The efficiency and distributive effects of local taxes: Evidence from Italian municipalities*

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Abstract

This paper analyzes the effect of local income taxation on taxable income, inequality and internal migration in Italy using two tax reforms and several administrative data sources. These reforms, introduced in 2007 and 2011, granted municipalities the authority to switch from a flat to a progressive local income tax. I obtain two main results. First, the progressive tax reduced taxable income by 5 percent and the income share held by the top percentile of the municipal income distribution by 6 percent. Second, I find compelling evidence of a positive effect of net-of-tax rate differentials across provinces on changing fiscal residence.

Keywords: Local income tax; Tax progressivity; Taxable income elasticity; Income inequality; Tax-induced migration.

JEL Classification: D31, H21, H24, H30, H71

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1 Introduction

Local income tax policy is a disputed public policy issue, especially when tax rates differ significantly across space and migration costs are low, as in fiscal jurisdictions within a country. Many countries allow local authorities to tax personal income, thereby creating spatial differences in the tax burden faced by their residents.[1] Arguments supporting local discretion to set tax rates are related to the decentralization theorem of Oates (1972). However, a more progressive local tax schedule may induce top incomes to migrate to fiscal jurisdictions where the tax burden is lower, thus creating tax competition to attract mobile tax bases (Lehmann, Simula and Trannoy, 2014). As a result, local governments may be unable to engage in tax redistribution (Epple and Romer, 1991; Feldstein and Wrobel, 1998).

This tension raises two important questions. First, how responsive is the tax base to variations in the local income tax rate? In particular, does a more progressive local tax affect reported income? Second, can local governments implement a more progressive tax to reduce inequality? The first question is crucial for evaluating the efficiency effect of local income taxes, while the second for understanding whether policy-makers operating in local governments can use taxes to shape the distribution of income. Both questions crucially depend on the extent to which individuals move across jurisdictions to minimize their tax liability. This paper breaks new ground on these questions using quasi-experimental variation created by two tax reforms introduced in 2007 and 2011 in Italy, which granted municipalities the authority to switch from a flat to a progressive local income tax.

Despite a large empirical literature has provided compelling evidence on the effect of taxation on taxable income (surveyed in Saez, Slemrod and Giertz, 2012), the existing evidence on the effect of *local* income taxes on reported income and inequality is mixed (Feldstein and Wrobel, 1998; Long, 1999; Leigh, 2008; Bruce, Fox and Young, 2010; Martinez, 2017; Yang and Heim, 2017; Spreen, 2018; Agrawal and Foremny 2019; Milligan and Smart, 2019). Likewise, studies considering tax-induced mobility of taxpayers across fiscal jurisdictions within a country provide contrasting results (see Esteller, Piolatto and Rablen, 2017, for a review). Although substantial fiscal incentives, mobility might be damped by the fact that individuals do not want to give up their jobs or commute (Kahneman et al., 2004), neither they want to change their local networks and neighborhoods (Dahl and Sorenson, 2010). Therefore, several studies (Bakija and Slemrod 2004; Leigh, 2008; Young and Varner, 2011; Young et al., 2016) find little evidence of tax-induced internal migration.[2]

However, when escaping a jurisdiction's tax net does not necessarily entail any physical

[1] According to OECD's *Taxing wages* 2018, personal income is taxed at the local level in Belgium, Canada, Denmark, Finland, Iceland, Italy, Korea, Norway, Portugal, Spain, Sweden, Switzerland, and the US.

[2] A small literature has studied migration of high-skilled workers across countries (see, for instance, Kleven, Landais and Saez, 2013, for football players; Kleven et al., 2014, for highly paid foreigners in Denmark; Akcigit, Baslandze and Stantcheva, 2016, for inventors) and across states (see Moretti and Wilson, 2017, for star scientists). However, these types of workers may be substantially more mobile because most of their lifetime income is earned over a short period and their skills are less likely to be location-specific.

movement and can be accomplished by the "mere stroke of a pen" (Slemrod, 2010), the real location can be different from the *fiscal* location and the general motives behind aversion to migrate weaken. In other words, the application of residence-based taxation - which Italy applies - as opposed to employment-based taxation allows taxpayers to shift their tax burden without shifting their economic activities. Consistent with this argument, studies related to countries applying the residence-based taxation provide significant evidence of tax-induced internal migration and large elasticity estimate (e.g., Milligan and Smart, 2019, for Canada; Agrawal and Foremny, 2019, for Spain; Schmidheiny, 2006, Martinez, 2017, and Schmidheiny and Slotwinski, 2018, for Switzerland). The effect I obtain provide robust empirical evidence in favor of tax-induced migration and, thus, of a negative effect of local tax progressivity on the tax base.

Since 1998, municipalities in Italy are allowed to levy surtaxes on personal income on top of those implemented by the central and regional governments. The tax rate is decided annually by the mayor and applies to the taxable income as determined by the National law. The rate is based on where a taxpayer has his or her fiscal residence in that year, regardless where he or she works. While in the initial stage of implementation the municipal tax rate was flat and quite homogeneous across municipalities, two recent tax reforms granted municipalities the authority to introduce a tax exemption for low incomes (2007 reform) and to switch to a system of multiple rates (2011 reform). After these reforms, almost one-third of the municipalities switched to a progressive local tax schedule and, consequently, substantial spatial variation in local tax rates had emerged. In 2015, the combined municipal plus regional top marginal income tax rate diverged by as much as 3 percentage points. For an individual in the top percentile of the income distribution this translates into a tax differential of nearly €5,000.

The 2007 and 2011 reforms thus arguably provide discontinuities in the tax burden individuals face depending on their fiscal residence (on which the tax rate is computed), income level (for municipalities with a progressive tax) and reform start date (which differs across municipalities). Hence, the reforms generate sharp quasi-experimental variation along several dimensions and provide a compelling way of identifying the effect of local income taxation using a difference-in-differences empirical strategy. For this analysis, I access to municipality-level data on tax returns for the full population of Italian municipalities since 2001. The data include information on income and total number of taxpayers specific for several income intervals. This detailed information allows to derive standard measure of inequality such as the Gini index and top income shares by using non-parametric methodologies (Milanovic, 1994; Van Ourti and Clarke, 2011) and Pareto interpolation techniques (Piketty, 2003). These data are then matched to series on local income tax rate, the tax scheme implemented (flat or progressive), and several other municipality characteristics provided by administrative sources.

To investigate whether taxpayers actively move their residence across borders to minimize their tax liability, I access to administrative data on transfers of fiscal residence. These data are based on administrative forms filled out and organized by the Civil Registry and provided by the Italian Institute of Statistics. Information on where and when individuals transfer their fiscal residence and their origin municipality is exploited to relate bilateral migration flows for each province pair (110 $\times$ 110) with the differential in the net-of-tax rates between destination and origin province in each year. By exploiting variation within province pairs over time, the model absorbs all time-invariant factors that can shift demand and supply of individuals at the province pair level.

The analysis of the effect of local income taxes in Italy yields two main empirical results. First, I find that the introduction of a progressive local tax scheme reduced the municipal aggregate taxable income by 5 percent. A back-of-the-envelope calculation suggests that a taxpayer located in a municipality with a flat tax rate reports, on average, €200 more than one located in a municipality with a progressive tax for each year over the post-reform period. This would translate into an average annual revenue loss of nearly €23,500 for each municipality with a progressive tax. The reforms significantly reduced within-municipality inequality; specifically, the pre-tax income share held by the top percentile of the income distribution decreased by around 6 percent. This finding goes well in line with the existing cross-country and cross-state evidence of responsiveness of the rich to tax progressivity and top marginal tax rate (Saez, Slemrod and Giertz, 2012; Kleven, Landais and Saez, 2013; Kleven et al., 2014; Piketty, Saez and Stantcheva, 2014; Akcigit, Baslandze and Stantcheva, 2016; Moretti and Wilson, 2017; Rubolino and Waldenström, 2017; Agrawal and Foremny, 2019; Rubolino and Waldenström, 2019). To put these figures into international perspective, I exploit within-municipality variation in taxable income and net-of-tax rates to estimate the elasticity of municipal taxable income with respect to the net-of-tax rate. I estimate an elasticity of 0.3, which lies in the range of other international estimates carried out at the state- or county-level.[3] The behavioral response is mostly concentrated among rich taxpayers: a one percent increase in the net-of-tax rate raises the income share held by the top percentile by 0.8 percent. Furthermore, I find that the taxable income elasticity is significantly larger in places with larger population size, larger share of rental income and over the regional borders. In contrast, the elasticity is relatively lower in municipalities characterized by higher value of civic capital, suggesting complementarity between norms of cooperation and behavioral responses to tax changes (Andreoni, Erald and Feinstein, 1998).

Second, I find large and stable effects of taxes on the probability of changing tax residence. On average, a one percent increase in the net-of-tax rate differential between destination and origin provinces rises migration flows by 1.6 percent. This estimate goes in line with the existing

[3]For the US, studies on state tax base elasticity provide contrasting findings. Long (1999) uses cross-sectional state income tax changes and estimates a taxable income elasticity in the range of 0.2-0.8, while Spreen (2018) exploits time-variation in local individual income tax rates and estimates an elasticity of 0.72 in the state of Illinois. On the other hand, Bruce, Fox and Young (2010) and Yang and Heim (2017) do not find a significant effect of state income taxes on the tax base. The external validity of these studies, however, is limited: Long (1999) only focuses on income reported in 1999, while Bruce, Fox and Young (2010), Yang and Heim (2017) and Spreen (2018) rely on a small sample, which is not representative for the overall US population. For Canada, Milligan and Smart (2019) focus on tax rates set by provinces and estimate an elasticity of the income share held by the top percentile with respect to one minus the tax rate of 1.14, which mostly reflects tax avoidance behaviors. Similarly, Agrawal and Foremny (2019) exploit variation in the regional tax rates in Spain and estimate an elasticity of the number of top taxpayers with respect to net-of-tax rates of 0.85.

international evidence related to countries applying the residence-based tax.[4] As an example for the Milan (origin)-Rome (destination) province pair, this estimate implies that the effect of Lazio - the region where Rome is located - to increase its top tax rate of one percentage point in 2015 was to reduce the net inflow of individuals coming from Milan by about 64 per year. Assuming those individuals reported annual incomes equal to Milan's average taxable income, this reduction in the number of inflows coming from the Milan province would translate into annual revenue losses of around €46,000 per year; the figure would increase to more than €330,000 per year if we assume that those individuals were in the top percentile of the Milan's pre-tax income distribution.

Studies following Oates (1969) find suggestive evidence that fiscal differences are capitalized into house prices, interpreting them as evidence in favor of the Tiebout hypothesis. If the migration response involves a change in property ownership, then the increase in the progressivity of the local income tax would lower (raise) the value of property in high (low)-tax areas of the country. I empirically test this hypothesis by estimating the effect on property selling prices. I do not find any significant effect of local income tax rates on property prices, thereby suggesting that the migration response did not involve an actual variation in property ownership.

The nature of the data, however, does not allow to disentangle a real from a fraudulent move, where a taxpayer changes the tax residence to a second property without physically moving. Distinguishing between real responses (e.g. labor supply) and cross-municipality income-shifting is crucial in terms of welfare conclusions and policy recommendations (Chetty, 2009). If income, totally or partially, is shifted toward other (less) taxed base, then the deadweight loss would be smaller than in the case that the impact reflected real responses. I investigate cross-municipality income-shifting responses by testing whether the own tax base is sensitive to variations in the tax differential with respect to competitor municipalities, i.e. bordering municipalities or those located in the same local labor market. While the own tax base does not significantly respond to the tax rate set by bordering municipalities, income-shifting within local labor markets seems to explain part of the changes in the tax base. This would suggest income (and, possibly, labor force) relocation within local labor markets, thus implying that the deadweight loss of taxation born by local governments does not necessarily translate into a similar overall welfare loss under a national perspective.

The rest of the paper is organized as follows. Section 2 provides the institutional background of the municipal tax system. In section 3, I illustrate the conceptual framework and the empirical strategy implemented in this paper. Section 4 describes the data. Section 5 and 6 present the results and the main mechanisms behind them. Section 7 concludes.

[4]Martinez (2017) finds a large elasticity of the inflow of rich taxpayers with respect to the average net-of-tax rate ranging from 3.2 to 6.5 in Switzerland. Agrawal and Foremny (2019) study tax-induced location choice in Spain and find that a one percent increase in the net-of-tax rate differential raises the probability of moving of 1.7 percent. Finally Kleven et al. (2014) finds an elasticity of migration with respect to the net-of-tax rate between 1.5 and 2 for foreigners in Denmark.

2 Local income taxes in Italy

Italy is composed of three different sub-national tiers of government: there are 20 regions (*Regioni*), 110 provinces (*Province*), and around 8000 municipalities (*Comuni*).[5] As an autonomous source of revenue, municipalities have legislative power to levy taxes, duties or fees on properties, income, advertisement, landfill, visitors and public areas. The property tax and the surtax on personal income constitute the bulk of municipal tax revenue, while the remaining taxes, duties and fees represent a negligible share. Municipal balance sheets show that property and income taxes formed, on average, nearly the 75 percent of municipal tax revenue, which is more than one-fifth of the municipal total revenue in 2015. Revenue from the surtax on personal income have increased considerably over the recent decades (from around €1 billion in 2001 to nearly €4.5 billion in 2015), compensating, at least in part, the substantial reduction in central government transfers and underlining the ongoing process of fiscal decentralization.

The decree 360/1998 introduced the municipal surtax on personal income, establishing that each municipality can choose to levy a surtax on personal income on top of those implemented by the central and regional governments with a cap on 0.8 percent.[6] The tax rate is decided annually by the mayor and approved by the municipal council at the end of each year. It applies to the taxable income as determined by the National law and has the same tax base of the national personal income tax. The rate is based on where a taxpayer has his or her fiscal residence in that year, regardless where he or she works. The number of municipalities which have set their own surtax on personal income is increasing: while there were about 4,800 (out of 7,960) municipalities with a non-zero tax rate in 2001, in 2015 almost 90 percent of the municipalities has set their own tax rate. The same rules apply to the regional surtax on personal income, which allows each region to levy a (flat or progressive) surtax on personal income that may vary within a range fixed by the National law.

Since 2007, municipalities have been allowed to introduce an exemption threshold conditional on specific income requirements (decree 296/2006). Another change in the setting of the municipal tax originated with the 138/2011 decree, which granted municipalities the opportunity to switch from the existing flat tax schedule to a system of multiple tax rates.[7] The rates must be structured according to the same income brackets defined by the national personal income tax and be increasing with income. Since 2011, the number of municipalities with a progressive tax schedule has risen; in 2015 more than one-third of the municipalities had a progressive tax.

The 2007 and 2011 reforms thus arguably provide variation in how the tax burden differs according to taxpayers' fiscal residence and income level. This discontinuity is shown by Figure

[5]See the online appendix Table B1 for information on the number of provinces and municipalies for each Italian region along with some demographic and economic data.

[6]The only exception is Rome, which is allowed to set a tax rate of 0.9 percent. The cap was initially set at 0.5 percent and then increased in 2007.

[7]This reform was sudden and unanticipated as it was part of a larger reform approved to face a sovereign debt crisis, with the aim of increasing local revenues and promote fiscal equity.

1, which compares trends in tax progressivity (including both regional and municipal tax rates) between municipalities with a progressive tax schedule ("treated") and those with a flat tax rate ("untreated").[8] The two groups of municipalities followed a similar pattern until 2007, when the legislator allowed for the introduction of a tax exemption for low income taxpayers. From that year on, the difference in progressivity started to increase and substantially accelerated after the 2011 reform. While over the 2001-2006 period the local average tax rate faced by the poorest taxpayers was almost the same as the one faced by the richest regardless of where income was reported, from 2015 the rich paid 1.7 times more than the poor in treated municipalities and around 1.2 in untreated municipalities.

[Figure 1 about here]

Figures 2 depicts the geographical distribution of the local progressive tax and local top marginal personal income tax rate in 2015. The left-hand side graph shows that there are several clusters of bordering municipalities which have (or do not have) the progressive tax schedule; this might suggest yardstick competition or tax mimicking across neighbouring municipalities (Bordignon et al., 2003), but it might also arise because spatially proximate jurisdictions have similar preferences on tax policy. The local top marginal tax rate reaches its highest value in North-West (Piedmont), Center-West (Rome metropolitan area) and in some Southern municipalities located around the coast, the lowest across the country border and in Sardinia. The spatial and time variation in tax rates is also illustrated by Table B1 in the online appendix, which compares the local (i.e., regional plus population-weighted average municipal rate) top marginal tax rate set by each region over different time periods. In 2015, the rate varied from 1.282 percent in Trentino Alto-Adige to 4.146 percent in Lazio.

[Figure 2 about here]

This spatial differential in the the amount of tax paid may create an incentive for top incomes to move their fiscal residence. Figure 3 shows how the tax burden (including both regional and municipal rates) had varied over time between high and low-tax fiscal jurisdictions and across income groups.[9] While over the 2001-2006 period moving the tax residence from a high- to a low-tax jurisdiction would allow to save nearly €2,000 to a top income taxpayer, this amount increased of around three times over the post-reform period. In contrast, fiscal incentives for migrating towards low-tax jurisdictions are relatively small and did not change dramatically over time for the rest of the population.

[8]For this figure, progressivity is measured as the ratio between the average local tax rate faced by the richest taxpayers (i.e., those whose income is larger than 6 times the national average income) and the poorest (i.e., those whose income is equal to one-third of the average national income). Note that the nature of the data does not allow to compute other common measures of tax progressivity such as the Kakwani or Suits index.

[9]I use the following definition for the taxpayers' group: i. poor (reported income lower than two-third of the average national income); ii. average (reported income equal to the average national income); iii. high (reported income equal to ten times the average national income); iv. top (reported income equal to twenty times the average national income). High and low-tax jurisdictions are classified as those in the top and bottom percentile of the average tax rate distribution.

[Figure 3 about here]

3 Framework and empirical specifications

In this section, I present the conceptual framework and the empirical specification implemented to estimate the behavioral response of individuals to local income taxes.

3.1 Conceptual framework

Local income taxes can affect the tax base through two main channels. First, taxpayers may adjust their reported taxable income. Second, they may transfer their fiscal residence to another (less-taxed) municipality to minimize their tax liability. To model these behavioral responses, I build on the large existing literature on estimating behavioral responses to taxation to develop a simple model of income reporting behavior (see, in particular, Saez, Slemrod and Giertz, 2012, and Piketty, Saez and Stantcheva, 2014).

Denoting by z pre-tax reported incomes and by $T(z)$ the tax schedule (that may be flat or progressive), individual i maximizes a utility function $u_i(c, z) = c - f_i(z)$, where $c = z - T(z)$ is disposable income and $f(z)$ denotes the labor supply cost of earning z, with $f_i'(z) > 0$ and$f_i''(z) > 0$.[10] The solution of the taxpayer's maximization problem is given by the first order condition $f_i'(z) = 1 - \tau$.

