main reason is that low housing taxation leads to over-investment in housing.

In a longer-term perspective, Norway, as well as most of Europe, face an aging of the population that will strain the fiscal situation.[5] As shown in Aaberge *et al*. (2004), high employment rates are important to reduce the negative fiscal effect of an aging society. Taxation of housing is a source of revenue that does not disincentivize labor supply.

Thus, increased taxation of housing can be seen as a solution to several problems: (1) it will reduce housing prices and debt levels; (2) it is advantageous for economic efficiency through restructuring of investments; and (3) it raises tax revenue without discouraging labor supply. In any discussion on optimal taxes, distributional effects are important alongside efficiency considerations (Sandmo, 1976). Distributional effects are also crucial to the politics of implementing a tax reform.

[4]While there have been only small changes in the taxation of housing in Norway over the period, low taxes could exacerbate the effect of decreasing interest rates and increasing population growth on housing prices.

[5]See Siebert (2002) for a general discussion, and Antolín and Suyker (2001) and Aaberge *et al*. (2004) for the Norwegian case.

This paper uses a microsimulation tax-benefit model with feedback to discuss the effects on housing prices, tax revenue, and distribution of a hypothetical change in the taxation of housing, using cross-section data from 2013.

The Norwegian government recently implemented a procedure for hedonic valuation of all housing. With this market price based housing valuation, it is possible to impute rental income for the whole house-owning population. The microsimulation model is then used to calculate the tax-revenue and distributional effects of a housing-tax reform in which houses are taxed similarly to other types of capital assets.[6]

An increase in housing taxation would affect housing demand. To illustrate the feedback effect of taxation on housing prices, I use a simple user-cost model á la Poterba (1984). It allows me to model the tax-induced reduction in housing prices and the second-order effect of the house-price reductions on distribution. Previous literature on the distributional effects of housing taxation has not taken this into account.

I find that the housing-tax reform would decrease housing prices by 20 percent and increase direct tax revenue by 11 percent, with almost two thirds of the increase coming from the taxation of imputed rent. It would also increase the progressivity of the tax system, measured both by the Gini-based Reynolds–Smolensky index and a similar index of the 90/10 percentile ratio. Then, I discuss the distributional effects of a revenue-neutral reform. Finally, special attention is given to the effect on elderly households, who often combine large housing wealth with low disposable income.

The next section discusses the previous literature. Section 3 gives an overview of Norwegian housing taxation. In Section 4, I look at data and modeling choices for the microsimulation, as well as the imputation of rental income, before dealing with how the reform affects housing prices in Section 5. Section 6 presents a distributional analysis of the housing-tax reform, and the impact of revenue-neutral reforms. Section 7 concludes.

2. Previous Literature

There is a sizable theoretical literature on the taxation of housing, which generally recommends neutrality of taxation (Mirrlees *et al.*, 2011). Several papers document the efficiency cost of low housing taxation (Skinner, 1996; Gervais, 2002; Bye and Åvitsland, 2003; Van Ewijk *et al.*, 2007; Sommer and Sullivan, 2018) in a number of different countries. The estimated size of the cost depends on the tax system and the method, but can be large: Skinner (1996) reports that low housing tax in the U.S. has an efficiency cost of 2.2 percent of GNP. The main reason is distortion of capital investments. Relatively low housing taxation leads to overinvestment in owner-occupied housing, at the expense of investments in business capital. An increase in housing taxation will thus likely bring efficiency gains, though discussions of the magnitude of any gains are outside the scope of this paper. In the rest of the paper, I focus on the distributional effects of a housing-tax increase.

[6]This implies a 28 percent flat tax on returns and a wealth tax valuation of 100 percent of market value.

The previous works most similar to this paper are the papers on how the inclusion of imputed rent[7] in the measure of income affects distribution. Two other papers also use tax simulations to study the taxation of imputed rental income. Saarimaa (2011) uses data from a wealth survey to determine the distributional effects of taxation of imputed housing income in Finland. Imputed rent increases average income by 8.5 percent, and its taxation would increase personal income tax revenue by 15 percent while not having much of an effect on inequality. The taxation of imputed rent in six different European countries is explored in Figari *et al*. (2017), using the Euromod tax-benefit model on survey data. A reform taxing net imputed rents gives small reductions in inequality in all countries. The tax also increases personal income tax revenue by between 6 percent (Germany) and 27 percent (the Netherlands).

A related paper by Paetzold and Tiefenbacher (2018) shows that the use of market values instead of outdated cadastral values as a base in the German housing tax would lead to a sizable revenue increase, but only have moderate distributional effects. The tax revenue is used to reduce social insurance contributions, and the exact effect on distribution depends on the detailed implementation of this reduction.

Studying Great Britain, West Germany, and the U.S., Frick and Grabka (2003) show the effect on income inequality of adding imputed rent to income. The data come from household panels, and rental income is imputed using several methods. The inclusion of imputed rent increases inequality between renters and owners, while decreasing it within the group of owners. The total effect on inequality is small, and the sign depends on which of the two effects is stronger. The authors also note that imputed rent adds a relatively large share to the income of elderly; the inclusion of imputed rent in the income definition significantly reduces the share of elderly poor.

Frick *et al*. (2010) compare the distributional effects of imputing rental income in five European countries with differently structured housing markets. To ensure comparability, they use methods that are as similar as possible in all countries. The inclusion of imputed rental income reduces measured inequality and poverty.

Yates (1994) imputes housing income for Australian households, using a household survey. Aggregate inequality, measured by the Gini coefficient, does not differ much whether gross income or gross income plus imputed rental income is used. Nevertheless, this hides a lot of redistribution between households. Owners with no mortgage, often pensioners, move up in the income distributions. Renters, and owners with high mortgages and maintenance costs, move down.

My paper combines a study of the distribution of imputed rental income with a user-cost approach to study how taxes influence demand for housing. A couple of previous papers also combine the user-cost approach and distribution analysis: Poterba (1992) and Poterba and Sinai (2008) look at the distribution of gains from housing taxes and subsidies. Both show the monetary cost for different groups and the effect on user cost of hypothetical changes to the taxation of housing in the U.S., although they do not consider effects on housing prices. The imputed

[7]Throughout the paper, I use imputed rental income, imputed rent, and imputed housing income as synonyms.

income from housing in the U.S. increases with income and with age, while mortgage deductions are highest for wealthy, younger households.

