Homestead Exemptions, Heterogeneous Assessment, and Property Tax Progressivity

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Homestead exemptions and caps to valuation growth are two policies ostensibly intended to reduce the property tax burden of lower-income homeowners. Because assessment rates tend be lower for higher-priced homes, the opposing effects of exemptions and regressive assessments can result in either a regressive or progressive property tax. While most view the property tax as regressive, this will depend on the relative sizes of the these opposing effects. Using 2018 data on all single-family homes in Florida, we find that in the majority of counties the homestead exemption dominates regressive assessment, resulting in a progressive tax. We also explore how progressivity of the property tax would be affected by modifying current features of the property tax, including the homestead exemption take-up rate among eligible homeowners, the cap on growth in assessments, and regressive assessments.

Keywords: Property Tax, Tax Incidence, Homestead Exemption, Assessment, Regressivity, Progressivity

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I. Introduction

State and local governments raised over $525 billion from property taxes in 2017, more than their combined revenue raised from both individual and corporate income taxes and nearly as much as their revenue raised from sales taxes (Census, 2017). Although there is substantial variation in property tax reliance across the United States, property tax revenue contributes around 20 percent of total state and local government revenue on average. A natural question concerning any source of tax revenue, let alone one as ubiquitous as property taxation, is who bears the burden of the tax. Just as an accurate picture of who pays income tax requires more than a list of marginal tax rates, understanding who pays property taxes requires more than a list of county millage rates. Property assessment practices and exemption policies are central to understanding how property taxation affects households along the income distribution. In this paper we empirically decompose how various elasticities and policies influence the overall progressivity of the property tax as it applies to homeowners residing in single-family homes.

Prior research on property taxation is varied in both scope and method, even within the area of tax incidence. As summarized in Zodrow (2001), Fullerton & Metcalf (2002), and Oates & Fischel (2016), economists have been debating the theoretical incidence of the property tax since the turn of the 20th century.[1] Efforts to provide empirical evidence on the incidence of property taxes are similarly diverse, with each study varying in methodology, setting, and data. The work most relevant to our purposes, which we review in more detail in the next section, focuses on how various policies affect the estimated progressivity or regressivity of the property

[1] In essence, the debate has been about whether the property tax is a regressive excise tax that disproportionately falls on lower-income households who spend a larger portion of their budgets on housing ("old view"), if the property tax should be considered a progressive tax on capital income that accrues largely to higher-income households ("new view"), or if property taxes are instead fees for benefits and amenities that go to Tiebout-sorting homeowners and is therefore neither progressive nor regressive ("benefits view"). In Section III, we consider the applicability of each of these views to our setting.

tax. In particular, the homestead exemption, which effectively reduces the taxable value of property used as a primary residence, is a common policy (currently offered in some form in 48 states) designed to make the tax statutorily progressive. Tax relief programs intended to limit increases in property tax bills caused by rising home values, such as caps on assessed value growth, can shift the burden of property taxation in ways that reduce equity and have clear implications for tax progressivity (Bowman, 2006).[2] Also of central importance to this study is the assessment literature's common finding that assessment rates tend be lower for higher-priced homes.[3] Recent evidence on the City of Philadelphia, Pennsylvania from McMillen & Singh (2020a) suggests that the homestead exemption may not be sufficient to overcome regressivity in assessments, rendering the property tax a regressive tax, which could contribute to the general negative opinion of the tax (Cabral & Hoxby, 2015).[4]

Our contributions to the literature are threefold. First, we provide estimates of the progressivity of the property tax in the 67 county jurisdictions that cover the entire state of Florida, one of the most populated states in the United States. In addition to the large metropolitan areas that have been the focus of much prior work, our data make it possible to study property tax progressivity in less dense and even rural areas. Second, our methodology takes advantage of the detailed data by decomposing the various factors that contribute to tax progressivity. For example, we are able to directly compare the relative influences of assessment practices and homestead exemptions on progressivity. Such comparisons generate tangible

[2] For detailed descriptions of the features of each state's property tax, see Lincoln Institute of Land Policy (2017).
[3] Hodge et al. (2017) cite seven studies that provide evidence on the vertical equity of property tax assessments and add their own results to this literature. Their findings are consistent with prior evidence showing that assessment ratios decline with sale price.
[4] The potential for homestead exemptions to offset problematic property assessment practices was a topic of discussion as early as Thomas (1935).

policy implications for modifying property tax progressivity. Third, and finally, our transparent framework can easily be reproduced in other settings and with other assumptions

It is theoretically possible to ascertain how property taxation varies over the income distribution by estimating the elasticity of property taxes (T) to permanent income (Y), or E_{TY}. Data limitations typically prevent the feasibility of this direct approach, however, sometimes due to common survey data weaknesses or due to the requirement of additional assumptions. Instead, we indirectly calculate property tax progressivity by separately estimating related elasticities whose product yields E_{TY}. These elasticities show how E_{TY} is affected by the responsiveness of assessed value to market value, property taxes to assessed value, and market value to a proxy for permanent household income, thus allowing us to uncover the sources underlying the progressivity of the tax. We use property tax records from Florida to estimate the elasticities necessary to back out E_{TY} and explore various factors that contribute to the overall regressivity or progressivity of property taxation.[5] Our large sample across a wide variety of jurisdictions enables us to more generally address the issue of whether homestead exemptions and growth caps are sufficient to overcome regressivity in assessments.

Our analysis reveals that property taxation is slightly progressive in Florida: 72 percent of counties have an $E_{TY} > 1$ and the statewide average is 1.09. Our calculations show that assessment practices, which disproportionately favor higher-priced houses, introduce a powerful regressive element into E_{TY}, consistent with the findings in previous work. However, in contrast to McMillen & Singh (2020a), we find that in the majority of counties the homestead exemption, by providing a constant exemption amount for all homeowners that is larger in percentage terms

[5] While homeowners also reside in condominiums and mobile homes, single-family homes are by far where most homeowners reside, accounting for 80 percent of owner-occupied housing in Florida, according to the 2018 American Community Survey.

for low-priced houses, more than offsets the regressive assessment influence, resulting in a property tax that is progressive overall. We also find that assessment growth caps, which have the potential to increase or decrease progressivity depending on assessment practices and local market conditions, increase progressivity in the state. After establishing the current level of progressivity, we explore how our measures of progressivity would change under a number of alternative policies by generating counterfactual tax liabilities. Relative to the baseline average E_{TY}, progressivity increases by 10 percent under full take-up of the homestead exemption, increases by 22 percent under proportional assessment, is unaffected if the $10,000 cap on the state and local tax (SALT) deduction were repealed, and decreases by 46 percent in the absence of all state and local property tax relief programs. With a better understanding of how these different aspects of property taxation influence the overall progressivity of the tax, policymakers may be able to more effectively balance revenue and equity concerns.

II. Literature Review

Our literature review focuses on the empirical studies most relevant to our study. It is not exhaustive; in particular, a promising direction for future research is to analyze how policies in other settings affect property tax progressivity, including circuit-breaker programs (Bowman, 2006) and policies intended to inform and protect homeowners from higher taxes following reassessment (Cornia & Walters, 2006).

Plummer (2003) uses property tax records for single-family homes in Dallas County, Texas, where homestead exemption amounts vary across jurisdictions within the county. Plummer estimates Suits indices that indicate that county and school taxes are proportional to

slightly progressive, whereas city taxes are moderately regressive.[6] She also finds that exemptions for residents over the age of 65, another common property tax exemption, increases progressivity. Our results are broadly consistent with her findings. It is worth noting that Plummer uses the assessed value as a proxy for permanent income. Housing consumption may or may not be good indicator of permanent income. There is also a concern that the assessor's estimate of market value captures much of variance in housing consumption.

Beal-Hodges, Borg, & Stranahan (2016) use 2010 data on individual owner-occupied properties in Florida to regress the ratio of taxes paid to income on income and neighborhood demographic variables. They use the median income of the block group that contains the home as a proxy for a homeowner's income and find that the property tax is regressive. Apart from possible attenuation bias resulting from their measure of the homeowner's income, because median income appears as the dominator of their dependent variable and is their main regressor, their conclusion that the property tax on owner-occupied housing is regressive may be affected by spurious correlation.[7] Given that we use updated data from the same setting as Beal-Hodges et al. (2016), we attribute our contrasting conclusion to different methodological approaches.

McMillen & Singh (2020a) obtain the incomes for a sample of homeowners by matching characteristics of the loan found in both the CoreLogic and Home Mortgage Disclosure Act (HMDA) data bases, where the former contains tax data and the latter the current income of recent mortgage holders. They restrict their analysis to four cities (Baltimore, Cleveland, Denver

[6] The Suits index compares the cumulative percentage of the tax burden and the cumulative percentage of total income. A value less (more) than one indicates a regressive (progressive) tax. Describing this approach, Plummer writes that "differences between a property's assessed value and its actual market value should not bias S unless assessed-to-actual market value varies systematically with value." This assumption may not be realistic according to studies documenting that assessment practices differ across the distribution (e.g., McMillen & Weber, 2008).

[7] Moore (2008) also uses Florida data to study how property tax equity is affected by the homestead exemption and assessment growth caps. The aggregation of older data (1995-2004) into coastal and inland groups combined with methodology focused on different outcomes (e.g., coefficient of dispersion) may explain why he concludes that the policies in question reduce equity. Replicating his study with current data is left for future research.

and Philadelphia) spanning the years 2014 to 2017. They use three versions of taxes paid: the statutory tax rate times the assessed value, the statutory rate times the sales price, and the taxes reported in the CoreLogic data. The results for all four cities and all three measures of the taxes paid reveal that the property tax is a regressive tax. Most relevant to our study is that in Philadelphia, the only city in their paper with a homestead exemption, the tax is as regressive as in the other three cities. The authors acknowledge that the use of permanent rather than current income may yield different findings. Our conclusions may differ from those in McMillen & Singh (2020a) due to a combination of data and methodological differences. Where they focus on four large cities, our sample covers the entire state of Florida. The property tax is a local tax and what may be true in one jurisdiction may not be true in another. Furthermore, their sample is restricted to mortgage holders that can be found in the HMDA data base. It is not clear that this is a representative sample across the income distribution. Finally, our work differs from theirs in that we do not assume that all homeowners eligible for the homestead exemption take it.

