Department of Economics and Finance

Chair: Macroeconomic Analysis

Welfare Gains from Reforming the Italian Personal Income Tax

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A.Y. 2019 - 2020

Acknowledgements

I want to deeply thank my supervisor Professor Claudio Michelacci, who has helped me in every stage of this process and in these two years. He has shown to believe in me since the first day and has improved me and my work profoundly. I also thank Professor Facundo Piguillem for the useful comments and ideas. I will greatly benefit from our discussions and the time he has spent on building myself as a researcher and as a person. I also thank Professor Pietro Reichlin, Professor Nicola Borri and the entire faculty of the RoME program.

Furthermore, I wish to thank all the people who supported me and contributed in making this journey more enjoyable and less tough. In particular, my colleagues Felipe Berrutti, Andrea Ferrara, Chiara Lattanzio, Daniel Mele, Emil Mortensen, Roberto Saitto, Giuseppe Spataro, Alessandro Stella and Pietro Visaggio have constituted for me a well of knowledge, reliable peers, and, most of all, absolutely fantastic friends. My lifelong friends from the high school, my brothers, have stood by my side again during these years and their presence has been fundamental for me. Also, I have always felt the support of my bachelor's friends, even though the time spent together has decreased.

Finally, I thank my family. Without their presence, love and support all this could not have been possible. Their million efforts in attempting to simplify my life are just a small proof of their infinite affection for me.

Thank you all.

Welfare Gains from Reforming the Italian Personal Income Tax

Marco Castelluccio

Abstract

This work studies the actual degree of progressivity in the Italian tax and transfer system and examines possible reforms towards the optimum. It analyzes the distribution of personal income and effective tax rates across the Italian population, computing income and tax liabilities from survey data, and studies the optimal level of progressivity. To this end, it uses a model developed in Heathcote et al. (2017) with heterogeneous agents where skill investment and labor supply are endogenous and the government provides a public good running a balanced budget. All the main trade-offs that shape optimal progressivity are present: inequality in initial conditions and imperfect private insurance push for positive progressivity, whereas labor supply and skill investment are incentivized by a regressive system. The model suggests a drastic reduction in progressivity under both the baseline and the alternative specification. In particular, it calls for wide reductions in marginal tax rates above approximately 0.25 times the mean income at the expenses of an increase in tax rates at the lower end of the income distribution. These reforms may be approximated by a flat tax at 28% under the baseline and by a system with two tax rates (22.5% and 32%) under the alternative specification.

1 Introduction

What is the actual level of progressivity in the Italian personal income tax (PIT) system? How can policymakers reform the system towards the optimum? These are two important questions on which the Italian academic and public debate is focusing nowadays. However, this work is relevant not only from an Italian perspective. Italy represents an extraordinarily interesting case because of some of its features: tax rates on labor income are among the highest in the EU, the ratio between tax revenues and GDP is well above the average for the OECD countries (43% against 34%), some income categories within the PIT framework are subject to substitute taxes which are proportional and therefore lower the actual level of progressivity, estimates of tax evasion declare that 2% of the Italian GDP is constituted by missing PIT revenues) but still it is considered a country with middle income inequality.

This research has two main goals. Firstly, it aims at characterizing the distribution of several relevant variables, such as before-tax and after-tax income, and at providing estimates of effective tax functions. These tax functions describe in a simplified way the Italian PIT system preserving the heterogeneity observed in data and are valuable for working with macroeconomic models with heterogeneous agents. This work gauges the impact of the Italian tax system on income inequality and shows the difference between statutory and effective tax rates. Secondly, it determines the optimal degree of progressivity predicted for the Italian economy and identifies the different forces that shape it. For doing this, it uses an analytically tractable equilibrium model with heterogeneous agents who choose endogenously their skill investment and labor supply.

The data used for this research come from two main sources: the European Union Statistics on Income and Living Conditions (EU-SILC), conducted by ISTAT following the European rules, and the Survey on Household Income and Wealth (SHIW), led by the Bank of Italy. Therefore, it deals with survey data.

The key takeaways from the descriptive part of this work are the following. Firstly, income is unevenly distributed across Italy, since living standards are higher in the Northern and Central area than those in the Southern area and the Islands. Secondly, income inequality is present both at the individual and household level. In this respect, the Italian PIT helps in redistributing income since the Gini coefficient of disposable income is six percentage points lower than the index of gross income. Thirdly, tax liabilities are heterogeneously distributed. Indeed, the vast majority of individuals at the very bottom of income distribution does not face positive tax liabilities and even those who face positive tax rates pay effective average tax rates below 10%. On the other hand, effective marginal tax rates happen to increase steeply at the middle of income distribution and to stay approximately flat at the top.

For what concerns the normative part, the model, developed in Heathcote et al. (2017), features all the main trade-offs which concern progressive taxation. In particular, optimal progressivity is shaped by the counteracting forces of skill investment and labor supply, which are distorted by progressivity, labor market uncertainty and redistribution, which are addressed by a progressive tax system, and private risk sharing which, being incomplete, needs the government intervention. The presence of public goods increases the social cost of a progressive system. The Italian tax and transfer PIT system is proxied by a two-parameter functional form firstly introduced by Feldstein (1969) and Benabou (2002). The resulting actual progressivity measured using Italian data is 19%, slightly higher than the US estimate and considerably higher than the optimal degree predicted by the model, which equals 7.1% under the baseline specification. The social welfare gains deriving from adopting the optimal level of progressivity are equivalent to almost 1% of lifetime consumption.

This research contributes to two main literatures. On the one hand, the effects of PIT on the distribution of individual and household income and the differences between statutory and effective tax rates have been studied in several papers. García-Miralles et al. (2019) and Guner et al. (2014) have provided also parametric estimates of the tax functions using US and Spanish data, whereas Curci et al. (2017) and Di Caro (2018) have conducted earlier studies on Italian data using data sources different from EU-SILC. On the other hand, there is a growing literature investigating the determinants of optimal tax progressivity. Apart from Heathcote et al. (2014, 2017), to which this work is fully indebted since it inherits their analytical framework, Krueger and Ludwig (2013) and Guvenen et al. (2013) have extensively investigated the distortionary effects of progressivity on labor supply and skill investment. Conesa and Krueger (2006) develop an environment which is comparable to the one used here but it cannot be studied in closed form. Others, without restricting the functional form of taxes, in the spirit of Mirrlees (1971), focused on human capital accumulation (Stantcheva (2017)), labor productivity shocks (Farhi and Werning (2013); Golosov et al. (2016)) and imperfect substitutability across skills (Rothschild and Scheuer (2013)).

This work is organized as follows. Section 2 provides a concise description of the Italian tax code and Section 3 describes the datasets used in this work, together with their limitations and restrictions. Section 4 analyzes individual and household income distribution and effective tax rates. Section 5 briefly describes the model and its main trade-offs. Section 6 presents the quantitative results of the model, showing the optimal degree of progressivity predicted for the Italian economy. Finally, Section 7 concludes.

2 The Institutional Framework

The Italian tax system is regulated by the *Testo Unico delle Imposte dei Redditi* (TUIR), that is, the Italian income tax code. The rules are based on Article 53 of the Italian Constitution, which says "*Every person shall contribute to public expenditure in accordance with their capability. The tax system shall be progressive".* The vast majority of Italian taxes is proportional, whereas the *Imposta sul Reddito delle Persone Fisiche* (IRPEF), which is the Italian personal income tax (PIT), is progressive. Thus, this work focuses on the Italian PIT, which is the main source of progressivity in the Italian tax system. However, I must underline that within the class of income subject to IRPEF there exist some particular types, such as specific categories of real estate and capital income, which are subject to substitute taxes.

These alternative regimes are progressive and therefore this fact implies that an important part of personal income, mostly earned by middle- and high-income individuals, is not taxed progressively.

	Tax Revenues (in billions)	Percent of GDP	Type
Personal Income Tax	184.6	11.2%	Progressive
Corporate Income Tax	33.5	2.0%	Proportional
Social Security Contributions	214.4	13.0%	Proportional
Taxes on Property	46.3	2.8%	Proportional
Taxes on Goods and Services	191.9	11.6%	Proportional
Total	708.8	42.9%	

Source: OECD Tax Statistics (http://dx.doi.org/10.1787/tax-data-en)

Table 1: The Main Italian Taxes in 2015

All taxpayers are obliged to file a tax return based on the previous calendar year's total income. In 2015, roughly 40.8 millions of individuals filed their tax return. *Gross income* is defined by the TUIR as a sum of six categories:

1. real estate income
2. capital income
3. employees' income
4. self-employed income
5. business income
6. other incomes.

Deductions are subtracted from these sources and *taxable income* is obtained. Deductions consist of a set of expenses that the legislator has decided to exempt from taxes, such as social security contributions, medical expenses and some types of alimonies paid to the spouse. In order to compute *gross tax liabilities*, the state and the additional regional and municipal tax schedules are applied to taxable income. Finally, *net tax liabilities* are obtained subtracting detractions to gross tax liabilities. The main detractions are due to the number of dependent children and relatives, disability status of the taxpayer and of other family members, employee status and interests paid on mortgages. *Disposable income* equals taxable income minus net tax liabilities.

The detractions exceeding the total of gross tax liabilities do not generate any sort of additional benefit for the taxpayer, who simply will not pay any tax on his personal income.

In 2015, a so-called *no-tax area* exempts all individuals with gross income below €8,000 from paying taxes. Moreover, employees and retirees with gross income below €55,000 benefit from a detraction which fades away up to €55,000, point at which it is zero.

Income Bracket	Tax Rate
< 15,000	23%
15,000 - 28,000	27%
28,000 - 55,000	38%
55,000 - 75,000	41%
> 75,000	43%

Table 2: Statutory Marginal Tax Rates

Some individuals in the dataset receive some transfers. In particular, the disability benefits and the education-related allowances for PhDs, specialization courses or allowances paid directly by universities do not constitute taxable income, as well as the so-called *social pensions*, and are categorized as transfers.