The elasticity of income with respect to the net-of-tax rate is then equal to:

$$\varepsilon_1 = \frac{1-\tau}{z} \frac{\partial z}{\partial(1-\tau)} \tag{1}$$

and measures the percent change in reported income as the net-of-tax rate changes by one percent. This is the classical elasticity which reflects real economic responses (e.g., hours of work, productivity efforts or occupational choice) to the net-of-tax rate.

The effect of taxes on economic choices involves not only the traditional impact on labor supply that cause progressive taxes in a closed economy to have a larger deadweight loss than a proportional tax raising an equal amount of revenue (Musgrave and Musgrave, 1973). In particular, responses to tax rates can take the form of tax evasion or tax avoidance, which arises when taxpayers have the opportunity to shift part (or all) of their taxable income into other (less taxed) bases or other time periods to minimize their tax liability. In an open economy with low migration costs, a change in the progressivity of the local income tax might induce a geographical reallocation of the tax base. When migration is not physical but only fiscal, this response is an example of tax evasion. The crucial difference between real and income shifting responses is that while the former reflects individual preferences for consumption or attitude towards working efforts, the latter crucially depends on the design of the tax system.

Following Piketty, Saez and Stantcheva (2014), I extend the standard model of labor-supply

[10] For tractability, I assume away income effects.

responses to include tax avoidance and tax evasion. Denoting real income by y and sheltered income by x, then reported taxable income is $z = y - x$, where y is taxes at the marginal tax rate τ and x at a tax rate t, with $0 \leq t < \tau$. It follows a utility function of the form $u_i(c, y, x) = c - f_i(y) - g_i(x)$, where $c = y - \tau z - tx = (1 - \tau)y + (\tau - t)x$ is disposable after-tax income, $f_i(y)$ is the utility cost of earning y and $g_i(x)$ is the cost of sheltering income x. Assuming that both $f_i(y)$ and $g_i(x)$ are increasing and convex, the optimal solutions are $f_i'(y) = 1 - \tau$ and $g_i'(x) = \tau - t$.

Denoting by ε the elasticity of z with respect to $1 - \tau$, by $s = [dx/d(\tau - t)]/[\partial z/\partial(1 - \tau)]$ the income shifting component of the behavioral response of z to dt, and by $\varepsilon_2 = s \times \varepsilon$ the income shifting elasticity component, we have:

$$\varepsilon_2 = s \times \varepsilon = \frac{1 - \tau}{z} \frac{\partial x}{\partial(\tau - t)}. \tag{2}$$

The total elasticity is then the sum of the standard labor supply elasticity and the income shifting elasticity component: $\varepsilon = \varepsilon_1 + \varepsilon_2$.

3.2 Empirical strategy

This section presents the econometric strategy implemented to identify the efficiency and distributive effect of local taxes.

3.2.1 Progressive tax reform

To analyze the efficiency and distributive impact of local tax progressivity, I exploit the 2007 and 2011 tax reforms to implement a difference-in-differences (DiD) empirical strategy. These reforms provide treated and control groups for testing taxable income and inequality responses to different levels of tax progressivity. The municipalities which have switched from the flat to the progressive tax scheme are considered as treated, while those which carry on to apply a flat tax rate are considered a plausible control group. The effect of the reform is then estimated as the difference in the outcomes for these two groups. Formally, defining $Reform_{i,t}$ as a dummy variable equal to 1 in each treated municipality *i* for each year *t* following the tax reform and 0 otherwise, I estimate the parameter ϵ from a regression of the following form:

$$log(y_{i,t}) = \varepsilon \times Reform_{i,t} + \beta X_{i,t} + \gamma_i + \delta_{r(i),t} + u_{i,t} \tag{3}$$

where *i* represents a municipality and *t* a year. $y_{i,t}$ denotes taxable income or the inequality index. The parameter of interest, ε, is the DiD estimator and measures the average causal effect of implementing a progressive tax scheme on treated municipalities. Municipality fixed effects, γ_i, control for permanent differences that affect taxable income or inequality; if the systematic determinants of $y_{i,t}$ are additive, time-invariant municipality characteristics, then these factors are controlled for by the municipality fixed effects. The region-year fixed effects, $\delta_{r(i),t}$, capture the influence of regional shocks or policies, as well as any change in regional business or income tax rates. $X_{i,t}$ contains time-varying municipality-level controls (see section 4.3 below). Finally, $u_{i,t}$ is the error term. Throughout the analysis, I cluster the standard errors at local labor market-level ($N = 686$), allowing for an arbitrary covariance structure within municipalities over time (Bertrand, Duflo and Mullainathan, 2004) and across municipalities within a local labor market.[11] This accounts for within-municipality serial correlation due to omitted factors that evolve progressively over time and for spatial correlation due to tax competition, but I assume error independence across municipalities located in different local labor markets.[12]

The identifying assumption to estimate ε is that treated and untreated municipalities are similar except for the local tax schedule and that, if the two groups of municipalities had the same tax system, then their post-reform taxable income or inequality level would evolve similarly. If this assumption holds, then the exogenous variation in tax progressivity is what permits a well-identified estimate of the tax reform effect on taxable income and inequality. In other words, the decision to implement the progressive tax should be considered *as good as random*. Public policies, however, are hardly random choices (Besley and Case, 2000) and the previous assumption could be violated by selection bias if treated and untreated municipalities have different characteristics.

Table 1 reports summary statistics separately for treated and control municipalities over the pre-reform period. There are striking differences in many observable characteristics between the two groups; in particular, treated municipalities are richer, more populated, with larger share of foreign residents, lower unemployment rate and larger share of public spending for education and social activities than control municipalities.

[Table 1 about here]

In a situation where the distribution of the pre-treatment variables differ across treatment and control groups, a widely-used approach to reduce the bias is through the use of matching (Heckman, Ichimura and Todd, 1998). Matching procedures pair treated and untreated groups on baseline characteristics to create a control group that is as similar to the treatment group in observables as they would be under randomization. Therefore, I complement the empirical analysis by estimating a propensity-score weighting version of equation (3) following Hirano and Imbens (2001).[13] This approach attenuates potential bias due to covariates unbalance by reweighting the control group observations by a function of their estimated probability to switch to the progressive tax scheme. In practice, this is done by estimating a probit model of the propensity that a municipality switches to the progressive tax scheme as a function of the set

[11]The National Institute of Statistics classifies a local labor market as aggregation of two or more municipalities sharing daily movements of commuters. Clustering at province-level (N=110) does not affect the statistical significance of the results. Standard errors are similar even performing region-level cluster bootstrapping following Cameron, Gelbach and Miller (2008) that allows to account for issues related to small group size (N=20).

[12]Note that since the inequality measures used in this study are estimates, it is possible that the error term contains measurement errors. Even in presence of measurement errors in the dependent variable, OLS can still consistently estimate ε, but estimates will be less precise than with perfect data.

[13]A recent application of this methodology in public finance literature is Gadenne (2017).

of pre-reform characteristics,[14] obtaining the predicted propensity $p(w)$, and then estimating regression (3) with weights equal to unity for the treated and $p(w)/(1-p(w))$ for the controls.[15] Column 5 of Table 1 clearly shows that the weighting procedure leads to a reasonable balance in pre-reform characteristics.

The DiD estimator is based on the critical assumption that, in absence of the reforms, the average in the outcomes of interest for treated and untreated municipalities would have followed parallel trends over time. A transparent way to test the validity of the common trend assumption would be to use lags and leads of the reforms:

$$log(y_{i,t}) = \sum_{j=-m}^{q} \varepsilon_j \times Reform_{i,t}(t = k + j) + \beta X_{i,t} + \gamma_i + \delta_t + u_{i,t} \tag{4}$$

In this model, instead of a single treatment effect, I have now also included m “leads” and q “lags” of the reform.[16] ε_j is the coefficient on the jth lead or lag. The parallel trend assumption holds if $\varepsilon_j = 0 \; \forall j < 0$, i.e. the coefficients on all leads of $Reform_{i,t}$ are zero.

3.2.2 Net-of-tax elasticities

Following the existing literature that aims to estimate the elasticity of taxable income with respect to the net-of-tax rate (reviewed in Saez, Slemrod and Giertz, 2012), I exploit within-municipality variation in taxable income (or inequality) and net-of-tax rate to identify behavioral responses. Formally, I run regressions of the following type:

$$log(y_{i,t}) = \varepsilon \times log(1 - \tau_{i,t}) + \beta X_{i,t} + \gamma_i + \delta_{m(i),t} + t \times \mu_{p(i)} + u_{i,t}, \tag{5}$$

where the notation is the same as in (3) and $\tau_{i,t}$ is the local (i.e., municipal plus regional) top marginal tax rate on personal income, so that $1 - \tau_{i,t}$ represents the net-of-tax rate. Since here I exploit variation in *both* municipal and regional income tax rates, to control for local shocks I include time fixed effects specific for each macro area *m* (i.e. North, Center and South) in which municipality *i* is located and a set of linear time trends specific for each province p in which municipality *i* is located, $t \times \mu_{p(i)}$. The latter is motivated by the concern that the choice of changing the tax rate is related to differential pre-trends in the outcome variables and the

[14]Apart from the control variables listed in Table 1, I also add pre-treatment mean of taxable income and Gini index to the set of covariates used to predict the decision to implement a progressive tax scheme.

[15]Hirano, Imbens and Ridder (2003) prove that this estimator is efficient, while Wooldridge (2007) shows that ignoring the first-stage estimation of the selection probabilities when performing inference gives conservative standard errors. All the results will present standard errors non-adjusted for first-stage estimation, since there is little efficiency gain in implementing bootstrapping procedures. The distribution of the estimated propensity score for the treated and control groups shows overlapping (see Figure B2), suggesting that for each treated municipality there is a control with equal characteristics, so that it is possible to obtain a valid inference (Wooldridge, 2010). Coefficients are more precisely estimated when implementing the Crump et al. (2009) suggestion to run regressions from a sample which excludes observations at the bottom and at the top of the propensity score distribution (see table B7 in the online appendix).

[16]Namely, I include dummies that span the whole period but omit 2001, which is absorbed in the constant and hence serves as a reference year.

possibility that the observed effects are due to these pre-trends rather than the reform itself. The parameter of interest, ε, measures the approximate percent change in $y_{i,t}$ when $1-\tau_{i,t}$ increases by one percent.

One potential concern is that municipality might set tax rates with behavioral responses in mind. A municipality that expects a large response might be reluctant to change the tax rate than a municipality that expects a little response. In other words, the decision to change the tax rate (or the tax scheme) might be not random with respect to the disturbance term. The standard way to deal with this issue would be to find a suitable instrument for the tax rate. This suggests that a plausible model of tax rate setting can be approximated by:

$$log(1-\tau_{i,t}) = \alpha Z_{i,t} + \beta X_{i,t} + \gamma_i + \delta_{m(i),t} + t \times \mu_{p(i)} + v_{i,t}, \quad (6)$$

where the instrument $Z_{i,t}$ is required to be informative, i.e. $\alpha \neq 0$, and valid, that is $E(Z_{i,t}, u_{i,t}) = 0$. My approach is to use the net-of-local tax rate grouped by municipalities similar in terms of population size, income level and geography as instrument for the own net-of-local tax rate. Under the idea to purge correlation between the error term and the endogenous variable by assigning municipalities to groups and to use group-specific means as instrument, this approach is similar in spirit to the Wald-type grouping instrumental variables estimator used in the labor supply literature (Heckmann and Robb, 1985; Angrist, 1991; Blundell, Duncan and Meghir, 1998).[17] The correlation in the tax rates is remarkably high in the data (see Figure B1 in the online appendix for a graphical representation) and might arise from yardstick competition (Bordignon, Cerniglia and Revelli, 2003) or because spatially proximate jurisdictions have similar preferences on tax policy. This instrument exploits the variation in the net-of-tax rate driven by changes in the net-of-tax rate of similar municipalities and it is plausibly exogenous to any individual municipality.[18]

The same arguments related to the endogeneity in the tax rate setting can be advanced in the context of the decision to change the local tax scheme. Hence, I use the same strategy to instrument $Reform_{i,t}$ with the $Reform_{i,t}$ group mean of municipalities similar in terms of population size, income level and geography.

[17]Specifically, I group municipalities by region-population group-income deciles. Population thresholds are selected according to the national rule that determines the size of the city council, the electoral rule, the size of the executive committee, and whether a municipality can have additional elective bodies at the neighborhood level. I use the eleven legislative thresholds set in 2001: below 1,000; 1,000-3,000; 3,000-5,000; 5,000-10,000; 10,000-15,000; 15,000-30,000; 30,000-50,000; 50,000-100,000; 100,000-250,000; 250,000-500,000; above 500,000. Most of the thresholds apply on the policies above have been fixed over the period of interest and date back to 1960. For the few cases in which a "similar" municipality does not exist, I use the average net-of-tax rate set by neighboring municipalities as instrument.

[18]A similar approach has been recently implemented by Breuillé, Duran-Vigneor and Samson (2018), which group municipalities according to population density, share of individuals aged under 15 and the level of taxable income per-capita. Similarly, Fajgelbaum et al. (2019) exploit only geographical characteristics and instrument state tax rate with a weighted average of tax rate in other states, where weights are proportional to distance. In a cross-country analysis, a grouping estimator by year $\times$ country $\times$ foreign $\times$ quality has been used by Kleven, Landais and Saez (2013) to account for the endogeneity of the tax rate.

4 Data

This section presents the data collected for this study. Summary statistics are presented by Table B2 in the online appendix.

4.1 Income and tax data

The Ministry of Economy and Finance provides grouped data on income and total number of taxpayers specific for seven income intervals and for each municipality over the 2001-2015 period (see Table A1 for an example). Income intervals are constant both over time and across municipalities to guarantee comparability. Nominal income data are converted to real income using the consumer price index and 2015 as the base year. The definition of income is taxable income (e.g. gross income minus deductions) as fixed by the National law and includes positive incomes from all sources (labor, including pensions, business, capital). The tax unit is the individual.

Left-hand side of Figure 4 provides a geographical illustration of municipal taxable income per-capita in 2015. Unsurprisingly, richest municipalities are common in the Northern area, while the poorest are mostly concentrated in the South, a well-known Italian phenomenon (Daniele and Malanima, 2007).

[Figure 4 about here]

The Ministry of Economy and Finance provides data on the tax rate (or the multiple rates in the case of a graduated tax scheme) and, if implemented, the exemption threshold set by each municipality. Using these information, I construct the dummy variable $Reform_{i,t}$, which is equal to 1 in each "treated" municipality *i* for each year *t* under the progressive tax scheme and 0 otherwise. Each municipality with either multiple tax rates or a tax exemption is considered under the progressive tax scheme and, hence, as "treated".[19]

In addition to local personal income tax rates, I retrieve data on the property tax rates set by each municipality over the period of interest. These series are provided by the Italian Institute of Finance and Local Economy (*Fondazione IFEL*) and contain information on the basic property tax rate, the rate which applies to the main dwelling and the size of the tax allowance granted to the main dwelling.

Income and tax information are available over the period of interest for 7,682 out of the total 7,960 Italian municipalities (i.e., about the 97 percent). I drop from the sample the municipalities which have experienced modifications to their administrative borders (i.e., aggregations or divisions) and those without data over the full time period.

[19] 84 percent of the treated municipalities in 2015 implemented both multiple rates and a tax exemption, 15 percent had multiple rates without a tax exemption and 1 percent provided a tax exemption with a local flat rate.

4.2 Inequality indexes

To estimate the impact of local taxes on the pre-tax income distribution, I compute the Gini index and top income shares for each municipality over the period of interest. For the sake of space, the details on how I move from the limited information published by the Ministry of Economy and Finance to the broad distributional statements in which I am interested are reported in the online appendix A.

I derive the (pre-tax) Gini index by applying non-parametric methodologies (Milanovic, 1994; Van Ourti and Clarke, 2011) to the raw income data (see Table A2 in the online appendix for an example of how the Gini index is computed). Right-hand side of Figure 4 illustrates the inequality level of the Italian municipalities, according to the value of the Gini index in 2015. Within-municipality inequality appears larger in the poorer South, especially in Sicily and Campania.

Since the previous literature has provided convincing evidence that high-income taxpayers are more sensitive to tax progressivity and marginal tax rates than the rest of the population, I compute the income share held by groups of taxpayers in the top tail of the pre-tax municipal income distribution. The standard practice to compute top income shares from grouped data is to assume that the top tail of the income distribution can be approximated by a Pareto distribution (Piketty, 2003), and this gives a distribution function for top incomes of the following form:

$$1 - F(y) = (k/y)^a, \tag{7}$$

where $k > 0$ is a constant and $a > 1$ is the (municipality-specific and time-varying) Pareto parameter of the distribution. The corresponding density function is $f(y) = ak^a/y^{(1+a)}$.

Using Pareto interpolation techniques, I compute the structural parameters needed to infer the income share held by the top decile (P90-100) and the top percentile (P99-100). Then, from these estimates, I compute the income share held by the bottom 90 percent of the income distribution (P0-90) and the bottom 90 percent of the top decile (P90-99).[20]

4.3 Control variables

Policy measures are themselves responsive to economic and/or political conditions and therefore usually endogenous (Besley and Case, 2000). In order to overcome any resulting empirical problem, I collect time-varying demographic, economic and political variables that may affect the tax rate and the outcome of interest for each municipality.

To account for demographic factors, I retrieve municipality-level data from the National Institute of Statistics database on total population, the proportion of population above the age of 65 and those under the age of 15, and the share of foreign residents for each year.

[20] Some estimates (around 17 percent) on top income shares are missed because of a lack of sufficient observations on income and number of taxpayers in the top interval. Replacing these missing data with interpolations based on provincial or regional averages do not affect the main results.

Periods of budget deficits might stimulate local policy-makers to raise more distortionary taxes to increase revenue.[21] I exploit information from *The Gazzetta Ufficiale della Repubblica Italiana* - the official journal of record of the Italian government - on municipalities reporting fiscal difficulties in a given year. Then, I create the dummy variable $Crisis_{i,t}$, which assumes value 1 if the municipality *i* has reported fiscal difficulties in year *t*, and 0 otherwise. In addition, I exploit information on fiscal imbalance from municipal balance sheets to create the dummy variable $Deficit_{i,t}$, which is equal to 1 if total spending in year *t* is larger than total revenue in the same year for municipality *i*, 0 otherwise. Moreover, to account for idiosyncratic shocks in labor demand and supply, I collect province-level data on the unemployment share from the National Institute of Statistics database.

