ECONOMICS BULLETIN

PERSONAL AND HOUSEHOLD INCOME TAXATION IN A PROGRESSIVE TAX SYSTEM: EVIDENCE FROM ITALY

Valentino Larcinese
London School of Economics

Abstract

I compare personal and household income taxation and study the effects of tax progression under the two systems. Potential reforms of the Italian tax system are simulated, endogenizing labor supply reactions. Results show that, with respect to a number of indicators, the choice of the tax unit is more relevant than the degree of progression of the tax schedule. A personal and progressive tax system provides incentives to female labor supply and turns out to be the most effective in redistributing income and raising revenue, with little productive costs compared with a flat tax rate. Household taxation has instead a number of drawbacks when coupled with a progressive tax schedule.

1. Introduction

A vast theoretical literature has established that, for a given pre-tax income distribution, post-tax inequality decreases as the degree of tax progression increases[1]. When income is endogenous then the relationship between tax progression and inequality depends, among other things, on labor supply elasticity[2]: empirical investigation on real tax systems seems in this case the only way to derive any conclusion. A related feature of a tax system is the choice of the tax unit[3]. While this choice is neutral under proportional taxation, this is clearly not the case in a progressive tax system. Consider for example a household with given total income: different pre-tax income distributions among family members will have no consequences under proportionality but can produce significantly different total tax liabilities under progression. It is then clear that the choice of the tax unit can also induce significant behavioral reaction by taxed agents and that those reactions can actively interact with the degree of progression.

This paper has two main purposes. On one side we will ask if income tax progression is still effective as a redistributive device when we take into account labor supply. On the other side, and most importantly, we will try to understand what are the consequences of different tax unit choices and how do they interact with the degree of progression in the tax schedule. Most countries have adopted solutions that lie between the two extreme possibilities of individual and household taxation. Also, a number of family benefits and deductions are in place also where individual income is taxed. It is then legitimate to ask what are the consequences of this choice.

For this purpose, we will present an empirical analysis on Italian data. Labor supply reactions depend on many country-specific elements and therefore, rather than attempting at deriving general conclusions, it seems that the best strategy is to focus on a specific case. We found that the disincentives on labor supply are much stronger when tax progression is coupled with household income taxation. Also, because of its low impact on labor supply, personal progressive income taxation seems the most effective in equalizing post-tax income distribution and generating revenue.

2. The model

We will carry out the analysis by using a miscrosimulation model of the Italian tax system. This model is divided into two parts: the first reproduces the Italian income tax system (IRPEF) and its impact in transforming gross incomes into net incomes; the second model simulates labor supply for any exogenous tax system and, therefore, determines gross incomes. Preferences, wage rates and the tax system are the exogenous ingredients of this model.

Our work will rely on the paper by Aaberge, Colombino and Strøm (1999) (ACS) on labor supply in Italy. This is the first study on labor supply in Italy based on survey data. In particular we will use the same dataset used in ACS, we will adopt the same utility function to represent agents' behavior and we will use their estimates of the wage rates[4].

Our data-set is derived from the *Banca d'Italia* household survey for the year 1987. It consists of 2953 households and 5906 individuals. Households' income comes mainly from paid

---

[1] See Fellman (1976), Jakobsson (1977), Kakwani (1977).
[2] See Preston (1990).
[3] This has received far less attention than the degree of progression. In Lambert (1993), a comprehensive review of the literature, the term *tax unit* is mentioned only once.
[4] We will assume that wage rates are independent of labor supply and of the fiscal system. Details on preferences and the reconstruction of wage rates (as well as descriptive statistics) can be found in ACS.

employment: the limit for income from self-employment is set to 20% of total household income. This income, as well as capital income not subject to IRPEF is kept constant.

The IRPEF system is represented by the function $t(.)$ in the following equation:

$$C_i = GY_i - [t(Y_i, I_i, DED_i, DET_i) + s(K_i)] \qquad [1]$$

where C_i is agent i's net income, GY_i is total gross income, Y_i is gross income from employment, I_i is taxable unearned income, DED_i are deductions from the tax base, DET_i are deductions from the tax liability, $s(.)$ represents the tax system applied to other incomes and K_i is income not subject to IRPEF.