3 Data

This work uses two different datasets: the European Union Statistics on Income and Living Conditions (EU-SILC)[1], conducted by the Italian National Statistics Institute (ISTAT) following the European rules, and the Survey on Household Income and Wealth (SHIW), led by the Bank of Italy. Both sources exhibit peculiarities that make each one of them more suitable for different parts of the research. I will use EU-SILC in the descriptive part of my analysis, whereas SHIW will be used for calibrating the model. The sample sizes are quite small, since both datasets cover approximately 0.06 % of the Italian population, but they are designed to be representative of the entire population.

Firstly, time coverage differs across sources. EU-SILC starts only in 2005, whereas the longitudinal panel of SHIW covers the period 1977-2016.

Secondly, EU-SILC provides both gross and net variables, thanks to the exact matching with administrative data. On the other hand, SHIW provides wider and more accurate information on individuals' savings and consumption choices, despite of less extensive information on income.

[1] Istat, Survey on Income and Living Conditions (UDB IT - SILC).

3.1 Data limitations and sample restrictions

EU-SILC delivers detailed information on income for each individual and household, both gross and net of taxes. However, since it provides the majority of the personal income categories needed for computing tax liabilities, I compute them applying the rules stated by the *Testo Unico delle Imposte dei Redditi* (TUIR), that is, the Italian income tax code. This has been done since not all the variables of interest are present in the dataset.

The dataset gives us detailed data on every category constituting gross income except for capital income and other incomes. Moreover, it lacks of some of the sources of deductions and detractions, and imposed the necessity of making some approximations in the computations. In particular, the following approximations have been made:

- Real estate income - missing data on not rented buildings. The taxpayer can choose one of the two available options for computing taxes on rented buildings. I imposed to compute the gross income coming from this source as the 95 % of the total real estate income. Moreover, since data on this category was present only at household level, I imputed it entirely to the household head.

- Capital income - missing. This limitation is very important since capital income is subject to substitue taxes, which are progressive and with low tax rate (for instance, 10% or 21%). Their inclusion would have reduced the average tax rates for the top earners (since there is a strong positive correlation between wealth and income) and therefore also progressivity would have gone down.

- Business income - again, data was present only at household level, so I imputed it entirely to the household head.

- Detractions due to interests paid on mortgages - are imputed to the individual who appears as being responsible for the accommodation.

Nonetheless, it provides a good measure for gross and net income, as well as for tax liabilities. Indeed, Table 3 compares mean gross income in each of the five areas in which we can divide Italy. It compares survey data (EU-SILC and SHIW) with the official estimates computed by the Ministry of Economics and Finance (MEF).

Northern regions and the centre are substantially richer compared to the South and Islands. These differences are roughly equal in 2014 and in 2015, implying that there has been no convergence between them. Average gross income in the poorest areas constitutes roughly two thirds of the richest area of Italy, namely the North West.

As for differences across datasets, it is easy to notice that both datasets are very accurate with respect to Northern and Central Italy data, whereas only SHIW exhibits an accurate

	EU-SILC (2015)	MEF (2015)	SHIW (2014)	MEF (2014)
North West	23,457	23,640	23,265	23,150
North East	22,367	22,060	22,532	21,580
Centre	20,852	21,530	21,381	21,230
South	13,908	16,380	15,731	16,090
Islands	13,412	16,490	16,726	16,330
	19,412	20,690	20,521	20,320

Note: the sample is restricted to individuals with non-negative gross income.

Table 3: Average gross income per macro-area

average for gross income in Southern Italy. EU-SILC happens to miss some important components of gross income in Southern Italy, since the differences between official estimates and computed averages exceed €2,000.

Following some studies that have been carried out on American data (Guner et al. (2014) and Heathcote et al. (2017)) and on Spanish data (García-Miralles et al. (2019)), some sample restrictions will be used. In particular, the baseline is constituted by the inclusion in the sample of individuals (i) with positive gross income and (ii) with an effective average tax rate lower than 47%, which is the maximum marginal tax rate that can be obtained by summing up state and regional tax rates. It will be clearly specified when sample restrictions different from the baseline will be applied and they will be mainly represented by the possibility of restricting the sample to individuals in the working age (25-65).

4 Main Facts on Income Distribution and Effective Tax Rates

Table 4 shows some summary statistics for the EU-SILC (2015) cross-sectional dataset. This dataset is constituted by 36,602 observations, grouped in 17,985 households. However, applying the baseline sample restrictions leads to an important decrease in the sample size, which reaches 29,999 observations. Some of the statistics shown have been computed by the author, using the variables that are present in the dataset. It is worth noting that taxes decrease substantially the amount of income that is available to most of the individuals. However, it is not always the case. Indeed, net income is almost equal to taxable income at the first quartile, meaning that the individuals with a gross income below €10,713 pay very few or zero taxes. In other words, slightly less the one fourth of individuals with positive gross income does not have positive tax liabilities. These peculiarities can be interpreted as signals that the entire tax and transfer system works: it gives positive transfers to low-income individuals and extracts resources from middle- and higher-income individuals. Moreover, the progressivity criterion seems to be respected by the fact that as income increases tax liabilities increase more than proportionally.

	Mean	25%	50%	75%
Age	53	40	52	68
Male	0.53			
Gross income	23,786	10,713	19,750	29,993
Taxable income	21,847	9,957	18,427	27,598
Net income	16,976	9,714	15,385	21,422
Tax liabilities	4,872	490	3,199	6,337
Observations	29,999			

Table 4: Summary statistics (EU-SILC 2015)

4.1 Income Statistics

4.1.1 Individuals

Table 5 displays some summary statistics on the distribution of income across individuals, using three different notions of income. Columns (1), (3), and (5) display the percentage of income earned by each quantile in 2015, whereas columns (2), (4), and (6) display income cutoffs for each quantile. It is crucial to notice that income inequality is significant in gross incomes. It is similar to the Spanish levels but substantially lower compared to the US. The ratio of the share of income earned by the top quintile over the share earned by the bottom quintile is higher than 10. This statistic is very similar for Spain, whereas it is around 30 in the United States. Concentration in gross incomes is even more striking considering that the top 10% of the population accounts for almost 30% of the entire gross income and the bottom 10% account for less than 1%. Moreover, the Gini coefficient is equal to 0.40, again very much in line with the Spanish estimate reported by García-Miralles et al. (2019). Unexpectedly, the Gini coefficient stays constant in column (3), which focuses on taxable income. This result is at odds with Spanish and US data. Indeed, one would expect that richer people have even higher shares of taxable income than of gross income. However, this result should not worry us since detractions help decreasing inequality, as showed by column (5). Moreover, we should recall that the dataset does not include all the deductions so taxable income estimates may exhibit some flaws. The Gini coefficient diminishes significantly when looking at disposable income. Also, only top income shares fall significantly, whereas all the others gain some fraction of total income, implying that inequality decreases after government's intervention. The decrease in income inequality is noticeable also looking at the variance of log income. Indeed, it is significantly lower when computed on disposable income than when it is computed using gross and taxable income.

Quantiles	Gross Income		Taxable Income		Disposable Income	
	Percentage (1)	Threshold (2)	Percentage (3)	Threshold (4)	Percentage (5)	Threshold (6)
Bottom						
1%	0.00%	0	0.01%	3	0.02%	4
1-5%	0.09%	4	0.28%	556	0.38%	602
5-10%	0.72%	1,671	0.94%	2,669	1.14%	2,666
Quintiles						
1st (bottom 20%)	3.86%	0	4.55%	3	5.65%	4
2nd (20-40%)	10.56%	9,144	10.92%	9,146	12.78%	8,685
3rd (40-60%)	16.64%	16,322	16.70%	15,696	18.00%	13,282
4th (60-80%)	23.26%	23,323	22.96%	21,948	23.47%	17,492
5th (80-100%)	45.68%	33,094	44.87%	30,702	40.10%	23,007
Top						
90-95%	10.51%	44,321	10.26%	41,147	9.32%	28,929
95-99%	12.55%	57,923	12.27%	53,776	10.52%	36,200
1%	6.73%	106,849	6.80%	100,783	5.31%	62,244
Other statistics						
Gini coefficient	0.40		0.40		0.34	
Var - log income	0.91		0.94		0.73	

Table 5: Individual Income Distribution

In order to give a better sense to the table that has just been examined, Table 5 displays also income cutoffs for different quantiles of the distribution, that is, the income threshold that an individual has earned for belonging to his percentile. Again, the cutoffs regarding gross income are very much in line with the Spanish ones. Looking at the difference between gross income and disposable income cutoffs, one can notice that the difference is negative for the bottom 20% and positive for the others. This implies that the bottom 20% receives positive transfers whereas the rest pays positive tax liabilities, which increase more than proportionally as income increases.

4.1.2 Households

It is very interesting to analyze the distribution of income not only across individuals, but also across households. Indeed, Greenwood et al. (2014) show that the US marriage market has exhibited a steep increase in positive assortative mating since the 1960s. This trend implies that individuals tend increasingly to marry with others who exhibit the same educational background. In addition, they show that this phenomenon is deeply related with the rising inequality pattern observed in household data. As it is well known at least since Mincer (1974), education transmits also to earnings. To this extent, it is crucial to understand whether household income inequality was higher or lower than individual income inequality in Italy in 2015. For this purpose, Table 6 displays household and individual income distributions, as well as the differences among them per quantile.

