Optimal Earned Income Tax Credit under decreasing long-run labor aversion

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ABSTRACT: According to Saez (2002) the existence of an optimal EITC system depends on the extensive-margin elasticity, which measures the reaction of working poor's labor market participation to wages. In this paper we add to Saez's analysis two components: i) Heterogeneous tastes for leisure that allow explaining the nature of the extensive-margin elasticity; ii) an analysis of the optimal EITC for the case in which persistent participation of the working poor at the labor market causes a reduction in his labor aversion, which is one of the explicit long-run goals of policy makers. We find that the interaction between the evolution of tastes toward a reduction in labor aversion, the extensive and intensive-margin elasticities and the government budget constraint, produces a variety of optimal long-run EITC schedules. The simulations show two main scenarios: i) when the initial proportion of the working poor is high relatively to the unemployed, the reduction of labor aversion derives in a decreasing optimal EITC; ii) when the proportion of the working poor is initially low relatively to the unemployed, the reduction of labor aversion derives in an increasing optimal EITC.

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1. Introduction

While the Earned Income Tax Credit (EITC) became the main policy tool in the US for incentivizing persistent working poor's participation at the labor market[1], its analytical characterization is scarce. The most prominent analytical paper was written by Saez (2002), who showed that the appropriateness of implementing the EITC is enhanced by high working poor's extensive-margin elasticity, which favors providing him a wage subsidy over an allowance to the non-participating poor. However, Saez (2002) did not model directly the participation decision by the working poor, which is related to heterogeneous leisure preferences by different individuals. In this paper we build a model of the optimal EITC with heterogeneous tastes for leisure, in order to obtain an insight about the nature of the extensive-margin elasticity. Identifying the driving forces of this elasticity is crucial for characterizing the optimal EITC schedule.

Another remarkable point of the EITC system from the point of view of policy makers, is that its main goal is providing incentives for *persistent* participation at the labor market, as a mean for allowing the working poor to fight poverty on a permanent basis through his labor market compensation, as opposed to a situation in which he depends on government transfers like child allowances or income maintenance. In fact, the EITC became the most prominent tool of the approach

[1] In the federal system at the US the maximum subsidy at the top of the EITC trapeze is 45 percent of working poor's wage.

adopted by many OECD countries known as "from welfare to work". Under this approach, one of the main purposes of the policy makers has been to embed working ambitions and abilities among the working poor. By persistently keeping the working poor at the labor market, he is supposed to experience by himself the advantages of the labor market as a mean for escaping poverty and for establishing a tradition that will be passed on to the next generation. In fact, many papers have documented the pros and cons of different welfare mechanisms as tools for improving the prospects of the working poor's long-term participation.[2] However, none of these papers has analyzed the optimal EITC when evolving to the long-run equilibrium of working poor's increased participation: note that as long as the poor remains at the labor market, his aversion to labor shall decrease over time. In this paper we analyze the optimal EITC in a world where the working poor changes his tastes, toward the long-term objective of the government – i.e., his labor aversion declines over time.

The paper is organized as follows. In the next section we survey the literature in two aspects: papers that analyzed the optimality of the EITC, and papers that studied the impact of welfare programs on the persistence of labor market participation by the working poor. Section 3 introduces a model with heterogeneous tastes for leisure, and analyzes the dynamics of labor aversion in the long-run, in a world in which the government implements policy tools for reducing the working poor's labor aversion. Section 4 introduces heterogeneous tastes for leisure into an optimal EITC model along the lines of Saez (2002). We provide simulations of the optimal EITC, which

[2] See f.e. Freedman, Friedlander, Hamilton, Rock, Mitchell, Nudelman, Schweder and Storto (2000) who evaluate the two-years effect of eleven Welfare to Work programs.

results from changes in individuals' tastes toward a reduction of labor aversion over time. Section 5 summarizes and concludes.

2. Literature Survey

One of the pioneering papers on the issue of the desired government policy for implementing the right incentives for enhancing working poor's participation at the labor market was written by Besley and Coate (1992). They show that when the government has no information about the true tastes and about the abilities of individuals, a combination of welfare payments, and a minimum required amount of work, are both needed as part of the optimal policy package.