A related area of study with clear implications for property tax progressivity pertains to regressivity in assessment practices, where less expensive homes are over-assessed in comparison to more expensive homes. Much of this literature is methodologically focused, essentially debating the best way to estimate assessment regressivity. We review this debate in Appendix A as it applies to our chosen methodology. What can be considered as a stylized fact from these studies, most recently in a systematic national study by Berry (2021), is that assessment regressivity is a pervasive phenomenon. Possible explanations for this pattern could be the higher frequency of successful assessment appeals by owners of higher-priced properties (McMillen & Weber, 2010), the lack of comparable sales for use in the assessment process (McMillen & Weber, 2008), or other limitations in the data and methods used by assessors

(Berry, 2021). Holding everything else constant, assessment regressivity will reduce property tax progressivity.

III. Background

There is considerable variation in both property taxation and property tax exemptions across the United States, yet throughout the country the property tax comprises a substantial percentage of own source revenue by state and local governments. Our data come from Florida, a state that falls very close to the median in terms of reliance on the property tax for government revenue (Census, 2017). That Florida is fairly representative in this dimension combined with the fact that it is the fourth most populated state make it an attractive setting in which to study the property tax.

Counties, municipalities, and school districts can levy property taxes in Florida. Both county and municipal governments collect property taxes in Florida, but the administration of the tax is at the county level. The overwhelming majority of property taxation is raised for county governments. For example, the average millage rate for county government operations is 0.699 percent while the average millage rate for municipalities is 0.146 percent.[8] There is sizeable variation in millage rates across the state, the largest county millage rates being nearly four times as large as the lowest county millage rates, but rates are fairly constant within a county given the relatively small rates levied by municipalities and the fact that school districts are synonymous with counties in Florida. On average, only 16 percent of the total millage rate is due to sub-county levies.

Because the property tax is an ad valorem tax, it is necessary for each county tax assessor to determine the taxable value of the property in order to estimate how much a homeowner owes

[8] We present summary statistics of Florida's millage rates in Appendix Table 1.

in property taxes. In Florida, assessors evaluate properties annually in order to provide an estimate of what each home would sell for on January 1 of the tax roll year. This estimate, labeled the "just value," is in part influenced by recent sales of comparable properties, however each county has their own assessment methods and policies.[9] In Florida, the "assessed value" commonly referred to in the literature has a separate meaning, though it can be equivalent to the just value in the absence of assessment limitations. Concerns that large price increases in comparable properties could burden existing homeowners with increasing property tax payments, despite no tangible increases in liquid wealth, helped motivate the passage of the "Save Our Homes" (SOH) policy in 1995 that caps the growth in assessed value at 3 percent or the change in Consumer Price Index, whichever is smaller.[10] Applying the SOH cap to the previous year's assessed value, establishes the current assessed value of a house.

The next step is to apply property tax exemptions to the current assessed value, thereby generating the "taxable value" of a home. Florida's property tax homestead exemption originated in response to the Great Depression, when many property owners found themselves unable to pay their property taxes and feared losing their homes. While there have been multiple changes and expansions since its inception, the policy has remained constant during our period of analysis.[11] A $25,000 exemption is applied to the first $50,000 of a homeowner's assessed value if the property is the homeowner's permanent residence and the property is owned on January 1 of the tax year. This exemption applies to all taxes, including school district taxes. If the

[9] Title XIV, Chapter 193 covers assessment practices in Florida. In addition to the standard assessments, Section 11 lists eight factors (location, size, condition, etc.) that appraisers should use in generating a just valuation. How much weight is placed on these factors is left up to the discretion of the appraisers.

[10] The SOH limitation is not unlike the more famous and extensively studied California policy Proposition 13 (see, for example, Rosen, 1982).

[11] Voters approved a $5,000 Homestead Exemption as an Amendment to the Florida Constitution in 1934. The Florida Legislature increased the exemption to $10,000 during the 1960s. Subsequent voter referendums raised the exemption to $25,000 in 1980 and then again in 2008 to a maximum possible amount of $50,000. Roughly 85 to 99 percent of homeowners, depending on the county, receive the maximum amount.

property's assessed value is at least $50,000, an additional exemption of up to $25,000 is applied to the assessed value between $50,000 and $75,000. This additional exemption is not applied to school district taxes. The homestead exemption does not come automatically, rather eligible homeowners must apply for the exemption, which involves providing documentation that they use the property as their primary residence. A homeowner continues to receive the benefit unless they notify the assessor of a change in status. Depending on millage rates, Ihlanfeldt (forthcoming) shows that the homestead exemption will save the homeowner between $800 and $1200 in annual property taxes. Receiving the homestead exemption automatically grants the homeowner the SOH assessment limitation. The SOH limitation is not available to homeowners without the homestead exemption. Other exemptions granted to specific groups of homeowners, including the disabled, veterans, and low-income senior residents, can be claimed simultaneously and similarly reduce the taxable value of a home, sometimes to zero, though they apply to only 4 percent of homeowners. Finally, multiplying the taxable value by the millage rate determines the homeowner's tax liability.

Each part of the process by which property tax liability is calculated has the potential to affect the progressivity of the property tax. Because our combined millage rates are relatively flat within a county, their effect on overall progressivity is limited. As previously noted, prior work documents how assessment practices generally lead to more regressive property taxation, whereby higher-priced homes receive lower effective rates (Hodge et al., 2017; Berry, 2021). The role played by the SOH cap in affecting the incidence of the tax depends on the relative growth in prices across different parts of the real estate market. If higher-priced (lower-priced) homes appreciate at a faster pace than lower-priced (higher-priced) homes, SOH could lead to less (more) progressive property taxation. Assessment exemptions such as the homestead

exemption should lead to more progressive property taxation because they make up a larger percentage of the value of lower-value properties.[12] And, of course, the relationship between income and housing consumption is central to any measure of property tax progressivity. If lower income homeowners spend relatively more of their income on housing than higher income homeowners then a property tax will tend to be more regressive. Although we consider how each of these elements affects progressivity, it is important acknowledge that our study does not account for other behavioral responses to property taxation that may be important in a general equilibrium model, such as location and house size decisions.

IV. Methodology

A researcher with data linking property taxes (T) to permanent income (Y) could directly estimate the elasticity E_{TY} to quantify how the burden of property taxation changes as income increases. Property taxation is progressive if E_{TY} is greater than one, regressive if E_{TY} is less than one, and proportional if $E_{TY} = 1$. Data limitations prevent this direct approach, however, so we employ a modified version of the framework presented in Ihlanfeldt (1982). The original framework described how a researcher with separate estimates of how the market price of a house (H) relates to permanent income and how property taxes relate to house price can determine how property taxes relate to permanent income. Specifically, multiplying E_{HY} and E_{TH} yields the desired parameter, E_{TY}.

In this paper, we expand upon the original framework in order to investigate the various factors that influence measures of property tax progressivity. We estimate multiple elasticities, the product of which quantifies the regressivity or progressivity of the property tax:

[12] The incidence of property taxes in the non-residential and rental markets are important but outside the scope of this paper. See England (2016) for a survey of the research on the latter.

$$E_{TY} = E_{HY} \times E_{JH} \times E_{TJ} \quad (1)$$

The elasticity of a house's market price to permanent income (E_{HY}) describes how housing consumption changes with income. To be clear, the relevant income measure is permanent income, which is more related to housing consumption than current income and allows a better assessment of the burden of the tax.[13] Property taxes are related to a house's market price, but tax assessors can have a meaningful impact on the how a house is valued for tax purposes. As described in the previous section, the first assessment by the county is labeled the just value (*J*). E_{JH} measures how an assessor's just value relates to the house price. If $E_{JH} < 1$ then just values do not rise proportionally with housing prices and assessment is categorized as regressive. Finally, E_{TJ} captures the relationship between property taxes and the just value. It is important to note that exemption eligibility and take-up are potentially correlated with the house price. By using the just value of a home before exemptions, we isolate the assessor influence on the just value in E_{JH} and the importance of exemptions and limitations in E_{TJ}. By simple algebraic manipulation, it is clear that the product of these three elasticities yields E_{TY}.

Using our detailed tax roll data on individual properties (*i)*, we perform separate regressions for each county in order to generate 67 separate estimates of both E_{JH} and E_{TJ}:

$$\ln(JV_{i,t}) = \alpha + E_{JH} \ln\left(H_{i,t}\right) + \tau_t + \epsilon_{i,t} \quad (2)$$

$$\ln(T_i) = \alpha + E_{TJ} \ln(JV_i) + \epsilon_i \quad (3)$$

Our log-log specifications will yield unbiased elasticity estimates under the standard OLS assumptions. We include year fixed effects (τ) when estimating E_{JH} because the sample includes pooled sales data over multiple years. Our decision to estimate county-level elasticities is due to

[13] See Mayo (1981) for a discussion of how different income measures can affect estimates of E_{HY}.

the fact that the tax is administered at the county level. Comparing estimates across the state permits us to explore patterns related to the estimates and understand to what extent local policy decisions can influence progressivity. We do not have data on individual homeowner income necessary for an analogous estimation of E_{HY}. Instead, we rely on median house expenditures and income reported at the block group level in the American Community Survey (ACS); we provide a full description of this process in Appendix B. We pool the ACS data to produce a statewide estimate of E_{HY} using a log-log specification with county fixed effects.[14]

To summarize, data limitations serve as the initial motivation for this indirect estimation of E_{TY}, yet this approach offers the opportunity to decompose and modify the various components of E_{TY} in order to better understand how characteristics of the tax affect its progressivity or regressivity (for example, homestead exemptions relative to assessment practices).