Quantiles	Gross Income			Disposable Income		
	Household (1)	Individual (2)	Difference (3)	Household (4)	Individual (5)	Difference (6)
Bottom						
1%	0.00%	0.00%	**0**	0.04%	0.02%	**0.02%**
1-5%	0.48%	0.09%	**0.39%**	0.74%	0.38%	**0.36%**
5-10%	1.18%	0.72%	**0.46%**	1.56%	1.14%	**0.42%**
Quintiles						
1st (bottom 20%)	5.09%	3.86%	**1.23%**	6.52%	5.65%	**0.87%**
2nd (20-40%)	10.41%	10.56%	**-0.15%**	11.73%	12.78%	**-1.05%**
3rd (40-60%)	15.51%	16.64%	**-1.13%**	16.47%	18.00%	**-1.53%**
4th (60-80%)	23.31%	23.26%	**0.05%**	23.55%	23.47%	**0.08%**
5th (80-100%)	45.68%	45.68%	**0**	41.73%	40.10%	**1.63%**
Top						
90-95%	10.87%	10.51%	**0.36%**	10.09%	9.32%	**0.77%**
95-99%	12.28%	12.55%	**-0.27%**	10.80%	10.52%	**0.28%**
1%	5.99%	6.73%	**-0.74%**	4.84%	5.31%	**-0.47%**
Other statistics						
Gini coefficient	0.40	0.42	**-0.02**	0.35	0.34	**0.01**
Var - log income	0.81	0.91	**-0.10**	0.56	0.73	**-0.17**

Table 6: Household Income Distribution

Actually what seems to emerge when comparing household and individual income distribution is that some sort of rebalancing happens at the household level. Indeed, the bottom quintile gains some share of total disposable income but the same happens at the top quintile as well, except for the top 1%, while the middle classes have slightly less disposable income. It is sensible to conjecture that some sort of positive assortative mating is present, especially at the top and bottom end, whereas it is less clear or maybe not present at all at the middle of the distribution. In fact, households at the middle of the income distribution have a lower share of income with respect to individuals at the same quintiles. The same pattern seems to be confirmed looking at gross and taxable income, but it is important to notice the following feature. The Gini coefficient of gross income is higher among individuals, whereas the Gini of disposable income is higher for households. In other words, gross income is less concentrated at the household level, implying that the presence of positive assortative mating is not so clear. On the other hand, disposable income is slightly more concentrated at the household level, and this may reflect the need of introducing some sort of taxation at the household level, as it happens in the US. These are clearly features that should be examined in further research, in order to understand whether Italy needs a PIT based on households rather than on individuals and whether the social and economic phenomenon called assortative mating is present.

4.2 Effective Tax Rates

It is worth focusing more on tax liabilities and their distribution among the population. Although statutory marginal tax rates are very relevant for a normative reason since individuals tend to internalize them rather than the effective tax rates, I focus more on the latter, which are harder to compute. They are quantified taking into account all the deductions and detractions that reduce tax rates. While effective average tax rates are simply computed as the ratio between net tax liabilities and gross income, effective marginal tax rates are computed as follows, following Guner et al. (2014). For each level of income y_0, expressed as a multiple of mean income, the marginal tax rate effectively paid is approximated as the average of the variation in tax liabilities individuals pay if income increases by Δy, $m(y_0^+)$, and if it decreases by the same amount, $m(y_0^-)$. I set Δy to be equal to 0.2. Letting $t(y_0)$ the average tax rate effectively paid at income level y_0, the two marginal tax rates are

$$m(y_0^+) = [t(y_0 + \Delta y) - t(y_0)] \frac{y_0}{\Delta y} + t(y_0 + \Delta y),$$

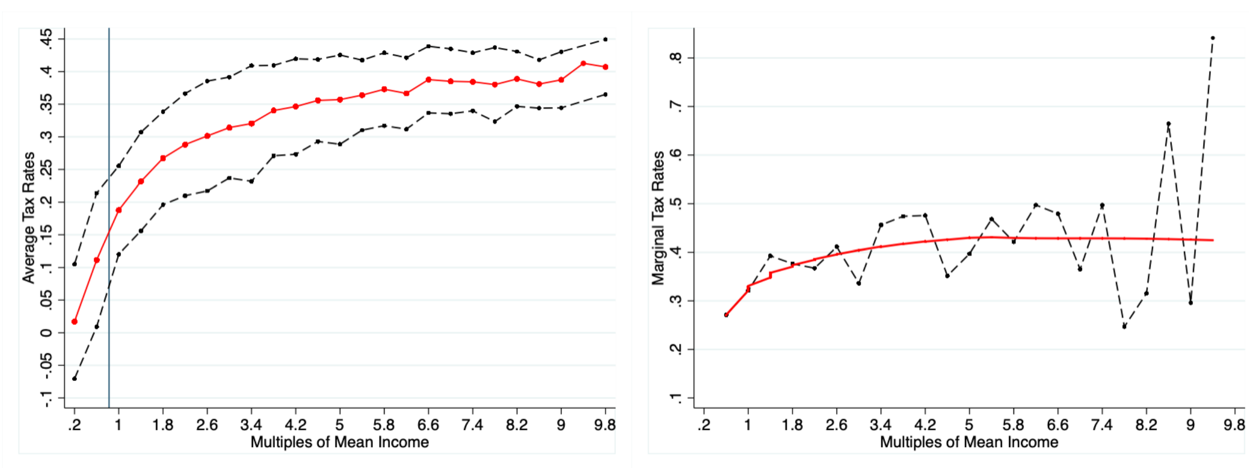
$$m(y_0^-) = [t(y_0) - t(y_0 - \Delta y)] \frac{y_0}{\Delta y} + t(y_0 - \Delta y).$$

Averaging them out, I obtain the effective marginal tax rates paid by the individuals at each multiple of mean income.

4.2.1 Individuals

Figure 1 shows the average and marginal tax rates across different multiples of mean gross income effectively paid by Italian taxpayers in 2015 with positive gross income and non-negative tax liabilities. Panel A depicts average tax rates effectively paid in red with bands of 2 standard errors at each point in black dashed lines. The blue vertical line at 0.84 times the mean income depicts the median. This implies that half of the population pays an average tax rate lower than 15%. Firstly, gross mean income equals €24,671. Secondly, effective average tax rates are basically strictly increasing. Effective average tax rates span between approximately 0 and more than 0.4. However, I should stress that the absence of some income categories which are subject to substitute taxes from the dataset implies that the average tax rates shown below constitute upper bounds for the real ones, especially at the very top end of the distribution. Thirdly, there is a wide heterogeneity across individuals within the same point, which is due to the differential possibility of applying the deductions and detractions established by the Italian tax code and to the existence of additional regional tax rates. Moreover, the width of these bands does not happen to depend directly to income, even if they tend to be narrower at the very top of income distribution. This phenomenon may impair the overall progressivity of the system, since individuals who earn very different incomes may pay the same average tax rate. For instance, an individual who earns around €40,000 (1.8 times the mean income) and another who earns more than €215,000 (9 times the mean income) may face the same effective average tax rate - around 35%.

Panel B shows effective marginal tax rates. They increase steeply up to roughly 3.5 times the mean income, point at which they become almost flat around 0.43. Only a small fraction of the population - slightly more than 5% - faces effective marginal tax rates above 40%, whereas statutory marginal tax rates above 40% are imposed on income earned above €55,000.



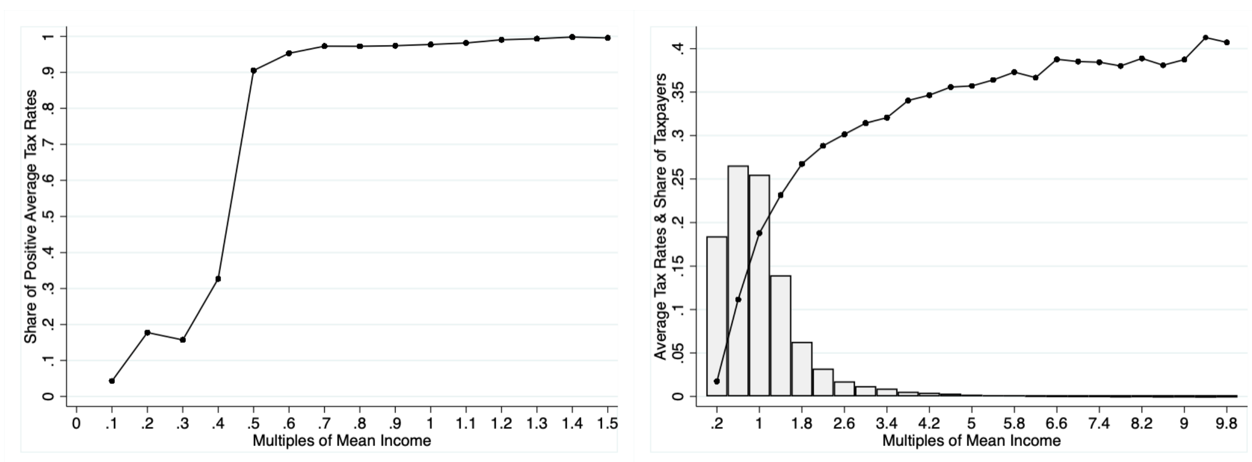
(a) Effective Average Tax Rates

(b) Effective Marginal Tax Rates

Note: Panel A shows the 2015 effective average tax rate (± 2 standard deviations) across multiples of mean income. Panel B shows the 2015 effective marginal tax rate in black, with a smoother in red. Each point corresponds to the average tax rate paid by all individuals that exhibit a multiple of mean income which is ± 0.2 that point. For instance, the point of mean income 1 is the mean average tax rate paid by individuals with income within the interval [0.8,1.2).

Figure 1: Individual Effective Tax Rates

However, by simply looking at Figure 1 it is not very clear the amount of individuals who effectively face each tax rate. Thus, Figure 2 shows the effective average tax rates in relation with the distribution of income. It highlights two main features of the Italian PIT system in 2015. Firstly, a significant share of the population pays zero taxes, especially at the bottom of the income distribution. Secondly, the vast majority of individuals pays effective average tax rates below 25%. In particular, Panel A shows that up to half of mean income very few individuals pay positive tax and the share of positive average tax rates reaches one only at 1.4 times the mean income. Panel B helps providing a better sense of the average tax rates effectively paid by most of the Italians. While the effective average tax rates range between 0 and 40%, most of individuals face low tax rates. Indeed, the median earner pays taxes that amount to around 11% of his gross income. Approximately 15% of the population pays a tax rate above 25% and only the top 1% faces an effective average tax rate above 35%.



(a) Positive Taxpayers (b) Tax Rates and Income Distribution

Note: Panel A shows the share of positive tax payers in each income bin up to 1.5 times the mean income in 2015. Panel B shows the 2015 effective average tax rate in black, with an histogram in grey displaying the fraction of the population contained in each bin.