Political budget cycles and individual characteristics of the mayor and the other members of the town council might affect growth, tax rate decision and public spending (Alesina, Cassidy and Troiano, 2015; Alesina and Paradisi, 2017). To account for strategic choices of fiscal variables in relation to elections, and for mayor- and town council-specific preferences for fiscal redistribution, I retrieve individual-level data from the Ministry of Interior on gender, educational attainment and age of the mayor and each other member of the town council for each year over the period of interest. Moreover, election-year fixed effects are added to the main empirical specification to control for municipality-specific political budget cycles.

Finally, I exploit data from the Ministry of Interior on municipal balance sheets to derive a municipality-specific and time-varying measure of spending shares. Namely, I account for the share of municipal spending in administration, development, law and order, education, and social welfare. These variables allow to control for any change in the composition of public service provision, which may affect taxable income, migration decision and tax rates.

5 Results

This section shows and discusses the effect of local taxes on taxable income and inequality. Overall, the results consistently show that local taxes have a significant negative effect on both taxable income and the pre-tax income distribution.

Table 2 presents the estimated coefficients of the progressive tax reform on taxable income (panel a) and the inequality measures (panels b-e). The coefficients measure the percent change over the post-reform period in taxable income or inequality for municipalities with a progressive local tax scheme with respect those with a flat tax. Column (1) reports the basic OLS specification with municipality and time fixed effects. The coefficients remain stable adding demographic controls (column 2), business cycle controls (column 3), political controls and election-year fixed effects (column 4) and region-year fixed effects (column 5). In columns (6) and (7), I instrument the reform dummy with the grouped reform dummy; the magnitude of

[21] The link between financial distress and local tax rates is also strengthened by the new article 119 of the Italian Constitution, which specifically forbids the increase in governmental transfers to local governments in financial crisis, thereby providing additional autonomy to municipal policy makers for raising tax rates.

the effects changes significantly once I instrument the decision to implement a progressive tax scheme with the share of "similar" municipalities having a progressive tax, but the sign does not change. This suggests that the OLS estimates are downward biased given that, in the absence of the reform, treated municipalities were more likely to experience a more positive growth in taxable income and inequality with respect to the control group. In column (7) - the baseline specification for the rest of the analysis -, I re-weight the control group by a function of its estimated probability to switch to the progressive tax scheme.

The baseline coefficient for taxable income is -0.054, significant at 1 percent; this magnitude implies that municipalities with a progressive tax experienced a reduction of 5.4 percent in taxable income over the post-reform period, relative to those with a flat tax. A back-of-the-envelope calculation suggests that a taxpayer located in a municipality with a flat tax rate reports, on average, €200 more than one located in a municipality with a progressive tax for each year over the post-reform period. This would translate into an average annual revenue loss of nearly €23,500 for each municipality with a progressive tax.

Panels b-e show the effect on inequality. While the coefficient on the Gini index is not significantly different from zero (panel b), the effect on income shares are statistically significant and large in the top tail of the income distribution. The baseline coefficient for the top percentile is 0.062, significant at 1 percent, implying that the income share held by taxpayers in the top percentile of the income distribution reduced by 6.2 percent over the post-reform period, relative to those with a flat tax. The coefficient for the bottom 90 percent (panel b) and the bottom half of the top decile (panel c) is also significant but has a lower magnitude than that for the top 1.[22]

The combination of the above results is consistent with the idea that most of the reduction in the tax base is due to a decrease in the taxable income reported by taxpayers in the top tail of the income distribution. This finding goes well in line with the existing empirical evidence of a larger responsiveness of the rich to tax progressivity (Saez, Slemrod and Giertz, 2012).

[Table 2 about here]

In Figure 5 and 6, I check whether treated and control municipalities were on different trends in taxable income and inequality over the pre-reform period. The figure reports points estimate and confidence intervals on the reform effect for each of the pre- and post-reform year. The figure consistently shows that, before municipalities were allowed to switch to the progressive tax scheme, the difference in taxable income and inequality was independent of the local tax scheme implemented. After the reforms, there is a statistically significant impact in taxable income (Figure 5) and in the income share held by the top percentile (panel d in Figure 6). Therefore, the coefficient pattern in Figure 5 and 6 suggests that the common trend assumption is valid.

[Figure 5 and 6 about here]

[22] This non-linear response over the income distribution is consistent with Rubolino and Waldenström (2019), which exploit variation in income tax rates and top income shares in Italy since 1974 and estimate a net-of-tax elasticity of 0.02 for the bottom half of the top decile, and of 0.16 for the top percentile.

In the online appendix, I test the sensitivity of the main results using a different definition of tax progressivity (see table B3): the average rate progression (i.e., the derivative of the tax rate with respect to income before tax). All the effects are similar to those estimated using the baseline dummy reform. In terms of magnitude, I find that a one percent increase in the ratio between the average local tax rate faced by the richest and the poorest taxpayers (proxied, respectively, by those whose income is equal to 6 times the national average and one-third of that) reduces taxable income by 0.3 percent.

Next, I focus on net-of-tax elasticities. Table 3 reports taxable income (panel a) and inequality (panels b-e) elasticity. The elasticity estimates are consistent with the picture provided by the progressive tax reform effect. The results show that an increase in the net-of-local tax rate has a positive effect on taxable income (panel a) and, to a larger extent, to the income share held by the top percentile (panel e). Column 6 of Table 3 - the baseline model estimated from a 2SLS regression specification model - presents a taxable income elasticity of 0.309, significant at 5 percent level, and a top 1 elasticity of 0.853, significant at 1 percent level. These coefficients lie in the range of other international estimates carried out at the state- or county-level. In particular, the top 1 elasticity is surprisingly similar to that estimated by Agrawal and Foremny (2019) for Spain and by Milligan and Smart (2019) for Canada.

[Table 3 about here]

The baseline estimates presented in Tables 2 and 3 are drawn from a sample composed of the universe of the Italian municipalities. In the following, I test the generalizability of these effects on different groups of municipalities. To determine whether some municipalities are more responsive, I interact $Reform_{i,t}$ or $log(1 - \tau_{i,t})$ with dummy variables for population size (labelled $Large_i$ ($Small_i$) for those whose population size is larger (lower) than 50,000 (1,000) inhabitants), share of rental income ($Rentier_i$ = 1 if municipality *i* has a share of rental income larger than the median value), civic capital ($Coop_i$ = 1 if municipality *i* has a share share of non-profit organizations larger than the median value), and for those located at the regional border ($Border_i$ = 1 if municipality *i* shares a border with at least one municipality located in a different region).

Table 4 presents the heterogeneity analysis for the taxable income (columns 1-4) and the top percentile (columns 5-8) and shows substantial heterogeneity in all the dimensions discussed above. I find a negative effect for municipalities with larger population size. This is consistent with models of tax competition emphasizing asymmetries among jurisdictions according to their population base and concluding that the optimal tax rate is higher in more populous regions (Bucovetsky, 1991; Kanbur and Keen, 1993). Since there is relatively lower responsiveness to tax rate changes in the tax base of larger municipalities, then those municipalities have more room for increasing the tax rate.

Second, coefficients are significantly larger in “rentier” municipalities; this is especially remarkable in the share of income held by the top percentile. This heterogeneity can be motivated, for example, by the possibility that municipalities with larger share of rental income are mostly composed of property owners, which presumably face lower costs for changing fiscal residence.[23]

Third, effects are damped in places with more cooperative associations, thus suggesting that there is complementarity between norms of cooperation and behavioral responses to tax changes. This relates with the literature arguing that standard crime models applied to tax evasion may be biased when citizens have social norms that affect the way through which they respond to government policy (Andreoni, Erald and Feinstein, 1998). Thus, taxpayers may be less likely to engaging in further avoidance or evasion behaviors as a response to increasing tax rates in places characterized by cooperative norms.

Forth, the net-of-tax elasticity is larger in municipalities located over the regional border, that is where the spatial tax differential is higher. However, in this case the progressive tax reform effect is not significantly different.

[Table 4 about here]

For the sake of the space, I report three additional tests in the online appendix. First, I investigate geographical heterogeneities in Table B4 and B5. I find that: i. estimates are qualitatively similar even dropping municipalities belonging to regions with special autonomy (i.e. Aosta Valley, Friuli-Venezia Giulia, Sardinia, Sicily and Trentino-Alto Adige), which have more autonomy to set their own fiscal rules; ii. progressive tax reform effect and taxable income elasticity are larger in the richer North; iii. the net-of-tax elasticity of the top percentile is significantly larger in the more unequal South.

Second, I add property tax rates and a time-varying municipality-specific proxy for tax evasion to the vector of the control variables in the baseline estimation. The property tax rate and the tax evasion proxy are not included in the main model because they can be considered as "bad controls".[24] Table B6 show that the main results do not significantly vary once I control for these variables.

Third, I implement the Crump et al. (2009) suggestion to run regressions excluding observations in the bottom and top of the propensity score distribution. In this table, the estimation sample is limited to observations with a predicted probability of implementing the progressive tax reform equal to at least 5 percent but no more than 95 percent (i.e., $0.5 < p(w) < 0.95$). Given that the distribution of the propensity score for the treated and control group does not show a perfect overlapping in the tails (see Figure B2 in the online appendix), this strategy allows to run regressions on a sample including only cells where there are at least few treated and control observations. Table B7 in the online appendix shows that using the Crump et al. (2009) suggestion the coefficients do not significantly change, but they are more precisely estimated.

[23]Evidence of a positive correlation between rentiers and attitude towards tax evasion is documented in Marino and Zizza (2012): they estimate that rentiers evade, on average, 80 percent of their income, while the average population value is 13.5 percent.

[24]Municipalities might ideally compensate any variation in personal income taxes with changes in property tax rates. Rubolino (2019) shows that there is strategic complementarity between tax evasion and both income and property local tax rates set by municipalities in Italy.

6 Mechanisms

In this section, I test whether the main results can be rationalized by tax-induced internal migration, capitalization in property prices and cross-municipality income shifting.

6.1 Tax-induced internal migration

If taxpayers are mobile across borders, spatial differences in the local tax rate can affect the geographical allocation of taxpayers across the country. As early discussed, local income taxes apply on the taxpayer *fiscal* residence, which might be different from their *physical* location. The application of a residence-based personal income tax system combined with differences over time and place in the local tax rate might thus induce taxpayers to intentionally misstate the location of the tax base by shifting their fiscal residence to a less taxed place.[25]

6.1.1 Data and descriptive evidence

To test whether taxpayers actively move as a reaction to local tax rate differentials, I compute bilateral migration flows for each pair of provinces (110×110) for every year over the 2007-2015 period by using administrative data on transfers of residence.[26] These data are based on administrative forms (called *modello APR.4*) filled out and organized by the Civil Registry (*Anagrafe comunale*) and provided by the Italian Institute of Statistics. For each individual moving his or her fiscal residence in a year t, these data provide information on the origin province of residence in year $t - 1$ and the destination province in year t. Figure B3 (Figure B4) in the online appendix displays patterns in migration flows and net-of-tax rate differential for the six province pairs with the largest number of flows (share of movers). On average and excluding within-province transfers of residence, each year 49 individuals move their fiscal residence within a province pair and around $12{,}100 \times 49 = 592{,}900$ individuals move each year from an origin province o to a destination province d, with $o \neq d$.[27]

The municipal and regional tax rates are salient to taxpayers. When filing their tax form, taxpayers are asked to report their fiscal residence. In the tax forms, employees find information on both the central, regional and municipal average tax rate paid. The procedure for changing

[25]Even within a residence-based tax system, the decision to move is costly. The cost includes access to public goods - such as voting or healthcare - provided by a municipality or a region on which consumption of these goods is conditional on the fiscal residence in that place. If the fiscal residence does not correspond with the actual residence, the cost of moving also includes the probability to be caught and the penalty to which they would be subject.

[26]Due to the change in the provincial administrative setup carried out in 2006, consistent series on migration flows between provincial pairs are available from 2007. In the final dataset, I exclude cells where origin = destination province and where there are no migration flows. Moreover, the final sample excludes observations where the origin province belongs to Emilia-Romagna region, since a devasting earthquake hit this region in 2012 and many individuals moved for obviously non-tax related reasons.

[27]Including within-province movements, on average about 1,300,000 individuals move within the country. Around 70 percent of the transfers of residence are within the same region.

the fiscal residence was substantially simplified in 2012 (see decree 5/2012), when the paper-based process was replaced with a quicker online procedure.

As a first step in testing whether spatial tax differentials have an effect on migration, Figure 7 shows the relationship between the intensity in the (log of) net-of-tax rate differentials and the (log of) migration flows across provincial pairs.[28] The left-hand graph shows that there is a positive link between the net-of-tax rate differentials between a destination province *d* and an origin province *o* and the share of individuals moving from *o* to *d*. Naturally, the number of individuals moving from *o* to *d* could be related by factors different from tax differences. In the right-hand graph, I compare the differentials between the first and the last available year in both net-of-tax differentials and share of movers. The graph shows that the share of individuals moving from *o* to *d* was relatively larger in the province pairs where the increase in the net-of-tax differentials was more intense.

[Figure 7 about here]

This graphical evidence, although suggestive, may be plagued by the omission of relevant variables (e.g. province pair-specific factors that might affect both the local tax rate and the migration decision) and therefore cannot be interpreted as constituting a causal nexus. In the following, I consider a very simple model of migration.

6.1.2 Framework and empirical strategy

To motivate the empirical analysis, consider the following model of internal migration. There are P provinces, labeled as $p \in 1, ..., P$. The wage of individual *i* in province *p* in year *t* is denoted by $w^i_{p,t}$. Denoting by $\varpi^i_{p,t}$ the corresponding marginal product, then if labor market is perfectly competitive, each individual is paid for his marginal product, i.e., $w^i_{p,t} = \varpi^i_{p,t}, \forall p, t, i$.

Suppose that an individual *i* living in province *p* has to pay a local income tax rate $\tau^i_{p,t}$ on his income in year *t*. In addition to the income received, individuals also benefit from locating in province *p* for unobservable reasons, denoted γ^i_p. This term is province-specific and can depend on local amenities or public goods. Then, utility from choosing province *p* in year *t* for individual *i* is given by

$$U^i_{p,t} = f(w^i_{p,t}(1 - \tau_{p,t}) + \gamma^i_p). \quad (8)$$

If there are no adjustment costs of moving, then location decision is history-dependent and province *p* will be chosen in year *t* if

$$U^i_{p,t} = f(w^i_{p,t}(1 - \tau_{p,t}) + \gamma^i_p) > U^i_{j,t} = f(w^i_{j,t}(1 - \tau_{j,t}) + \gamma^i_j), \forall j \neq p \in 1, ..., P. \quad (9)$$

[28]Namely, I sort the log of the net-of-tax rate differentials across provincial pairs in percentiles and then I plot the percentile-specific mean in the horizontal axis.

Conceptually, this model shows that what matters for location decision is the local average tax rate and province-specific unobservable characteristics.[29] Then, the probability that an individual *i* will move from an origin province *o* to a destination province *d* will normally depend on the net-of-average tax rate differential between *d* and *o* as well as on any difference in amenities and the cost of moving from *o* to *d*. Indeed, province-specific characteristics might be so strong to completely offset any tax incentive.

To absorb all time-invariant factors that can shift demand and supply of individuals at the province pair level, the identification strategy exploits within-province pair variation in migration flows and the net-of-tax rate differential in each year (Moretti and Wilson, 2017; Agrawal and Foremny, 2019). Formally, I run regressions as the following:

$$\begin{aligned} log(P_{o,d,t}/P_{o,o,t}) = \varepsilon \times log[(1-\tau_{d,t})/(1-\tau_{o,t})] + \beta log(X_{d,t}/X_{o,t}) + \\ + \gamma_{o,d} + \delta_t + \lambda_{m(o),m(d),t} + u_{o,d,t}, \end{aligned} \tag{10}$$

where $P_{o,d,t}/P_{o,o,t}$ is the population share that moves from province *o* to province *d*, $P_{o,d,t}$, relative to the population share in *o* that does not move, $P_{o,o,t}$. I also run regressions where the dependent variable is the population flow that moves from *o* to *d*. $log[(1-\tau_{d,t})/(1-\tau_{o,t})]$ captures the differential in the net-of-average tax rate between destination $(1-\tau_{d,t})$ and origin $(1-\tau_{o,t})$ province. $\mu_{o,d}$ is a vector of province pair fixed effects that captures the cost of moving for each province pair and differences in consumption and production amenities within the province pair. Moreover, these fixed effects capture any time-invariant policy of the provinces. δ_t are time fixed effects that capture any aggregate shock. In some specifications, I also include destination (origin) macro area-time fixed effects, $\lambda_{m(o),m(d),t}$, to control for time-varying shocks in origin or destination macro area *m* in which origin or destination province is located. $log(X_{d,t}/X_{o,t})$ controls for spending and property tax changes across province pairs and aims to capture the effect of any change in public goods provision or property tax rates that may make a province more attractive. Namely, I control for the differential in the share of public spending in education, social services, development, administrative and justice and for the differential in net-of-property tax rate on the main dwelling and the basic rate. $u_{o,d,t}$ is the error term. In estimating standard errors, I account for the possibility that they might be correlated over time within the panel dimension (Bertrand, Duflo and Mullainathan, 2004) and across pair $\times$ year observations within a given year sharing the same origin or destination province. Therefore, I allow for three-way clustering by origin $\times$ year, destination $\times$ year, and origin-destination pair (Cameron, Gelbach and Miller, 2011).[30]

By focusing on changes over time, within a given province pair, this model absorbs all the time-invariant determinants that can shift the demand and supply of individuals across

[29] If labor markets are not perfectly flexible, then wages are not equal to marginal product and might be a function of the tax system. This general equilibrium effect can be a potential reason for endogeneity of the tax rate.

[30] Formally, I allow for unrestricted serial correlation within the *o*-*d* pair: $corr(u_{o,d,t}, u_{o,d,t+j})$ can differ from 0, for any *j*; but I assume that $corr(u_{o,d,t}, u_{p,q,t+j})$ = 0 if $p \neq o$ or $q \neq d$.

provinces. Thus, the model controls for the permanent heterogeneity in migration flows at the province pair-level. For example, if individuals tend to move from one origin province located in the South Italy to a destination province in the North because the latter has historically important clusters of innovation-driven industries, then province pair effects will account for these factors as long as they are permanent.

This empirical model has two caveats. First, in the baseline specifications, I use the net-of-average tax rates. To compute the average tax rate, following Moretti and Wilson (2017) and Agrawal and Foremny (2019), I simulate taxes in all years and provinces for a representative taxpayer in the top percentile of the pre-tax national income distribution, thus holding fixed variations in income across provinces and years. This strategy guarantees that the variation in the tax rate is only due to statutory changes and not to local income shocks.[31] Although migration decisions should theoretically depend on the average tax rate, some previous studies have used the top marginal tax rate (Kleven, Landais and Saez, 2013; Akcigit, Baslandze and Stantcheva, 2016) as an approximation for the average rate. In the following, I will run regressions using both the average and the top marginal tax rate.[32]

Second, even accounting for a rich set of fixed effects and time-varying controls, some aspects of the tax system might be endogenous to migration decision, which might lead to a reverse causality bias. In the spirit of the net-of-tax elasticities estimation strategy discussed in section 3.2.2, I use the net-of-average tax rate differential grouped by province pairs similar in terms of population size, income level and geography as instrument for the own net-of-average tax rate differential.