A potential complication surrounding our approach to estimating the progressivity of the property tax on single-family homeowners is that there has long been disagreement on how to view the property tax. There are three distinct views of the property tax that have a bearing on estimating the incidence of the tax, generally labeled as the benefits view, the old view, and the new (or capital tax) view. The benefits view considers the tax a fee for the receipt of public services. Under this view estimating the incidence of the property tax is meaningless.[15] Homebuyers shop across jurisdictions to find their optimal public services/tax package (Tiebout, 1956) and, with perfect zoning, free riders are kept out of the jurisdiction (Hamilton, 1975).

[14] The statewide estimates of E_{TJ} and E_{JH} are similar to the means we present below. The decision to pool the block group data is due to the reduced number of observations and the stability of E_{HY} estimates across various specifications.

[15] As a reviewer noted, the benefit view does not imply the property tax has no incidence, rather it implies that the incidence of the tax is identical to the incidence of the benefits received.

Jurisdictional characteristics in Florida are inconsistent with this view. Counties and school districts are synonymous and there are only 67 of them within the state. Moreover, counties and not cities are the primary providers of non-school related public services. Within counties, on average, 50 percent of the population resides within the unincorporated area. Hence, shopping across communities in the Tiebout-sorting sense is extremely limited, especially within counties, which are the focus of our analysis.

According to the old view theory of property tax incidence (Netzer, 1973), the property tax on housing improvements acts completely as an excise tax on housing consumption. The current homeowner, therefore, bears the full burden of this tax in his capacity as a consumer of housing services. Under this view analyzing the incidence of the tax is meaningful and our E_{TY} estimation is a reasonable approach.

Under the new view the tax levied on owner- occupied housing capital consists of two components – the national average rate of taxation (t_n) on capital and an excise tax effect (t_e), equal to the difference between the average tax rate within the local homeownership market and the national average rate (Mieszkowsi, 1972). In his role as a capitalist, the homeowner pays t_n. If t_e is greater than (less than) t_n capital will exit (enter) the local metropolitan homeownership market until the net rate of return on capital is equalized across metropolitan areas and alternative capital employments. These capital movements imply that local area deviations from the national average rate of taxation will be shifted forward to homeowners as part of the price of housing services or backward to immobile factors employed in the production of housing. Our E_{TY} estimates assume an absence of backward shifting. How reasonable is this assumption? Labor and materials are mobile, and therefore bear little of the tax burden, especially in the long run. Because land is immobile landowners will bear

303 a portion of the tax. The issue for our E_{TY} estimates is the size of this portion. Ihlanfeldt (1982)
304 shows that this portion is small if the demand for housing is price inelastic, the elasticity of
305 substitution between land and the other inputs employed in the production of housing is close to
306 one, and land costs are a relatively small portion of total construction costs. Evidence lends
307 support to inelastic demand (Albouy et al., 2016, Pollinsky & Ellwood, 1979) and a unitary
308 substitution elasticity (Ahlfeldt & McMillen, 2014; Thorsnes, 1997). Using our data on the land
309 cost and the price of new homes, we computed the percentage land cost for every county in our
310 sample and found the average to be 19 percent. With inelastic demand, the elasticity of
311 substitution must be small if tax induced changes in the local demand for housing are going to
312 have an important impact on the price of land. Given that land costs are a small portion of
313 construction costs, a dramatic decline in the price of land must occur if landowners are to bear a
314 significant portion of the tax. The evidence therefore suggests that the lion's share of the new
315 view excise tax effect is shifted forward to homeowners. Hence, under either the old or new
316 view, we have confidence in our estimation strategy.

317 # V. Data

318 Our data come from the Florida Department of Revenue (FDOR), who provide the 2018
319 property tax rolls for all 67 counties. Each county has autonomy over the administration of the
320 property tax, with annual review provided by the FDOR. These tax rolls include a host of
321 information, including specific property tax exemptions granted, the just value, the assessed
322 value, and property tax liability. In addition to observing which owners actually received the
323 homestead exemption, we leverage the address information in order to identify owners who

failed to claim this benefit despite being eligible.[16] If the physical address of the home and the homeowner's mailing address match and there is no homestead exemption on the property, then we consider the homeowner a non-claimant.[17] We are unable to identify non-claimants of other property tax exemptions although we do analyze how these other exemptions compare to the homestead exemption in affecting tax progressivity. The most common are complete or partial exemptions for disabled residents (veteran or otherwise) and various county and municipality tax exemptions for low-income senior residents. For our analysis, we focus on owner-occupied, single-family homes in tax year 2018. Once flagged as owner-occupied in 2018, we retrieve all of the relevant tax information dating back to 2008. This enables us to determine the number of years over this period the current homeowner had occupied the home, which we then use calculate counterfactual housing values in the absence of various exemptions and limitations that can compound over time. We use data on the percentage of itemizers in a county (IRS, 2018) to account for federal deductibility and the SALT cap.[18]

We present summary statistics of our data in Table 1. We include county-specific information in Appendix Table 2. Our sample includes over 3.5 million houses in Florida. There is substantial variation in housing values, millage rates, and property tax amounts, in part reflecting the diversity of real estate in the state. The average just value is around $256,000.

[16] According to Florida Statute 196.031, this exemption is available to "[a] person who, on January 1st, has the legal title or beneficial title to real property in [Florida] and who in good faith makes the property his or her permanent residence or the permanent residence of another or others legally or naturally dependent upon him or her."

[17] It is possible that homeowners who have a mailing address that matches the home address are ineligible for the homestead exemption because the home is not their primary residence. For example, the home could be a second home or a rental. Although we cannot determine if a home is a rental or second home, the results are unaffected when we drop any observation where the homestead exemption is not claimed and the owner's name is affiliated with another property within the state.

[18] We assume that household income is JV/2.5, based on common realtor guidance on how much a prospective homeowner can afford to pay for a home, in order to map an observation to an income group in the IRS data and assign a federal marginal income tax rate (MTR). The modified taxable value is $(1-\rho)TV + \rho TV(1-MTR)$ where ρ is the percentage of itemizers in a county-income group in 2018. We limit the amount TV can decrease to account for the SALT cap.

Accounting for the SOH cap produces an average assessed value of $193,000. The average taxable value is $146,000, demonstrating the combined impact of exemptions and the SOH cap. The average millage rate is 0.015 and the average property tax liability is $2,151. The average number of properties per county is 52,753. As outlined above, estimating E_{JH} requires sales data that is more limited: the average number of sales between 2013-2018 per county is 22,624. Between 8 and 9 percent of eligible homeowners do not claim the homestead exemption. Senior exemptions, either at the county or municipality level, and disabled exemptions are claimed by 4.1 percent and 1.1 percent of the homeowners in the sample, respectively. As with the homestead exemption, these additional exemptions are not automatic but must be applied for with the requisite supporting documents, meaning there may be many homeowners eligible for these exemptions who do not take them.[19]

VI. Analysis

We report our elasticity estimates in Section VI.A. In Section VI.B we analyze these estimates from a number of perspectives: VI.B.I explores how our estimates relate to other county characteristics, VI.B.II considers how the homestead exemption affects the progressivity of property taxation, VI.B.III isolates the importance of assessment practices on the regressivity of property taxation, and VI.B.IV examines how modifying other policies (senior exemptions, SOH, SALT cap) would affect property tax progressivity.

VI.A. Baseline Elasticity Estimates

The first elasticity we estimate is E_{TJ}, the elasticity of property taxes to the just value. Regressing the log of property taxes on the log of the just value for each county produces 67

[19] For example, applicants for the senior citizen exemption must provide proof of residency and income information (e.g., IRS 1040, W-2) along with the Form DR-501SC.

362 different estimates of E_{TJ}, the summary of which we present in Table 2.[20] Under current policy
363 with incomplete take-up of the homestead exemption, the average increase in property taxes is
364 1.77 percent for a 1 percent increase in the just value of a home. Despite variation across
365 counties, E_{TJ} is always greater than 1, reflecting that, at least in this dimension, property taxation
366 in Florida favors homeowners with lower value properties.

367 The next component of Equation 1 we estimate is E_{JH}, the elasticity of the just value to the
368 house's market (sale) price. Once again using a log-log specification, we estimate separate E_{JH}
369 elasticities for each Florida county.[21] To estimate E_{JH} we restrict our sample to properties that were
370 recently sold. For these regressions, we use arm's length sales between 2013-2018 that occurred
371 in the year preceding the assessor's January 1 estimate of just value.[22] The average E_{JH} is 0.83,
372 indicating that for every 1 percent increase in the market value of a home the assessor's just value
373 estimate increases by about 0.8 percent. As previously mentioned, this pattern of assessment
374 practices can have important implications for the tax burden of homeowners across the income
375 distribution. It is worth noting that E_{JH} is never above 1, suggesting that current assessment
376 practices consistently favor higher priced homes.

377 The final step in measuring the regressivity or progressivity of property taxation is
378 merely multiplying these elasticities together as defined in Equation 1. For the remainder of the
379 paper we will use $E_{HY} = 0.75$, based on our investigation in Appendix B, as our estimate of the

[20] See Appendix Table 2 and Appendix Figure 2 for county-level estimates and Appendix Figure 1 for the distribution of E_{TJ} estimates.

[21] There has been some debate over which method of estimating E_{JH} produces the least biased results (DeCesare & Ruddock, 1998; McMillen & Singh, 2020a; 2020b), which we review in Appendix A.

[22] Arm's length sales are those identified as "qualified" by the FDOR and exclude a wide range of transactions where the reported sales price may be an unreliable estimate of the true market value of the property. In addition to including year fixed effects, we also trimmed our sales to check if our E_{TJ} estimates are affected by statistical outliers. The results are unaffected when we exclude the top and bottom 1 percent of sale prices from our regression samples.

elasticity of housing consumption with respect to permanent income. Although our estimate of E_{HY} is stable across numerous specifications and is comparable to prior work (Albouy, Ehrlich, & Liu, 2016), it is important to keep in mind that using different values of E_{HY} will shift the overall E_{TY} values accordingly. Referring again to Table 2, E_{TY} under current policy and benefit take-up indicates that the property tax is slightly progressive on average (1.09). There is substantial variation in this elasticity across counties with estimates ranging from around 0.61 up to 1.57. However, 72 percent of counties currently have progressive property taxation, which we show in Figure 1.