Agents' preferences are represented by a household utility function

$$U = U(x) \qquad [2]$$

where $x = \{C, L_m, L_f\}$, with L_m and L_f respectively the male's and female's leisure time and $C = C_m + C_f$. From [1] we know that net income is a function of labor supply; therefore the choice variable is two-dimensional; it can be represented as (h_m, h_f), the vector of household labor supply, with $h_i = T - L_i$ (T is total time available). Taking a one-year period as the time unit, we have that this vector has to satisfy the feasibility constraint $(h_m, h_f) \in \Omega \subseteq \Re^2$. As a matter of fact, each household's choice usually happens to be concentrated on a subset B_i (i = 1,…,2953) of the feasible set Ω. In the implementation of the model it is therefore convenient to focus our attention on B_i. For each household the set B_i will be represented by the observed choice plus a number of other alternatives randomly drawn from Ω, with probabilities determined according to the observed distributions[5] of h_f and h_m.

We can then state the maximization problem of household *i* as:

max $U(C_i, L_m, L_f)$ with respect to (L_m, L_f)
s.t. $C_i = GY_i - [t(Y_i, I_i, DED_i, DET_i) + s(K_i)]$
and $(h_m, h_f) \in B_i$.

Let us specify the utility function as

$$U(x) = V(x; \theta) + \varepsilon \qquad [3]$$

where θ is a vector of parameters and ε is assumed i.i.d. according to the first type extreme value (Gumbel) distribution. Indicating with S the number of alternatives in B_i, with p_j the probability that the alternative x_j is chosen from Ω and with Pr(j|B_i) the probability that our agent chooses j from the restricted choice set B_i, it is then possible to prove that[6]

---

[5] By drawing the choice set from the distribution of the observed number of hours, we are also implicitly considering constraints that derive from labor demand or institutional features of the labor market.
[6] See McFadden (1978).

$$Pr(j \,/ B_i) = \frac{\exp\{V(x_j;\theta) - \ln p_j\}}{\displaystyle\sum_{k=1}^{S} \exp\{V(x_k;\theta) - \ln p_k\}} \qquad [4]$$

where $p_j = Pr(h_m = h_{mj}) \times Pr(h_f = h_{fj})$. In general, the expected value of any function g(**x**) can be consistently estimated as

$$E(g) \approx \sum_{j=1}^{S} Pr(j \,|\, B_i) g(x_j) = \sum_{j=1}^{S} \frac{\exp\{V(x_j;q) - \ln p_j\}}{\displaystyle\sum_{k=1}^{S} \exp\{V(x_k;q) - \ln p_k\}} g(x_j). \qquad [5]$$

In our case g(**x**) = $(h_m, h_f)^*$. Once estimated $(h_m, h_f)^*$, the [1] provides the net income[7].

3. Tax progression in a personal tax system

The IRPEF system is first compared with a proportional tax rate under the constraint of *ex ante* balanced budget: i.e. the flat tax rate is such that, if there were no behavioral reactions, the tax revenue would be the same we simulate for IRPEF. This allows to isolate the effects of the different tax systems on total revenue.

We find that progressive taxation Lorenz-dominates[8] the proportional tax system (Tab. 2). Proportional taxation, however, increases average net income by 0.77% (Tab. 1). We then evaluate the two systems by using the Generalized Lorenz (GL) dominance criterion. Apart from the top decile the GL curve referred to progressive taxation dominates the one of the proportional system (Tab. 4). Thus, the increase in income generated by a flat tax rate is all concentrated among the richest decile of the population.

Looking at gross incomes, the shift from progression to proportional taxation increases total gross income by 0.05%: since the increase in net income is much bigger, we clearly have a decrease in public revenue (Tab. 1). Why this result? When we disaggregate by gender, it is possible to see that males income increases by 0.58% while females income decreases by 1.99%: the cross income effect (i.e. labor supply elasticity to the partner's income) is larger than the substitution effect in a certain number of households. Since husbands will generally face lower marginal tax rates under proportionality, they will increase their labor supply thus inducing a reduction in the labor supply of their partners, whose marginal tax rates are instead higher under proportionality.