Figure 2: Individual Effective Tax Rates and the Distribution of Income

A very interesting exercise may be to introduce compulsory social security contributions in the definition of tax liabilities. Indeed, workers must deposit part of their earnings to the National Social Security system and the employer takes charge of a part of them. Workers are obliged to pay them even if they adopt a private pension plan. Just for this exercise, I slightly modify the previous definition of net tax liabilities adding to it the social security contributions (SSCs). This exercise has some theoretical foundations since SSCs constitute a fraction of gross income that does not become disposable income and that individuals cannot use straight away[2]. Thus, it may seem legit to introduce in the definition of tax liabilities also

[2]For instance, see Guvenen et al. (2013)

the fraction of gross income that must be paid as SSCs, will eventually guarantee some sort of benefit in the future, such as old-age or disability pensions and unemployment benefits, and does not become disposable income. In the appendix, Figure A1 compares effective average tax rates using this and the baseline definition. Obviously, tax rates are higher when including SSCs. SSCs lead to an increase of roughly 10% in the effective average tax rate above 1.5 times the mean income. Luckily, progressivity happens to benefit from this inclusion since the majority of individuals - especially below mean income - exhibit an increase of roughly 6% in their average tax rates. This pattern is due to the properties of Italian SSCs, which are proportional.

4.2.2 Households

Again, it is worth comparing tax rates effectively faced by individuals and households. In doing this, I must recall that the Italian tax code does not allow any sort of deduction or detraction for couples that file their taxes jointly nor different tax rates for households with respect to the individual tax rates, but only detractions for dependent relatives. Thus, this exercise is taking into account a tax unit - the household - that is not actually disciplined by the tax code. In particular, Figure 4 shows effective marginal tax rates faced by Italians at the individual and household level. Effective marginal tax rates are computed as described above.

Mean income is different between individuals and households: individual mean income equals

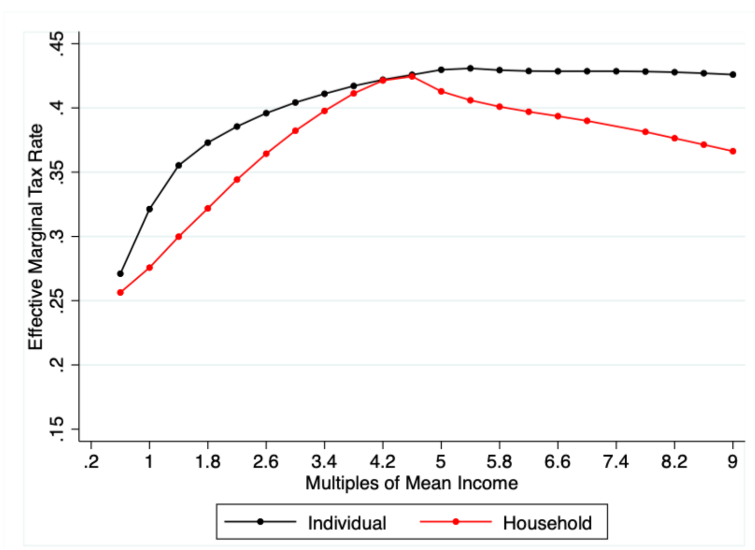


Figure 3: Effective Marginal Tax Rates across tax units

€24,671, whereas household mean income almost doubles it, being equal to €39,375. It is crucial to notice that, while taxation at the individual level is globally progressive, since effective marginal tax rates are increasing, taxation at the household level is not - being firstly progressive and then regressive. Household tax rates increase up to a peak at 4.6 times mean income and then start to decrease, going back to 0.36. This happens because above a certain point households increase their income thanks to the individual who is earning less, and therefore is facing lower marginal tax rates.

5 The Model

In order to assess optimal progressivity in the Italian economy I use the model theorized by Heathcote et al. (2017), which acts in an environment that constitutes an extension of the partial insurance framework developed in Heathcote et al. (2014). Therefore, I will sum it up briefly providing its main intuitions and results.

5.1 Environment

Consider an economy with a constant elasticity of substitution production technology, a public sector which runs a balanced budget and heterogeneous agents i, who differ in labor market shocks, learning ability, which helps in determining their skill investment, and disutility of work effort, which helps in determining their labor supply.

5.1.1 Technology

Output is produced using a CES production function which uses effective hours supplied by a continuum of skill types $s \in [0, \infty)$,

$$Y = \left(\int_0^\infty [N(s) \cdot m(s)]^{\frac{\theta-1}{\theta}} ds \right)^{\frac{\theta}{\theta-1}} \tag{1}$$

where $\theta > 1$ is the elasticity of substitution across skill types, $N(s)$ are effective hours supplied by each skill type s and $m(s)$ denotes the density of individuals with skill type s. Skill prices $p(s)$ are determined in equilibrium by the supply of each skill type s since the technology uses symmetrically all skills. In other words, relative skill prices will reflect the relative scarcity of the corresponding skill type.

Output is used for both private and public consumption G. Therefore, the resource feasibility constraint is

$$Y = \int_0^1 c_i di + G. \tag{2}$$

5.1.2 Government

Let $T(y)$ be net tax revenues at income level y. The Italian tax and transfer system is approximated by the function

$$T(y) = y - \lambda y^{1-\tau}, \tag{3}$$

where the parameter τ determines the degree of progressivity of the system, and λ determines the average tax level in the economy. Notice that the system is progressive, when $\tau > 0$, and is regressive when $\tau < 0$. If $\tau = 0$, the economy is characterized by a flat tax. The government funds public expenditure G through tax revenues. Letting g be the fraction of output that is devoted to government expenses, i.e., $gY = G$, the government runs a period balanced budget of the form

$$g\int_0^1 y_i di = \int_0^1 \left(y_i - \lambda y_i^{1-\tau}\right) di \tag{4}$$

with no possibility of issuing public debt. It chooses the pair $(g,\ \tau)$ and λ is determined residually by equation 4.

5.1.3 Agents

The life of an individual i starts at age $a = 0$ with an investment in skills which denotes her skill level s_i. At every age, she survives to the next period with constant probability $\delta \in (0,1)$ and, after seeing her labor productivity z_i she chooses her supply of hours of work $h \geq 0$ and consumption c. Each period a cohort of newborn agents of size $1-\delta$ enters the economy. Preferences for individual i are given by

$$U_i = -v_i(s_i) + (1-\beta\delta)\,\mathbb{E}_0 \sum_{a=0}^{\infty} (\beta\delta)^a u_i(c_{ia}, h_{ia}, G) \tag{5}$$

where $\beta \in (0,1)$ is the time discount factor. The expectation is taken over future histories of idiosyncratic productivity shocks, which are described below. The disutility of the initial skill investment is of the form

$$v_i(s_i) = \frac{\psi}{1+\psi}\kappa_i^{-\frac{1}{\psi}} s_i^{\frac{1+\psi}{\psi}} \tag{6}$$

where $\psi \geq 0$ determines the elasticity of skill investment with respect to the return to skill and $\kappa_i \sim Exp(\eta)$ determines the utility cost of investing in skills.

The period utility function u_i is

$$u_i(c_{ia}, h_{ia}, G) = \log(c_{ia}) - \frac{\exp[(1+\sigma)\phi_i]}{1+\sigma}(h_{ia})^{1+\sigma} + \chi\log(G) \tag{7}$$

where $\exp[(1+\sigma)\phi_i]$ measures the disutility of work effort. The parameter ϕ_i is normally distributed, $\phi_i \sim N\left(\frac{v_\phi}{2}, v_\phi\right)$.

Log individual labor efficiency z_{ia} is the sum of two orthogonal components

$$\log z_{ia} = \alpha_{ia} + \epsilon_{ia} \tag{8}$$

where α_{ia} is a permanent not insurable component which follows the unit root process $\alpha_{ia} = \alpha_{i,a-1} + \omega_{ia}$ with the innovation $\omega_{ia} \sim \left(-\frac{v_\omega}{2}, v_\omega\right)$ and initial condition $\alpha_{i0} = 0$. The second component is a transitory fully insurable i.i.d. shock $\epsilon_{ia} \sim N\left(-\frac{v_\epsilon}{2}, v_\epsilon\right)$, whose bonds are in zero net supply. Individual earnings y_{ia} are given by

$$y_{ia} = p(s_i) \times \exp(\alpha_{ia} + \epsilon_{ia}) \times h_{ia} \tag{9}$$

Thus, individual earnings depend on (1) skills accumulated before entering the labor market and their relative scarcity, (2) productivity shocks and (3) work effort.

Therefore, it is possible to write the first-order conditions of the agent's problem at $a = 0$, when she chooses her skill level

$$\frac{\partial v_i(s_i)}{\partial s_i} = \left(\frac{s_i}{\kappa_i}\right)^{\frac{1}{\psi}} = (1-\beta\delta)\,\mathbb{E}_0 \sum_{a=0}^{\infty} (\beta\delta)^a \frac{\partial u_i(c_{ia}, h_{ia}, G)}{\partial s_i} \tag{10}$$

The timing of the problem is as follows:

1. the innovation ω_{ia} is realized,
2. the individual insures herself against the i.i.d. shock ϵ_{ia},
3. ϵ_{ia} is realized and the individual chooses hours h_{ia} and consumption c_{ia} allocations.

The agent budget constraint when she purchases insurance claims is

$$\int_E Q(\epsilon)\, B(\epsilon)\, d\epsilon = 0 \tag{11}$$

whereas, once the shocks are realized is

$$c_{ia} = \lambda\left[p(s_i)\exp(\alpha_{ia} + \epsilon_{ia})\, h_{ia}\right]^{1-\tau} + B(\epsilon_{ia}) \tag{12}$$

5.2 Equilibrium

Given the pair $(g,\ \tau)$, a stationary recursive competitive equilibrium for the economy is a tax level λ, asset prices $Q(\epsilon)$, skill prices $p(s)$, decision rules $s(\kappa,\phi)$, $c(\phi,\alpha,\epsilon,s)$, $h(\phi,\alpha,\epsilon,s)$, and $B(\cdot;\phi,\alpha,s)$ such that

1. households maximize their utility as described by equation 5,
2. labor markets for each skill type clear, with the price of each skill being determined in equilibrium by the demand of skills (see equation 1) and the supply being determined by the agents' utility maximization,
3. asset markets clear,
4. the government budget is balanced and λ satisfies equation 4.

In particular, it can be shown that the hours-worked allocation is a function of parameters $\phi,\ \epsilon,\ \tau$ and the consumption allocation is a function of $\phi,\ \alpha,\ s,\ g,\ \tau$. Thus, it is interesting to notice that the hours choice is independent of the skill type and of the realization of the uninsurable shock and that the consumption choice is independent of the realization of the insurable shock.