VI.B. Factors related to the elasticity estimates

With our baseline elasticity estimates in hand, we turn now to identifying what factors underlie these estimates and how modifying the existing menu of property tax policies could affect our estimates.

V.B.I. County Characteristics Correlations

In Table 3, we show how our elasticity estimates relate to county variables from the 2018 American Community Survey. The first column shows that higher income, more populated, and more educated counties are associated with higher E_{JH}. A higher tax base per capita and less established residents, defined as the fraction of residents who moved into their current residence before the year 2000, also corresponds with a higher E_{JH}. Our preferred interpretation of these correlations is that places with higher economic activity have less regressive assessment practices. A robust real estate market, resulting from both a larger population and more mobile residents, would arguably make it easier to collect appropriate comparable sales to use when generating the just value of a house. Remarkably, the same variables are correlated in the

opposite way with our E_{TJ} estimates. If older residents living in less economically vibrant areas are more likely to qualify for various exemptions or have accrued substantial SOH benefits, this could explain why those locations have a subdued connection between just value and taxable value. The number of observations per county in our sample is positively correlated with a higher E_{JH} but uncorrelated with E_{TJ}, further supporting the hypothesis related to few comparable sales, a concern with precedent in the literature. The fact that the correlations of $E_{JH}$and E_{TJ} are in the opposite directions manifests itself in the third column, which shows there are no significant patterns when we consider our final measure of progressivity. Despite these plausible explanations, we hesitate to put too much weight on this correlational exercise though we recognize the potential for future work to shed light on this question.

VI.B.II. Homestead Exemption

Given the non-trivial percentage of homeowners who fail to apply for the homestead exemption (8 percent), it is important to consider how incomplete benefit take-up affects the progressivity of property taxation. Failure to claim this benefit not only leads to taxable values that are potentially $50,000 higher than they could be in the short-run, but the SOH cap on assessed value growth that is coupled with the homestead exemption means that even larger differences in potential versus actual taxable values emerge over time. The second panel of Table 2 shows that the average E_{TJ} increases from 1.77 to 1.96 when we assume complete benefit take-up.[23] When combined with the same E_{JH} and E_{HY} used in the first panel, this change boosts the average E_{TY} from 1.09 to 1.20. Complete take-up of the homestead exemption therefore has the potential to increase property tax progressivity on average by 10 percent. As illustrated in Figure

[23] This involved applying the homestead exemption to the assessed values of eligible homeowners, where the growth in assessed value under the cap was based on the number of years the homeowner resided in the home.

1, 11 of the 19 counties where the property tax is currently regressive would become progressive if every homeowner eligible for the exemption claimed it.

Another way to measure how the homestead exemption affects progressivity is to simulate its removal. Without the homestead exemption, the taxable value equals the assessed value minus other exemptions. Panel C shows that ending this homestead exemption policy would decrease the mean E_{TY} from the baseline of 1.09 down to 0.60. One way of quantifying the importance of the homestead exemption in making Florida's property tax system progressive on average is that, without this exemption, progressivity would be reduced by 45 percent. From a binary perspective, Figure 1 shows that eliminating the homestead exemption would lead to regressive property taxation in every county in the state.

VI.B.III. Assessment Significance

To isolate the importance of assessment practices on the regressivity of property taxation we assume proportional assessment by setting $E_{JH} = 1$ in Panel D of Table 2, holding the exemption take-up at actual values. In other words, assessors will increase the just value of a house by 1 percent for every 1 percent increase in the house's market (sale) price, thereby eliminating any regressive influence of E_{JH} on E_{TY}. The average E_{TY} increases from the baseline 1.09 to 1.33, representing a 22 percent increase in tax progressivity, and 16 of the 19 currently regressive counties would become progressive. Figure 2 illustrates the distribution of county E_{TY} estimates under various combinations of exemption policies and assessment practices. It is clear that while proportional assessment would increase progressivity, it would not be sufficient to achieve progressive property taxation. Absent homestead exemptions, Equation (1) shows that property taxation will be regressive as long as $E_{HY} < 1$, even if proportional assessment is feasible. Therefore, while proportional assessment helps to avoid making property taxation more

regressive and would increase progressivity more than full take-up of the homestead exemption, the homestead exemption is the primary driver of property tax progressivity.[24]

VI.B.IV. Alternative Policies' Impact on Progressivity

The remaining panels of Table 2 explore how modifying other policies would affect property tax progressivity. Except for the final panel of Table 2, where all exemptions and the SOH cap are eliminated, we consider each change in isolation, without changing any of the other factors affecting the tax liability.

The SOH cap on assessed value growth that homeowners in Florida automatically receive if they are granted a homestead exemption is another policy that affects property tax progressivity. This cap will differentially affect homeowners along the income distribution if there is heterogeneous growth in the value of houses. For each homeowner we constructed the counterfactual of not having the SOH cap by predicting the current assessed value without SOH over the number of years the homeowner occupied the home.[25] Panel E of Table 2 indicates that the SOH cap meaningfully contributes to property tax progressivity in Florida. Removing the cap would reduce average tax progressivity by 27 percent and there would be 61 counties with a regressive property tax instead of the current 19.[26] It is important to recall that the value of the SOH cap grows over time, making housing tenure a key feature in the value of this tax benefit. Property taxation may appear more progressive in a static sense if compounded SOH benefits

[24] See Appendix Figure 3 for county-level comparisons of the impact of full take-up versus proportional assessment.
[25] The data allowed a maximum duration of stay of ten years. For homeowners under the SOH cap for longer than 10 years, our estimate of what their property taxes would be 2018 without the cap contains some measurement error. The potential for bias in our counterfactual depends on whether the errors are correlated with just value. Although we have no reason to suspect a correlation, we cannot rule it out. Therefore, this counterfactual should be interpreted with the appropriate caution.
[26] Our results suggest that less expensive homes appreciated more rapidly than more expensive homes over the 2008-2018 time period. Davidson (2019) reports that "since the U.S. housing recovery began in 2012, affordable homes in modest neighborhoods have notched the sharpest price increases while luxury houses in wealthy neighborhoods have had the smallest percentage gains." This suggests that the Florida experience may have mirrored what was happening at the national level.

accrue to elderly residents with lower incomes in retirement, but these homeowners may nevertheless have high permanent incomes. Thus, a better understanding of the impact of the SOH cap on progressivity requires additional research, perhaps taking a life-cycle approach.[27]

Florida's reputation as a welcoming state for retirees motivates the consideration in Panel F: how important are low-income senior resident exemptions to overall property tax progressivity? Relative to the baseline, eliminating all county and municipality senior exemptions would reduce progressivity by about 10 percent. These exemptions do not dramatically affect statewide averages, likely because they are only available in a subset of jurisdictions and come with additional eligibility requirements. Nonetheless, senior exemptions appear to have a non-trivial impact on property tax progressivity. Without these exemptions there would be 21 more counties, more than double the current number, with regressive tax incidence.

The Tax Cuts and Jobs Act (TCJA) of 2018, among many other changes, imposed a $10,000 limit on the SALT deduction. Panel G relaxes this cap with minimal impact on our estimates: the average E_{TY} decreases by less than 1 percent and Figure 1 shows that 1 additional county became classified as regressive. We should point out, however, that the results of this particular exercise may be more sensitive to the state under investigation. Florida's reliance on property taxes and sales taxes, with no state income tax, limit the importance of the cap. Performing similar analyses in a state with progressive income taxation may yield markedly different results.

The final panel in Table 2 shows that eliminating all of the aforementioned state and local tax breaks (exemptions and the cap on assessment growth) would render the Florida property tax on single-family homes a regressive tax throughout the state. It is noteworthy that the decrease in

[27] The SOH cap may also have efficiency and mobility implications (Shan, 2010; Ihlanfeldt, 2011).

progressivity of nearly 46 percent from eliminating all tax advantages is only slightly larger than the decrease due to the elimination of the homestead exemption alone. To reiterate, the homestead exemption is the primary driver of property tax progressivity in Florida.

VII. Discussion and Conclusion

In this paper we explore how various tax exemptions and assessment patterns impact the progressivity of property taxation. By decomposing the elasticity of property taxation to household income into related elasticities that we can estimate with data from the Florida Department of Revenue (FDOR), we show not only that property taxation in Florida is on average (and for the majority of counties) progressive but also that property tax exemptions are by and large the main reason for this conclusion. Assessment practices that benefit homeowners with more expensive houses, possibly due to appeals processes or lack of comparable sales, are the primary reason why property taxation is not more progressive.

The competing influences of assessment-driven regressivity and exemption-driven progressivity provide policymakers with multidimensional options for modifying overall property tax progressivity. Of course, while it is possible to change various aspects of the property tax system in order to manipulate progressivity, revenue considerations cannot be ignored. On the one hand, moving assessments in a more proportional direction would not only increase progressivity but also increase property tax revenue. The feasibility of modifying assessment practices in this way may run into practical difficulties due to limited comparable sales of higher-priced houses. Furthermore, it is entirely possible that resistance by wealthier homeowners would make this effort politically untenable. In fact, these homeowners may respond to higher taxes by voting with their feet, choosing to move to lower tax jurisdictions, which could possibly attenuate the increase in revenue. Even a broadening of the base approach,

509 whereby more proportional assessment is combined with lower tax rates, may not be enough to
510 overcome the potential public choice challenges.

511 Instead, introducing or expanding tax exemptions that undo the regressivity of assessment
512 practices may be the more feasible approach. In particular, our results show that the complete
513 take-up of the homestead exemption among eligible homeowners, on average, would increase
514 property tax progressivity by nearly 10 percent, with over half of the counties in Florida where
515 the property tax is currently regressive becoming progressive. This leans in favor of greater
516 effort on the part of county assessors or the FDOR to publicize the existence of the exemption.
517 Each county tax assessor maintains a web page advertising the existence of the exemption and
518 instructions for filing an application. In a majority of Florida's counties residents can submit
519 applications online. Ihlanfeldt (forthcoming) shows there is considerable variance in efforts to
520 publicize the exemption. Only 26.3 percent of the counties advertise community outreach on
521 their web site, such as office staff meetings with church and community groups. He also shows
522 that greater effort is correlated with a higher take-up rate of the exemption among eligible
523 homeowners.