3. The Norwegian Setting

Leading up to the distributional analysis of housing taxation, here I give a short overview of how the Norwegian direct tax system treats housing, and the importance of owner-occupied housing for Norwegian households.

Since 1992, Norway has had a dual tax system.[8] Labor income is taxed with a progressive schedule, while there is a proportional tax on capital income (28 percent in 2013). There is no taxation of (imputed) housing income from owner-occupied housing. Capital gains are taxed as other capital income, but capital gains on housing are not taxed if the owner has been living in the house for at least 12 of the last 24 months before it was sold. Interest payments on debts (including mortgages) can be deducted at the capital income rate, in unlimited amounts.[9]

In addition, Norway has wealth taxation. Net wealth above a standard deduction is taxed. In 2013, the standard deduction was 870,000 NOK,[10] beyond which the tax rate was 1.1 percent.[11] Most assets were valued at 100 percent of market value. Owner-occupied housing on the other hand, enjoyed a large discount, being valued at 25 percent of market value.[12] This gave an incentive for wealth to be invested in housing.[13]

Owner-occupied housing is favorably taxed in most developed countries, but few other countries have the Norwegian combination of no taxation of imputed rents and unlimited deductability of mortgage interest (Hendershott and White, 2000; and Hemmelgarn *et al*., 2011). In addition, Norway has a unique wealth tax rebate on housing. In many countries, the favorable tax treatment of housing has been somewhat reduced since the 1970s (Hendershott and White, 2000). This has not happened in Norway, even though expert advice has recommended it. In fact, in 2005, the prevailing (low) taxation of imputed housing income was abolished.

In a government-mandated report that preceded the Norwegian tax reform of 2006, higher taxation of housing was called for NOU (2003). This was based on both a wish for neutrality and the view that housing is a tax base not threatened by capital mobility. The expert panel suggested increasing the taxation of imputed housing income and increasing the value of housing in the wealth tax toward market value (NOU, 2003). A 2014 review of taxation again touched upon housing

[8]See, for example, Thoresen *et al*. (2012) for more on the Norwegian tax system, and Sørensen (1994) on dual income tax.

[9]The interest deductability of non-mortgage debt is somewhat uncommon, and reduces the tax-favored status of housing compared to other countries.

[10]For 2013, 1$ ≈ 6NOK.

[11]In the years following 2013, the standard deduction has been increased and the tax rate somewhat reduced, which lessens the value of the housing rebate in the wealth tax.

[12]Or 50 percent of market value for secondary and investment housing.

[13]While there is no general property tax in Norway, municipalities may chose to have a property tax. In 2013, 205 of 430 municipalities had a property tax that covered housing Statistics Norway (2014a). Municipal property taxes are often seen as user fees, an interpretation supported by the law and the large freedom of municipalities in structuring the tax. I will follow that interpretation, and not include the municipal property tax in my analysis.

taxation (NOU, 2014), suggesting that all assets (including owner-occupied housing and debt) should be valued at 80 percent of market value for wealth tax purposes. Both the increase in housing valuation and the decrease in debt valuation would disincentivize owner-occupation.

The Mirrlees Review of the U.K. tax system (Mirrlees *et al*., 2011) recommended that housing should ideally be taxed as consumption. While the theoretical motivation is different, the implication is in fact similar to a tax on imputed housing income: the suggested tax is a value-added tax on the yearly consumption value of housing.

Reflecting the tax advantages of housing, owner-occupied housing is the main form of capital ownership for the Norwegian population. The house-ownership share is also among the highest in the OECD (see OECD, 2006). As shown in Table 1, housing represents half the wealth or more for all household income deciles; on average, two thirds of wealth. Housing wealth as a share of gross total wealth has an inverted U-shape, with the first and tenth deciles having the lowest shares. Ownership is very unequally distributed. While 92 percent of households in the tenth decile and two thirds of all households own their own homes, only 14 percent of households in the first decile do. The next two columns show average housing value and loan to value,[14] conditional on owning a house. Housing value mostly increases with disposable income, while loan to value is relatively high even for the highest deciles (debt is tax favored).[15]

The value of the interest deduction for debt, and the cost of the wealth taxation of housing for different deciles of the population is shown in Appendix A (in the Online Supporting Information). The interest deduction is on average higher than the wealth tax for all deciles, but the difference is smallest for the lowest deciles, where the interest deduction equals a low share of income.

Table 1 also shows the average age of each decile. The low average age in decile 1 is probably explained by the low disposable income of students, while pensioners seem to cluster in deciles 2–4, which may explain the low loan to value for these deciles.

4. Modeling the Housing Tax

4.1. *Data and Microsimulation*

To determine the distributional effects of a hypothetical tax reform, I use microdata on income and wealth for the whole Norwegian population, and a microsimulation model. The microsimulation, tax-benefit model LOTTE (Aasness *et al*., 2007), is also used by the Norwegian Ministry of Finance to estimate revenue effects of tax changes. The simulated taxes are virtually identical to real tax payments recorded in the data. The model takes the population

[14]The data do not allow separation of mortgages and other debt. Loan to value is calculated, for housing owners, as min(LTV,0.9), where LTV is total debt divided by housing value. The cutoff at 0.9 represents a rule restricting banks to loaning out a maximum of 90 percent of the sales price.

[15]Decile 1 includes a number of wealthy business-owner households with very low taxable income, which may explain the high housing value conditional on owning in the decile.

TABLE 1
THE DESCRIPTIVE STATISTICS

Decile	Disposable Income	Share Housing	Share Owners	Housing Value, Owners	Loan to Value, Owners	Age
1	93,200	0.57	0.14	2,565,600	0.40	33.6
2	190,600	0.72	0.38	2,115,500	0.24	57.3
3	231,700	0.75	0.51	2,275,000	0.32	54.3
4	270,700	0.76	0.64	2,432,800	0.37	54.0
5	308,000	0.76	0.72	2,591,700	0.42	52.4
6	345,100	0.76	0.78	2,785,400	0.46	51.2
7	385,800	0.76	0.83	2,995,000	0.49	50.9
8	436,000	0.75	0.86	3,268,600	0.50	51.2
9	510,300	0.72	0.89	3,646,600	0.51	51.9
10	784,700	0.55	0.92	4,871,800	0.50	53.6
Totals	355,600	0.69	0.67	3,138,400	0.44	51.0

Notes: All households with heads of household aged 18 or above and non-negative income; 2,403,053 observations. Deciles of equivalized disposable income, not including imputed rental income. "Share Housing" is housing wealth as the share of gross wealth. "Housing Value" and "Loan to Value" are conditional on ownership. "Age" refers to the age of the oldest household member. Values in NOK.

microdata as input, and simulates taxes and benefits based on a set of tax rules and tax rates. There are no behavioral responses in the model. As output, the model delivers aggregate taxes, and the taxes and benefits of each individual. By changing tax rates and by, for example, adding imputed rental income to the income base to be taxed, and then comparing the results to the baseline 2013 case, the model allows for estimation of the distribution of alternative housing-taxation schemes.