Tab. 4 also reports the GL curves of gross labor income in the two cases[9]. Males labor income is higher with proportional taxation across all deciles; however for the top decile the increase

---

[7] Notice that our consistent estimation of $(h_m, h_f)^*$ is not necessarily contained in B_i but we will certainly have

$(h_m, h_f)^* \in \text{conv}(B_i)$.

[8] In what follows we will use a number of concepts and instruments for measuring inequality that, for obvious reasons, cannot be presented in this paper. For introductions to inequality measures see for example Lambert (1993) or Champernowne and Cowell (1998). Also, notice that the term *dominance* here will be used only as a descriptive device and does not carry any normative judgment.

[9] Since we always consider the whole sample, the first deciles of females' labor income are equal to zero: this depends on the fact that not all agents will participate in the labor market. On the other side, focusing only on active labor force could be misleading as participation too depends on the tax system.

(ΔGL) is higher with IRPEF: among the richest, the income effect tends to prevail. Female labor supply (measured in efficiency units) is instead always lower: tax progression creates an incentive to female labor supply.

Coming to redistribution, the comparison of pre-tax and post-tax Lorenz curves shows clearly that progression has a stronger equalizing power (Tab. 2). When looking at GL curves (Tab. 4), we should consider both the effect on redistribution and that on revenue (which is lower with proportional taxation). Similar results are also confirmed by global indicators of inequality (Tab. 3). With progressive taxation the post-tax Gini index is lower and the pre-tax Gini index is higher, when compared with the correspondent index with proportional tax. This gives an higher Reynolds-Smolensky index of redistribution. At the same time tax liabilities are more concentrated in a progressive tax system (G_{tax}), and the Kakwani index is higher.

4. Tax progression and the choice of the tax unit

We will now consider a proposal of reform that was explicitly debated in the Italian parliament during the nineties. According to this proposal each household income Y is divided into "parts" y=Y/N, according to the family size: the IRPEF rule t(…) described in equation [1] is then applied to y instead of individual incomes. Total tax liability is then given by T=N×t(y). N is equal to 1 for the first household component and 0.5 for the others. Family benefits and deductions have been excluded from the model, since there is less scope for such correction mechanisms with household taxation. In the simulation, t(…) is represented by the IRPEF system in place in 1987; thus, we can directly compare these results with those of the previous section.

As one could expect, household taxation (HT) reduces women's labor supply, which is lower both compared with personal progressive or personal proportional taxation (Tab. 4). On the other side, men's labor supply is not particularly boosted (and is below what can be obtained with a flat tax rate). As a consequence, HT implies a substantial fall in income produced. Post-tax incomes are instead generally higher: this is due to the large loss in total tax revenue with respect to both proportional and personal progressive taxation. It seems also clear that HT reduces labor supply particularly among high-income households, while it tends to increase gross income among the poorest households. Disaggregating by gender, women have lower pre-tax income independently of their decile, while only men of the first eight deciles have higher pre-tax incomes.

Let us now turn to the redistributive implications of the reform. As a consequence of what obtained on labor supply, the pre-tax Lorenz curve dominates the one referred to personal taxation for the first seven deciles (see Tab. 2), though the entity of the difference is quite modest, as shown also by the Gini indices (Tab. 3). The Reynolds-Smolensky index, however, shows that the redistributive impact of HT goes beyond the effect on gross incomes. Also, the HT post-tax Lorenz curve is above the correspondent IRPEF curve for the first eight deciles. Tax liabilities are clearly more concentrated in the HT case but both average tax rate and total revenues fall considerably (see Tabs. 1 and 3).

A complete evaluation of the proposal also requires an analysis of the consequences of the reform for different household typologies. Looking at Tab. 5 one could be tempted to conclude that larger and poorer households should benefit from the reform. This conclusion would actually be wrong. It is true that the poorest households and the largest households benefit from the reform but this is not the case for the households that are both the poorest and the largest. Using the Atkinson-Bourguignon criterion of sequential generalized dominance (Tab. 6), it turns out that the HT system dominates IRPEF for households with less than 3 children. When the number of kids is equal or

larger than 3 then in the first decile IRPEF dominates HT: thus, HT ends up being harmful exactly for the largest and poorest households. In fact, when income is low and family size is large, the loss of family benefits and deductions (proportional to the size) is superior to the saving in tax liabilities (directly dependent on income).