524 Even with complete take-up, determining the "correct" homestead exemption amount
525 given a certain level of regressivity in assessment practices is a practical problem facing
526 policymakers. We should also highlight the fact that estimates of the elasticity of housing to
527 income are commonly below 1, mirroring our own estimate, suggesting that exemptions may be
528 necessary to reduce regressivity of the property tax even in the presence of proportional
529 assessment.

530 While the homestead exemption in Florida has almost universal support, the assessment
531 cap that accompanies the homestead exemption has its detractors. The concern is that the cap

creates an unfair system of taxation in which first time home buyers, new residents, seasonal residents, and businesses are burdened with more than their fair share of taxes. In the continuing debate over this issue, our results suggest that the importance of the cap in contributing to the progressivity of the property tax should not be overlooked. If Florida never instituted the SOH cap, even with the homestead exemption in place, the property tax would be regressive in over 90 percent of Florida's counties.

We close with two final thoughts. First, the policy implications of our analysis are heavily dependent on the component elasticities. Additional research is necessary to understand the relative importance of tax relief programs and assessment practices, not to mention the elasticity of housing demand to income, to property tax progressivity outside of Florida. Second, the focus of this paper is state and local property taxation, but federal policy can also affect the progressivity of the property tax, most recently when the TJCA capped the SALT deduction. Although our estimates do not show that repealing the cap would significantly reduce progressivity in Florida, this may not be true in states with progressive state income taxation, nor is the cap the only lever by which federal policy may influence this issue. Keeping in mind the difficult balance of revenue requirements, heterogeneous preferences of residents, and other parts of the tax system, the analysis presented in this paper may be useful for policymakers interested in affecting the progressivity of property taxation.

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Table 1: Summary Statistics

	Mean	Median	Q1	Q3
Statewide statistics (N = 3,534,471)				
Just value ($1000s)	$256 ($415)	$192	$134	$282
Assessed value ($1000s)	$193 ($325)	$141	$91.4	$216
Taxable value ($1000s)	$146 ($319)	$91.6	$39.2	$169
Millage rate	0.015 (0.004)	0.014	0.012	0.018
Property tax amount ($1000s)	$2.15 ($5.0)	$1.28	$0.55	$2.46
Fraction not claiming homestead exemption	0.085			
Fraction claiming senior exemption	0.041			
Fraction claiming disabled exemption	0.011			
County averages (N = 67)				
Just value ($1000s)	$191 ($112)	$162	$119	$228
Assessed value ($1000s)	$155 ($83)	$134	$99.3	$176
Taxable value ($1000s)	$110 ($80.4)	$86.4	$56.8	$129
Millage rate	0.015 (0.003)	0.016	0.014	0.017
Property tax amount ($1000s)	$1.54 ($0.93)	$1.20	$0.92	$1.95
Number of properties	52,753 (74,105)	24,636	2,891	66,651
Number of sales between 2013-2018	22,624 (31,044)	12,575	918	34,325
Fraction not claiming homestead exemption	0.081			
Fraction claiming senior exemption	0.051			
Fraction claiming disabled exemption	0.015			

Notes: Data from the Florida Department of Revenue. Restricted to owner-occupied, single-family homes in tax year 2018. All properties in the sample are eligible for the homestead exemption. Standard deviations in parentheses. Q1 and Q3 refer to the 25th percentile and 75th percentile, respectively. Just value is the county assessor's estimate of the house's current market price. Assessed value adjusts for assessment growth caps. Taxable value adjusts for exemptions and assessment growth caps. Millage rates are the combined county and municipality rates. The property tax is the product of the millage rate and the taxable value. County and municipality governments offer senior and disabled exemptions.

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Table 2: Elasticity Estimates

	(1) Mean	(2) St. Dev.	(3) Median	(4) Min	(5) Max	(6) Change from baseline
A. Current policy						
E_{TJ}	1.77	0.28	1.79	1.11	2.49	-
E_{JH}	0.83	0.13	0.85	0.34	0.99	-
E_{TY}	1.09	0.18	1.06	0.61	1.57	-
B. Complete take-up of homestead exemption						
E_{TJ}	1.96	0.37	1.91	1.11	2.78	+11%
E_{TY}	1.20	0.21	1.18	0.70	1.75	+10%
C. No homestead exemption						
E_{TJ}	0.96	0.08	0.96	0.76	1.18	-46%
E_{TY}	0.60	0.12	0.61	0.20	0.81	-45%
D. Proportional assessment						
E_{JH}	1.00	0	1.00	1.00	1.00	+20%
E_{TY}	1.33	0.21	1.34	0.83	1.87	+22%
E. No SOH (growth cap)						
E_{TJ}	1.32	0.22	1.26	0.98	1.93	-25%
E_{TY}	0.81	0.13	0.80	0.45	1.20	-27%
F. No senior exemptions						
E_{TJ}	1.59	0.28	1.56	1.11	2.42	-10%
E_{TY}	0.98	0.17	0.95	0.58	1.44	-10%
G. No SALT cap						
E_{TJ}	1.77	0.28	1.79	1.09	2.49	-0%
E_{TY}	1.09	0.18	1.06	0.61	1.57	-0%
H. No state or local tax breaks						
E_{TJ}	0.94	0.04	0.95	0.80	1.02	-47%
E_{TY}	0.59	0.09	0.60	0.25	0.73	-46%

Notes: $E_{HY} = 0.75$ for all estimates. There is an average of 52753 observations per county used to estimate E_{TJ} and 22624 observations per county used to estimate E_{JH}. E_{JH} is the same for each counterfactual with the exception of proportional assessment, in which case it is set to unity. Data for all 67 counties are from the Florida Department of Revenue for years 2018 with sales prices dating back to 2013. Complete take-up assigns the homestead exemption to homeowners identified as eligible non-claimants. Panels C and F remove the homestead and senior exemptions, respectively. Panel D assumes proportional assessment ($E_{JH} = 1$). Panel E removes the total accrued benefit of the SOH growth cap between 2008-2018. Panel H removes all exemptions and the accrued SOH benefit. Panel G removes the SALT cap of $10,000. Column 6 shows how the mean of an elasticity changes from its respective mean in Panel A.

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Table 3: County characteristic correlations

	(1) E_{JH}	(2) E_{TJ}	(3) E_{TY}
Median Income	0.48*	-0.55*	-0.11
Population	0.42*	-0.21	0.19
% College degree	0.61*	-0.67*	-0.09
% Black	-0.17	0.12	-0.03
% Hispanic	0.30	-0.10	0.20
Tax base per capita	0.55*	-0.60*	-0.12
% under age 18	-0.06	0.22	0.18
% over age 65	0.15	-0.21	-0.05
% owner	-0.37	0.29	-0.04
% established residents	-0.50*	0.48*	0.01
Number of properties (sample N)	0.46*	-0.26	0.17

Notes: Correlations between estimated elasticities and county characteristics from the 5-year estimates of the 2018 American Community Survey, with the exception of the property tax base per capita, which was based on the FDOR county property tax rolls. E_{JH} is the elasticity of the just value to the house (market) price. E_{TJ} is the elasticity of the property taxes to the just value. E_{TY} is the elasticity of property taxes to household (permanent) income. * indicate Bonferroni-adjusted statistical significance at a level of at least 5 percent.