The data come from the Income Statistics on Persons and Families (Statistics Norway, 2006), a yearly panel with detailed information (e.g. income, wealth, education, age, and family size) on the whole Norwegian population, including full coverage of variables from tax returns. The income and wealth variables are further disaggregated into, wage income, capital income, business income, benefits, bank deposits, stocks, and debt. The data also include (since 2010) tax values of housing based on imputed market valuation. This paper mainly uses cross-section data from 2013.[16] The data allow for the aggregation of individuals' income and wealth into household values. When analyzing effects on total revenue, I use the whole population (more than 5 million individuals), while distributional analyses are done at the household level, covering around 5 million individuals in 2.4 million households.[17] Household income is equivalized by dividing by the square root of household size.

The imputation of market and tax values of housing is done by the Norwegian tax authorities and documented in Kostøl and Holiløkk (2010). Data on housing transactions are used to impute a market value for the whole housing stock, and the tax value is set at 25 percent of the imputed market value. The imputations use the hedonic method; prices are estimated as a function of log housing size, age, and geographic information. The values are updated yearly. Due to the way in which the market value is calculated, it is likely that houses of particularly high or low quality are, respectively, under- and over-valued.[18]

While the housing-value calculation could probably be made more accurate by adding more information (e.g. if a house has a balcony or a fireplace), there are some advantages to using this valuation for a new housing tax. First, use of the same valuation that is already used for the wealth tax means that taxpayers only deal with one valuation. Second, the simplicity of the model makes it easy to explain it to the public. Finally, by not including housing details, it avoids behavioral responses. Making tax value dependent on, for example, the number of fireplaces could lead to costly distortions similar to those of the infamous English window tax (Oates and Schwab, 2015).

[16]Similar analyses on data from 2010 can be found in Bø (2015), the working-paper version of this paper.

[17]In the distributional analysis, I discard a few thousand observations of households led by children under 18 and households with negative income.

[18]There exists a procedure to reduce the tax valuation if an assessment shows the value to be higher than 30 percent of market value.

4.2. *The Calculation of Imputed Rent*

Neutral taxation of owner-occupied housing calls for the taxation of housing income; the housing equivalent of asset returns, or the owner-occupier equivalent of rent. But whereas asset returns are often observed, the returns to owner-occupied housing have to be imputed. There are several different ways of calculating imputed rent.[19] The method chosen usually depends on the available data, as well as the purpose of the measurement.

The most common method for imputing rent is the rental-equivalence approach, based on finding the rental value of owner-occupied housing by matching it with comparable rental housing. A problematic aspect of using this approach for Norway is the paucity of rental properties.[20] This makes it hard to find rental comparisons, especially for larger single-family houses. The same problem is reported by Saarimaa (2011) and Figari *et al*. (2017) for Finland and the Netherlands, respectively.

An alternative is the capital-market approach (Smeeding *et al*., 1993), which uses the alternative value of housing capital had it been invested in another asset. The questions using this approach are how to find the housing value and what is the appropriate interest rate. This approach is criticized in Frick and Grabka (2003) on two accounts. First, imputed rent is often calculated on net housing value (market value minus mortgage). Frick and Grabka claim that mortgage payments should be calculated using nominal interest, while housing returns should be calculated as the real interest rate times the full value of the house.[21] Ignoring this distinction will overstate imputed rent. Second, the housing values used are often owners' self-reported valuations of houses, which may give large measurement errors.

The Norwegian housing data can overcome these criticisms. Housing value and mortgage payments can be evaluated separately, using different interest rates, and the valuation of housing is based on imputed market value.

Given the suitability of my data for utilizing the capital-market approach, and the lack of rental equivalences for certain housing types, I estimate imputed rental income in the following as 3 percent of housing market value, 3 percent being a measure of the long-term average risk-free rate.[22] This is close to other studies from Norway, with Eika *et al*. (2017) using 2.88 percent based on the average aggregate rent-to-value ratio between 1994 and 2004, while Fagereng and Halvorsen (2017) use 3 percent, measured from the long-run real return to housing.

[19]See, for example, (Oates and Schwab, 2015). The various methods are discussed further in Appendix B.

[20]In 2011, 77 percent of the population were part of households who were owner-occupiers. The owner-occupying share of couples with grown children was higher than 90 percent (Statistics Norway, 2012).

[21]I disagree with this interpretation. Using nominal and real interest rates of 6 percent and 2 percent, respectively, as given in Frick and Grabka (2003), only owners with more than 66 percent equity will have positive imputed rent, which seems incorrect. However, the point that interest rates for mortgages and housing returns may be different is valid.

[22]Three percent is the average of the three-year Norwegian government bond rate over the ten years from 2004 to 2013 (Norges Bank, 2018). There are several possible ways to proxy the risk-free rate. I choose the three-year government bond, as it carries virtually no risk of default, but comes with a certain holding period. This fits with the asset profile of housing. It seems important that the calculation rate for imputed housing income is not too volatile between years, which is an argument for averaging the target rate over several years.

The calculation of imputed rent is based on the whole market value, not equity, as mortgage interest payments are already included in the standard income definition.[23] As in Frick and Grabka (2003), I equivalize imputed rent by household size, with the reasoning that the fewer persons who live in a house of a given size, the greater benefit it provides per person.