6.1.3 Results

Table 6 presents the estimated ε coefficient. The results consistently show that the probability of moving from an origin province o to a destination province d increases when the net-of-tax rate in d increases with respect to o. Namely, my preferred model (column 7) estimates that a one percent increase in the net-of-average tax rate differential is associated with a 1.65 percent increase in the population flow that moves from o to d (panel a) and with a 1.58 percent increase in the share of population that moves relative to non-movers (panel c) in the same province pair. The elasticity with respect to the net-of-top marginal tax rate differential is very similar, but more precisely estimated.

[Table 5 about here]

To provide an example across the bustling Milan (origin)-Rome (destination) province pair, this estimate implies that the effect of Lazio - the region where Rome is located - to increase its top tax rate of one percentage point in 2015 was to reduce the net inflow of individuals coming

[31] In the online appendix table B8, I show that the main empirical findings hold even using the average tax rate calculated at the income level equal to the national average for each year.

[32] Arguments supporting the use of top marginal tax rate are related to salience, since, despite knowing the average tax rate in their province, individuals are unlikely to be able to compute this for the other provinces.

from Milan by about 64 per year. Assuming those individuals reported annual incomes equal to Milan's average taxable income, this reduction in the number of inflows coming from the Milan province would translate into annual revenue losses of around €46,000 per year; the figure would increase to more than €330,000 per year if we assume that those individuals were in the top percentile of the Milan's pre-tax income distribution.

Given most of tax variation come from the 2011 tax reform, we should find a trend break in the migratory pattern after the reform. For this end, I perform an event study approach by estimating the following model:

$$
\begin{aligned}
log(P_{o,d,t}/P_{o,o,t}) = \sum_{j=-m}^{q} \varepsilon_j \times Reform_{o,d,t}(t = k + j) + \beta log(X_{d,t}/X_{o,t}) + \\
+ \gamma_{o,d} + \delta_t + \lambda_{m(o),m(d),t} + u_{o,d,t},
\end{aligned}
\tag{11}
$$

where I include m "leads" and q "lags" of the 2011 reform. The variable $Reform_{o,d,t}$ is equal to 1 if the net-of-tax differential increases in province *d* relative to province *o*, 0 otherwise. ε_j is the coefficient on the jth lead or lag of the reform.

Figure 8 displays the evolution of ε_j coefficient over time and consistently shows that both migration flows (panel a) and the share of movers (panel b) significantly increased in the post-reform years, while effects are not significantly different over the pre-reform period. In other words, this figure shows no pre-trends, but an immediate level increase in the migration response after the reform. The large jump might suggest tax evasion (i.e., only fiscal transfer of residence) rather than a gradual real migration response.

[Figure 8 about here]

Overall, these estimates suggest that the probability of migrating is sensitive to local tax differentials; the elasticity is in line with the existing international evidence related to countries applying the residence-based tax.[33] The nature of the data, however, does not allow to disentangle a real from a fraudulent move, where a taxpayer changes the tax residence to a second property without physically moving. This distinction is important from a labor supply perspective - real response would matter more than simple misreporting -, but it does not matter from a tax revenue perspective.

6.2 Property prices capitalization

Studies following Oates (1969) find suggestive evidence that fiscal differences are capitalized into house prices, interpreting them as evidence in favor of the Tiebout hypothesis (i.e., individ-

[33] Martinez (2017) finds a large elasticity of the inflow of rich taxpayers with respect to the average net-of-tax rate ranging from 3.2 to 6.5 in Switzerland. Agrawal and Foremny (2019) study tax-induced location choice in Spain and find that a one percent increase in the net-of-tax rate differential raises the probability of moving of 1.7 percent. Finally Kleven et al. (2014) finds an elasticity of migration with respect to the net-of-tax rate between 1.5 and 2 for foreigners in Denmark.

uals sort themselves across local jurisdictions according to their public good preferences). If the change in the progressivity of the local income tax induces a *real* (i.e., physical) geographical reallocation of individuals, then the migration response would affect property prices (Feldstein and Wrobel, 1998). Specifically, if the migration response involves a change in property ownership, then the increase in the progressivity of the local income tax would lower (raise) the value of property in high (low)-tax areas of the country.

To empirically test the tax capitalization hypothesis, I access to data on the average property selling price for each municipality over the 2005-2015 period. These data are provided by the Internal Revenue Service - called *Osservatorio del Mercato Immobiliare* dataset - and provide average selling prices for each municipality and specific for the geographical position of the property within a municipality (central or peripherical) and for different quality types (high, medium and low quality).[34] I run regressions as in the main model estimating the effect of the progressive tax reform and the net-of-tax elasticities. In additional to the baseline controls, I also control for the basic property tax rate, the rate applied to the main dwelling and the size of the tax allowance granted to the main dwelling.

Table 6 presents the results of this test. The table clearly shows that the tax capitalization hypothesis does not hold: in no regression the coefficient is statistically significant. It would suggest that the migration response did not involve an actual variation in property ownership.

[Table 6 about here]

However, the possibility of different variation in housing prices for high- and low-tax municipalities would depend the nature of the migration response (i.e., physical or fiscal), but also on the length of the adjustment period in the housing market. If, for instance, the housing stock changes more slowly than the labor force, than differences in prices would emerge later on. An additional assumption is the degree of homogeneity of the property in a municipality: if properties are not homogeneous (e.g., properties have more convenient location, nicer views or other intrinsic characteristics), property prices would not adjust even in the long-run.

6.3 Income shifting

Distinguishing real responses (e.g. labor supply-related) from cross-municipality income shifting is crucial for welfare implications and policy recommendations. Previous literature in sales and property tax (Wilson, 1999; Brueckner and Saavedra, 2001; Agrawal, 2015) shows that individuals take advantage of tax wedge created by differing tax burdens across jurisdictions through cross-border shopping, relocation, and other means. If this kind of tax-induced resource flows in which changes in a municipality tax base are due to tax policies in other competitor municipalities accounted for a majority of the overall taxable income elasticity, then the marginal

[34] Specifically, high quality includes properties classified as villa, chateaux and cottax (OMI code = 1); medium quality represents residential buildings (OMI code = 20); low quality types are affordable houses (OMI code = 21).

excess burden would significantly decrease. Indeed, if income is shifted toward another (less) taxed base, welfare losses are smaller compared to the case in which elasticity reflected only real responses (Chetty, 2009).

To distinguish between real response and cross-municipality income shifting, I follow the previous literature and rearrange equation (5) to allow for income-shifting responses:

$$\begin{aligned} log(y_{i,t}) = \varepsilon_1 \times log(1-\tau_{i,t}) - \varepsilon_2 \times log[(1-\sum_{j\neq i} w_{i,j}\tau_{j,t})/(1-\tau_{i,t})] + \\ + \beta X_{i,t} + \gamma_i + \delta_{m(i),t} + t \times \mu_{p(i)} + u_{i,t}, \end{aligned} \tag{12}$$

where $\sum_{j\neq i} w_{i,j}\tau_{j,t}$ is the weighted average of the competitor tax rate and $w_{i,j}$ is the weight of municipality j's tax rate in the weighted average. The income shifting elasticity, ε_2, measures how the own tax base reacts to changes in net-of-tax rate differences with respect to competitor municipalities, while ε_1 is the elasticity with respect to the own net-of-tax rate.

I employ two weighting schemes. First, I use weights related to contiguity since the potential cost of shifting tax base across taxing municipalities should be, *ceteris paribus*, inversely related to distance. Under this weighting procedure, each municipality *j* sharing a border with municipality *i* receives the same weight. Second, I assign the same weight to all the municipalities belonging to the same local labor market.

Table 7 compares the baseline taxable income estimates without income-shifting with those estimated from the model which includes the difference in the net-of-tax rates to the full set of covariates. Columns 2 and 5 define municipalities sharing a border as competitors, while columns 3 and 6 those in the same local labor market. Results consistently show that the income-shifting elasticity is negative, but it is statistically significant only across municipalities located in the same local labor markets. Elasticity estimate implies that the own tax base reduces by around 0.7 percent as the tax-of-tax differential increased by one percent. This would suggest income (and, possibly, labor force) relocation within local labor markets, thus implying that the deadweight loss of taxation born by local governments does not necessarily translate into a similar overall welfare loss under a national perspective.

[Table 7 about here]

7 Discussion and conclusion

This paper has analyzed the effects of local income taxation on taxable income, inequality and internal migration in Italy using two tax reforms which granted municipalities the authority to switch from a flat to a progressive local income tax. Using administrative data on municipality-level income and on transfers of fiscal residence, I obtain two main results. First, I find that the tax reforms reduced taxable income by 5 percent and the income share held by the top percentile of the municipal income distribution by 6 percent. In net-of-tax elasticity terms, these effects translate into a taxable income elasticity of 0.3 and a top 1 elasticity of 0.8. Second, I find compelling evidence of a positive effect of net-of-tax rate differential across province pair on changing fiscal residence. This finding cannot be explained by the Tiebout hypothesis, where fiscal differentials are capitalized into house prices, but can be rationalized by a *fiscal* relocation of the tax base.

These findings have implications for optimal tax design. Other things equal, the higher is the elasticity of taxable income to the net-of-tax rate, the lower should be the optimal tax rate, and the higher is the locational responsiveness of a tax base, the lower is the optimal tax rate on that base. Tax-induced mobility is a key element for optimal tax scheme design. From an overall perspective, free mobility improves global welfare by relocating individuals towards more productive places. However, mobility induces tax competition across fiscal jurisdictions to attract tax bases, where *fiscal* location depends on the comparison of net-of-tax returns and might be different from the *physical* location. Even if it may be welfare maximizing for an individual jurisdiction to attract taxpayers by offering a suitable tax scheme, this puts at risk the ability of other jurisdictions to collect taxes. Hence, distortionary taxes combined with mobility may produce an inefficiency when fiscal and physical locational choices are not jointly made.

Another role for these findings is in the determination of the optimal provision of public goods. Arguments supporting local discretion to set tax rates are related to the decentralization theorem of Oates (1972). When local tax rates and public good provisions can align to local preferences and cost conditions, a decentralization gain can be achieved compared to a situation with a global public good provision (i.e. set at the national-level). However, since a higher elasticity of taxable income implies larger marginal costs in public good funding, then the efficiency level of public goods provision becomes smaller than it would have been with nondistortionary taxes.

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Tables

Table 1: Balancing test for pre-reform values

Variable	Group			t-test	
	Treated	Unmatched control	Matched control	Treated vs Unmatched	Treated vs Matched
	(1)	(2)	(3)	(4)	(5)
Taxable income per-capita (€)	21,203	19,038	20,989	0.000	0.022
Gini index	0.395	0.396	0.394	0.057	0.168
P0-90 (%)	66.837	68.343	67.139	0.000	0.003
P90-99 (%)	25.296	25.415	25.210	0.068	0.205
P99-100 (%)	8.121	7.123	7.874	0.000	0.000
Population	12,846	4,127	14,329	0.000	0.361
Share of 65+	20.513	22.854	20.389	0.000	0.372
Share of 15-	13.702	13.089	13.724	0.000	0.743
Share of foreign	4.872	3.722	4.886	0.000	0.882
Mayor age	48.708	48.342	48.781	0.037	0.697
Mayor sex (0/1)	0.109	0.080	0.110	0.000	0.879
Mayor graduated (0/1)	0.450	0.396	0.455	0.000	0.651
Average age in town council	44.272	43.526	44.265	0.000	0.935
Proportion of women in town council	0.182	0.170	0.175	0.000	0.006
Proportion of graduated in town council	0.287	0.220	0.295	0.000	0.053
Crisis (0/1)	0.001	0.001	0.001	0.882	0.221
Unemployment rate (%)	6.697	7.376	6.797	0.000	0.368
Budget deficit	0.080	0.051	0.078	0.000	0.522
Administration expenses (%)	21.763	22.296	21.876	0.001	0.455
Development expenses (%)	0.375	0.286	0.360	0.000	0.378
Justice expenses (%)	0.080	0.045	0.087	0.000	0.398
Education expenses (%)	6.359	4.709	6.273	0.000	0.256
Social expenses (%)	7.467	4.747	7.564	0.000	0.507
Urban (0/1)	0.696	0.383	0.710	0.000	0.252
Density	0.010	0.026	0.010	0.000	0.782

Note: This table compares the mean value of the variables for treated, unmatched control, and matched control municipalities over the pre-reform period. Columns 4 and 5 show p-values from a t-test where the null hypothesis is of equality of coefficient between treated and unmatched control group (column 4) and treated and matched control group (column 5).

Table 2: Baseline results, progressive tax reform

	OLS	OLS	OLS	OLS	OLS	2SLS	2SLS & matching
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				a. log(Taxable income)			
$Reform_{i,t}$	-0.014***	-0.013***	-0.012***	-0.012***	-0.007***	-0.050***	-0.054***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.007)	(0.015)
Observations	115,230	115,230	115,230	115,230	115,230	115,230	115,230
Mean dep. (€1,000)	93,598	93,598	93,598	93,598	93,598	93,598	93,598
				b. log(Gini index)			
$Reform_{i,t}$	-0.003***	-0.002***	-0.003***	-0.003***	-0.001*	-0.007*	-0.004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.005)
Observations	115,230	115,230	115,230	115,230	115,230	115,230	115,230
Mean dep.	39.693	39.693	39.693	39.693	39.693	39.693	39.693
				c. log(P0-90)			
$Reform_{i,t}$	0.003***	0.003***	0.003***	0.003***	0.003***	0.028***	0.026***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.006)
Observations	114,930	114,930	114,930	114,930	114,930	114,930	114,930
Mean dep. (%)	67.658	67.658	67.658	67.658	67.658	67.658	67.658
				d. log(P90-99)			
$Reform_{i,t}$	-0.003**	-0.003**	-0.004**	-0.004**	-0.004***	-0.039***	-0.037***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.008)	(0.012)
Observations	95,751	95,751	95,751	95,751	95,751	95,751	95,751
Mean dep. (%)	25.483	25.483	25.483	25.483	25.483	25.483	25.483
				e. log(P99-100)			
$Reform_{i,t}$	-0.010***	-0.009***	-0.010***	-0.009***	-0.009***	-0.061***	-0.062***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.013)	(0.021)
Observations	95,751	95,751	95,751	95,751	95,751	95,751	95,751
Mean dep. (%)	7.693	7.693	7.693	7.693	7.693	7.693	7.693
Municipality FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
Demographic controls	YES	YES	YES	YES	YES	YES	YES
Business cycle controls	NO	YES	YES	YES	YES	YES	YES
Political controls	NO	NO	YES	YES	YES	YES	YES
Election-year FE	NO	NO	YES	YES	YES	YES	YES
Spending shares controls	NO	NO	NO	YES	YES	YES	YES
Region-time FEs	NO	NO	NO	NO	YES	YES	YES

Note: This table shows the effect of switching from a flat to a progressive income tax. The sample is composed of 7,682 municipalities over the 2001-2015 period. First-stage regressions coefficients are 0.384 (0.017) for column (6) and 0.250 (0.023) for column (7). Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Baseline results, net-of-tax elasticity

	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	2SLS (6)
			a. log(Taxable income)			
$log(1-\tau_{i,t})$	0.459***	0.576***	0.641***	0.644***	0.457***	0.309**
	(0.136)	(0.138)	(0.140)	(0.140)	(0.108)	(0.125)
Observations	115,230	115,230	115,230	115,230	115,230	115,230
Mean dep. (€1,000)	93,598	93,598	93,598	93,598	93,598	93,598
			b. log(Gini index)			
$log(1-\tau_{i,t})$	0.071	0.071	0.094	0.092	0.099	0.081
	(0.061)	(0.062)	(0.061)	(0.062)	(0.063)	(0.067)
Observations	115,230	115,230	115,230	115,230	115,230	115,230
Mean dep.	39.693	39.693	39.693	39.693	39.693	39.693
			c. log(P0-90)			
$log(1-\tau_{i,t})$	-0.115**	-0.110*	-0.089	-0.090	-0.114*	-0.137**
	(0.055)	(0.056)	(0.056)	(0.056)	(0.059)	(0.067)
Observations	114,930	114,930	114,930	114,930	114,930	114,930
Mean dep. (%)	67.658	67.658	67.658	67.658	67.658	67.658
			d. log(P90-99)			
$log(1-\tau_{i,t})$	0.074	0.075	0.034	0.030	0.049	0.030
	(0.130)	(0.132)	(0.132)	(0.132)	(0.133)	(0.163)
Observations	95,751	95,751	95,751	95,751	95,751	95,751
Mean dep. (%)	25.483	25.483	25.483	25.483	25.483	25.483
			e. log(P99-100)			
$log(1-\tau_{i,t})$	0.533**	0.516**	0.536**	0.532**	0.809***	0.853***
	(0.210)	(0.210)	(0.212)	(0.212)	(0.228)	(0.241)
Observations	95,751	95,751	95,751	95,751	95,751	95,751
Mean dep. (%)	7.693	7.693	7.693	7.693	7.693	7.693
Municipality FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Province-specific time trend	YES	YES	YES	YES	YES	YES
Demographic controls	YES	YES	YES	YES	YES	YES
Business cycle controls	NO	YES	YES	YES	YES	YES
Political controls	NO	NO	YES	YES	YES	YES
Election-year FE	NO	NO	YES	YES	YES	YES
Spending shares controls	NO	NO	NO	YES	YES	YES
Macro area-time FEs	NO	NO	NO	NO	YES	YES

Note: This table shows net-of-local tax rate elasticities. The sample is composed of 7,682 municipalities over the 2001-2015 period. Fist-stage regression coefficient is 0.926 (0.006). Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Heterogeneity analysis

	log(Taxable income)				log(P99-100)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				a. Progressive tax reform				
$Reform_{i,t}$	-0.017	-0.021	-0.058***	-0.055***	-0.051**	-0.012	-0.069***	-0.063***
	(0.012)	(0.016)	(0.015)	(0.016)	(0.021)	(0.024)	(0.021)	(0.021)
... × $Large_i$	-0.070***				-0.010			
	(0.020)				(0.024)			
... × $Small_i$	0.076***				0.059			
	(0.016)				(0.045)			
... × $Rentier_i$		-0.032***				-0.048***		
		(0.006)				(0.013)		
... × $Coop_i$			0.024***				0.039***	
			(0.007)				(0.014)	
... × $Border_i$				0.004				0.008
				(0.008)				(0.014)
				b. Net-of-tax rate elasticity				
$log(1-\tau_{i,t})$	0.309**	0.020	0.528***	0.243*	0.849***	0.326	1.394***	0.898***
	(0.125)	(0.146)	(0.157)	(0.136)	(0.241)	(0.312)	(0.289)	(0.244)
... × $Large_i$	-0.004***				0.001			
	(0.001)				(0.002)			
... × $Small_i$	-0.000				-0.008**			
	(0.001)				(0.003)			
... × $Rentier_i$		0.526***				0.885**		
		(0.155)				(0.350)		
... × $Coop_i$			-0.403***				-1.166***	
			(0.126)				(0.322)	
... × $Border_i$				0.346*				-0.245
				(0.179)				(0.446)
Observations	115,230	115,230	115,230	115,230	95,751	95,751	95,751	95,751
Baseline controls	YES	YES	YES	YES	YES	YES	YES	YES
Mean dependent	93,598	93,598	93,958	93,958	7.693	7.693	7.693	7.693