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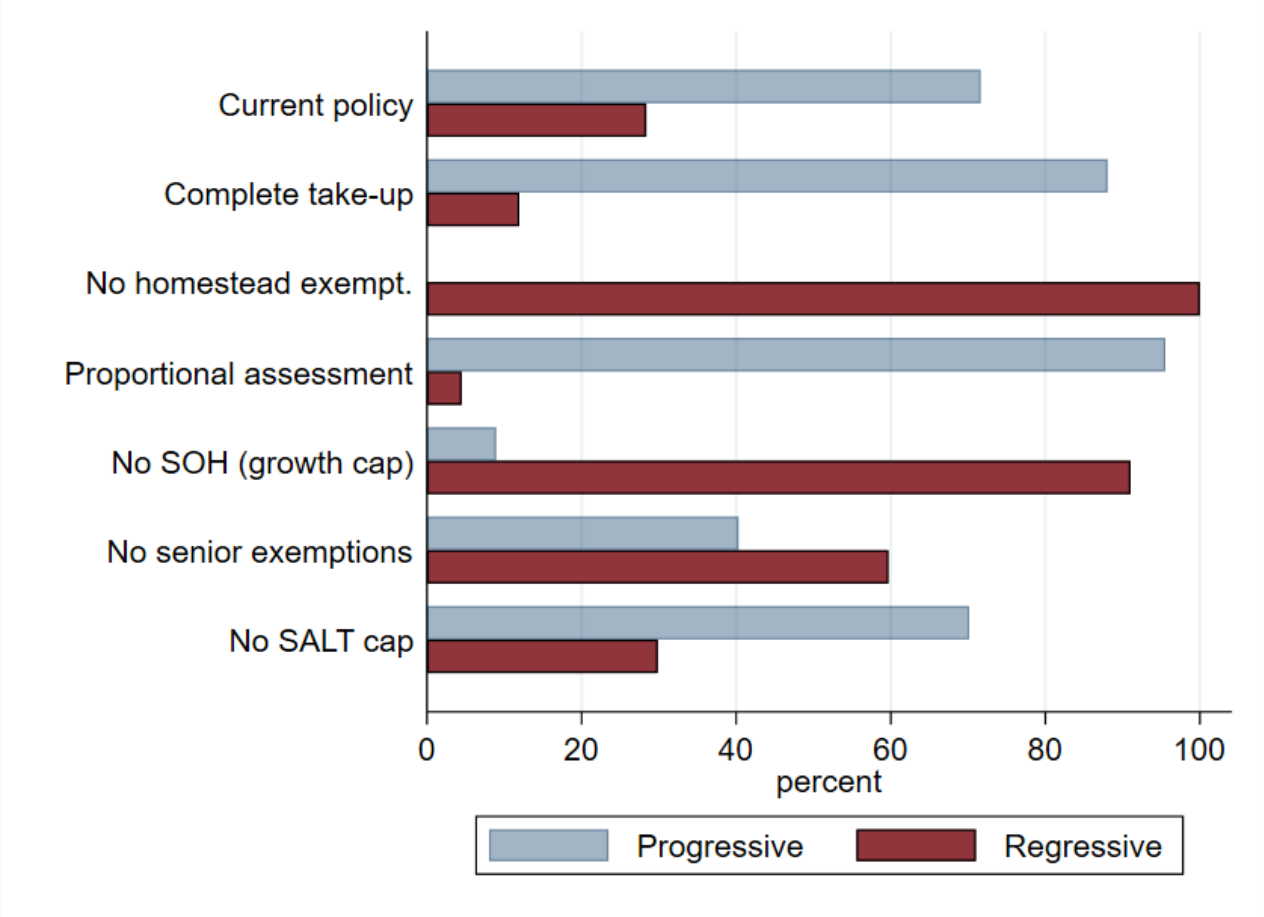
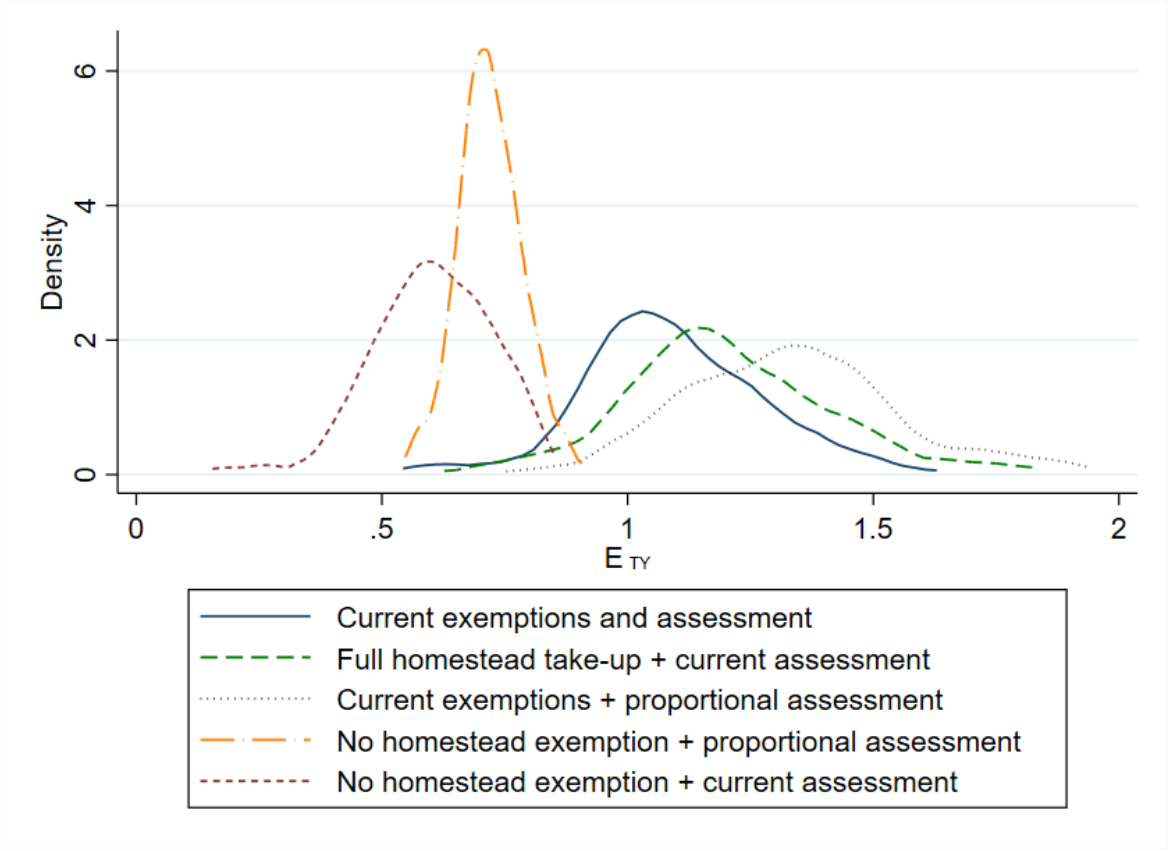
Figure 1: Percentage of regressive counties under different policies



Notes: The percentage of counties with elasticities of property taxation to household income that are progressive ($E_{TY} \geq 1$) or regressive ($E_{TY} < 1$) under various counterfactual policies. Current policy accounts for the SALT deduction of $10,000 and includes incomplete take-up of the homestead exemption, additional exemptions at the local level (e.g., senior, disabled), SOH benefits accruing between 2008-2018, and the presence of regressive assessment practices. Complete take-up assumes that all eligible homeowners benefit from the exemption. Removing the homestead exemption increases the taxable value of homes by up to $50,000. Proportional assessment assumes $E_{JH} = 1$. Removing the SOH growth cap eliminates the aforementioned benefits. The removal of the SALT cap assumes unlimited deduction of state and local property taxes from federal income taxes.

Figure 2: Assessment, exemptions, and the distribution of elasticities



Notes: Epanechnikov kernel densities of the 67 county-level estimates of the elasticity of property taxation to household income (E_{TY}) under various counterfactual policies. Current policy reflects regressive assessment practices ($E_{JH} < 1$) and incomplete take-up of the homestead exemption. Around 8 percent of eligible homeowners currently do not apply for the homestead exemption in Florida. Complete take-up assumes that all eligible homeowners benefit from the exemption and increases the progressivity of property taxation across the state. Proportional assessment assumes $E_{JH} = 1$. Removing the homestead exemption increases the taxable value of homes by up to $50,000 and results in higher tax liability.

Appendix Material

Appendix Table 1 – Florida Terminology and Policies

Millage Rate	Mean	St. Dev.	Max	Min
County government (operating)	6.99	2.11	10	2.7
School board (operating)	6.31	0.67	7.3	3.36
Independent school districts	0.54	0.79	4.24	0.04
Municipality	1.46	1.14	5.89	0.03
Total	16.5	2.75	22.8	9.00

Property value	Description
Just Value	Value of property estimated by county assessor; the assessor's estimate of the home's market price.
Assessed value	Value of property after growth caps are applied to the just value. See Save Our Homes below.
Taxable Value	Value of property once the homestead exemption (and any other eligible exemptions) are applied to the assessed value. Multiplying this by the millage rate generates the homeowner's tax liability.

Policies	Description
Homestead Exemption	After verifying that the property is used as a homeowner's primary residence, the first $25,000 of assessed value is exempt from all property taxes. An additional $25,000 exemption applies to the assessed value between $50,000 and $75,000 but only applies to non-school property taxes.
Save Our Homes	Policy that caps the annual increase in the assessed value of a homestead at 3 percent or the change in the Consumer Price Index (CPI), whichever is smaller. The effects can compound over time and the value can be transferred when moving to a new homestead.
Other exemptions	Offered by various jurisdictions to disabled, veterans, low-income, or elderly residents. The application of these exemptions is similar to the homestead exemption but can range from modest amounts up to full exemption from all property taxes.

Notes: Millage rates are statewide averages provided by the Florida Department of Revenue (FDOR). Millage rates are one one-thousandth of a dollar. Additional information is hosted on the FDOR website.

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	Obs.	Just value	Taxable value	Millage rate	Tax amount	E_{TJ}	E_{JH}	E_{TY}
Alachua	38,447	$188	$111	0.019	$2.06	1.58	0.91	1.08
Baker	3,019	$142	$75.7	0.016	$1.20	2.11	0.72	1.14
Bay	32,603	$162	$100	0.012	$1.21	1.72	0.87	1.12
Bradford	3,512	$107	$56.4	0.017	$0.92	1.88	0.73	1.02
Brevard	66,651	$193	$77.9	0.016	$1.11	1.66	0.92	1.15
Broward	295,528	$349	$194	0.019	$3.58	1.62	0.99	1.20
Calhoun	1,427	$79.8	$35.6	0.017	$0.59	2.49	0.84	1.57
Charlotte	47,179	$207	$110	0.013	$1.51	1.97	0.88	1.31
Citrus	36,667	$143	$73.9	0.015	$1.09	1.56	0.86	1.00
Clay	42,461	$190	$104	0.012	$1.26	1.64	0.84	1.03
Collier	55,876	$567	$391	0.009	$3.66	1.26	0.99	0.94
Columbia	8,075	$122	$67.6	0.017	$1.11	1.96	0.80	1.18
Dade	300,596	$376	$199	0.015	$3.12	1.65	0.96	1.19
DeSoto	3,301	$129	$59.9	0.018	$0.99	1.68	0.76	0.96
Dixie	838	$70.2	$26.1	0.018	$0.45	2.42	0.79	1.43
Duval	183,557	$188	$108	0.007	$0.75	1.64	0.96	1.19
Escambia	63,842	$145	$80.6	0.014	$1.13	1.33	0.91	0.91
Flagler	90,106	$162	$90.8	0.017	$1.52	1.88	0.82	1.16
Franklin	1,280	$202	$129	0.015	$1.75	1.79	0.89	1.19
Gadsden	6,481	$96.2	$53.6	0.017	$0.90	1.85	0.67	0.93
Gilchrist	1,125	$125	$65.8	0.018	$1.17	1.79	0.64	0.87
Glades	643	$116	$65.3	0.016	$1.03	1.59	0.69	0.82
Gulf	2,475	$174	$97.9	0.016	$1.45	1.76	0.92	1.22
Hamilton	874	$80.8	$38.0	0.019	$0.70	2.00	0.94	1.41
Hardee	2,022	$99.9	$44.3	0.018	$0.77	2.16	0.76	1.23
Hendry	1,564	$124	$54.0	0.022	$1.20	1.85	0.92	1.27
Hernando	45,003	$138	$64.0	0.014	$0.93	1.93	0.89	1.28
Highlands	19,973	$119	$56.7	0.015	$0.88	1.85	0.78	1.08
Hillsborough	238,464	$228	$122	0.015	$1.86	1.77	0.92	1.22
Holmes	1,961	$75.8	$30.5	0.016	$0.48	1.82	0.48	0.66
Indian River	34,910	$297	$178	0.012	$2.05	1.50	0.85	0.95
Jackson	6,053	$90.5	$48.4	0.015	$0.70	1.93	0.75	1.08
Jefferson	1,520	$120	$62.9	0.017	$1.00	1.79	0.70	0.94
Lafayette	494	$102	$51.2	0.017	$0.86	2.20	0.84	1.39
Lake	69,506	$187	$108	0.015	$1.54	1.65	0.85	1.05
Lee	128,510	$243	$141	0.014	$1.90	1.90	0.94	1.34
Leon	49,201	$201	$127	0.017	$2.13	1.47	0.92	1.02
Levy	3,981	$125	$57.5	0.017	$0.96	1.93	0.75	1.08
Liberty	530	$100	$38.4	0.017	$0.64	2.39	0.34	0.61
Madison	1,651	$77.9	$36.6	0.019	$0.67	1.87	0.67	0.95
Manatee	62,647	$261	$162	0.015	$2.40	1.46	0.91	0.99
Marion	73,953	$139	$74.4	0.012	$0.92	1.57	0.90	1.06
Martin	24,636	$421	$288	0.015	$4.28	1.43	0.94	1.00
Monroe	3,790	$646	$412	0.007	$3.03	1.11	0.98	0.81
Nassau	20,571	$406	$324	0.015	$4.71	1.40	0.83	0.88
Okaloosa	40,311	$208	$128	0.012	$1.52	1.42	0.93	0.98
Okeechobee	4,720	$132	$56.8	0.016	$0.92	1.88	0.83	1.16
Orange	209,144	$252	$148	0.014	$2.05	1.85	0.91	1.27
Osceola	55,627	$177	$95.7	0.015	$1.42	1.83	0.95	1.30
Palm Beach	267,585	$385	$243	0.016	$3.86	1.45	0.96	1.04