The interest rate that I use is nominal, not real. The main reason for using a nominal rate is that the tax system is nominal. Taxation of returns on other savings is based on nominal values, as is the mortgage interest deduction. Neutral taxation thus calls for imputation using the nominal interest rate.[24]

An alternative way to think of the imputation of rent is to consider tax neutrality between landlords and owner-occupiers, as in Englund (2003). Englund shows that also in this case, the imputed rental income should equal the nominal interest rate times market value, assuming neutrality of taxation in the rental sector, equal maintenance costs for renters and owners, and no taxation of capital gains for owner-occupied housing. However, Englund (2003) does not state whether the risk-free interest rate or the mortgage interest rate should be used.[25]

Figure 3 shows that imputed housing income adds 10.9 percent to the average disposable household income. The lower bound of the imputed rent net of mortgage interest is 8.6 percent (see Appendix A), a relatively high share compared to the countries reported in Frick and Grabka (2003), Frick *et al*. (2010), Saarimaa (2011), and Figari *et al*. (2017). This underlines the importance of owner-occupied housing in the portfolio of Norwegian households. Imputed rent is important, on average, even for household in the first decile, but the share is largest for middle-income households.

The inclusion of imputed rental income slightly reduces the Gini coefficient of gross income, and increases the Gini coefficient of disposable income somewhat, as shown in Table 2. The 90/10 ratio is higher when imputed rental income is added, both pre- and post-tax. For both measures, the difference between the pre- and post-tax measures is smaller when imputed income is included.

Extended gross income is defined as gross income plus imputed rental income, and extended disposable income as net of tax extended gross income (or disposable income plus net of tax imputed rental income). In theoretical discussions of income, it is commonly seen as preferable to use the extended-income definition (see, e.g., Canberra Group, 2011), as it better reflects the real consumption opportunities of households. The normal definition of disposable income already subtracts interest payments on debt. Not including imputed rental income thus gives an asymmetry. The extended-income definition will be used in the following.[26]

[23]Taking return only on equity would thus double-count mortgage interest.

[24]For more on this choice, see Appendix B.

[25]The difference is large; in, for example, December 2013, the risk-free yearly rate was 1.7 percent (Norges Bank, 2018), while the average interest rate for new mortgages was around 4 percent (Statistics Norway, 2014b).

[26]The distinction between an income definition with or without imputed rental income makes a difference for the results. Increased housing taxation decreases the redistributional effects of the tax system if inequality is measured using disposable income, but increases redistribution if imputed rental income is added to disposable income. As argued, extended income is the preferable definition, but disposable income may well be more salient. Thus, a reform that increases housing taxation may be perceived as regressive.

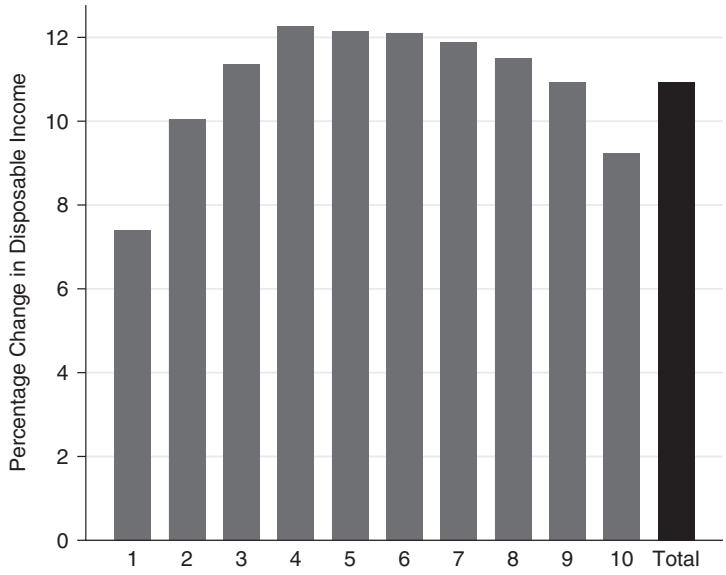

Figure 3. Imputed Rent as the Share of Disposable Income
Notes: All households with heads of household aged 18 or above and non-negative income; 2,403,053 observations. Deciles of equivalized disposable income.

TABLE 2
Adding Imputed Income

	Gini Coefficient		90/10 Ratio	
	Without	With	Without	With
Pre-tax	0.3043	0.3011	3.946	3.970
Post-tax	0.2590	0.2601	3.090	3.228

Notes: All persons with heads of household aged 18 or above and non-negative household income; 5,099,766 observations.

5. Accounting for Feedback Effects

5.1. *Modeling Housing Demand*

The micro-simulation model that I use is an arithmetical model (Bourguignon and Spadaro, 2006), with no behavioral effects. But an increase in housing taxation—in effect, a permanent increase in the cost of owning housing—would likely reduce housing demand, as the user cost of owning a house would increase. There is very little empirical evidence on the elasticity of housing prices to taxation, which leads me to model the response. I use the top-down approach (Bourguignon and Spadaro, 2006) to add feedback from a representative-agent model of tax-induced reductions in housing prices into the microsimulation model. The microsimulation model can then be run again, estimating revenue and distributional effects when tax-induced housing prices are taken into account.

I use a simple model based on the user-cost approach, following Poterba (1984), Englund (2003), and Svensson (2013), to calculate how housing prices would be affected by the fall in demand due to increased taxation. The idea is that, in equilibrium, the cost of owning a house will equal the value of the housing service provided by the house. In this fairly basic two-period model, I will obviously not be able to account for the dynamics of a transition period following the change. What I compare is the steady state housing price before and after a change in the tax. There is reason, however, to believe that the immediate price reaction will be fairly large.[27]

While a more thorough estimation of the housing-price elasticity to taxation is outside the scope of this paper, the message to take away is that a housing tax will change prices. This change has an impact on the revenue gains and distributional effects of the reform.

As in Svensson (2013), the marginal costs and investment gains of home ownership and the services that a home provides should be equivalized in equilibrium. The real value of housing services, or imputed rental value, over a year, is denoted by h_t. This value will equal

$$h_t = [(1-\tau_i)i_t - E_t\pi_{t+1} + \delta + \tau_h + \sigma]p_t - (E_t p_{t+1} - p_t), \tag{1}$$

where $(1-\tau_i)i_t$ is the mortgage payment net of income tax, $E_t\pi_{t+1}$ is expected inflation, δ is depreciation, τ_h is a combined term for wealth and income taxes on housing, and σ reflects the premium required to cover the risk and down-payment constraints of owner-occupied housing. The term $(E_t p_{t+1} - p_t)$ represents the (expected) capital gain over the year. The capital gains tax is assumed to be zero, which reflects the fact that in the Norwegian tax system, few housing sales are affected by capital gains tax. Equation (1) can be rewritten as follows:

$$h_t = \gamma_t p_t - (E_t p_{t+1} - p_t), \tag{2}$$

where $\gamma_t = (1-\tau_i)i_t - E_t\pi_{t+1} + \delta + \tau_h + \sigma$. Here, γ_t represents the percentage cost of owning a house, which depends on the mortgage rate, inflation, depreciation, the risk premium, and housing taxes.