Note: This table shows effects of local taxes on taxable income (columns 1-4) and top percentile (columns 5-8) from a model which interacts the reform dummy (panel a) or the net-of-tax rate (panel b) with dummy variables for municipalities whose population size is lower than 1,000 inhabitants ($Small$), larger than 50,000 inhabitants ($Large$), those having a share of rental income larger than the median value ($Rentier$), those having a share of non-profit organizations larger than the median value ($Coop$), and those having at least one bordering municipalities located in a different region ($Border$). Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Tax-induced migration

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) 2SLS
a. Flow elasticity using average tax rates							
$log[(1-\tau_{d,t})/(1-\tau_{o,t})]$	3.486***	2.717***	3.071***	3.049***	2.203**	2.171**	1.646**
	(0.837)	(0.891)	(0.928)	(0.933)	(0.986)	(0.994)	(0.786)
Mean dependent (#)	49.319	49.319	49.319	49.319	49.319	49.319	49.319
b. Flow elasticity using marginal tax rates							
$log[(1-\tau_{d,t})/(1-\tau_{o,t})]$	2.565***	1.998***	2.160***	2.208***	1.555**	1.599**	1.432***
	(0.607)	(0.621)	(0.635)	(0.634)	(0.668)	(0.667)	(0.547)
Mean dependent (#)	49.319	49.319	49.319	49.319	49.319	49.319	49.319
c. Share of movers elasticity using average tax rates							
$log[(1-\tau_{d,t})/(1-\tau_{o,t})]$	4.979***	2.719***	2.949***	2.934***	2.194*	2.168*	1.579*
	(1.000)	(1.036)	(1.071)	(1.076)	(1.141)	(1.149)	(0.939)
Mean dependent (%)	0.136	0.136	0.136	0.136	0.136	0.136	0.136
d. Share of movers elasticity using marginal tax rates							
$log[(1-\tau_{d,t})/(1-\tau_{o,t})]$	3.604***	1.990***	2.066***	2.119***	1.543**	1.590**	1.406**
	(0.726)	(0.725)	(0.737)	(0.735)	(0.780)	(0.778)	(0.655)
Mean dependent (%)	0.136	0.136	0.136	0.136	0.136	0.136	0.136
Observations	83,814	83,814	83,814	83,814	83,814	83,814	83,814
Origin-destination pair FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	YES	YES	YES	YES	YES	YES
Spending and property taxes	NO	NO	YES	YES	YES	YES	YES
Destination macro area-time FE	NO	NO	NO	YES	NO	NO	NO
Origin macro area-time FE	NO	NO	NO	NO	YES	NO	NO
Macro area pair-time FE	NO	NO	NO	NO	NO	YES	YES

Note: This table shows the flow (panel a and b) and share of movers (panel c and d) elasticity with respect to the differential in the net-of-average (panel a and c) or marginal (panel b and d) tax rate between destination and origin province. First-stage coefficient is 0.981 (0.004) for columns 1 and 2, 0.985 (0.004) for columns 3 and 4. The sample is composed of 10,707 origin and destination provincial pair over the 2007-2015 period. Standard errors in parentheses, with three-way clustering by origin-province × year, destination-province × year and province-pair. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Property prices capitalization

	log(Property price)					
	All	Central area	Non central area	High quality	Medium quality	Low quality
	(1)	(2)	(3)	(4)	(5)	(6)
	a. Tax reform					
$Reform_{i,t}$	-0.027	-0.032	-0.037	-0.033	-0.069	0.001
	(0.060)	(0.064)	(0.056)	(0.029)	(0.059)	(0.039)
	b. Net-of-tax elasticities					
$log(1-\tau_{i,t})$	0.099	0.113	-1.748	0.992	0.794	-1.489
	(1.118)	(1.267)	(1.103)	(1.766)	(1.078)	(0.971)
Observations	84,301	66,452	84,290	39,335	61,529	36,897
Baseline controls	YES	YES	YES	YES	YES	YES
Pr. tax (main dwelling)	YES	YES	YES	YES	YES	YES
Pr. tax (basic)	YES	YES	YES	YES	YES	YES
Pr. tax (allowance)	YES	YES	YES	YES	YES	YES
Mean dependent (€/square meter)	1,121	1,045	1,182	1,397	1,143	924

Note: This table shows the effect of the progressive tax reform (panel a) or net-of-local income tax rate (panel b) on property selling prices. Baseline controls include the variables listed in table 2, column (7) and table 3, column (6). High quality (column 4) includes properties classified as villa, chateaux and cottax (OMI code = 1), medium quality (column 5) represents residential buildings (OMI code = 20), low quality (column 6) are affordable houses (OMI code = 21). Data over the 2005-2015 period from *Osservatorio del Mercato Immobiliare*. *** p<0.01, ** p<0.05, * p<0.1.

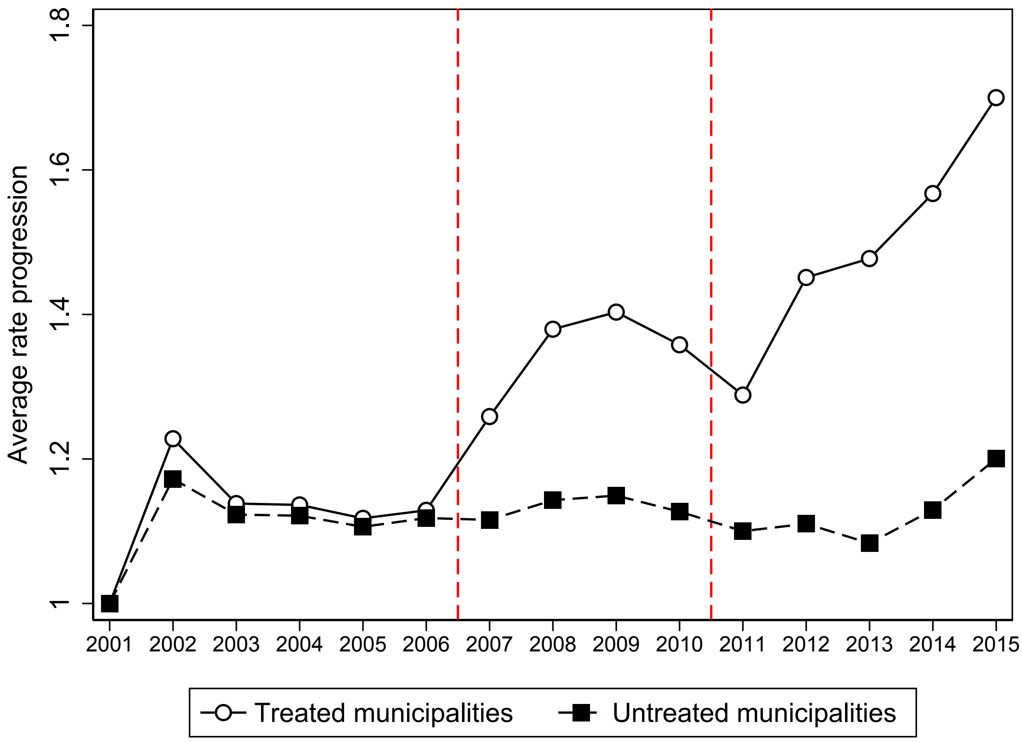
Table 7: Income shifting

	log(Taxable income)					
	OLS	OLS	OLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
$log(1-\tau_{i,t})$	0.457***	0.411***	0.266**	0.308**	0.309**	0.261**
	(0.108)	(0.135)	(0.124)	(0.125)	(0.140)	(0.131)
$log[(1-\sum_{j\neq i} w_{i,j}\tau_{j,t})/(1-\tau_{i,t})]$		-0.169	-0.732***		-0.255	-0.735***
		(0.210)	(0.210)		(0.209)	(0.212)
Observations	115,230	106,800	111,929	115,230	106,800	111,929
Baseline controls	YES	YES	YES	YES	YES	YES
Competitor tax rate	NO	Neigh.	LLM	NO	Neigh.	LLM
Mean dependent (€1,000)	93,598	89,696	94,524	93,598	89,696	94,524

Note: This table compares the baseline taxable income elasticities (columns 1 and 4) with those estimated controlling for the difference between the (log of) net-of-local tax rate set by municipalities sharing a border (columns 2 and 5) or belonging to the same local labor market (columns 3 and 6) and the (log of) net-of-own local tax rate. Baseline controls include the variables listed in table 3, column (6). Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

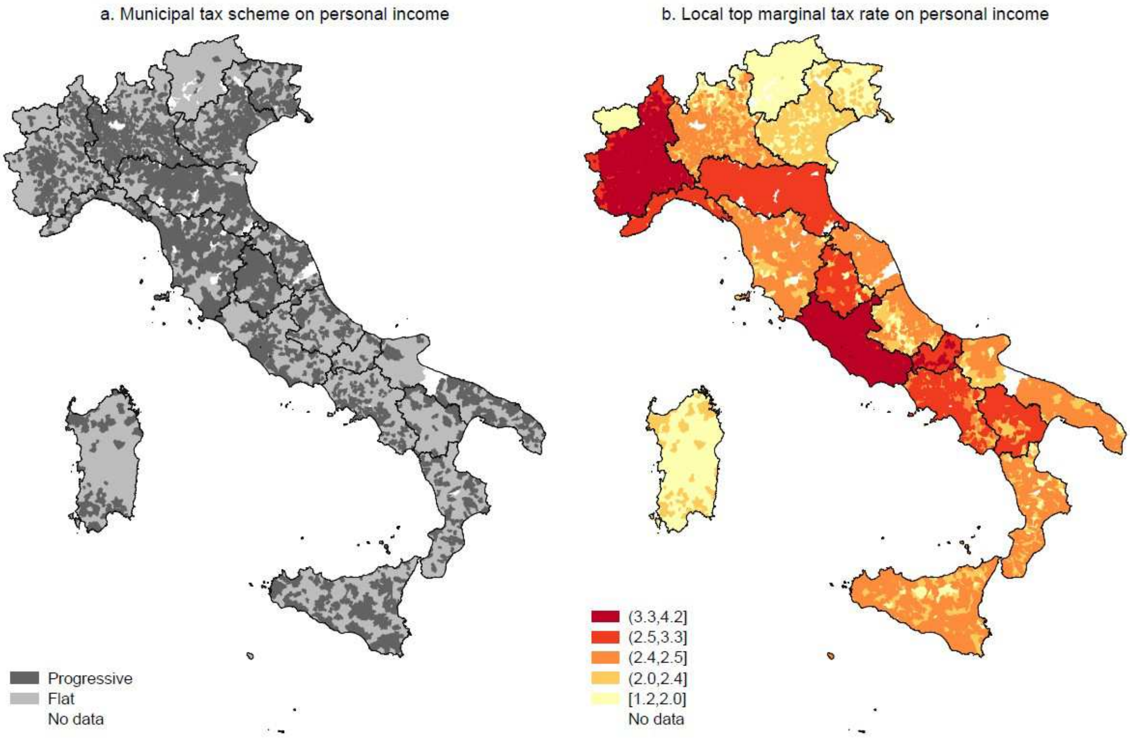
Figures

Figure 1: Tax progressivity trends



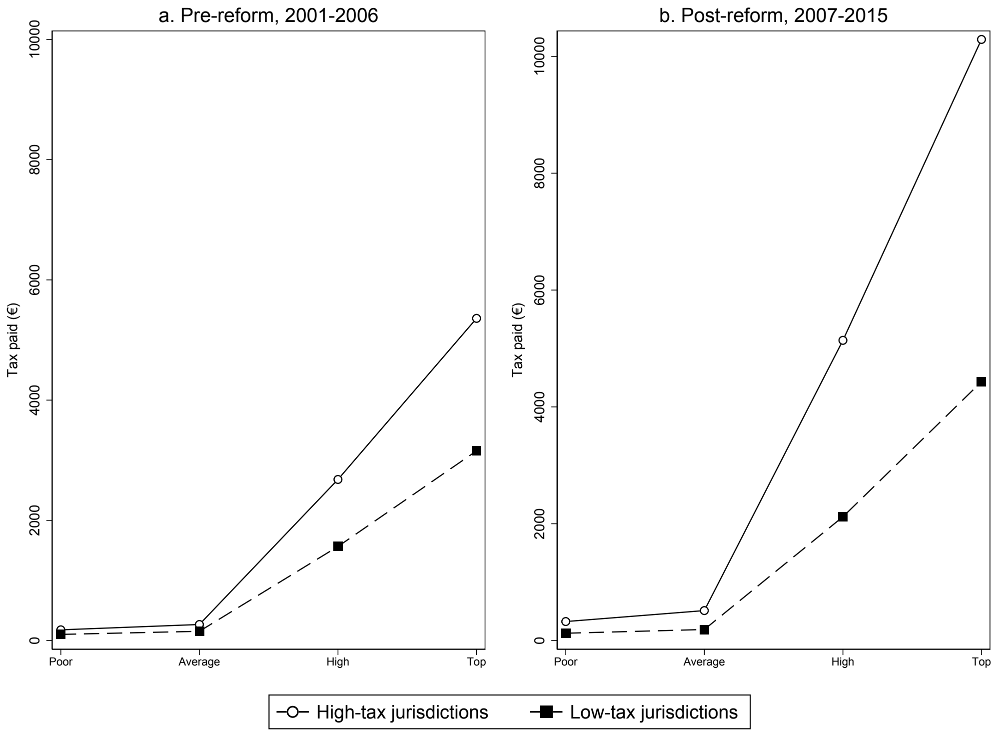
Note: This figure shows the evolution in the structural progressivity of local (municipal plus regional) personal income tax between municipalities which implemented the progressive tax schedule (treated) and those which did not (untreated). The average rate progression is measured as the ratio between the average local tax rate faced by richest taxpayers (i.e., those whose income is larger than 6 times the average national income) and poorest (i.e., those whose income is equal to one-third of the average national income). The vertical lines refer to the year in which it became possible to provide a tax exemption (2007) and to switch from a flat to a graduated tax scheme (2011). Author's elaboration on data from the Italian Ministry of Economy and Finance.

Figure 2: Geographical distribution of local tax scheme and local top tax rate



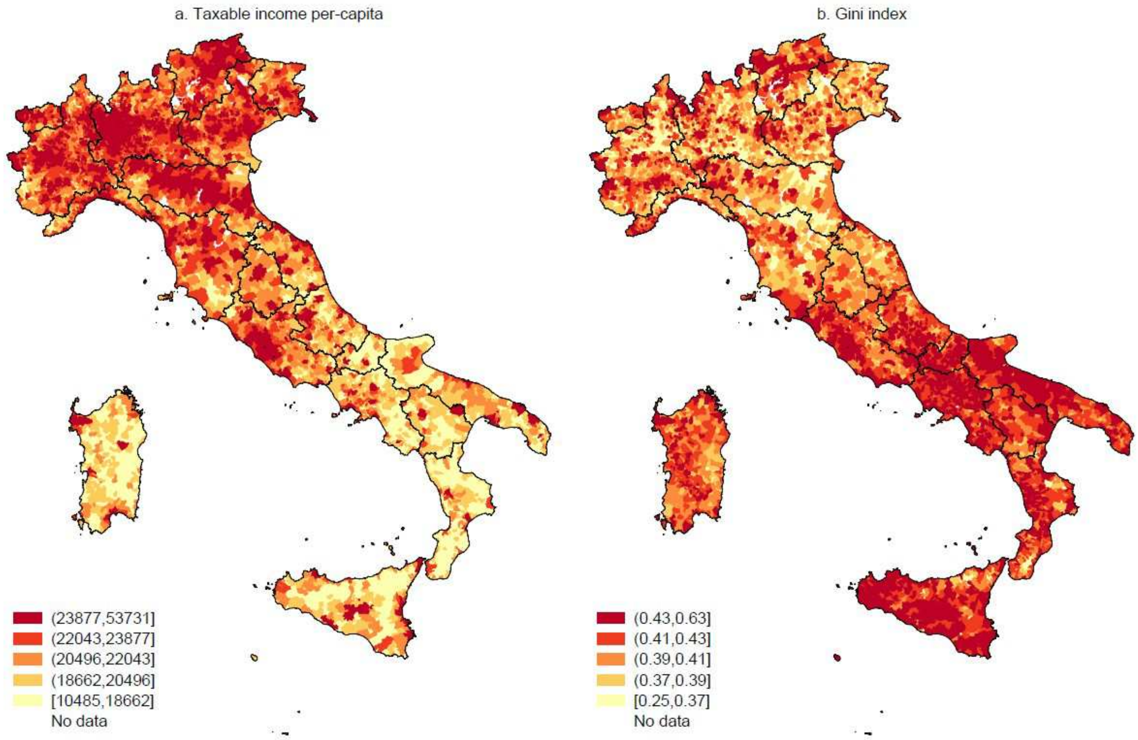
Note: Left figure shows the tax scheme - progressive or flat - on the surtax on personal income adopted by each municipality. Right figure displays the combined regional and municipal top marginal tax rate (%) on personal income in 2015. Author's elaboration on data from the Italian Ministry of Economy and Finance.