Pasco	107,442	$181	$101	0.015	$1.46	1.57	0.85	1.00
Pinellas	185,227	$249	$129	0.017	$2.17	1.57	0.97	1.14
Polk	113,412	$156	$75.4	0.016	$1.17	2.11	0.66	1.05
Putnam	8,196	$130	$62.2	0.017	$1.03	1.80	0.73	0.98
Saint Johns	49,701	$320	$219	0.013	$2.80	1.44	0.95	1.03
Saint Lucie	26,955	$188	$91.0	0.022	$2.02	2.35	0.83	1.47
Santa Rosa	37,438	$176	$105	0.013	$1.34	1.63	0.77	0.95
Sarasota	91,273	$295	$182	0.013	$2.33	1.42	0.98	1.04
Seminole	92,234	$242	$143	0.013	$1.85	1.78	0.86	1.14
Sumter	23,809	$205	$125	0.011	$1.36	1.65	0.88	1.09
Suwannee	3,574	$109	$56.9	0.018	$0.97	1.86	0.73	1.01
Taylor	2,623	$82.8	$40.8	0.017	$0.69	1.97	0.82	1.21
Union	767	$90.3	$43.1	0.017	$0.75	2.21	0.64	1.06
Volusia	117,687	$187	$86.4	0.018	$1.48	1.89	0.95	1.34
Wakulla	4,696	$141	$74.5	0.014	$1.08	2.02	0.65	0.98
Walton	11,656	$307	$216	0.009	$1.95	1.48	0.94	1.05
Washington	2,891	$86.5	$42.8	0.017	$0.69	1.94	0.68	0.99

Notes: Data for all 67 counties are from the Florida Department of Revenue for years 2018. Sales prices dating back to 2013 required for estimation of E_{JH}. All amounts are in $1000s. Just value is the county assessor's estimate of the house's current market price. Taxable value adjusts for exemptions and assessment growth caps. Millage rates are the combined county and municipality rates. The property tax amount is the product of the millage rate and the taxable value. After estimating E_{JH} and E_{TJ}, we use $E_{HY} = 0.75$ and Equation 1 to generate E_{TY}.

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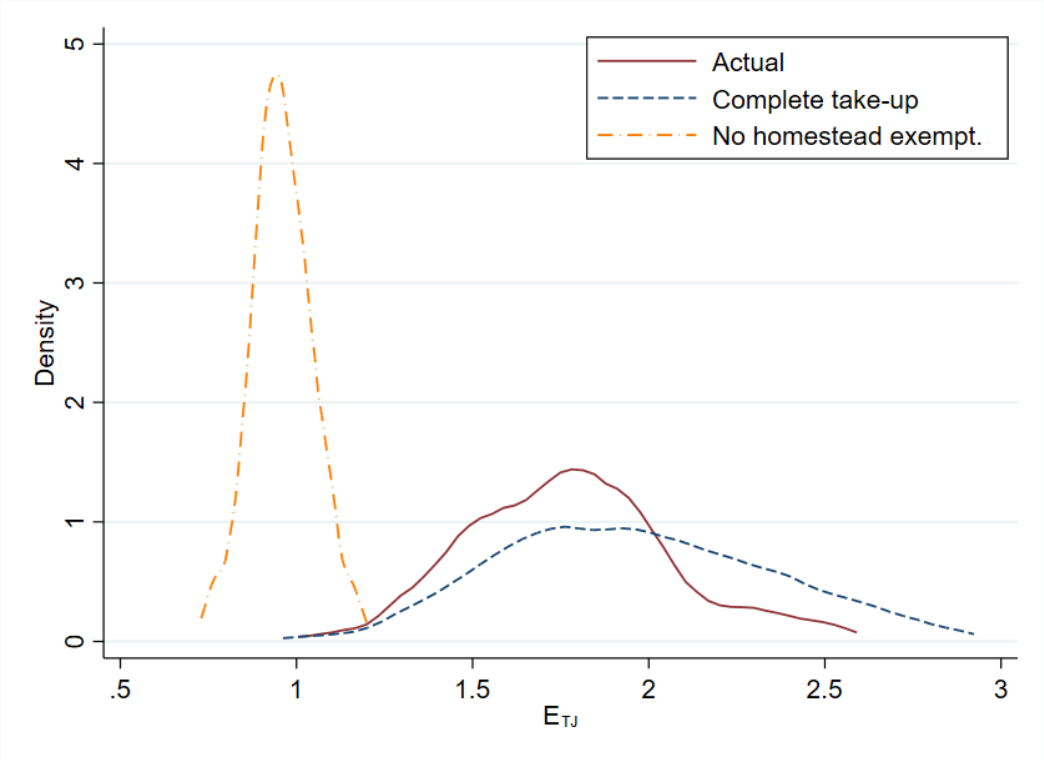
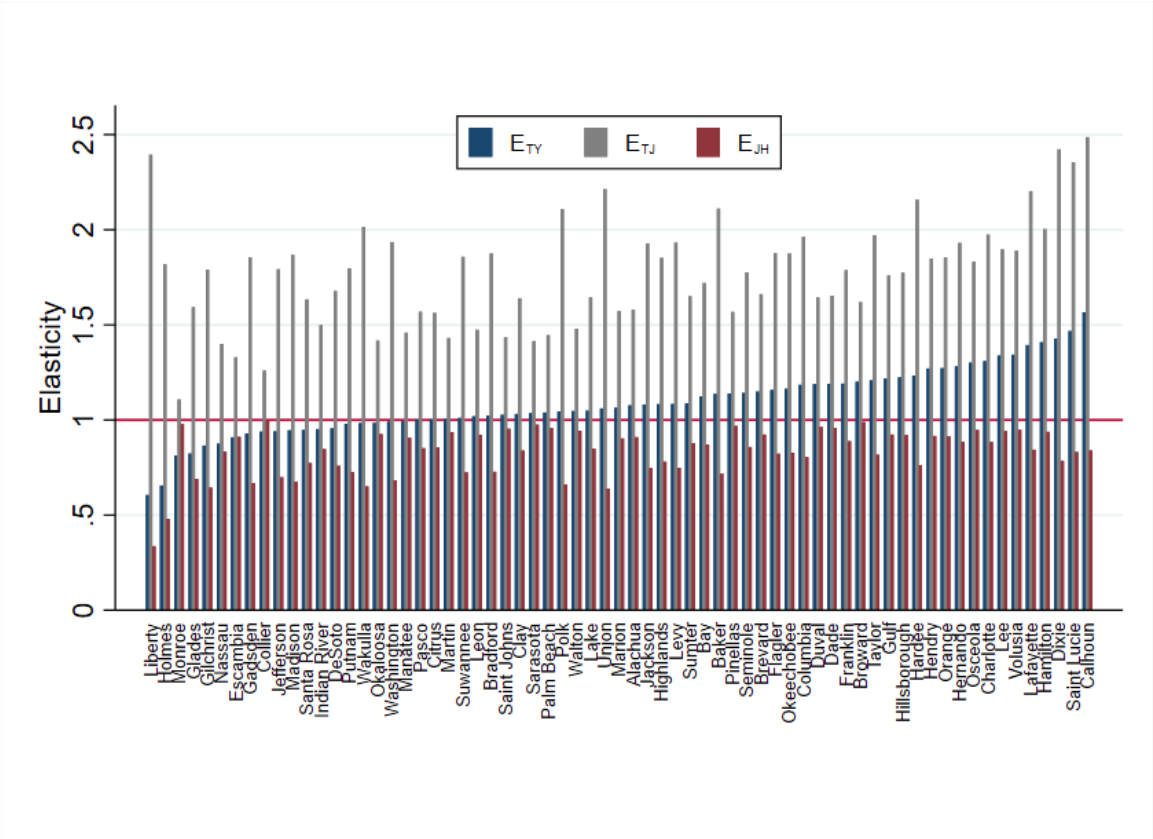
Appendix Figure 1: The distribution of E_{TJ} and the homestead exemption