Rearranging to find the housing price,

$$p_t = \frac{h_t + E_t p_{t+1}}{1+\gamma_t}. \tag{3}$$

This equation can be solved in steady state. Assuming $\gamma_t = \gamma$ and a constant growth rate g of housing services, and solving equation (3) forward, gives a present value of housing services as follows:

$$p_t = E_t \sum_{s=1}^{\infty} d_{t+s} h_{t+s-1}, \tag{4}$$

where $d_{t+s} = \frac{1}{1+\gamma}$ and $h_{t+s} = (1+g)^s h_t$.

[27]Sommer and Sullivan (2018) provide an interesting recent attempt at finding the transitional dynamics of a housing-tax reform in the U.S. In their model, following removal of the mortgage deduction, prices immediately fall by around half of the total adjustment. Thereafter, there is a smooth decline, with 73 percent of the adjustment occurring within the first five years.

$$p_t = \sum_{s=1}^{\infty} \left(\frac{1+g}{1+\gamma}\right)^s \frac{1}{1+g} h_t = \frac{h_t}{\gamma - g}, \tag{5}$$

assuming that $\gamma > g$.[28]

Using equation (5), it is possible to find the steady state semielasticity of housing prices with respect to an increase in housing taxes:

$$\frac{\partial \ln p_t}{\partial \tau_h} = -\frac{1}{\gamma - g}. \tag{6}$$

5.2. *The Effect on Housing Prices*

When I simulate the model, I mainly use the same values as in Svensson (2013), although I make some adjustments to reflect the Norwegian tax system and interest rates. Thus, $\delta + \tau_h + \sigma = 0.09$, $g = 0.02$, $i = 0.048$, and $\pi_{t+1} = 0.02$. The housing tax is very low, so in practice, I assume depreciation plus risk premium to be roughly 9 percent. The interest rate, i, is the average nominal interest rate on bank loans in 2013 (Statistics Norway, 2015, table 8.1), while I assume that households correctly predict the inflation rate, π_{t+1}, of 2014 (Statistics Norway, 2015, table 7.1). The capital tax $\tau_i = 0.28$, as previously noted. These values give $\gamma = 0.105$, and a semielasticity with respect to an increase in housing taxes of -0.118. For each percentage point increase in the taxation of housing, housing prices decrease by 11.8 percent.

Assuming that wealth tax was paid in full, the 2013 tax rate on housing was $1 \times 0.25 \times 0.011 = 0.0028$.[29] With the tax reform, it would change to $(1 \times 0.011) + (1 \times 0.03 \times 0.28) = 0.0194$. The tax rate increases from 0.28 percent to 1.94 percent of housing value, a change of 1.66 percentage points. Applying the previously calculated semielasticity of housing prices to taxation, housing prices would decrease by 19.6 percent. If no wealth tax were paid, the tax would only increase by 0.84 percentage points, roughly half as much, with a corresponding 10 percent decrease in housing prices. It should be noted that the estimates are shown by Svensson (2013) to be quite sensitive to the assumed value of the cost of owning a house, γ.[30]

In evaluating distributional effects, I show results both for the case where housing prices do not decrease at all and where all housing prices decrease by 20 percent, which should also give an idea of what would happen with intermediate price changes.

[28]The assumption of time-invariant parameters is required to solve the equation in steady state. It may not be a realistic assumption as, for example, interest rates have displayed a long-term falling trend (Caballero *et al.*, 2008). However, relaxing this assumption is outside the scope of the paper. In general, more uncertainty about stochastic realizations of the parameters around a steady state should increase the risk premium, and thus γ, leading to a lower price elasticity.

[29]Given a valuation of 25 percent and a tax rate of 1.1 percent.

[30]For example, if depreciation, housing taxes, and the risk premium ($\delta + \tau_h + \sigma$) total 0.08 or 0.1, instead of the base case 0.09, the effect on prices would be 22 percent and 17.5 percent, respectively. Using 2010 values of interest and inflation, Bø (2015) finds the price effect to be 18 percent.

An immediate reduction of prices by almost 20 percent, as predicted here, would cause large problems for many households, who would end up with negative equity, as well as for the financial sector. Obviously, a reform of this scale would have to be introduced gradually. The reduction in housing prices represents a one-time windfall loss to current home owners, and a gain to current renters and future home owners, in addition to the distributional effects calculated below.

6. Results

6.1. *Distributional Effects of Alternative Taxation*

The distributional effects of the alternative schedule depend on the distribution of housing wealth and imputed housing income. This section presents the results of four tax simulations:

1. A simulation in which imputed rental income is taxed (at the same rate as capital income).
2. A simulation in which the full market value of housing is used in computing the wealth tax.
3. A simulation of the full tax reform, which implements both measures.
4. The full reform when the effect on housing prices is taken into account.

The distributional effects of different tax reforms are evaluated using the Reynolds–Smolensky index Reynolds Smolensky (1977), a measure of redistribution based on the Gini index, and a similar index of the 90/10 percentile ratio. The Reynolds–Smolensky index, Π_{RS}, measures the difference between the Gini of pre-tax income, G_I and of post-tax (i.e. disposable) income, G_D: $\Pi_{RS} = G_I - G_D$. The higher the Reynolds–Smolensky index, the more redistributional is the tax system. This index is more useful than the simple post-tax Gini for studying the impact of the tax system when pre-tax income may differ. To only look at the post-tax Gini, G_D, would be misleading in a case in which the tax also changes, G_I, which happens when housing demand responses are included. Similarly, instead of presenting the 90/10 ratio on income inequality, I will present an index, $\Pi_{90/10}$, which is the difference between the pre- and post-tax 90/10 ratios.

While the Gini index is sensitive to changes in the middle of the income distribution, the 90/10 ratio, the ratio of the 90th percentile to the tenth percentile, captures changes at the top and bottom of the income distribution. Thus, the two indices Π_{RS} and $\Pi_{90/10}$ complement each other.