5.2.1 Social Welfare Function

In order to assess the aggregate impacts of a policy reform, I imagine that the steady state economy characterized by a policy pair $(g_{-1},\ \tau_{-1})$ is hit by an unanticipated policy change $(g,\ \tau)$. The baseline specification is characterized by full reversibility of skill choices. In this specification, agents immediately react to the policy change by adjusting their skill type since their earnings depend on the level of progressivity. The second specification I will examine is characterized by fixed skill investment.

The social welfare function I will use is one that puts equal weight γ on all agents within a cohort. Letting date 0 be the time at which social welfare is evaluated, the function is

$$\mathcal{W}(g,\tau;\tau_{-1}) \equiv (1-\gamma)\frac{\gamma-\beta\delta}{\gamma(1-\beta\delta)}\sum_{j=-\infty}^{+\infty}\gamma^{j}U_{j,0}(g,\tau;\tau_{-1}), \tag{13}$$

where $U_{j,0}(g,\tau;\tau_{-1})$ is remaining expected lifetime utility at date 0 for the cohort j.

In order to analyze all the factors affecting social welfare, it is possible to rewrite equation

13 in the model with fully reversible investment as

$$\mathcal{W}(g,\tau;\tau_{-1}) = \log(1-g) + \chi\log g + (1+\chi)\frac{\log(1-\tau)}{(1+\hat{\sigma})(1-\tau)} - \frac{1}{1+\hat{\sigma}} \tag{14}$$

$$+(1+\chi)\frac{1}{(1+\psi)(\theta-1)}\left[\psi\log(1-\tau)+\log\left(\frac{1}{\eta\theta^{\psi}}\left(\frac{\theta}{\theta-1}\right)^{\theta(1+\psi)}\right)\right] \tag{15}$$

$$-\frac{\psi}{(1+\psi)\theta}\left[(1-\tau)-\frac{\beta\delta}{\gamma}\frac{(1-\gamma)}{(1-\beta\delta)}(1-\tau_{-1})\right] \tag{16}$$

$$-\left[-\log\left(1-\left(\frac{1-\tau}{\theta}\right)\right)-\frac{(1-\tau)}{\theta}\right] \tag{17}$$

$$-(1-\tau)^2\frac{v_{\phi}}{2} \tag{18}$$

$$-\left[(1-\tau)\left(\frac{\beta\delta}{\gamma-\beta\delta}\right)\frac{v_{\omega}}{2}-\log\left(\frac{1-\delta\exp\left(\frac{-\tau(1-\tau)}{2}v_{\omega}\right)}{1-\delta}\right)\right] \tag{19}$$

$$+(1+\chi)\left[\frac{1}{\hat{\sigma}}v_{\epsilon}-\sigma\frac{1}{\hat{\sigma}^2}\frac{v_{\epsilon}}{2}\right]. \tag{20}$$

In the above equation, each line has a different meaning and it captures one of the forces which determine optimal tax progressivity. Line 14 is the expression for the welfare of the representative agent. It pushes for regressive taxes, which increase the private return to work and therefore labor supply. 15, 16 and 17 are all related to the skill investment choice. However, there are two offsetting forces that link welfare with skill investment. On the one hand, higher progressivity reduces skill investment and therefore, because of imperfect substitutability across skills, reduces productivity and welfare. On the other hand, lower progressivity increases skill investment and aggregate productivity, leading to higher wages but also to higher consumption dispersion, which dampens social welfare. 18 is the welfare cost of heterogeneity in preference for leisure, which transmits to heterogeneity in hours worked, earnings and consumption. Also 19 measures the welfare cost of heterogeneity in consumption, which now is caused by the presence of uninsurable shocks. A higher level of progressivity lowers consumption inequality and therefore increases welfare. Finally, 20 pushes optimal progressivity to zero, being the byproduct of two offsetting forces: more insurable wage dispersion, which improves welfare, and hours dispersion, which is costly in terms of welfare because of the convexity in the disutility of hours.

5.3 Calibration

5.3.1 The Tax Functional Form

It is possible to test through data the hypothesis that equation 4 approximates the Italian system rewriting it as a mapping between post-government income $\tilde{y}_i$ and pre-government income y_i

$$\tilde{y}_i = \lambda y_i^{1-\tau}. \tag{21}$$

In particular, I run the regression of equation (21) in log form, using taxable income as the empirical counterpart for y_i, and taxable income minus taxes plus transfers for $\tilde{y}_i$. I restrict the sample to individuals aged 25-65, being considered the working age for Italy in 2015. This choice is driven by the fact that there is no retirement in the model and agents work as long as they survive. Firstly, it is worth noting that the R^2 is equal to 0.90, therefore the proposed functional form approximates very accurately the Italian personal income tax system. Secondly, $\tau^{IT} = 19.0\%$ and it is statistically significant at the 99% level. Being $\tau^{IT} > 0$, $T(y_i)$ happens to be proxied by a globally concave function in income, with marginal tax rates which are monotonic in income. Finally, the sample size almost halves in this specification, counting 19,506 observations, because of the applied sample restriction and of the log form, which excludes automatically those with either non-positive taxable or disposable income. It is worth noting that the estimate I found for Italy in 2015 is slightly higher than the estimate found for the US economy by Heathcote et al. (2017) using PSID data for the period 2000-2006, being it equal to 18.1%[3].

Estimates	EU-SILC (2015)
τ	19.0%
λ	1.67
Observations	19,506
R^2	0.90

Table 7: Parametric estimates

The functional form tends to overestimate marginal tax rates at the top of income distribution, due to the fact that these individuals have lower weights in the regression and are

[3]Progressivity in the US has been estimated using equation (21) also by Guner et al. (2016) and Holter et al. (2019) who found, respectively, estimates of 5.3% and 13.7%. These wide differences across different papers are due to the dataset used and, in particular, to the completeness of the measures of transfers.

fewer, whereas it approximates very well the progressivity at the bottom. Obviously, the two-parameter functional form is a simplification that, although very useful for the purpose of solving the model in closed form, brings some costs in terms of accuracy. Indeed, other functional forms endowed with three parameters, as the one proposed by Gouveia and Strauss (1994) and used by Conesa and Krueger (2006), perform better with both Italian and US data.

Figure 5 displays average and marginal tax rates estimated using the functional form across multiples of mean income. At a first glance, one may conjecture that marginal tax rates implied by the model are way higher than the ones computed in Section 4 and implied by Italian data. However, one must recall that I estimated the pair (λ, τ) using taxable income rather than disposable income and therefore the resulting tax rates are higher than the ones computed above. On the other hand, average tax rates seem to be in line with those displayed in Figure 1, despite being slightly overestimated at the top.

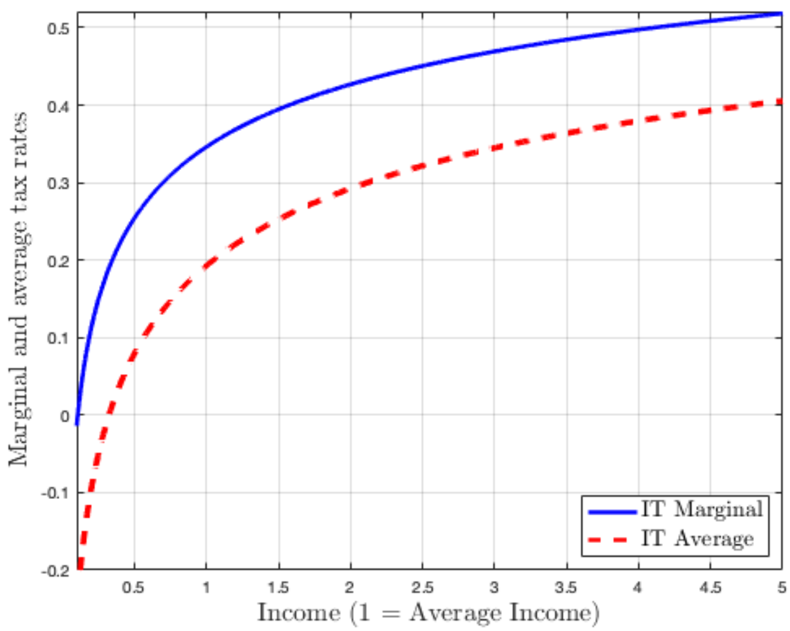


Figure 4: Effective Marginal and Average Tax Rates (Parametric Estimates)

5.3.2 Structural Parameters

In order to parameterize the model, I mainly follow the procedure that can be found in Heathcote et al. (2014), using micro data from SHIW. Thanks to the closed-form solution for allocations, it is possible to equate theoretical moments with their empirical counterparts.

Firstly, it is useful to recall that this work deals with survey data. Thus, hours worked, consumption and individual earnings are measured with error and hourly wages inherit it from the first two variables. Let the variance of reporting errors in hours worked, consumption and earnings be, respectively, $v_{\mu h}$, $v_{\mu c}$ and $v_{\mu y}$, and assume measurement error is classical. Moreover, I introduce the tax-modified Frisch elasticity $\frac{1}{\hat{\sigma}} = \frac{1-\tau}{\sigma+\tau}$. Relying on the results by Gottschalk and Huynh (2010), I impose that the variance of measurement error in earnings equals 0.