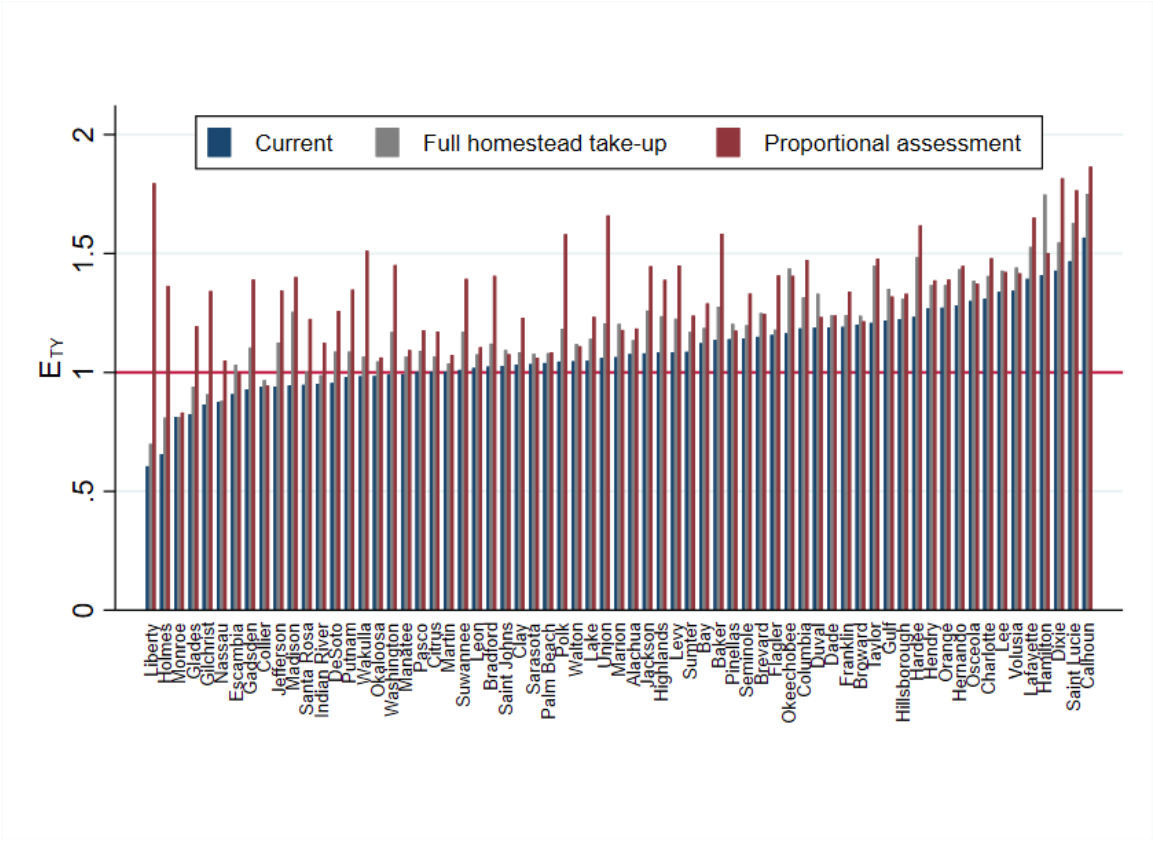
Notes: Epanechnikov kernel densities of the 67 county-level estimates of the elasticity of property taxation to just value (E_{TJ}) under various counterfactual policies. Actual estimates include 8 percent of eligible homeowners who currently do not apply for the homestead exemption in Florida. Complete take-up assumes that all eligible homeowners benefit from the exemption. Removing the homestead exemption increases the taxable value of homes by up to $50,000.

Appendix Figure 2 – County elasticity estimates



Notes: County-level estimates of the elasticity of property taxation to just value (E_{TJ}), the elasticity of just value to house (market) price (E_{JH}), and the elasticity of property taxation to income (E_{TY}).

Appendix Figure 3 – County counterfactual elasticities



Notes: County-level estimates of the elasticity of property taxation to income (E_{TY}). under various two counterfactual policies. Current estimates include 8 percent of eligible homeowners who currently do not apply for the homestead exemption in Florida. Full take-up assumes that all eligible homeowners benefit from the exemption. Proportional assessment imposes an $E_{JH} = 1$.

Appendix A: Estimating E_{JH}

Our method for estimating the elasticity of just value to market value (E_{JH}), which is a common measure of assessment regressivity, is to regress the log of a household's just value on the log of the sale price, using samples of arm's length sales that occurred in the year preceding the assessor's January 1 estimate of just value.[28] This bivariate approach, while simple, has been part of an ongoing debate about the best way to measure assessment regressivity. Among the issues have been the use of sales price as a measure of market value, whether sales price should be the dependent rather than the independent variable, and the appropriate functional form of the model. Carter (2016) critiques the various methods and concludes that no one can claim superiority over the others. He also identifies our approach as the most popular, which De Cesare (1998) has labeled the traditional approach. Recently, McMillen & Singh (2020b) argue that the traditional approach of regressing the log of assessed value on the log of the sales price will produce estimates biased towards finding regressive assessment practices. As is always the case in research, this conclusion is based on various assumptions, the most relevant for our purposes being the way in which assessors determine assessed value. The authors point out that the bias becomes an issue if assessors regress sales prices on house and neighborhood characteristics in order to get a predicted price that they in turn use as the assessed value of the home.[29] The importance of this concern is clearly dependent on how assessments are performed in a given jurisdiction.

[28] In order to better relate to the existing literature, we will refer to assessed value rather than just value for the remainder of this appendix. As discussed in Section III, the two terms are not interchangeable within Florida.

[29] As stated on page 7 of McMillen & Singh (2020b), "…the validity of using regressions to evaluate assessments is dubious at best when regressions are also used to calculate the assessed values because there is a clear tendency toward an artificial finding of regressivity." We are grateful to Ruchi Singh for her correspondence on this issue.

Florida statutes require that each assessment be based on at least one of the three standard assessment methods: comparative sales, replacement value, and the income approach. It is possible that assessors use some type of hedonic regression method in their selection of comparison sales, although this is obviously not the same as using hedonics to generate an assessed value. Even if a Florida assessor used hedonic regressions to generate an assessed value, the assessed value in our data that we use in our regressions would be a weighted-average of the assessment methods used in the jurisdiction.

Despite our doubts that the aforementioned bias is a large concern in our setting, we performed an additional test in order to explore the likelihood that assessors are actually employing the method that would generate the bias. We predicted assessed values by regressing the log sale price on the age of the house, the log lot size, the log interior square footage, dummy variables for property quality as recorded by an assessor, jurisdiction fixed effects, and year-by-month fixed effects. If assessors use this method to generate their assessed values, then our predicted values should be relatively close to what is actually recorded in the data. We define errors to be a percent difference between the predicted and the recorded values: $\frac{|predicted - recorded|}{recorded} \times 100$. The errors across Florida counties are sizeable. The average difference between what is recorded in the tax data and what would be predicted using a hedonic regression is nearly 32% of the recorded value of the house. A few outlying counties do not appear to be causing these aggregate differences as the median error is 19%. To that point, the minimum average error and minimum median error across all of Florida's counties are 15% and 9.5%, respectively.

In addition to the McMillen & Singh critique of the traditional approach not being applicable to our estimates of E_{JH}, our estimates are based on best practices. We use "good sales"

753 and “good timing”, where the former refers to our use of only arms-length transactions and the
754 latter the sale date immediately preceding the date of assessment. As noted by Hodge et al.
755 (2017), it is advisable to have the sale date precede the date of assessment to avoid the possible
756 endogeneity of the assessed value.
757

758 Appendix B: Estimating E_{HY}

759 To estimate E_{HY}, the elasticity of housing consumption to permanent income, we regress
760 homeowners’ median housing expenditure of the block group on the median income of the block
761 group. These variables are from the 5-year estimates of the 2018 ACS and we transform them
762 both into logs. We use all block groups in Florida, with the limitation identified below. Included
763 in all models are metropolitan area fixed effects and a measure of the average quality of single-
764 family housing within the block group. Median income is a proxy for permanent income, based
765 upon the assumption that the transitory components of current incomes cancel out from
766 aggregation, resulting in a correlation with only the permanent and not the transitory component
767 of current income. Homeowner housing costs are the sum of payments for mortgages, deeds of
768 trust, contracts to purchase, or similar debts on the property (including payments for the first
769 mortgage, second mortgages, home equity loans, and other junior mortgages); real estate taxes;
770 fire, hazard, and flood insurance on the property; utilities (electricity, gas, and water and sewer);
771 and fuels (oil, coal, kerosene, wood, etc.). Lee (1968) notes that census tracts and block groups
772 are defined in part based on the quality of housing. As a result, median housing consumption
773 tends to be higher (lower) than that of permanent housing consumption at a high (low) level of
774 permanent housing consumption, resulting in an upward bias in the estimated permanent income
775 elasticity. To guard against this bias, we include the mean quality score of homes in the block

group. The score ranges from 1 (poor) to 5 (excellent) and is determined by a physical inspection of the home by a staff member of the property tax assessor's office. In addition to the quality measure and the metro area dummy variables (rural counties are grouped together as the reference group), we estimated our models with and without the covariates mean family size, median age of adults, and the percentages of the population who are non-Hispanic blacks and Hispanics. We limit block groups to those that are predominately owner-occupied units (greater than 65 percent). This resulted in a sample size of 6,097 block groups. To gauge the sensitivity of our estimate, we ran our models for various subsamples: urban and rural areas, and groups based on the median income of the block group. In the latter case, we divided the block groups into terciles based on their median income. All of the estimates centered on an E_{HY} of 0.75, with a small range around this number, and none of the E_{HY} estimates obtained from the subsamples is significantly different than 0.75. For comparison, Albouy, Ehrlich, & Liu (2016) use E_{HY} values of 0.83 and 0.66 in their analysis of housing demand.