Figure 3: Evolution of tax incidence across taxpayers-jurisdiction groups and over time



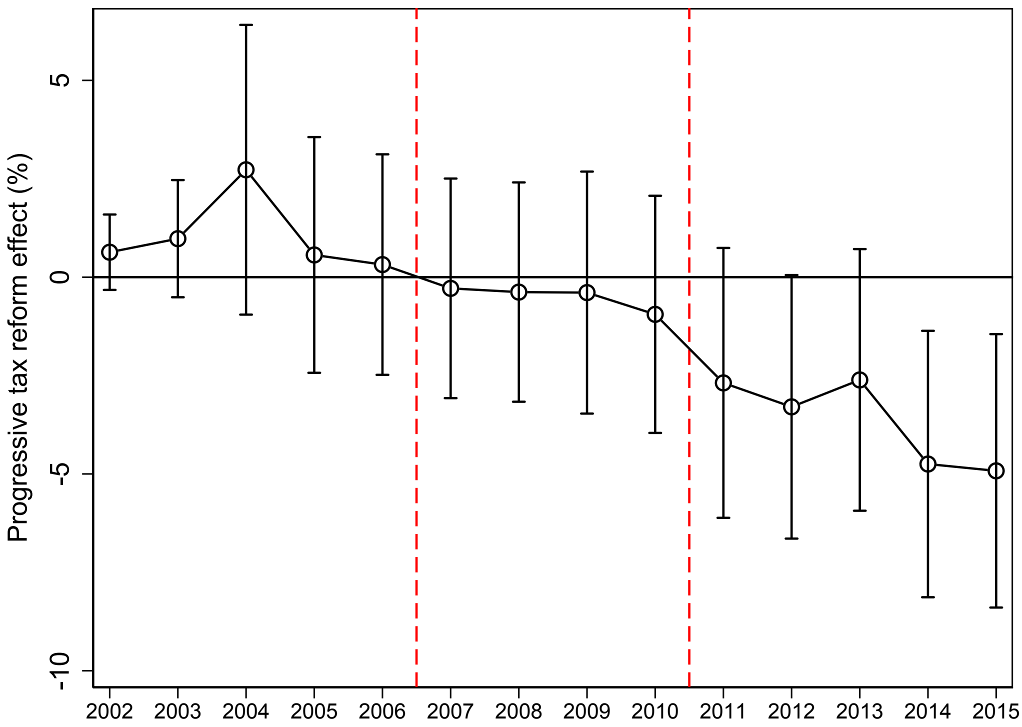
Note: This figure compares the variation over time in the amount of local taxes paid (including both regional and municipal rates) across jurisdictions and income groups. Author's elaboration on data from the Italian Ministry of Economy and Finance.

Figure 4: A map of taxable income per-capita and its distribution



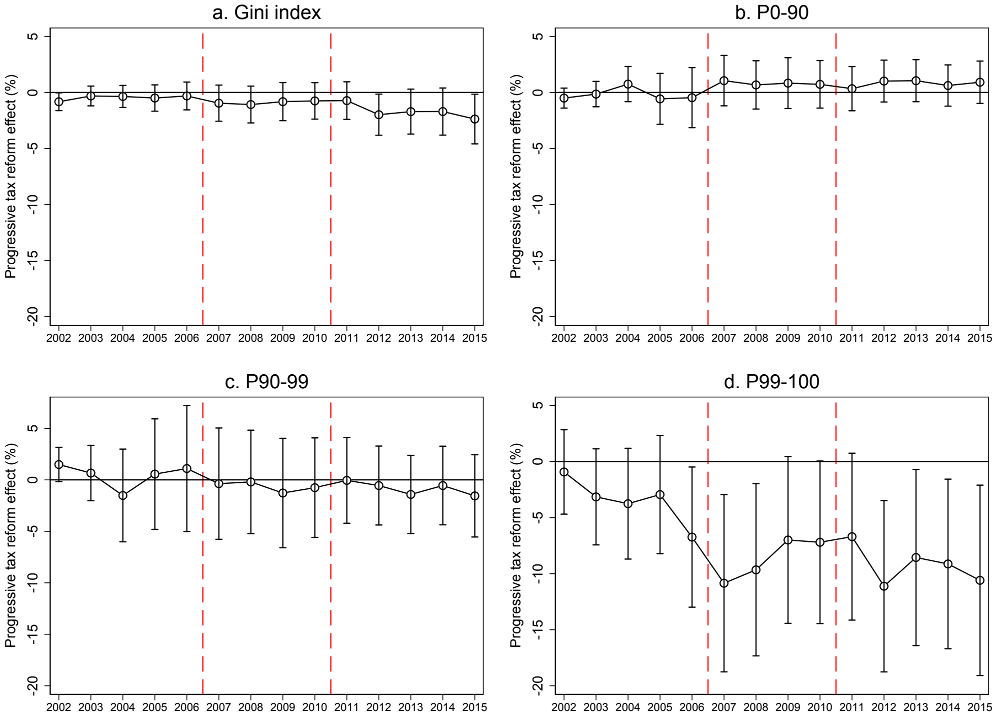
Note: This figure shows taxable income per-capita and Gini index for each municipality in 2015. Author's elaboration on data from the Italian Ministry of Economy and Finance.

Figure 5: Leads and lags effect on taxable income



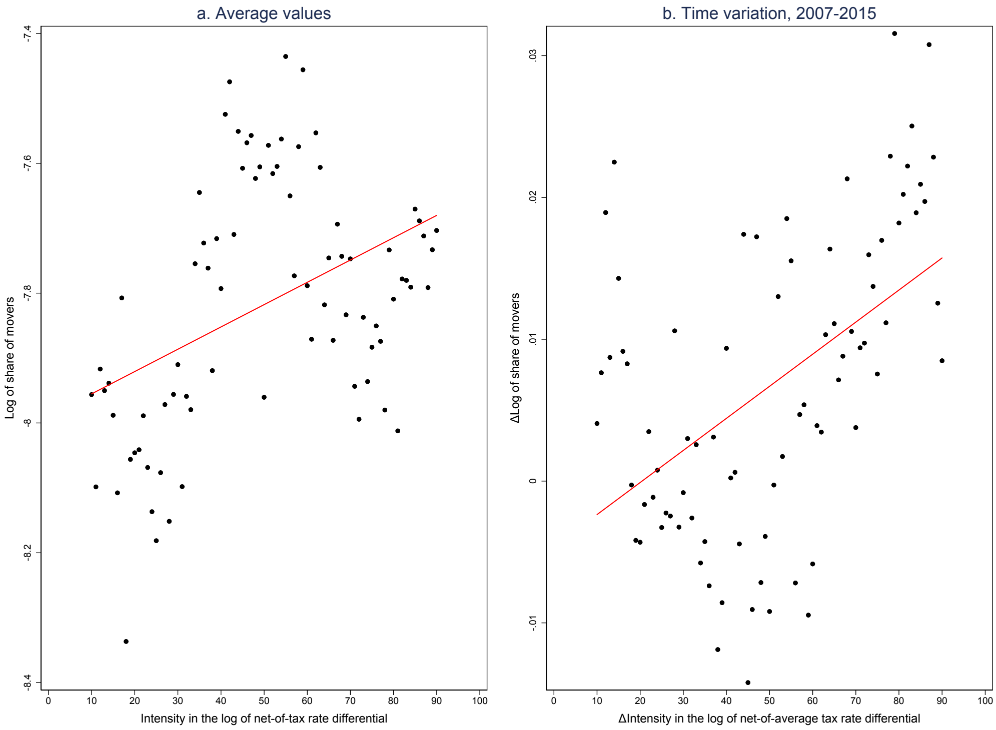
Note: This figure displays estimated coefficients and confidence intervals of the 2007 and 2011 tax reforms and their leads and lags. The vertical lines refer to the year in which it became possible to provide a tax exemption (2007) and to switch from the flat to the graduated tax scheme (2011).

Figure 6: Leads and lags effect on inequality indexes



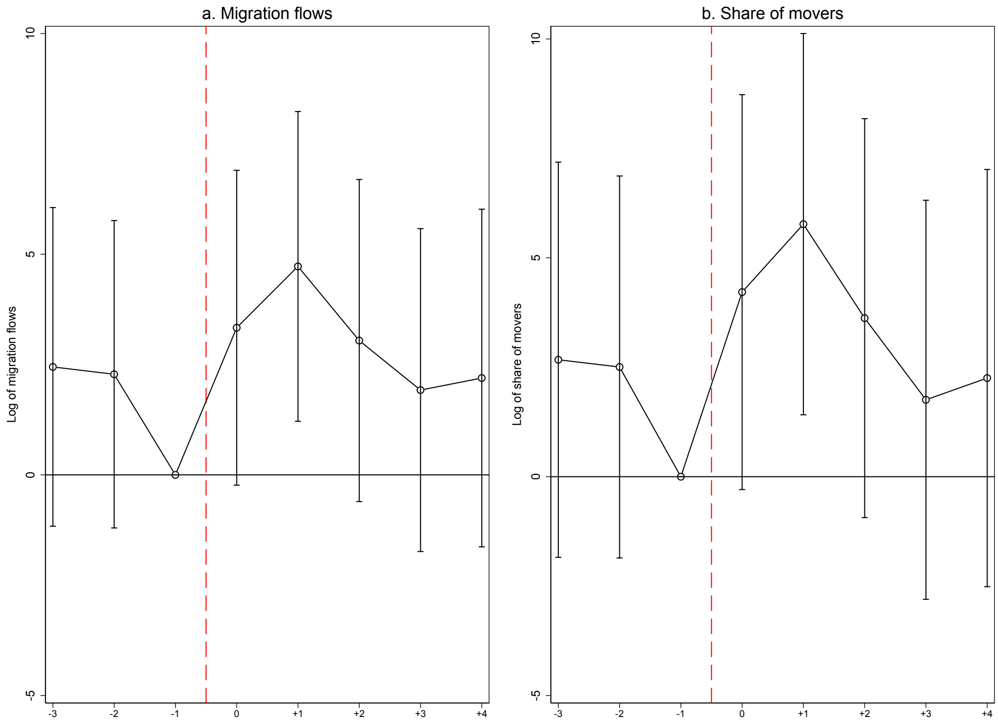
Note: This figure displays estimated coefficients and confidence intervals of the 2007 and 2011 tax reforms and their leads and lags. The vertical lines refer to the year in which it became possible to provide a tax exemption (2007) and to switch from the flat to the graduated tax scheme (2011).

Figure 7: Net-of-tax differentials and migration across province pairs



Note: The left-hand figure plots the relation between the (log of) share of movers and the intensity in the (log of) net-of-tax differential across province pairs. The horizontal axis is partitioned into percentiles. The vertical axis is the average value of the (log of) share of movers in the percentile. I cut the bottom and top 5 of the horizontal axis from the graph. The right-hand figure plots the difference in the relation above between 2007 and 2015. Author's computation on data from transfer of residence.

Figure 8: Event study approach



Note: This figure shows estimated coefficients and 90 percent confidence intervals on migration flows (panel a) and share of movers (panel b) in province pairs where the net-of-average tax rate increases in province *d* relative to province *o* following the 2011 tax reform.

Online appendix

Appendix A: Inequality measures

The basic income data on which I draw inequality measures are in form of grouped tabulations, as in Table A1. This table illustrates the number of taxpayers and the total income assessed for each income class for Rome in the 2015 fiscal year. A typical issue with this kind of data is that the income intervals do not coincide with the percentage groups of the population of interest. Therefore, I need to interpolate in order to derive inequality statistics such as Gini index and top income shares.

A1. Gini index

The basic assumption to derive the Gini index from data as in Table A1 is that in each income class all the units receive the same income (i.e., the average income of that income class). Several methods have been proposed for calculating the Gini index. The natural approach consists in approximating the Lorenz curve by a number of linear segments, and then estimate the Gini coefficients as the areas (or, weighted areas, as discussed later) between the linear segments and the 45 degrees line. The computation can be performed both parametrically (i.e., assuming a known income distribution), or non-parametrically (i.e., without any assumption on the underlying income distribution).[35] Milanovic (1994) proposes a simple and accurate non-parametric measure designed for ungrouped data. Abounoori and McCloughan (2003) arrange the Milanovic's (1994) formula for grouped data. They show that the original Milanovic (1994)'s formula can be expressed as:

$$G = C[n(1 - y_1/\bar{y}) + (n-1)(1 - y_2/\bar{y}) + ... + (n - (n-1))(1 - y_n/\bar{y})], \quad (1)$$

where $C = 2/n(n+1)$. After reversing the terms of the series in brackets, it becomes:

$$G = C\sum_{j=1}^{n} j(1 - y_{n-j+1}/\bar{y}). \quad (2)$$

With grouped data as in Table A1, the *n* taxpayers are arranged into K=7 mutually exclusive and exhaustive income classes with n_k taxpayers in group *k*, with $k = 1, 2, ...7$. To apply the last equation for grouped data, Abounoori and McCloughan (2003) suggest to calculate the weights corresponding to each group *k* (i.e. the analogue of *j* in the ungrouped version). According to Abounoori and McCloughan (2003), the general formula for calculating weight of group *k* is:

$$w_k = 1/2[\sum_{k=k}^{K} n_k(\sum_{k=k}^{K} n_k + 1) - \sum_{k=k+1}^{K} n_k(\sum_{k=k+1}^{K} n_k + 1)]. \quad (3)$$

[35]Note, however, that they both give a downward biased estimator.

Finally, the original Milanovic (1994) formula becomes:

$$G = C \sum_{k=1}^{K} w_k (1 - \bar{y_k}/\bar{y}). \tag{4}$$

Since Gastwirth (1972), previous literature has extensively discussed the pitfalls deriving from estimation of Gini index from grouped data.[36] The main concern of using grouped data to compute Gini index is that it imparts a nonnegligible downward bias, which is increasing with the level of inequality and more severe when the number of groups is small. This bias would complicate comparisons of Gini coefficient both across municipalities and within-municipality over time. Van Ourti and Clarke (2011) propose to use a correction term for the Gini coefficient to address the bias due to grouping. They provide an exact expression for the difference between the Gini based on grouped data and the one that would be obtained from ungrouped data by drawing a parallel with the econometric literature on measurement error models. They suggest to weight the estimated Gini coefficient by a term equal to $K^2/(K^2 - 1)$, where K is the number of income classes. This correction term is a "grouped data" adjustment of the variance of the fractional rank, which turns out to be equal to the attenuation bias in the classical measurement error model.

Panel a in Figure A1 plots the estimated Gini index for Rome over the 2001-2015 period. Table A2 shows an application of the last equation for Rome in 2015 using the information illustrated in Table A1 as input data.

A2. Top income shares

The standard practice to compute top income shares from grouped data is to assume that the top tail of the income distribution can be approximated by a Pareto distribution (see Kuznets, 1953, Feenberg and Poterba, 1993, and the studies following Piketty, 2003).[37] The Pareto law for top incomes gives a distribution function for top incomes of the following form:

$$1 - F(y) = (k/y)^a, \tag{5}$$

where $k > 0$ is a constant and $a > 1$ is the (municipality-specific) Pareto parameter of the distribution. The corresponding density function is $f(y) = ak^a/y^{(1+a)}$. The main property of the Pareto distribution is that the ratio between the average income $y^*(y)$ of taxpayers with income above y and y does not depend on the income threshold y. Formally:

[36] Lerman and Yitzhaki (1989) show that the bias using grouped data is about 2.5 and 7 percent of the Gini as computed from microdata from Israel and the US. Similar results were found by Davies and Shorrocks (1989) using Canadian data. They show that the bias is significantly reduced as the number of groups increases. In their estimation, just five groups are needed to generate a Gini coefficient equal to 95 percent of the true value, and only twelve classes are required to converge within 1 percent of the actual value (see Figure 1 in Davies and Shorrocks, 1989 for a graphical representation of these numbers). However, Cowell and Mehta (1982), which arbitrary compress the nineteen official classes for Swedish income data into five groups, show that it is possible to get good estimates of the Gini index even when the number of groups is small.

[37] The technical appendix in Alvaredo and Saez (2010) provides a detailed overview on this procedure.

$$y^*(y) = [\int_{z>y} zf(z)dz]/[\int_{z>y} f(z)dz] = [\int_{z>y} dz/z^a]/[\int_{z>y} dz/z^{1+a}] = ay/(a-1). \quad (6)$$

A simpler way to express the last equation is as $b = y^*(y)/y$, with $b = a/(a-1)$. Then, b represents how much times the income of taxpayers with income above y is larger than the income threshold y. These structural parameters allow to compute top fractile thresholds and average income. I use these municipality-specific and time-varying estimates to infer the income share held by the top decile (P90-100) and the top percentile (P99-100). Then, from these estimations, I derive the income share held by the bottom 90 percent of the income distribution (P0-90) and the bottom 90 percent of the top decile (P90-99).

In practice, the first step consists in computing the income thresholds corresponding to the percentiles P90 and P99. For these two percentiles, I look first for the published income bracket [r,s] containing the percentile p. Then, I estimate the parameters k and α as the solutions of the equations: $k = rp^{1-a}$ and $k = sf^{1/a}$, where p is the fraction of tax returns above r and f is the fraction of tax returns above s.

Then, I estimate the amount of income reported above the income threshold y_p. Using the estimated Pareto density with parameters α and k, I compute the income reported between the income threshold y_p and s, i.e. the upper bound of the brackets [r,s] containing y_p. This amount is then added to the remaining amounts of income, if exist, reported in all the brackets above s.

The mean income above percentile p is then computed by dividing the total income above y_p by the number of individuals above p. Finally, the income share owned by the individuals above the percentile p is obtained by dividing the total amount of income above y_p by the total income (which is corrected for income of non-filers, see below).

Table A3 shows the income thresholds (columns 1 and 5), the average income (columns 2 and 6), the number of tax units (columns 3 and 7) and the income share (columns 4 and 8) for the top decile and the top percentile in Rome over the 2001-2015 period. Panels b-d in Figure A1 illustrate the time trend in the bottom 90 percent (panel b), the bottom half of the top decile (panel c) and in the top percentile (panel d) of the Rome's pre-tax income distribution.

When computing top income shares, two methodological problems should be addressed. First, since individuals with income lower than a certain threshold do not fill the tax form, we need to relate the number of taxpayers with the total population. I follow the Atkinson (2007) suggestion and restrict total population to only the "adult" population for each municipality, defined as those aged 15, using data from the National Institute of Statistics. This definition removes from the denominator those aged under 15 who receive income and may be included in the income tax statistics. It could be argued that the age cut-off is too low since people enter the labour force later. However, this is the only age cut-off for which it is possible to retrieve information for all the municipalities over the period covered. To investigate how much difference the population cut-off is likely to make, let us compare this cut-off with another larger by amount $1+e$. Assuming that the top tail can be approximated by a Pareto distribution, then the effect of taking a control for population larger by $(1+e)$ is that we have to go further down the income distribution to compute the income share, and the level of income reduced by a factor $(1+e)^{1/a}$. This would raise the estimated share by a factor $(1+e)^{1-1/a}$. To put this number in perspective, let us compute the effect of using the age cut-off at 15 years with another at 20 years. According to National Institute of Statistics data, in 2015 the population in Rome aged over 15 and over was about 5 percent larger than aged 20 and over. Since the estimated α for Rome in 2015 was 2.096, with e = 5 percent this yields an adjustment of about 2.5 percent. It means that if the top percentile were to be 10 percent with an assumed cut-off age of 20, then it would be 10.25 percent with the cut-off of 15, a difference that can interpreted as negligible.