Secondly, let me introduce the 12 moments that have been used to estimate 7 structural parameters. These moments are the 6 variances and covariances in hours, consumption and hourly wages as predicted by the model, 3 of these moments at age $a = 0$, and the three variances in first differences:

$$var(\log(w)) = \frac{1}{\theta^2} + v_\alpha + v_\epsilon + v_{\mu y} + v_{mh} \tag{22}$$

$$var(\log(h)) = v_\phi + \frac{1}{\hat{\sigma}^2} v_\epsilon + v_{\mu h} \tag{23}$$

$$var(\log(c)) = (1-\tau)^2 \left(v_\phi + \frac{1}{\theta^2} + v_\alpha \right) + v_{\mu c} \tag{24}$$

$$cov\left(\log(h), \log(w)\right) = \frac{1}{\hat{\sigma}} v_\epsilon - v_{\mu h} \tag{25}$$

$$cov\left(\log(h), \log(c)\right) = (1-\tau)\, v_\phi \tag{26}$$

$$cov\left(\log(c), \log(w)\right) = (1-\tau) \left(\frac{1}{\theta^2} + \nu_\alpha \right) \tag{27}$$

$$var(\log(w_0)) = \frac{1}{\theta^2} + v_\epsilon + v_{\mu y} + v_{mh} \tag{28}$$

$$var(\log(c_0)) = (1-\tau)^2 \left(v_\phi + \frac{1}{\theta^2} \right) + v_{\mu c} \tag{29}$$

$$cov\left(\log(c_0), \log(w_0)\right) = (1-\tau) \frac{1}{\theta^2} \tag{30}$$

$$var(\Delta \log(w)) = \left(\frac{1-\delta}{\delta} \right) v_\alpha \tag{31}$$

$$var(\Delta \log(h)) = 2 v_{\mu h} \tag{32}$$

$$var(\Delta \log(c)) = 2 \left[(1-\tau)^2 \left(\frac{1-\delta}{\delta} \right) v_\alpha + v_{\mu c} \right] \tag{33}$$

For estimating the sample moments I use the SHIW historical dataset, covering the period 1977-2016. I keep households in which there is at least a male in working age. Hourly wage is computed as annual net labor earnings divided by annual hours worked. In computing annual labor earnings, household earnings and hours worked in family businesses are imputed entirely to the household head. This may lead to an overestimation of the variance in consumption, but the estimate found is lower than the US estimate.

I regress individual log wages, individual log consumption and individual log earnings on year dummies, a quartic in age and - only for consumption - household composition dummies using only data from men in working age. In this way, I try to limit the possible distortions that may emerge when including women because of the diffuse gender wage gap[4]. Then, I cluster observations in each year in 31 five-year overlapping age classes (27-57).

The structural estimation has been conducted through the general method of moments, which minimizes the following matrix

$$\hat{\Lambda} = \arg\min_{\Lambda} \left[\hat{m} - m(\Lambda)\right]' W \left[\hat{m} - m(\Lambda)\right] \tag{34}$$

where $m(\Lambda)$ is the vector of theoretical variances, $\hat{m}$ is the vector of empirical covariances and W is the identity matrix.

The 58,306 variances and covariances found through the above procedure have been used to minimize equation (34) and Table 8 presents the parameters estimates.

Description	Parameter	Value	Source
var. of meas. error in hours	v_{mh}	0.021	SHIW
var. of meas. error in earnings	v_{my}	0	SHIW
var. of meas. error in cons.	v_{mc}	0.033	SHIW
var. of disutility to work	v_{ϕ}	0.087	SHIW
var. of insurable shocks	v_{ϵ}	0.042	SHIW
var. of uninsurable shocks	v_{α}	0.032	SHIW
elast. of subst. across skills	θ	2.968	SHIW
interest rate	r	0.017	ECB
public expenditure	g	0.216	OECD
survival probability	δ	0.975	author's computation
elast. of labor supply	σ	2.16	Heathcote et al. (2014)
degree of progressivity	τ	0.19	EU-SILC (2015)
elast. of skill invest. wrt return to skill	ψ	0.65	Heathcote et al. (2017)

Table 8: Parameterization

These estimates imply that (1) the variance of wages implied by the model is explained by the variance of insurable and uninsurable shocks for roughly 20% each and by heterogeneity in skills for 60% - more than double the importance of heterogeneity in skills found in the US; (2) variance in the disutility of work effort accounts for almost 95% of dispersion in hours;

[4]See, for instance, Blau and Kahn (2017), Addabbo and Favaro (2011) and Mussida and Picchio (2013)

(3) cross-sectional dispersion in disutility of work effort explains roughly 35% of consumption inequality, heterogeneity in skills explains half of it and the rest is accounted by the variance in uninsurable shocks.

The last five parameters have been imposed in the GMM procedure. The parameter r is the long term interest rate prevalent in Italy in 2015 from the ECB harmonized series[5], g is the fraction of output devoted to public expenditure as reported by OECD[6], δ has been chosen in order to match the expected duration of the working life, σ and ψ equate the US estimates because it is not possible to estimate them with the Italian data in my possess and τ has been estimated regressing equation (21). The values of σ and τ make the Frisch elasticity consistent with microeconomic evidence (Keane (2011)).

6 Results

In this section I will provide the main results driven by the quantitative simulation of the model. In particular, I will focus on optimal progressivity in the two alternative specifications: when skill investment is fully reversible and when already born agents cannot change their skill endowment.

6.1 Progressivity with Fully Reversible Skill Investment

Under the baseline specification, the optimal degree of progressivity is independent of the preexisting distribution of skills. Substituting the optimality condition $g^* = -\chi$ and the parameters found through the procedures described in Section 5.3 into equation 14-20, one obtains the social welfare function $\mathcal{W}(\tau)$ as a function of progressivity τ only. Plugging $\gamma = \beta$ that is, the social planner weights equal to the individual time discount factor, I obtain the optimal degree of progressivity for the Italian economy $\tau^* = 7.1\%$. The welfare gain deriving from such a decrease in progressivity equals 0.87% of lifetime consumption. It is worth stressing that, although the observed progressivity is higher than the US estimate (19% vs 18.1%), the optimal progressivity for Italy is lower than the degree estimated for the US economy (7.1% vs 8.4%).

Figure 5 plots the cumulative social welfare gains deriving from the components expressed by equation 14-20 . As discussed above, the welfare of the representative agent - which is maximized at $\tau = -\chi = -0.276$ - and the variance of insurable shocks push, respectively, for regressive taxation and flat tax whereas the other components contribute positively to reach the optimal progressivity of 7.1%. Welfare deriving from skill investment, which as discussed

[5]Source: ECB Statistical Data Warehouse

[6]Source: OECD (2020), Government production costs (indicator). doi: 10.1787/44ec61e6-en

above is divided into three components, calls for positive progressivity. Indeed, education costs deriving from skill investment and the consumption dispersion across skills component prevail on the productivity gain and therefore push for higher progressivity.

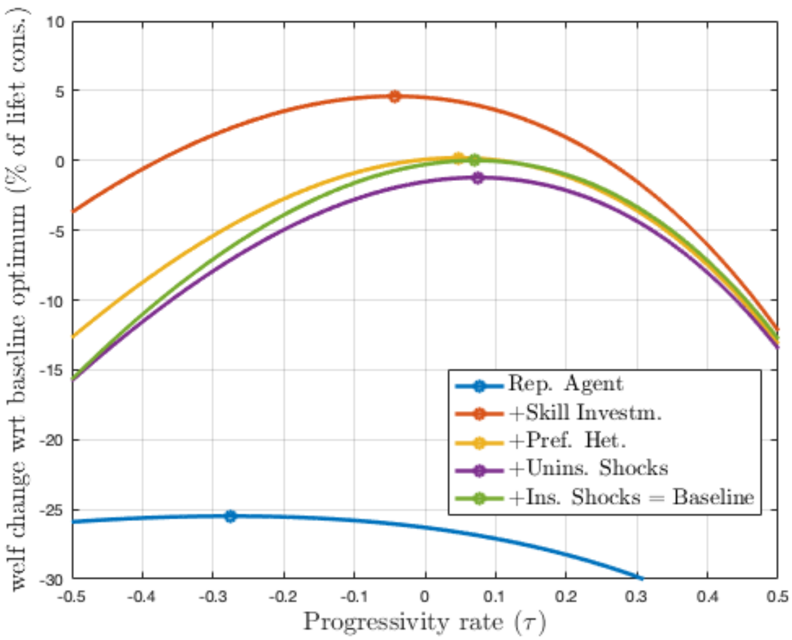


Figure 5: Cumulative Welfare Gains under Fully Reversible Skill Investment

A difference of 12 percent in τ does not explain clearly what are the implications of such a tax reform. The optimal system requires positive marginal tax rates at the very bottom, for individuals above 2% of the mean income. On the other hand, the implied marginal tax rate at the top is lower than 33%. This result is striking, especially after recalling that this tax rate is computed using taxable rather than gross income and therefore would be even lower when using its proper definition. The optimal system under the baseline can be approximated in a revenue-neutral manner by a flat tax at 28% with a standard deduction of €8,000 and a flat transfer of 20% to those with negative income. The flat tax approximates the optimal system predicted by the model very accurately: regressing the optimal marginal tax rates on the approximated ones without a constant, I find a β of 1.01 and an R^2 equal to 0.97.

Such an approximation is both realistic and really interesting from a normative perspective. Individuals internalize statutory tax rates and therefore they may be confounded by a continuous tax function when choosing their labor supply. Furthermore this flat tax system, while preserving progressivity to some extent, reduces even more skill investment and labor supply distortions. However, the political feasibility of such a reform is debatable, especially in Western advanced economies.

6.2 Progressivity with Fixed Past Skill Investment

Now I consider the case in which already born agents cannot adjust their skill investment. In this specification an additional force pushes for higher progressivity: progressivity can be increased and therefore consumption can be reduced without distorting skill choices for currently living agents. In other words, the planner uses progressive taxation to expropriate the returns to past skill investments made by already born agents.

To maintain tractability, an additional assumption is needed: production is segregated by age groups. It is necessary so that the skills distribution within a cohort is still exponential whereas the overall distribution does not. Again, I set $\gamma = \beta$ and the existing progressivity equal to the degree found with Italian data, i.e., $\tau_{-1} = \tau^{IT} = 19.0\%$.