Figure 4 shows the percentage change in the Reynolds–Smolensky indices, and in the differenced 90/10 ratio compared to the no-reform baseline.[31] The first two bars show the separate effects of the two elements of the tax change: taxing imputed rent and taxing housing at market value in the wealth tax. Increased housing taxation clearly increases redistribution. Note that the result marked "Taxing imputed rent" in Figure 4 can be related to the results of Figari *et al*. (2017); as in the six

[31]The underlying data, the pre- and post-tax Gini coefficients and 90/10 ratios, are presented in Appendix C.

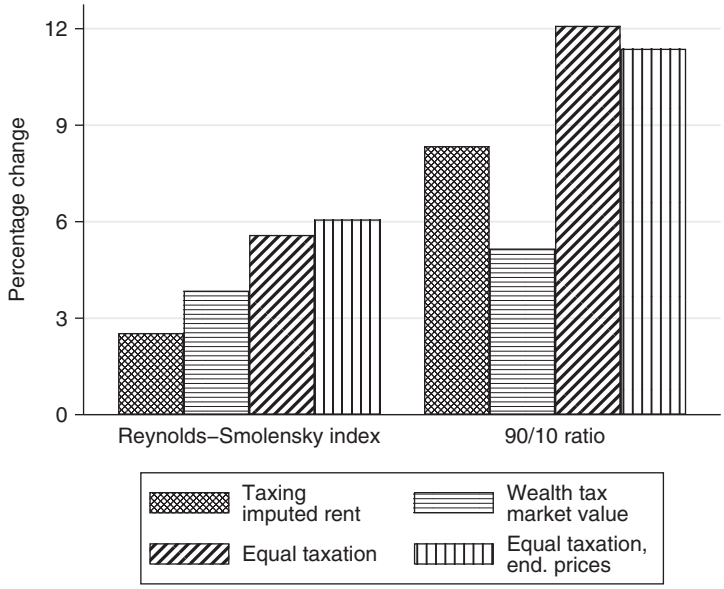

Figure 4. Change in the Reynolds–Smolensky and 90/10 Indices

Notes: All persons with heads of household aged 18 or above and non-negative household income; 5,099,766 observations.

other European countries covered there,[32] treating imputed rent as taxable income decreases inequality.

When taking into account that increased taxation affects housing values, the reform increases the progressivity slightly relative to when prices remain unchanged measured by the Reynolds–Smolensky index, while the differenced 90/10 ratio is a little lower. The effects of the tax reform on redistribution are sizable; an increase in Π_{RS} of 6 percent, and 12 percent for $\Pi_{90/10}$.

The impact of the two elements of the tax reform on different deciles of the household income distribution is shown in Figure 5. For the taxation of imputed rental income, the effect on the first decile is less than a tenth of the average effect, and the sixth to eight deciles are relatively hardest hit. The total added revenue is 37.7 billion NOK, 9.3 percent of the 2013 personal tax revenue.[33] Changing the value of housing in the wealth tax to market value brings in around half the sum, 21 billion NOK. Here, the cost is increasing over the income deciles, with the first and second deciles again little affected.[34] Figure 5 explains an aspect of Figure 4: while taxation of imputed rent is less progressive than wealth taxation measured by

[32]But unlike Finland, where the reform barely changes inequality (Saarimaa, 2011).

[33]This part of the reform is roughly similar to taxation of net imputed rent in Figari *et al.* (2017). Compared with those results, a 9.3 percent tax-revenue increase is in the lower range, but the Norwegian wealth tax complicates the comparison.

[34]It is worth noting that a similar exercise on the individual level gives fairly different results, with the first decile much harder hit by a wealth tax. This shows the importance of having household-level data when analyzing housing taxation.

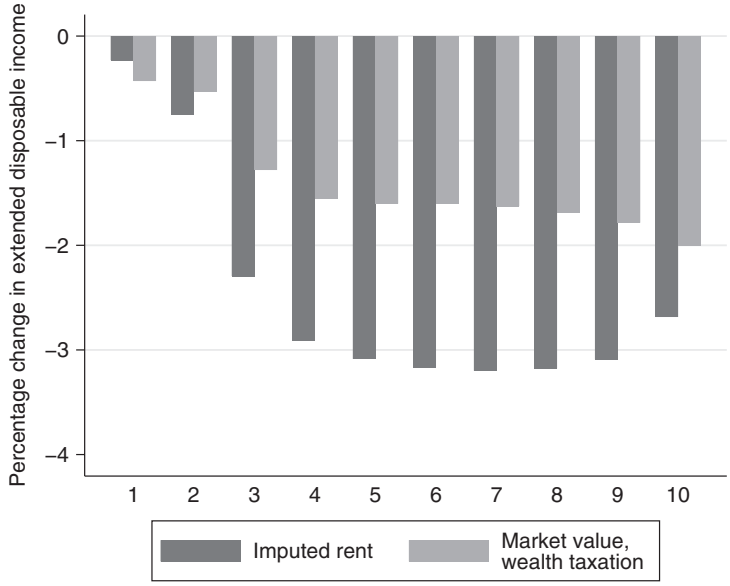

Figure 5. Taxation of Imputed Rent and Market Value
Notes: All households with heads of household aged 18 or above and non-negative income; 2,403,053 observations. Deciles of equivalized disposable income including imputed rental income.

the change in Π_{RS}, which is sensitive to the middle deciles, the opposite is clearly true when measured by the change in $\Pi_{90/10}$.

As there is little interaction between wealth and income tax, a reform that implemented both these changes would increase personal tax revenue by 14.5 percent, 58.8 billion NOK. This revenue represents around a fifth of the revenue from the income tax.

When the effect on housing prices of increased taxation is taken into account, the full reform would increase personal tax revenue by 11 percent, or 43.4 billion NOK. Such a large revenue increase may leave room to reduce other taxes; revenue-neutral reforms are discussed shortly.

To ascertain the robustness of the results over time, the same procedure has also been used to determine the distributional effects of the hypothetical reform in 2010. Simulation of a reform of the very similar 2010 tax system on 2010 data gives qualitatively similar effects, although they are somewhat smaller in size, especially for $\Pi_{90/10}$, as shown in Figure 6.[35] The reason for the lower $\Pi_{90/10}$ in 2010 is that real housing prices were growing strongly from 2010 to 2013 (see Figure 1). As both housing income and housing wealth are calculated from market values, higher housing prices lead to higher housing taxes. But households at the tenth percentile barely own their housing, so they are much less affected than households at the 90th percentile.