In order to implement this type of solution the main tool that has been used in OECD countries in general, and in the US in particular, is the EITC. Saez (2002) wrote the first paper that analyzed the optimality of the EITC, in a model that compares the optimal government policy toward the working poor, among two alternatives: receiving a welfare payment, that is not subject to labor market participation, versus receiving an Earned Income Tax Credit, that is contingent on participation at the labor market. Saez (2002) solves an analytical model that has two kinds of elasticities: the extensive-margin elasticity summarizes the reaction of individuals in terms of participation at the labor market, while the intensive-margin elasticity summarizes his reaction in terms of the share of time he dedicates to work (i.e., his job partiality). The first type of elasticity is crucial for the optimality of an EITC system: the higher is the extensive-margin elasticity, the more effective is the EITC subsidy for keeping individuals at the labor market.

Another important aspect of the Welfare to Work approach is whether the adopted policy tools are the right ones for allowing persistent participation at the labor market by the working poor, in the most cost effective manner.

Pavoni and Violante (2007) show that the help to the working poor shall include social assistance, unemployment insurance, job monitoring and wage subsidies. Pavoni, Setty and Violante (2014) model welfare-to-work programs as contracts offered by the government to unemployed agents in an environment with moral hazard. According to their paper the generosity of the program depends on the skilled level of the unemployed agent, and they show that it is possible to adopt "soft" programs (i.e., with absence of punishments) that avoid hidden savings by the unemployed.

After the adoption of the Personal Responsibility and Work Reconciliation Act implemented in the US in August 1996, many evaluation reports have been written with the purpose of evaluating the effectiveness of the different programs for improving working prospects by the working poor. These studies show that the outcomes are fairly explained by the details of the different programs. Freedman et al. (2000) show that employment-focused programs increased participation primarily in job search activities, whereas education-focused programs raised participation levels primarily in basic education and vocational skills training classes. They also found that employment-focused programs produced larger gains in employment and earnings over the two-year follow-up period than education-focused programs, but these effects may not be sustained everywhere in the long run. One of the best performers was the Portland's Program, which was evaluated by Scrivener et al.

(1998). This program provided job search assistance to a large segment of their caseload and encouraged enrollees to find work as quickly as possible. While all regional programs were benefited by the implementation of the federal EITC, the Portland program further employed full-time job developers to help place program enrollees in unsubsidized jobs. Its employment message was strong, and the program offered high-quality education and training services as well as job search; it also enforced a participation mandate, and had strong job development and placement services. In addition, contextual factors may have contributed to the program's success: it worked with a less disadvantaged welfare caseload and operated within a good labor market with a relatively high state minimum wage.

An important finding from the point of view of the present paper was shown by Hamilton, Freedman, Gennetian, Michalopoulos, Adams-Ciardullo and Gassman-Pines (2001): they show that all three human capital development programs (HCD) increased participation over the control group in a higher extent for the 5-years period compared to the 2-years period. This finding hints that there is a long-term impact on participation, an issue that is at the heart of our paper.

3. The Model

2.1 A model with heterogeneous tastes for leisure

Let us define the utility function and budget constraint as :

1) $U_j(c, l, q) = \beta_j \mathrm{u}(c_j) - \alpha_j v(l_j) - q \cdot 1(l > 0)$

2) $U_j(w_j l - T(w_j l, z), l, q) = \beta_j u[w_j l - T(w_j l, z)] - \alpha_j v(l) - q \cdot 1(l > 0)$

Where sub-index j represents the individual, U is total utility, u is the utility of consumption, v is the utility of labor, c and l represent, respectively, consumption and labor; α represents labor aversion; q is a fixed cost measured in utility terms, that applies only when the individual participates at the labor market. T is the taxation function, which will be defined later.

Logarithmic Utility

Assume that individuals have tastes for consumption and leisure, represented by (1-α_i) and α_i respectively[3]:

6) $U_i(c, 1-l) = (1-\alpha_i)\ln(c_i) + \alpha_i \ln(1-l_i)$

Where (1-l) represents leisure. Assuming that the government intervenes with the aim of re-distributing income, through a demogrant T_0 and a piecewise linear income tax $t_i = 1-\beta_i$, the budget constraint is:

7) $c_i = T_0 + \beta_i w_i l_i$

Where w represents the hourly wage that the worker is paid at the labor market (his marginal productivity) and β is the average tax for the relevant wage. For low wage workers this wage is lower or close to the minimum wage paid in the economy.