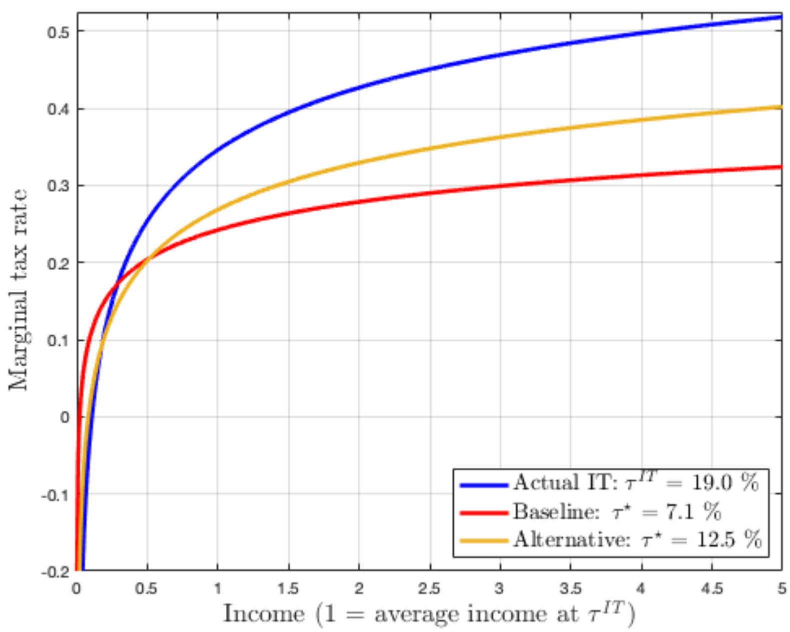


Figure 6: Actual vs Optimal System

In this case, I find that the optimal choice of progressivity is 12.5%, which roughly averages the actual and the optimal degrees for the Italian economy. This level is far more realistic than the one previously found and also exploits a setting in which, as it would happen in the real world, individuals cannot instantaneously change their past skill investments.

Figure 6 compares the three systems examined: actual, baseline and alternative. The alternative system exhibits an implied marginal tax rate at the top around 40%, which is more than 12 percent lower than the actual level. Again, this system may be approximated with a more realistic one as follows, obeying revenue-neutrality. In order to reflect the higher level of progressivity with respect to the baseline, it would be approximated by two different tax rates: one at 32% for income above €25,000, which is basically the mean income, and another one at 22.5% between €25,000 and €8,000. As before, there is a standard deduction of €8,000 and individuals with negative income receive a transfer of 50%.

6.3 Evolution of Actual and Optimal Progressivity across Time

Finally, I inspect the evolution of actual and optimal progressivity across time, measured by the right axis, as well as of a standard measure of inequality in disposable income across time, measured by the right axis. Actual progressivity has been computed using the 2015 tax code. This approximation may sound quite strong but actually it is not: the components of the tax code that have been used in this work for computing tax liabilities and disposable income have not been changed since then. It would have been interesting to assess the effects that the reform of tax brackets and tax rates would have led on actual progressivity and income inequality but EU-SILC have not provided complete data regarding the years 2005-2006.

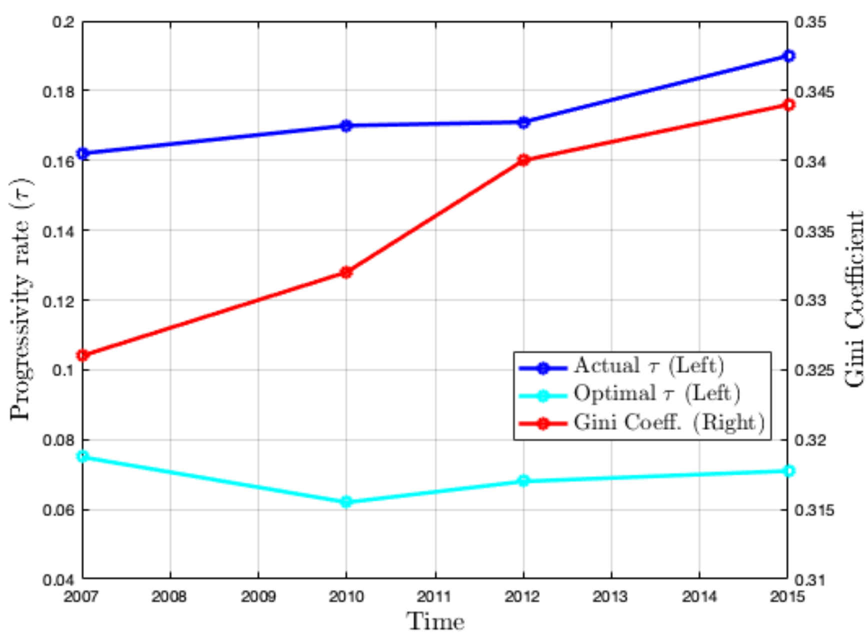


Figure 7: Time Comparison

Income inequality has increased considerably in the period 2007-2015. This is shown by an increase of roughly two percentage points in the Gini coefficient of disposable income. Simultaneously, actual progressivity has increased by almost three percentage points whereas optimal progressivity has remained approximately stable.

7 Conclusions

This work reaches two main aims, using survey data (EU-SILC and SHIW) and focusing on the years following the Italian Personal Income Tax reform of 2006.

On the one hand, it provides a positive analysis of the current PIT system, underlying some of its main characteristics and consequences. It evaluates income and tax liabilities distribution at both individual and household level, calling for the need of introducing a form of household taxation. It does so computing gross, taxable and disposable income, as well as gross and net tax liabilities, from the gross variables present in EU-SILC.

On the other hand, it studies progressivity from a normative point of view. The actual tax and transfer system is approximated fairly well in the model by a two-parameter functional form. The model, developed in Heathcote et al. (2017), compares the degree of progressivity of the Italian economy with its optimal level, using a utilitarian social welfare criterion. Opt

imal progressivity is shaped by two main counteracting forces: skill investment, labor supply and therefore wages are dampened by higher progressivity levels, whereas heterogeneity in consumption, which reduces social welfare, pushes for higher progressivity.

The main results are that the model prescribes an important reduction in tax progressivity, which should decrease from 19% to 7.1% under the baseline specification, and to 12.5% under the alternative specification. In other words, the model calls for wide reductions in marginal tax rates above approximately 0.25 times the mean income at the expenses of an increase in tax rates at the lower end of the income distribution. In particular, the model declares that the top income tax rate should be diminished by more than 12%. These reforms may be approximated by a flat tax at 28% under the baseline and by a system with two tax rates (22.5% and 32%) under the baseline. Both exhibit a standard deduction of €8,000.

However, the model has required several simplifying assumptions. An important direction to extend the current framework would be by carefully modeling heterogeneity in tax liabilities which emerged in my descriptive analysis. In particular, it would be very insightful to introduce into the model the differential treatment that part of personal income receives through the substitute taxes, or the possibility of tax evasion.

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A. Appendix

A.1 Additional Tables and Figures

Gross Income	-
Deductions	=
Taxable Income	x
Tax Rates	=
Gross Tax Liabilities	-
Detractions	=
Tax Liabilities	

Table A1: How Are Tax Liabilities Computed?

	EU-SILC	SHIW	MEF
<0	0.0%	0.0%	0.0%
0 - 15,000	**11.0%**	11.8%	15.7%
15,000 - 26,000	**23.9%**	28.7%	29.7%
26,000 - 55,000	41.2%	36.8%	**34.7%**
55,000 - 75,000	8.3%	6.9%	**6.4%**
75,000 - 120,000	8.6%	7.8%	**6.6%**
>120,000	**6.9%**	7.9%	7.1%
Mean Income	19,081	20,521	20,690

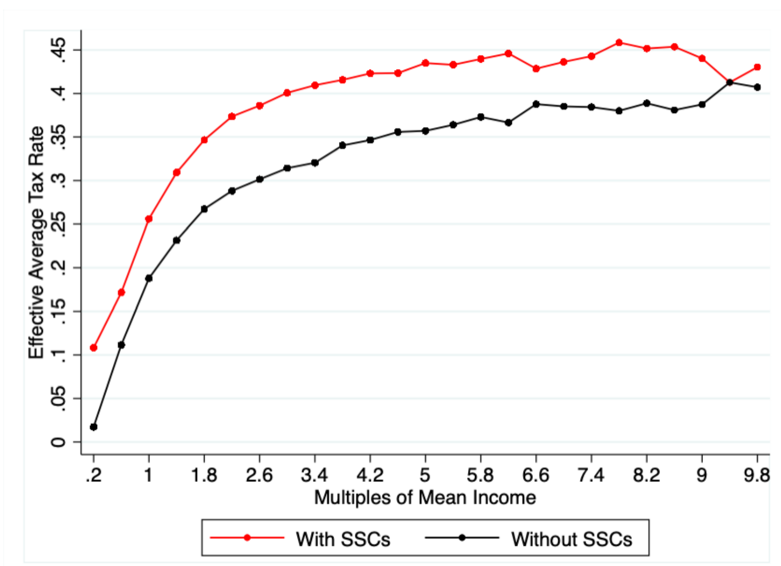
Table A2: Income Distribution across Datasets

	North West		North East		Centre		South		Islands	
	EU-SILC	MEF	EU-SILC	MEF	EU-SILC	MEF	EU-SILC	MEF	EU-SILC	MEF
<0	0.0%	0.1%	0.0%	0.1%	0.0%	0.2%	0.0%	0.3%	0.0%	0.3%
0 - 15,000	**8.2%**	11.8%	**8.7%**	13.2%	**10.7%**	14.5%	**19.2%**	23.5%	**17.3%**	23.4%
15,000 - 26,000	21.7%	28.7%	22.7%	31.1%	24.7%	27.9%	27.0%	30.2%	26.4%	29.5%
26,000 - 55,000	42.6%	**35.5%**	42.0%	**35.5%**	41.3%	**35.2%**	39.5%	**32.9%**	37.7%	**33.1%**
55,000 - 75,000	10.1%	**7.1%**	8.6%	**6.4%**	8.0%	**7.1%**	5.3%	**5.0%**	6.4%	**5.6%**
75,000 - 120,000	9.9%	7.4%	9.7%	6.6%	9.4%	7.5%	5.3%	5.2%	5.8%	5.5%
>120,000	**7.4%**	9.7%	8.3%	7.2%	**6.0%**	8.0%	3.7%	3.5%	6.4%	3.2%
Mean Income	22,948	23,640	21,848	22,060	20,539	21,530	13,821	16,380	13,352	16,490

Table A3: Income Distribution across Areas

	Italy		US		Spain	
	Gross Income	Taxable Income	Gross Income	Taxable Income	Gross Income	Taxable Income
Gini coefficient	0.40	0.40	0.59	0.63	0.42	0.50
Var-log income	0.91	0.94	1.50	2.04	1.14	2.97