Second, taxable income differs from actual total income because we do not observe the income of non-filers and incomes not included in the tax base. Computation of top income shares at country-level typically relates the amounts recorded in the tax data to those derived from the national accounts. Then, the income of non-filers would appear as a residual. Unfortunately, such kind of data is not available at municipality-level. Hence, a different approach should be followed to estimate the total income that would have been reported if everybody had been required to file a tax return. Following Piketty and Saez (2003), I impute to non-filers a fixed fraction equal to 20 percent of filers' average income.

Appendix B: Data and Additional results

This appendix presents data and additional results.

Table B1 provides economic and demographic information on Italian regions.

Table B2 presents the summary statistics of the data used.

Table B3 replicates the main specifications by using the average rate progression (the average rate progression (i.e. the derivative of the tax rate with respect to income before tax)) instead of the baseline reform dummy as a measure of structural PIT progressivity and the combined income and property local tax rates instead of the baseline regional and municipal top marginal surtaxes. Coefficients are qualitatively similar.

Table B4 and B5 test for geographical differences in tax progressivity effects and net-of-tax elasticities. The tables compare the baseline coefficients with those estimated from four sub-samples including: i. municipalities belonging to *Statuto Speciale* regions (Aosta Valley, Friuli-Venezia Giulia, Sardinia, Sicily and Trentino-Alto Adige), which have special autonomy in setting their own fiscal rules; ii. municipalities located in Northern regions (Aosta Valley, Emilia-Romagna, Friuli-Venezia Giulia, Liguria, Lombardy, Piedmont, Trentino-Alto Adige, Veneto); iii. municipalities located in Center regions (Lazio, Marche, Tuscany, Umbria); iv. municipalities located in Southern regions (Abruzzo, Apulia, Basilicata, Calabria, Campania, Molise, Sardinia, Sicily).

Table B6 adds property tax rates and a time-varying municipality-level proxy for tax evasion to the vector of control variables. This robustness test is motivated by two reasons. First, municipalities might compensate any variation in personal income taxes with changes in property tax rates. Property taxes were subject to several reforms over the recent years which, as long as they are common to all the municipalities, are controlled by the time dummies.[38] Apart from the property tax rate applied on the main dwelling, municipalities set a basic property tax rate on the other properties. As taxpayers choose their actual (or fiscal) residence between different municipalities, they are likely to compare the marginal cost indicated by the combined tax rates of the property and income tax rates with the marginal benefit of public services. Hence, to obtain an unbiased estimate of the taxable income elasticity, it is required to control for the property tax. For this end, I retrieve municipality-level data on the property tax rate applied to the main dwelling, the amount of tax allowance provided and the basic rate for each year over the period of interest. These variables (in log form) are then added to list of the control variables used in the baseline specification.

Second, in 2007, the Italian central government carried out a nationwide anti tax evasion policy that used innovative monitoring technologies to target buildings hidden from tax authorities. The program led to a substantial increase in local tax revenue, which substantially varies in its intensity across municipalities and might a direct effect on taxable income and local taxes (Rubolino, 2019). I retrieve administrative data from the Ministry of Revenue on the share of the so-called “ghost” buildings - share of properties not included in the land registry as a share of total buildings - for each municipality. Then, I add to the baseline model the interaction of this proxy for tax evasion intensity with a dummy equal to 1 for all the years after the anti tax evasion program.

To keep a common sample across models, I drop municipalities for which data on ”ghost” buildings are missing (around 4 percent of the original sample). Coefficients do not significantly change.

Table B7 I implement the Crump et al. (2009) suggestion to run regression excluding observations in the bottom and top of the propensity score distribution. In this table, the estimation sample is limited to observations with a predicted probability of implementing the progressive tax reform equal to at least 5 percent but no more than 95 percent. Given that the distribution of the propensity scores for the treated and control group does not show a perfect overlapping in the tails (see Figure B2), this strategy allows to run regressions on a sample including only cells where there are at least few treated and control observations.

Table B8 shows migration elasticity estimates using the net-of-average tax rate differential computed for a representative taxpayer whose income is equal to the national average.

Figure B1 plots the local tax rate and its instrument to test for the relevance condition.

Figure B2 presents the distribution of the estimated propensity score between treated and control municipalities.

Figure B3 (B4) present pattern in migration flows (share of movers) and net-of-tax rate dif-

[38]The most salient were the 2008 and 2012 reforms (decree 93/2008 and 276/2011), which first removed and then restored the municipal property tax on owner-occupied dwellings. However, the rate continued to apply on luxury properties (i.e., those belonging to cadastral unit A/1, A/8 and A/9).

ferential for the six province pair with the largest number of flows (share of movers).

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Appendix tables and figures

Table A1: Income tax data, Rome in 2015

Income class (€)	Total taxpayers	Income assessed (€)
1 - 10,000	547,176	2,353,967,201
10,001 - 15,000	207,374	2,353,967,201
15,001 - 26,000	465,392	9,523,343,768
26,001 - 55,000	513,087	18,438,065,283
55,001 - 75,000	77,506	4,944,213,442
75,001 - 120,000	62,438	5,743,228,043
$>$ 120,000	32,888	7,545,279,203

Note: Income data from Italian Ministry of Economy and Finance on reported taxable personal income for the year 2015 in Rome.

Table A2: Application of grouped Milanovic formula to Rome in 2015

k	Frequency	$\bar{y_k}$	$1-\bar{y_k}/\bar{y}$	Reverse cdf	x = Col. 5*(Col.5+1)/2	$w_k = x_k - x_{k-1}$	$Cw_k(1-\bar{y_k}/\bar{y_k})$	Sum of Col. 8 = Gini
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	547,176	4,302	0.840	1,905,861	1.82e+12	8.93e+11	0.413	
2	207,374	12,469	0.535	1,358,685	9.23e+11	2.60e+11	0.077	
3	465,392	20,463	0.237	1,151,311	6.63e+11	4.28e+11	0.056	
4	513,087	35,936	-0.339	685,919	2.35e+11	2.20e+11	-0.041	0.489
5	77,506	63,791	-1.378	172,832	1.49e+10	1.04e+10	-0.008	
6	62,438	91,983	-2.428	95,326	4.54e+09	4.00e+09	-0.005	
7	32,888	229,424	-7.551	32,888	5.41e+08	5.41e+08	-0.002	

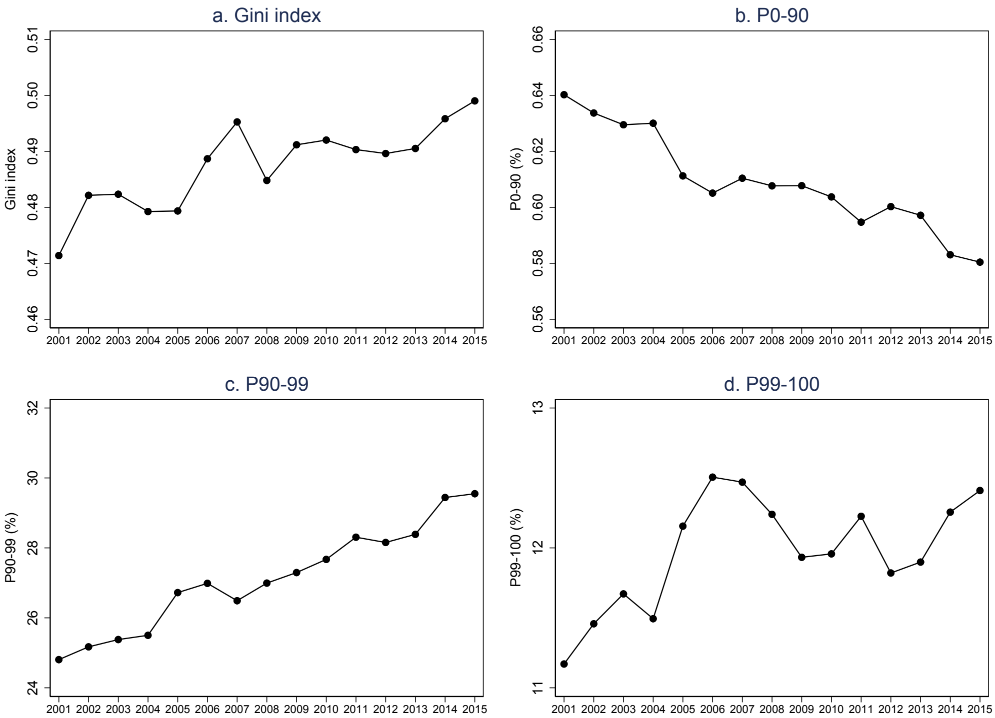
Note: C =5.51e-13 and $\bar{y} = 26,829$.

Table A3: Thresholds and average incomes in top income groups in Rome

Year	Top 10 (P90-100)				Top 1 (P99-100)			
	Threshold	Tax units	$\bar{y}$	Share	Threshold	Tax units	$\bar{y}$	Share
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2001	€32,626	221,917	€77,700	35.98%	€96,818	22,192	€241,248	11.17%
2002	€34,488	221,155	€80,773	36.63%	€102,700	22,116	€252,659	11.46%
2003	€36,384	220,729	€84,063	37.05%	€110,970	22,073	€264,805	11.67%
2004	€37,803	221,512	€85,357	37.00%	€114,952	22,151	€265,193	11.49%
2005	€39,496	220,813	€88,500	38.88%	€120,373	22,081	€276,706	12.16%
2006	€41,333	221,334	€92,314	39.49%	€128,543	22,133	€292,318	12.51%
2007	€42,717	222,675	€94,951	38.96%	€134,399	22,268	€303,907	12.47%
2008	€44,032	222,763	€93,963	39.23%	€136,510	22,276	€293,140	12.24%
2009	€44,763	223,964	€93,876	39.23%	€138,489	22,396	€285,565	11.93%
2010	€45,614	225,645	€94,165	39.63%	€140.688	22,565	€284,132	11.96%
2011	€46,316	226,547	€93,772	40.53%	€142.422	22,654	€282,857	12.23%
2012	€46,107	228,298	€89,834	39.98%	€139,163	22,830	€265,648	11.82%
2013	€46,596	228,298	€89,756	40.29%	€139,814	22,830	€265,101	11.90%
2014	€45,858	247,691	€87,662	41.70%	€136,215	24,769	€257,664	12.26%
2015	€46,241	248,323	€88,694	41.96%	€137.208	24,832	€262.323	12.41%

Note: Author's elaboration from tax returns data.

Figure A1: Inequality indexes in Rome, 2001-2015



Note: This figure shows time trend in Gini index (panel a), the bottom 90 percent (panel b), the bottom half of the top decile (panel c) and the top percentile (panel d) of the pre-tax income distribution for Rome over the 2001-2015 period. See the text for information on how these measures are derived.

Table B1: Demographic and economic information on Italian regions

Region	Capital city	Prov. (N)	Mun. (N)	Pop. (Mill.)	Income pc (Thous. €)	Local top PIT rate (%) in year:			
						2001	2005	2010	2015
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Abruzzo	L'Aquila	4	305	1.299	20.660	1.153	1.218	1.922	2.433
Aosta Valley	Aosta	0	74	0.125	23.954	0.900	0.900	0.985	1.354
Apulia	Bari	6	258	3.654	19.962	1.192	1.247	1.432	2.461
Basilicata	Potenza	2	131	0.585	19.215	1.171	1.212	1.418	2.972
Calabria	Catanzaro	5	409	1.977	19.072	1.097	1.711	2.200	2.439
Campania	Naples	5	551	5.741	21.006	1.168	1.229	2.229	2.757
Emilia-Romagna	Bologna	9	348	4.156	24.371	1.011	1.128	1.871	3.056
Friuli-Venezia Giulia	Trieste	4	218	1.200	23.532	0.940	1.025	1.228	1.761
Lazio	Rome	5	378	5.414	26.168	1.043	1.167	2.236	4.146
Liguria	Genoa	4	235	1.574	24.129	1.123	1.241	1.936	3.036
Lombardy	Milan	8	1,544	8.616	26.442	1.050	1.594	1.696	2.415
Marche	Ancona	5	239	1.323	21.761	1.225	1.805	2.049	2.512
Molise	Campobasso	2	136	0.317	19.781	1.156	1.496	2.135	3.210
Piedmont	Turin	8	1,206	4.321	24.029	1.124	1.718	1.854	4.048
Sardinia	Cagliari	8	377	1.170	21.213	1.105	1.132	1.218	1.751
Sicily	Palermo	9	390	4.988	20.528	1.074	1.138	1.839	2.468
Trentino-Alto Adige	Trento	2	333	0.939	24.616	0.914	0.947	0.951	1.282
Tuscany	Florence	10	287	3.557	23.304	1.128	1.248	1.365	2.412
Umbria	Perugia	2	92	0.867	21.762	1.131	1.394	1.622	2.579
Veneto	Venice	7	581	4.753	23.525	1.143	1.704	1.343	1.958

Note: This table provides information on each Italian region. Columns 2-5 show the number of provinces, municipalities, total population (averaged over the 2001-2015 period) and taxable income per-capita (municipal population-weighted average over the 2001-2015 period). Columns 6-9 presents the local top marginal income tax rate, computed as the sum of the regional and the population-weighted average municipal rate.

Table B2: Summary statistics

	Obs (1)	Mean (2)	Std. Dev. (3)	Min (4)	Max (5)
a. Outcome variables					
Taxable income per-capita	115,230	20,389	3,898	6,523	96,101
Gini index	115,230	0.397	0.038	0.240	0.765
Bottom 90 (%)	114,930	67.692	4.472	28.274	92.174
Top 10-1 (%)	95,751	25.483	2.847	6.564	51.940
Top 1 (%)	95,751	7.693	2.265	1.262	61.480
b. Tax variables					
Municipal (top) MTR (%)	115,230	0.340	0.267	0	0.900
Regional (top) MTR (%)	115,230	1.404	0.465	0.900	4
Municipal ATR (%)	115,230	0.326	0.258	0	0.900
Regional ATR (%)	115,230	1.183	0.314	0	2.051
Property tax (main dwelling)	115,230	0.492	0.091	0	0.860
Property tax (basic)	115,230	0.672	0.153	0.300	1.110
Property tax allowance (€)	115,230	139.061	55.533	0	2,500
Municipal (top) MTR (%) - neigh. competitor	115,035	0.344	0.203	0	0.850
Municipal (top) MTR (%) - SLL competitor	111,929	0.349	0.190	0	0.800
Reform (0/1)	115,230	0.120	0.325	0	1
c. Demographic characteristics					
Population	115,230	7,365	40,878	30	2,872,021
Share of 65+	115,230	22.409	6.131	4.363	66.379
Share of 15-	115,230	13.198	2.859	0	26.459
Share of foreign	115,230	5.017	4.047	0	38.961
d. Business cycle variables					
Crisis (0/1)	115,230	0.001	0.031	0	1
Unemployment rate (%)	115,230	8.357	4.953	1.600	31.456
Budget deficit (0/1)	115,230	0.115	0.318	0	1
e. Political and economic variables					
Mayor age	115,230	49.094	9.702	19	94
Mayor sex	115,230	0.102	0.299	0	1
Mayor graduated	115,230	0.423	0.489	0	1
Average age in town council	115,230	44.186	4.139	26	77
Proportion of women in town council	115,230	0.196	0.119	0	1
Proportion of graduated in town council	115,230	0.255	0.163	0	1
Administration expenditure (%)	115,230	22.602	9.102	0	85.335
Development expenditure (%)	115,230	0.304	0.760	0	32.738
Education expenditure (%)	115,230	5.469	3.497	0	31.468
Law and order expenditure (%)	115,230	0.057	0.303	0	42.510
Social welfare expenditure (%)	115,230	6.139	5.794	0	73.620

Note: The sample covers 7,682 municipalities over the 2001-2015 period.

Table B3: Alternative progressivity and tax rate definitions

	Progressivity definition:		Local tax rate on:	
	Reform dummy	ARP	Income	Inc. + prop.
	(1)	(2)	(3)	(4)
a. log(Taxable income)				
$Progressivity_{i,t}$	-0.054***	-0.306***		
	(0.015)	(0.082)		
$log(1-\tau_{i,t})$			0.309**	0.415***
			(0.125)	(0.129)
Observations	115,230	115,230	115,230	115,230
b. log(Gini index)				
$Progressivity_{i,t}$	-0.004	-0.012		
	(0.004)	(0.025)		
$log(1-\tau_{i,t})$			0.081	0.132*
			(0.067)	(0.069)
Observations	115,230	115,230	115,230	115,230
c. log(P0-90)				
$Progressivity_{i,t}$	0.026***	0.149***		
	(0.006)	(0.037)		
$log(1-\tau_{i,t})$			-0.037**	-0.171**
			(0.019)	(0.067)
Observations	114,930	114,930	114,930	114,930
d. log(P90-99)				
$Progressivity_{i,t}$	-0.037***	-0.262***		
	(0.012)	(0.078)		
$log(1-\tau_{i,t})$			0.030	0.003
			(0.163)	(0.166)
Observations	95,751	95,751	95,751	95,751
e. log(P99-100)				
$Progressivity_{i,t}$	-0.062***	-0.260***		
	(0.021)	(0.119)		
$log(1-\tau_{i,t})$			0.853***	1.046***
			(0.241)	(0.245)
Observations	95,751	95,751	95,751	95,751
Baseline controls	YES	YES	YES	YES
Progressivity or tax measure	Reform dummy	Average rate progression	Income	Income + Property

Note: This table compares the baseline coefficients (column 1 and 3) with those estimated using the average rate progression (i.e. the derivative of the tax rate with respect to income before tax) instead of the baseline reform dummy (column 2) and the combined local income and property tax rate instead of the baseline income rate (column 4). Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B4: Geographical differences in the progressive tax reform effect

	Baseline	Subsample:			
		St. ord.	North	Center	South
	(1)	(2)	(3)	(4)	(5)
	a. log(Taxable income)				
$Reform_{i,t}$	-0.054***	-0.075***	-0.115***	0.003	-0.022
	(0.015)	(0.018)	(0.032)	(0.024)	(0.017)
Observations	115,230	97,275	64,935	14,010	36,285
	b. log(Gini index)				
$Reform_{i,t}$	-0.004	-0.006	-0.009	0.004	-0.002
	(0.005)	(0.006)	(0.009)	(0.009)	(0.007)
Observations	115,230	97,275	64,935	14,010	36,285
	c. log(P0-90)				
$Reform_{i,t}$	0.026***	0.026***	0.046***	0.032**	0.002
	(0.006)	(0.007)	(0.013)	(0.013)	(0.005)
Observations	114,930	97,031	64,658	14,008	36,264
	d. log(P90-99)				
$Reform_{i,t}$	-0.037***	-0.036***	-0.060**	-0.080***	0.010
	(0.012)	(0.014)	(0.026)	(0.026)	(0.010)
Observations	95,751	81,266	55,132	12,276	28,343
	e. log(P99-100)				
$Reform_{i,t}$	-0.062***	-0.057**	-0.093**	0.006	-0.054**
	(0.021)	(0.025)	(0.041)	(0.040)	(0.022)
Observations	95,751	81,266	55,132	12,276	28,343
Baseline controls	YES	YES	YES	YES	YES
Sub-sample	NO	St. ord.	North	Center	South