[35]Further numbers and figures based on 2010 data can be found in the working-paper version of this paper, Bø (2015).

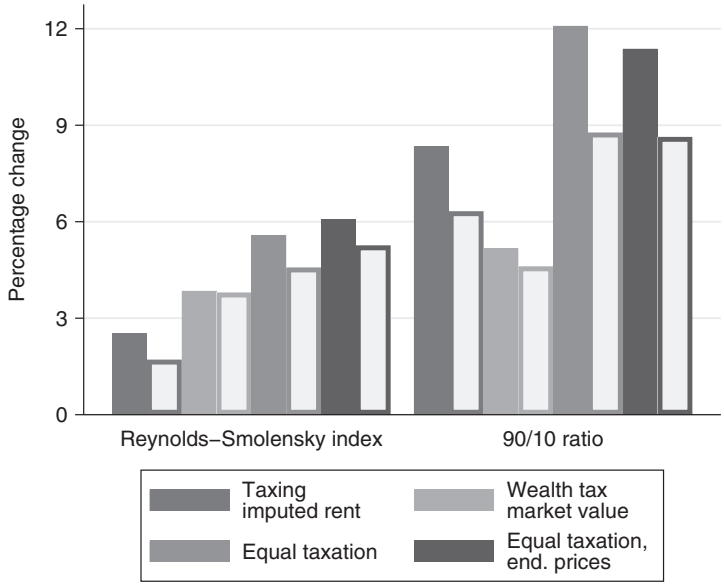

Figure 6. Change in the Reynolds–Smolensky and 90/10 Indices, 2013 and 2010
Notes: Results from 2013 shown in full bars, results from 2010 in hollow bars. All persons with heads of household aged 18 or above and non-negative household income; 5,099,766 and 4,907,014 observations, respectively.

6.2. *Revenue Neutrality*

The massive increase in tax revenue that would follow from the simulated housing-tax reform is probably politically infeasible. Thus, I also analyze two revenue-neutral reforms. There are innumerable combinations of tax cuts and tax changes that could be enacted with the extra revenue from the housing tax, and the progressivity of the reform obviously depends on how revenue is returned.

Both Figari *et al.* (2017) and Paetzold and Tiefenbacher (2018) include simulations of revenue-neutral scenarios. In the countries analyzed in Figari *et al.* (2017), a tax rate reduction leads to gains only in the upper quintile, while a general increase in tax exemption increases the disposable income of the lower /middle quintiles. Paetzold and Tiefenbacher (2018) find that the largest gains from a housing-tax reform accrue to the upper middle deciles when revenue is spent on a proportionate reduction of the social insurance contribution. When revenue is instead spent on a lump-sum rebate on the social insurance contribution, the lower middle deciles show the largest gains.

I present two different revenue-neutral reforms. The first is a case in which the revenue from the housing tax is given out as a lump-sum payment to all adults. This scenario is intended to show how progressive the reform could possibly be.[36] When

[36]Alternatively, one could imagine reducing taxes with a higher compliance cost than for a housing tax. Since the housing valuations already exist, and the tax would be hard to evade (a house is not easy to hide), efficiency gains could be had by spending revenue from a housing tax at, for example, reducing the income tax.

43.4 billion NOK is given out as lump-sum payments, it equals 10,900 NOK (or 3 percent of average extended disposable income) to each inhabitant aged 18 or above.

The second reform achieves revenue neutrality by reducing the social security contribution by three percentage points.[37] The social security contribution affects all income over a quite low minimum, so this reduction will be proportional to wages for most wage earners, but will not benefit those without earnings, or pensioners.

Figure 7 shows the results from the full reform in Figure 4, alongside the percentage increase in the Reynolds–Smolensky index and the differenced 90/10 index when all extra revenue is given back as lump-sum payments, and as reductions in social security contributions. The lump-sum reform increases the progressivity of increased housing taxation in each case, by large amounts. By both measures, the redistribution through the tax system increases by more than 20 percent. When the social security contribution is reduced, the reform has almost no effect on tax progressivity. The Reynolds–Smolensky index is slightly negative, while the differenced 90/10 ratio is slightly positive. Thus, spending the revenue of the housing tax on reducing the tax wedge on labor, which will presumably increase efficiency in the economy, does not harm the progressivity of the tax system.[38]

6.3. *The Age Dimension*

The age aspect is of special interest when discussing housing taxation in a redistributional context, as the elderly often own valuable and mortgage-free houses. Thus, a tax on housing income may hit the elderly hard. Frick and Grabka (2003) find that imputed rental income is particularly significant for elderly people in the U.S., the U.K., and West Germany. A first look at the connection between age and housing in Norway comes in Figure 8(a), which shows the average net and gross value of housing by the age of the head of household. Gross value has an inverse U shape, increasing steeply from close to zero at age 20 to 2 million at age 40, topping out in the fifties before a marked decrease from the late sixties. As housing is usually bought with borrowed money, net housing value has a different pattern, increasing more slowly to a maximum around age 65.

Another way to see how a tax on housing affects the elderly is Figure 8(b), which repeats Figure 5 with only households with heads over age 67 (the standard pension age in Norway is 67). The tax reform puts a much higher burden on pensioners in all deciles. In particular, for the pensioners in deciles 3–5, the tax reform would, on average, increase taxes by almost 7 percent of extended disposable income.

Thus, it is clear that an increased tax on the net value of housing will be relatively high for quite a few pensioners, some of whom already have low disposable

[37]From 7.8 percent to 4.8 percent for ordinary income; from 11 percent to 8 percent for business income. The social security contribution for pension income is not changed. This change gives total tax revenue that is 285 million NOK, or less than 0.1 percent, higher than in the baseline.

[38]Although the effect on labor supply, which could well increase inequality, is not included in this analysis.