Table A4: Income Inequality Across Countries

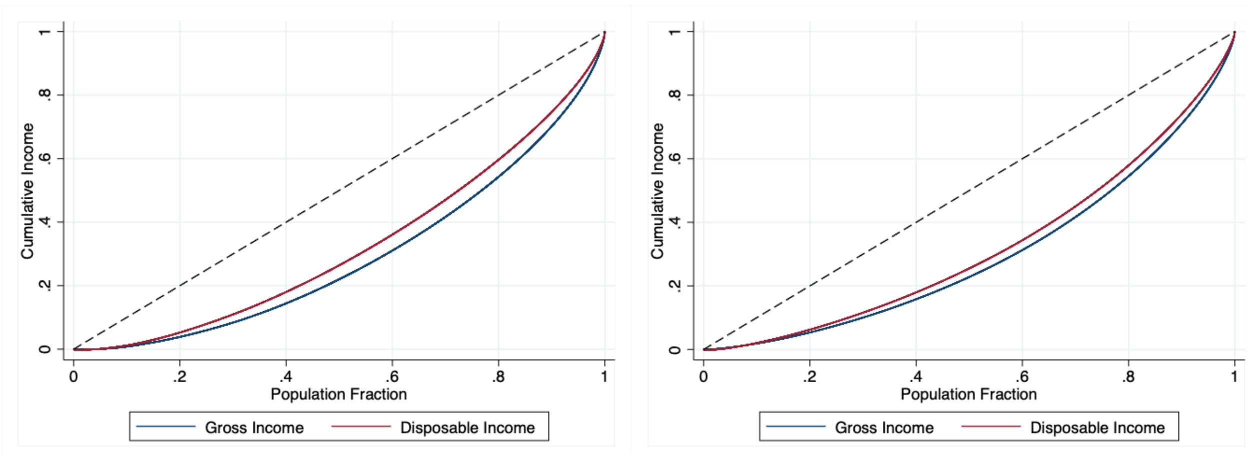


Note: Average Tax rates that include SSCs are constructed adding SSCs paid in 2015 to net tax liabilities.

Figure A1: Effective Average Tax Rates

	North	Centre	South and Islands
τ	19.0%	21.3%	17.7%
λ	1.68	1.89	1.54

Table A5: Progressivity by Area



(a) Individual (b) Household

Figure A2: Lorenz Curves

A.2 Empirical Analysis of the Dataset

Using the EU-SILC (2015) dataset I study the distribution of income and effective tax rates across individuals. Moreover, I use it for estimating the actual level of progressivity in the Italian economy, using the gross variables to compute net tax liabilities. In order to do this, I use as sources of gross income the following variables: PY010G, PY020G, PY050G, PY090G, PY100G (in some cases), PY110G, HY040G and HY090G. The last two variables, which are at the household level, have been imputed to the household head. PY100G (only when prescribed by the law), PY130G and PY140G constitute transfers. CSDI, CSA, RICMAN_E and VERMAN_E constitute deductions. Subtracting the deductions to gross income I obtain taxable income. Gross tax liabilities, both state and regional, are applied to taxable income. Detractions (for family status, employee status, renting the dwelling and interests on mortgages) are computed following the tax code and subtracted to gross tax liabilities in order to obtain net tax liabilities.

Finally, I regress in log form disposable income on taxable income for obtaining the estimate of $\tau^{IT} = 19.0\%$.

Summary

What is the actual level of progressivity in the Italian personal income tax (PIT) system? How can policymakers reform the system towards the optimum? These are two important questions on which the Italian academic and public debate is focusing nowadays. However, this work is relevant not only from an Italian perspective. Italy represents an extraordinarily interesting case because of some of its features: tax rates on labor income are among the highest in the EU, the ratio between tax revenues and GDP is well above the average for the OECD countries (43% against 34%), some income categories within the PIT framework are subject to substitute taxes which are proportional and therefore lower the actual level of progressivity, estimates of tax evasion declare that 2% of the Italian GDP is constituted by missing PIT revenues) but still it is considered a country with middle income inequality.

This research has two main goals. Firstly, it aims at characterizing the distribution of several relevant variables, such as before-tax and after-tax income, and at providing estimates of effective tax functions. These tax functions describe in a simplified way the Italian PIT system preserving the heterogeneity observed in data and are valuable for working with macroeconomic models with heterogeneous agents. This work gauges the impact of the Italian tax system on income inequality and shows the difference between statutory and effective tax rates. Secondly, it determines the optimal degree of progressivity predicted for the Italian economy and identifies the different forces that shape it. For doing this, it uses an analytically tractable equilibrium model with heterogeneous agents who choose endogenously their skill investment and labor supply.

The data used for this research come from two main sources: the European Union Statistics on Income and Living Conditions (EU-SILC), conducted by ISTAT following the European rules, and the Survey on Household Income and Wealth (SHIW), led by the Bank of Italy. Therefore, it deals with survey data.

The key takeaways from the descriptive part of this work are the following. Firstly, income is unevenly distributed across Italy, since living standards are higher in the Northern and

Central area and substantially lower in the Southern area and the Islands. Secondly, income inequality is present both at the individual and household level. However, the Italian PIT helps in redistributing income since the Gini coefficient of disposable income is six percentage points lower than the index of gross income. Moreover, the Italian PIT leads to an increase in the share of income accruing by the bottom 80%, whereas the income earned by the top quintile decreases by almost six percentage points. Thirdly, tax liabilities are heterogeneously distributed. Indeed, the vast majority of individuals at the very bottom of income distribution does not face positive tax liabilities and even those who face positive tax rates pay effective average tax rates below 10%. Effective average tax rates span from 0 to 40% but, especially at the top of income distribution, they constitute an upper bound for the real estimates. On the other hand, effective personal marginal tax rates happen to increase steeply at the middle of income distribution and to stay approximately flat at the top. As for marginal tax rates across households, their behavior is drastically different. They are concave, reaching a maximum between 4 and 5 times the mean income, i.e., around €130,000. At that point, they start to decrease up to approximately 35%. This implies that the progressivity criterion is not respected at the household level and therefore it may be useful to introduce some sort of household taxation as well.

For what concerns the normative part, the model, developed in Heathcote et al. (2017), features all the main trade-offs which concern progressive taxation. In particular, optimal progressivity is shaped by the counteracting forces of skill investment and labor supply, which are distorted by progressivity, labor market uncertainty and redistribution, which are addressed by a progressive tax system, and private risk sharing which, being incomplete, needs the government intervention. The presence of public goods increases the social cost of a progressive system. Agents are heterogeneous. They differ along three dimensions: learning ability, which helps in determining their skill investment before entering the labor market, disutility of work effort, which helps in determining their labor supply, and productivity shocks. The environment is characterized by partial insurance, since permanent shocks are uninsurable and transitory shocks are fully insurable. There are no intertemporal savings and output is produced using a constant elasticity of substitution production function which uses a continuum of skill types. The Italian tax and transfer PIT system is proxied by a two-parameter functional form firstly introduced by Feldstein (1969) and Benabou (2002). In particular, it shows that labor supply is independent of the skill type and of the realization of the uninsurable shock whereas the consumption allocation is independent of the realization of the insurable shock.

The resulting actual progressivity measured using Italian data is 19%, slightly higher than the US estimate and considerably higher than the optimal degree predicted by the model, which equals 7.1% under the model with irreversible skill investment (the baseline specification). The social welfare gains deriving from adopting the optimal level of progressivity are equivalent to almost 1% of lifetime consumption. The model suggests a drastic reduction in progressivity even under the alternative specification, that is, with fixed past skill investment. The optimal choice of progressivity is 12.5%, which roughly averages the actual and the optimal degrees for the Italian economy. This level is far more realistic than the one previously found and also exploits a setting in which, as it would happen in the real world, individuals cannot instantaneously change their past skill investments. In other words, the model calls for wide reductions in marginal tax rates above approximately 0.25 times the mean income at the expenses of an increase in tax rates at the lower end of the income distribution. Moreover, it declares that the top income tax rate should be diminished by more than 12%. These reforms may be approximated by a flat tax at 28% under the baseline and by a system with two tax rates (22.5% and 32%) under the alternative specification. Both exhibit a standard deduction of €8,000.

These types of approximations are both realistic and really interesting from a normative perspective. Individuals internalize statutory tax rates and therefore they may be confounded by a continuous tax function when choosing their labor supply. Furthermore this flat tax system, while preserving progressivity to some extent, reduces even more skill investment and labor supply distortions. However, the political feasibility of such reforms is debatable, especially in Western advanced economies.

However, the model has required several simplifying assumptions. An important direction to extend the current framework would be by carefully modeling heterogeneity in tax liabilities which emerged in my descriptive analysis. In particular, it would be very insightful to introduce into the model the differential treatment that part of personal income receives through the substitute taxes, or the possibility of tax evasion. These additions have been prevented by the structure of the model, in which, in order to be solved in closed form, consumption and labor allocations need to be additive in log form.

This research contributes to two main literatures. On the one hand, the effects of PIT on the distribution of individual and household income and the differences between statutory and effective tax rates have been studied in several papers. García-Miralles et al. (2019) and Guner et al. (2014) have provided also parametric estimates of the tax functions using US and Spanish data, whereas Curci et al. (2017) and Di Caro (2018) have conducted earlier studies on Italian data using data sources different from EU-SILC. On the other hand, there is a growing literature investigating the determinants of optimal tax progressivity. Apart from Heathcote et al. (2014, 2017), to which this work is fully indebted since it inherits their analytical framework, Krueger and Ludwig (2013) and Guvenen et al. (2013) have extensively investigated the distortionary effects of progressivity on labor supply and skill investment. Conesa and Krueger (2006) develop an environment which is comparable to the one used here but it cannot be studied in closed form. Others, without restricting the functional form of taxes, in the spirit of Mirrlees (1971), focused on human capital accumulation (Stantcheva (2017)), labor productivity shocks (Farhi and Werning (2013); Golosov et al. (2016)) and imperfect substitutability across skills (Rothschild and Scheuer (2013)).

This work is organized as follows. Section 2 provides a concise description of the Italian tax code and Section 3 describes the datasets used in this work, together with their limitations and restrictions. Section 4 analyzes individual and household income distribution and effective tax rates. Section 5 briefly describes the model and its main trade-offs. Section 6 presents the quantitative results of the model, showing the optimal degree of progressivity predicted for the Italian economy. Finally, Section 7 concludes.