Finally, HT substantially reduces total revenue: the tendency of HT generalized Lorenz curves to dominate the correspondent IRPEF curves is mainly due to an increase in average net income. If this was due to an increase in overall output then the generalized Lorenz dominance could represent a valid normative criterion. However, when this is only due to a revenue loss, any judgment would be arbitrary or it must be based on the assumption that revenue has no impact on public welfare. It should be noted that if each income class receives back 5.1% of their income (thus maintaining a balanced budget), IRPEF would dominate HT. To say anything about welfare it is then necessary to know the incidence of public expenditure and the behavioral reactions it would induce, and this goes far beyond our purposes.

5. Conclusion

The disincentives associated with high marginal tax rates are well known in economic literature and have often influenced actual tax reforms. Comparably little attention has been devoted to the choice of the tax unit. It is worth noting that the disincentives attributed to tax progression have received particular attention in countries that tax households rather than individuals. This work analyzes the effects of income tax progression under alternative tax units when labor supply is endogenous. Our results show that progressivity and the choice of the tax unit interact in many interesting ways. By distinguishing between the two we conclude that the choice of the tax unit can have much more relevant implications for labor supply, inequality and the tax revenue than the degree of tax progression.

References

Aaberge, R. – Colombino, U.- Strøm, S. (1999): "Labor supply in Italy: an empirical analysis of joint household decisions, with taxes and quantity constraints". *Journal of Applied Econometrics,* **14***, 403-422.*

Banca d'Italia (1989): "I bilanci delle famiglie italiane nell'anno 1987", *Supplemento al Bollettino Statistico.*

Champernowne, D.G and Cowell, F.A. (1998): *Economic Inequality and Income Distribution*, Cambridge, Cambridge University Press.

Fellman, J. (1976): "The effect of transformations on Lorenz curves", *Econometrica*, **44**, 823-4

Jakobsson, U. (1976): "On the measurement of the degree of progression", *Journal of Public Economics*, **5**, 161-8

Kakwani, N.C. (1977): "Applications of Lorenz curves in economic analysis", *Econometrica*, **45,** 719-27.

Lambert, P.J. (1993), *The distribution and redistribution of income*, Manchester, Manchester University Press.

McFadden D. (1978): "Modelling the choice of residential location". In A. Karlquist, L. Lundquist, F. Snickard, J.J. Weibull (eds.), *Spatial Interaction Theory and Planning Models,* Amsterdam, North Holland.

Preston, I.P. (1990): "Income redistribution and labour supply specification", W.P. IFS W90/14.

Tab. 1: Comparison of aggregate variables (IRPEF = 100)

	Proportional (t=22,8%)	HT
Males' Gross Labour Income	+0.58%	+0.1%
Females' Gross Labour Income.	-1.99%	-3%
Total Gross Labour Income	+0.05%	-0.56%
Gross Income	+0.04%	-0.35%
Net Income	+0.77%	+1.14%
Tax Revenue	-2.1%	-5.1%

Tab. 2: Lorenz Curves of Gross and Net Income

Deciles	IRPEF Gross	IRPEF Net	Flat Tax Rate Gross	Flat Tax Rate Net	HT Gross	HT Net
1°	0.0441	0.0495	0.0441	0.0477	0.0446	0.0508
2°	0.1028	0.1121	0.1029	0.1083	0.1033	0.1140
3°	0.1709	0.1833	0.1709	0.1775	0.1712	0.1855
4°	0.2476	0.2627	0.2478	0.2551	0.2477	0.2647
5°	03327	0.3496	0.3332	0.3408	0.3329	0.3516
6°	0.4265	0.4448	0.4274	0.4348	0.4268	0.4465
7°	0.5313	0.5497	0.5322	0.5392	0.5314	0.5509
8°	0.6505	0.6678	0.6513	0.6571	0.6504	0.6681
9°	0.7923	0.8056	0.7930	0.7968	0.7921	0.8055
10°	1	1	1	1	1	1