Note: This table compares coefficients from full sample with those estimated from four sub-samples: i. dropping Statuto Speciale regions; ii. Northern Italy; iii. Center Italy; iv. Southern Italy. Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B5: Geographical differences in net-of-tax elasticities

	Baseline	Subsample:			
		St. ord.	North	Center	South
	(1)	(2)	(3)	(4)	(5)
		a. log(Taxable income)			
$log(1-\tau_{i,t})$	0.309**	0.330***	0.522**	0.152	0.185
	(0.125)	(0.126)	(0.232)	(0.134)	(0.442)
Observations	115,230	97,275	64,935	14,010	36,285
		b. log(Gini index)			
$log(1-\tau_{i,t})$	0.081	0.040	0.139	0.050	0.192
	(0.067)	(0.066)	(0.142)	(0.062)	(0.217)
Observations	115,230	97,275	64,935	14,010	36,285
		c. log(P0-90)			
$log(1-\tau_{i,t})$	-0.137**	-0.100	-0.074	-0.032	-0.206
	(0.067)	(0.067)	(0.150)	(0.050)	(0.153)
Observations	114,930	97,031	64,658	14,008	36,264
		d. log(P90-99)			
$log(1-\tau_{i,t})$	0.030	-0.068	-0.540	0.010	0.030
	(0.163)	(0.168)	(0.330)	(0.132)	(0.348)
Observations	95,751	81,266	55,132	12,276	28,343
		e. log(P99-100)			
$log(1-\tau_{i,t})$	0.853***	0.847***	1.090**	0.287	2.155***
	(0.241)	(0.242)	(0.509)	(0.287)	(0.540)
Observations	95,751	81,266	55,132	12,276	28,343
Baseline controls	YES	YES	YES	YES	YES
Sub-sample	NO	St. ord.	North	Center	South

Note: This table compares coefficients from full sample with those estimated from four sub-samples: i. dropping regions with special autonomy (i.e. *Regioni a Statuto Speciale*); ii. Northern Italy; iii. Center Italy; iv. Southern Italy. Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B6: Controlling for municipality-level variations in tax evasion and property tax rates

	Specification:					
	Baseline	+ Evasion	+ Pr. taxes	Baseline	+ Evasion	+ Pr. taxes
	(1)	(2)	(3)	(4)	(5)	(6)
			a. log(Taxable income)			
$Reform_{i,t}$	-0.055***	-0.055***	-0.051***			
	(0.015)	(0.015)	(0.015)			
$log(1-\tau_{i,t})$				0.302**	0.312**	0.307**
				(0.124)	(0.123)	(0.123)
Observations	110,609	110,609	110,609	110,609	110,609	110,609
Mean dep. (€1,000)	95,016	95,016	95,016	95,016	95,016	95,016
			b. log(Gini index)			
$Reform_{i,t}$	-0.004	-0.004	-0.003			
	(0.005)	(0.005)	(0.005)			
$log(1-\tau_{i,t})$				0.089	0.091	0.090
				(0.067)	(0.067)	(0.067)
Observations	110,609	110,609	110,609	110,609	110,609	110,609
Mean dep.	39.595	39.595	39.595	39.595	39.595	39.595
			c. log(P0-90)			
$Reform_{i,t}$	0.027***	0.027***	0.027***			
	(0.006)	(0.006)	(0.006)			
$log(1-\tau_{i,t})$				-0.138**	-0.131**	-0.129*
				(0.067)	(0.067)	(0.067)
Observations	110,317	110,317	110,317	110,317	110,317	110,317
Mean dep. (%)	67.629	67.629	67.629	67.629	67.629	67.629
			d. log(P90-99)			
$Reform_{i,t}$	-0.037***	-0.037***	-0.038***			
	(0.012)	(0.012)	(0.012)			
$log(1-\tau_{i,t})$				0.010	0.004	0.004
				(0.163)	(0.163)	(0.163)
Observations	91,598	91,598	91,598	91,598	91,598	91,598
Mean dep. (%)	25.516	25.516	25.516	25.516	25.516	25.516
			e. log(P99-100)			
$Reform_{i,t}$	-0.064***	-0.064***	-0.062***			
	(0.021)	(0.021)	(0.021)			
$log(1-\tau_{i,t})$				0.886***	0.883***	0.879***
				(0.241)	(0.241)	(0.241)
Observations	91,598	91,598	91,598	91,598	91,598	91,598
Mean dep. (%)	7.690	7.690	7.690	7.690	7.690	7.690
Baseline controls	YES	YES	YES	YES	YES	YES
Ghost-building program	NO	YES	YES	NO	YES	YES
Pr. tax (main dwelling)	NO	NO	YES	NO	NO	YES
Pr. tax (basic)	NO	NO	YES	NO	NO	YES
Pr. tax (allowance)	NO	NO	YES	NO	NO	YES

Note: This table compares the baseline coefficients from 2SLS regressions with those obtained controlling for property tax rates and a time-varying municipality-specific measure of tax evasion. Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B7: Progressive tax reform effect excluding observations with 0.05 < p(w) < 0.95

	log(TI)		log(Gini)		log(P0-90)		log(P90-99)		log(P99-100)	
	Full sample	Restricted sample	Full sample	Restricted sample	Full sample	Restricted sample	Full sample	Restricted sample	Full sample	Restricted sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Reform_{i,t}$	-0.054***	-0.052***	-0.004	-0.004	0.026***	0.021***	-0.037***	-0.027***	-0.062***	-0.056***
	(0.015)	(0.006)	(0.005)	(0.003)	(0.006)	(0.004)	(0.012)	(0.008)	(0.021)	(0.014)
Observations	115,230	103,695	115,230	103,695	114,930	103,579	95,615	88,472	95,615	88,472
Sample	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted	Full	Restricted

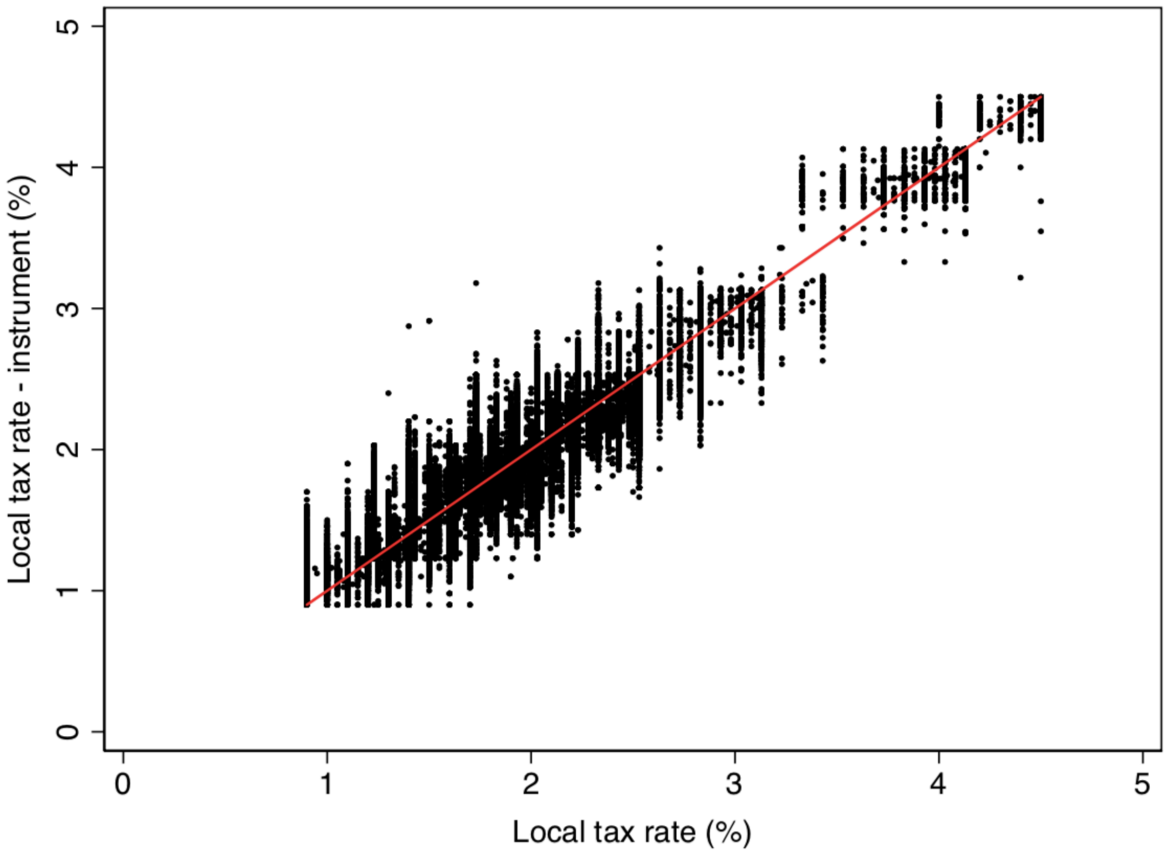
Note: This table compares baseline coefficients with those estimated excluding observations with 0.05 < p(w) < 0.95, as suggested by Crump et al. (2009). Standard errors clustered at local labor market-level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B8: Tax-induced migration using average tax rate computed at national average level

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) 2SLS
			a. Flow elasticity				
$log[(1-\tau_{d,t})/(1-\tau_{o,t})]$	3.575***	2.797**	3.148***	3.169***	2.226*	2.264*	2.261**
	(1.219)	(1.142)	(1.185)	(1.193)	(1.221)	(1.235)	(0.997)
Mean dependent (#)	49.319	49.319	49.319	49.319	49.319	49.319	49.319
			b. Share of movers elasticity				
$log[(1-\tau_{d,t})/(1-\tau_{o,t})]$	5.265***	3.217**	3.483**	3.526**	2.571*	2.635*	2.242**
	(1.443)	(1.331)	(1.371)	(1.382)	(1.425)	(1.443)	(1.054)
Mean dependent (%)	0.136	0.136	0.136	0.136	0.136	0.136	0.136
Observations	83,814	83,814	83,814	83,814	83,814	83,814	83,814
Origin-destination pair FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	YES	YES	YES	YES	YES	YES
Spending and property taxes	NO	NO	YES	YES	YES	YES	YES
Destination macro area-time FE	NO	NO	NO	YES	NO	NO	NO
Origin macro area-time FE	NO	NO	NO	NO	YES	NO	NO
Macro area pair-time FE	NO	NO	NO	NO	NO	YES	YES

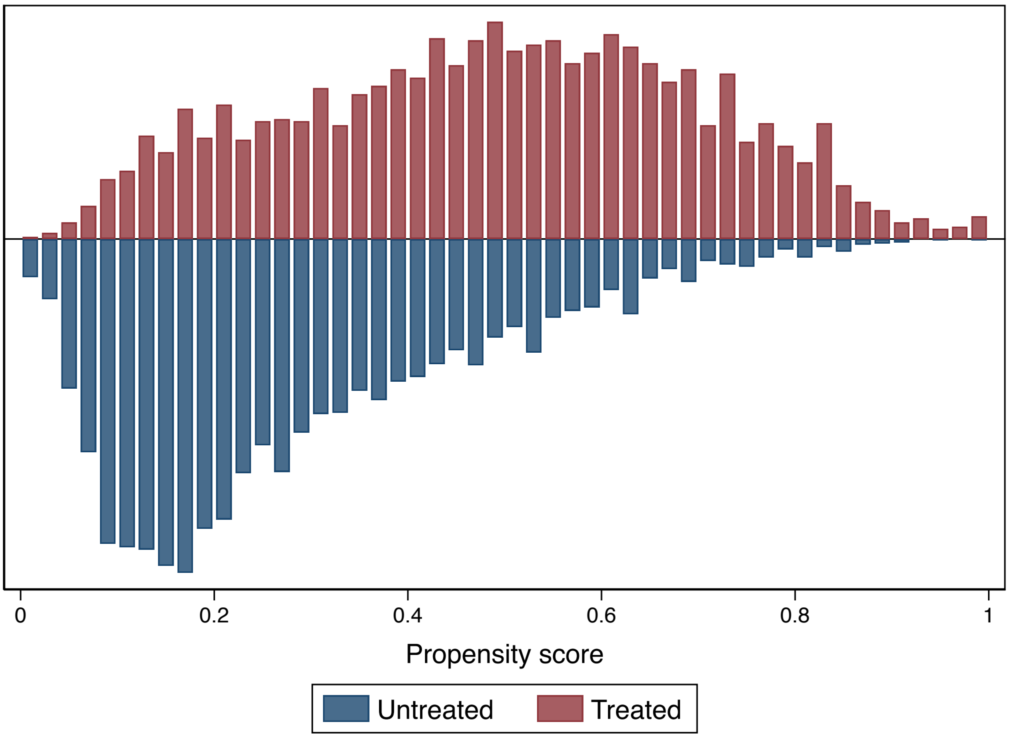
Note: This table shows the flow (panel a) and share of movers (panel b) elasticity with respect to the differential in the net-of-average tax rate between destination and origin province. First-stage coefficient is 0.954 (0.005). The sample is composed of 10,707 origin and destination provincial pair over the 2007-2015 period. Standard errors in parentheses, with three-way clustering by origin-province $\times$ year, destination-province $\times$ year and province-pair. *** p<0.01, ** p<0.05, * p<0.1.

Figure B1: Correlation between the local tax rate and its instrument



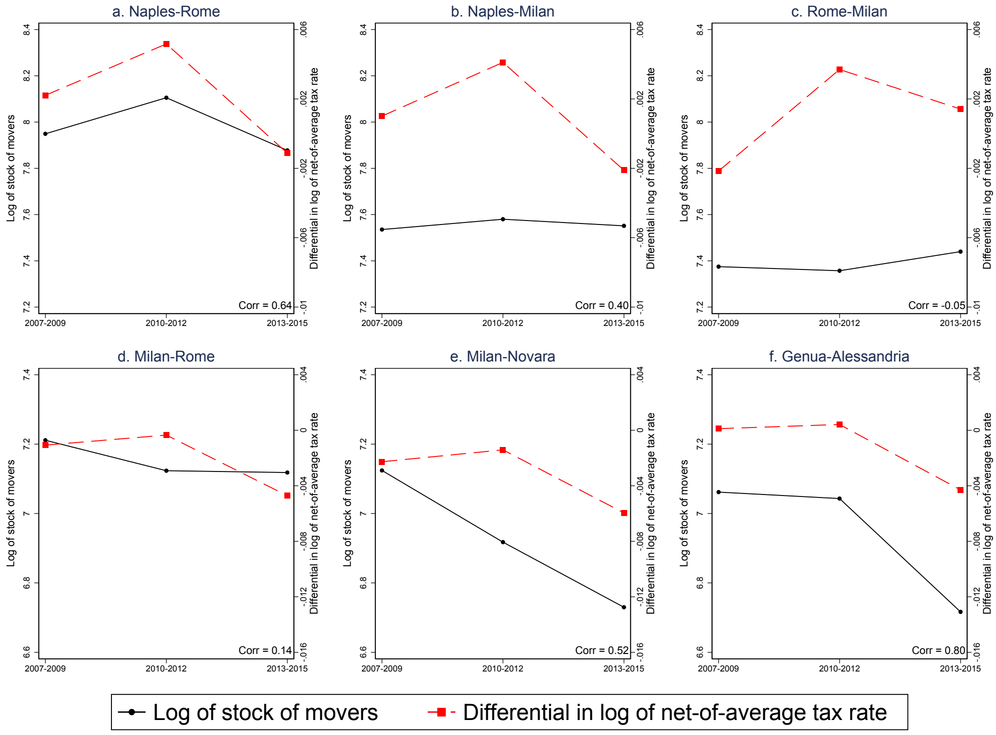
Note: This figure plots the local tax rate, its instrument and the 45° line.

Figure B2: Propensity score distribution



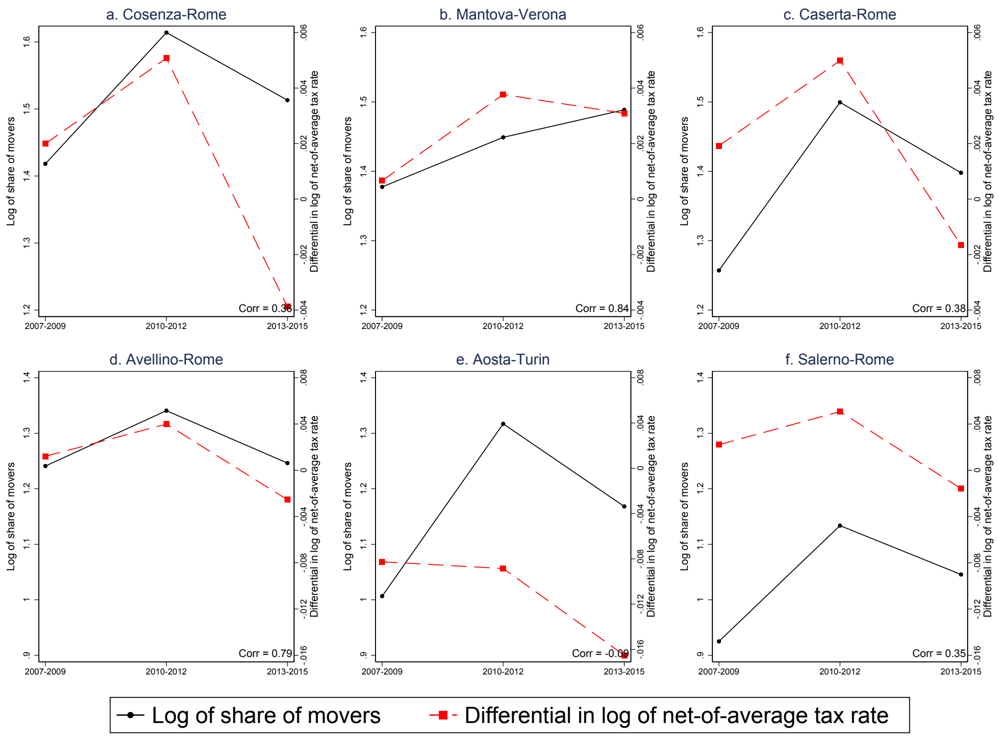
Note: This figure presents the distribution of the estimated propensity score between treated and untreated municipalities.

Figure B3: Migration flows and net-of-tax differentials across the most bustling province pairs



Note: This figure presents the evolution in (log of) migration flows and the differential in the net-of-average tax rate across the six province pairs with the largest number of movers. Author's elaboration on data from transfers of residence.

Figure B4: Migration share and net-of-tax differentials across the most bustling province pairs



Note: This figure presents the evolution in (log of) share of movers and the differential in the net-of-average tax rate across the six province pairs with the largest number of share of movers. Author's elaboration on data from transfers of residence.