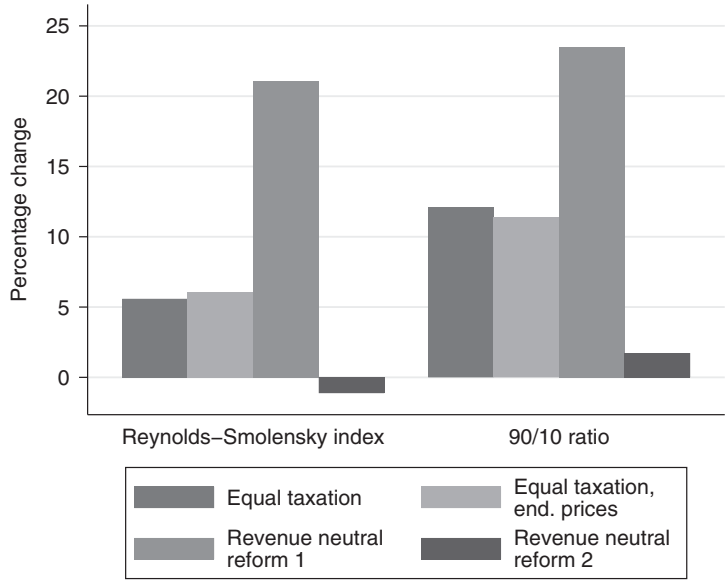

Figure 7. Revenue-Neutral Reform

Notes: Revenue-neutral reform 1 is lump-sum payments to all adults. Reform 2 is a three percentage point reduction in social security contribution. All persons with heads of household aged 18 or above and non-negative household income; 5,099,766 observations.

incomes.[39] It seems politically unfeasible to force pensioners with valuable houses to pay a tax that may take a large share of their income. What could be implemented is a solution where housing taxes for certain groups (i.e. low-income elderly) are deferred until the sale or bequest of the house. Such a system exists in Denmark (Mirrlees *et al*., 2011). Another way to reduce the burden on pensioners, or others with high net housing equity, could be to increase the standard deduction in the wealth tax, to reflect the general increase in wealth as housing tax values are increased.

7. Conclusion

The relationship between tax policy and housing prices is a concern in the Norwegian public policy debate, as in many other countries, especially after the 2008 financial crisis. Most OECD countries have tax systems that favor housing over other assets. Norway combines very lenient taxation with a very high home-ownership rate. This combination leads to worries about households' indebtedness and inefficient investments.

This paper looks at the effects of changing the Norwegian housing taxation on revenue, house prices, and distribution by using a detailed tax-benefit model

[39]The tax reform gives 17,150 households (3.5 percent of households) with a head of household aged 67 or above a tax increase of at least 25 percent of disposable non-housing income.

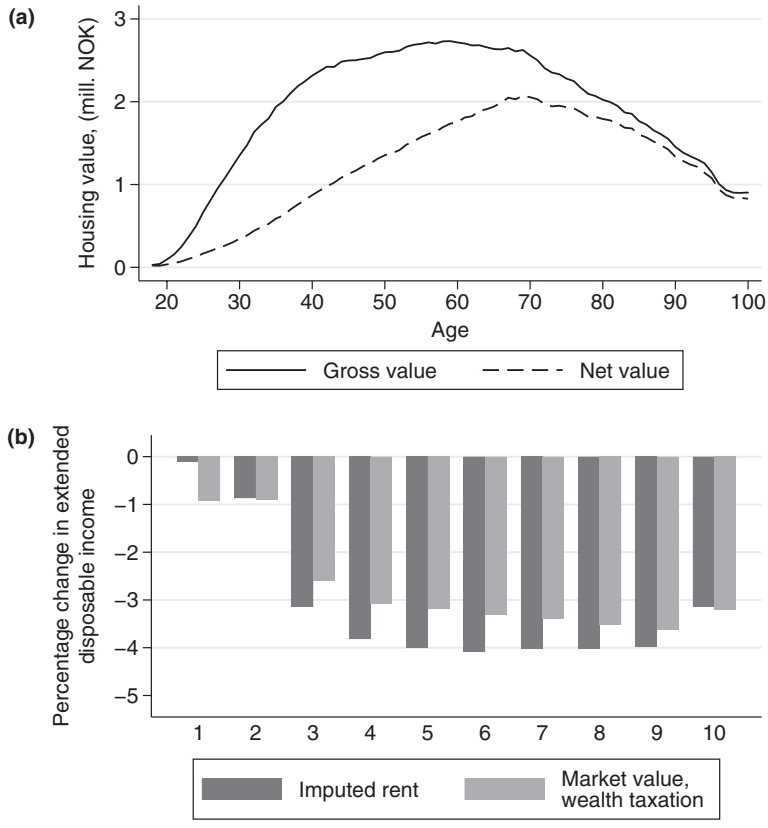

Figure 8. The Age Dimension of Housing Wealth and Income

Notes: (a) The average gross and net housing value for different ages of heads of household. Values in million NOK. (b) All households with heads of household above age 67, and non-negative income; 496,439 observations. Deciles of equivalized disposable income including imputed rental income.

on microdata that includes housing valuations for all Norwegian households. In addition, I use a simple model to suggest how housing prices would react to the increase in taxation, showing a 20 percent decrease in prices. A housing-tax reform that treats housing as a normal asset, by taxing the imputed rent and removing the wealth tax housing rebate, has large revenue effects. Direct taxes increase by a total of 11 percent even when accounting for the induced decrease in housing prices, with two thirds of the increase coming from the taxation of imputed rent. The large predicted reduction in housing prices suggests that a smaller reform may be more feasible; that is, moving partly, but not all the way, toward neutrality of taxation with other assets.

The reform increases the progressivity of the tax system, measured both by the Reynolds–Smolensky index and the differenced 90/10 index. I thus confirm the results of Figari *et al*. (2017), from six other European countries: more neutral taxation of housing decreases inequality. Making the reform revenue neutral can potentially increase the progressivity even more.

While the Norwegian wealth tax, and the high housing ownership share of Norwegian households, make it hard to transfer these results directly to other countries, the lenient taxation of houses, and the rapid housing price and debt growth can also be observed in many other developed countries. The potential for revenue gain, housing price decreases, and increased progressivity should also be investigated in other countries.

Taxation of housing comes with an important age dimension, which may constitute a challenge to political feasibility. The tax burden on pensioners with low disposable incomes and high housing income will increase. This burden could be a reason for the difficulty of enacting an efficiency-improving housing-tax reform in Norway, even though the reform would fulfill several other policy goals.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix A: Distribution of Present Taxes

Table A.1: Difference in Disposable Income, 2013

Appendix B: Imputation of Housing Income

B.1: Imputation Methods
B.2: Real or Nominal Interest Rate

Appendix C: Gini Coefficients and 90/10 Ratios

Table C.1: Tax Reforms