Tab. 3: Global Indicators

	G_{pre}	G_{post}	Π_{RS}	G_{tax}	Π_K	t	Π_{RS}/G_{pre}
IRPEF	0,240	0,215	0,025	0,345	0,105	21,08	0,104
Flat tax	0,239	0,228	0,011	0,290	0,051	20,47	0,046
HT	0,239	0,212	0,027	0,352	0,113	19,55	0.113

G = Gini Index; Π_{RS} = Reynolds & Smolensky Index = $G_{pre} - G_{post}$; Π_K = Kakwani Index = G_{tax} - G_{pre}
t = average tax rate

Tab. 4: Generalized Lorenz Curves
(in thousand liras)

Dec.	IRPEF					Flat Tax Rate					HT				
	ML	FL	HL	HTG	HTN	ML	FL	HL	HTG	HTN	ML	FL	HL	HTG	HTN
1°	997	0	1481	1787	1589	1014	0	1481	1789	1544	1006	0	1495	1801	1648
2°	2611	0	3511	4166	3596	2648	0	3520	4171	3501	2629	0	3526	4170	3698
3°	4497	0	5875	6924	5882	4554	0	5892	6930	5739	4523	0	5883	6912	6018
4°	6602	25	8561	10033	8428	6679	0	8582	10047	8245	6637	0	8551	10000	8588
5°	8927	518	11510	13483	11215	9025	448	11585	13508	11014	8969	454	11523	13440	11406
6°	11498	1226	14871	17282	14266	11610	1131	14909	17323	14054	11540	1131	14815	17231	14482
7°	14352	2176	18552	21525	17630	14485	2062	18599	21575	17426	14395	2053	18475	21454	17869
8°	17590	3373	22669	26356	21417	17746	3249	22721	26401	21238	17637	3226	22565	26258	21672
9°	21471	4854	27535	32102	25836	21635	4724	27582	32141	25736	21509	4678	27392	31979	26120
10°	27541	7139	34675	40513	32070	27702	6996	34693	40531	32318	27561	6924	34481	40372	32435

ML= male gross labour income
FL = female gross labour income
HL = Total household gross labour income
HTG = Total household gross income
HTN = Total household net income

Tab. 5: Gains and losses from IRPEF to HT

Per Income Deciles		Per family size	
1	+ 3.7	No kids	-0.47
2	+2.10	1 kid	+1.64
3	+1.48	2 kids	+3.56
4	+0.90	3 or more kids	+4.44
5	+1.12		
6	+0.80		
7	+0.70		
8	+0.40		
9	+0.80		
10	+1.17		

Tab. 6: Generalized and Sequential Lorenz Dominance: IRPEF versus HT
(in thousand liras)

Dec.	$n \geq 3$		$n \geq 2$		$n \geq 1$		All the sample	
	QF	IRPEF	QF	IRPEF	QF	IRPEF	QF	IRPEF
1°	1582.86	1617.59	1646.68	1607.72	1634.58	1586.95	1648.21	1589.11
2°	3456.64	3414.39	3624.63	3496.98	3610.01	3494.515	3698.46	3596.09
3°	5571.63	5433.04	5821.30	5597.46	5827.17	5650.61	6017.81	5881.50
4°	7859.76	7622.48	8215.78	7911.03	8270.74	8041.41	8587.73	8427.83
5°	10298.05	9984.69	10799.60	10433.60	10921.21	10651.46	11405.70	11214.58
6°	12933.40	12587.20	13602.81	13165.39	13814.11	13492.77	14481.76	14266.07
7°	16029.95	15579.92	16661.80	16149.89	16954.99	16596.13	17869.24	17629.59
8°	19479.52	18941.54	20050.36	19462.78	20431.93	20029.40	21672.42	21417.11
9°	23511.40	22949.88	23925.66	23271.38	24455.57	23996.72	26128.12	25835.57
10°	28181.40	26981.86	29232.36	28178.50	30214.07	29454.53	32435.33	32069.61