At the optimum the individual decides about consumption and leisure. Assuming that λ is the Lagrange multiplier, the F.O.C. is:

$$L_l \to \frac{\alpha}{1-l} = \lambda\beta w$$
$$L_c \to \frac{1-\alpha}{c} = \lambda$$
$$c = \frac{1-\alpha}{\alpha} \cdot (1-l)w$$
$$\frac{1-\alpha}{\alpha} \cdot (1-l)w = lw + T_0$$

Which implies the following solution:

[3] Note that since marginal utility of consumption decreases with income, in this case there are income effects. Thus, there is a range of values for which the individual does not participate. We assume that in this case q is lower than the utility associated with participation.

8) $l_i = 1 - \alpha(1 + \frac{T_0}{\beta_i w_i})$, $w_i > w_i^* = \frac{\alpha_i}{\beta_i(1-\alpha_i)} \cdot T_0$

$c_i = (1 - \alpha_i)(T_0 + \beta_i w_i), l_i > 0$

Note that there is a minimum hourly wage, w_i^*, above which the individual participates at the labor market ("participation wage").

Since in this paper we concentrate on the optimal EITC, the extensive margin will play a crucial role. In particular, we will concentrate on the density function:

9) $g(\alpha_i) = f(w_i^* - w_i) = \theta_i \left(\frac{\alpha_i}{\beta_i(1-\alpha_i)} T_0 - w_i\right)$

Where θ is a parameter that translates the gap between the participation and the actual wage to the group density; i.e., the distribution of α depends on two factors: a general factor that is subject to government policy (for example through advertisement on the importance of working), and the participation at the labor market, which depends on the term that appears in the parenthesis of the right term of (5). Note that this term depends on the distribution of α and w.

Since empirical research on labor supply overwhelmingly shows that high income individuals have a low (zero) extensive margin elasticity,[4] we will assume that they have low values for α and we will concentrate on the distributions of α and w for low-income individuals. Based on observed economic behavior we assume as a benchmark assumption that the density functions of α and w are decreasing.

For simplicity we will think of a three-point distribution in which there is a high income individual group with a zero extensive margin elasticity, a middle income individual group that participates but is close to indifference, and a low-income

[4] In fact, we show later that our model produces this result in an endogenous manner.

individuals group with high leisure preferences that tends not to participate at the labor market:

$$9')\quad g(\alpha_1) = f(w_1^* - w_1) = \theta_1 \left(\frac{\alpha_1}{\beta_1(1-\alpha_1)}A - w_1\right)$$

$$g(\alpha_2) = f(w_2^* - w_2) = \theta_2 \left(\frac{\alpha_2}{\beta_2(1-\alpha_2)}A - w_2\right)$$

$$g(\alpha_3) = f(w_3^* - w_3) = -\theta_3 \left(\frac{\alpha_3}{\beta_3(1-\alpha_3)}A - w_3\right)$$

Where:

$$\alpha_1 > \alpha_2 > \alpha_3;\ \ w_1 < w_2 < w_3; g(\alpha_1) + g(\alpha_2) + g(\alpha_3) = 1$$

A low α and high w, together with a low θ (that tends to zero) characterize the high-income group. A high α and a low w characterize the low-income group. The middle income group has a mid-values range. These facts explain the decreasing pattern of the density function.

In the next section we will use this model for characterizing the optimal piecewise linear EITC. Before doing so, it is useful to study different patterns of the model which will help us in the optimal EITC analysis. This task will be done in the next sub-section.

Constant Elasticity of labor supply

Another empirically relevant case is when we apply equation 1 to the case in which u(c)=c, and $v(l) = \frac{l^{1+k}}{1+k}$, which means that there are no income effects and that the labor supply elasticity equals k[5]; i.e., in this case:

[5] For an explanation see Saez (2001), page 222. Like in his paper, a further option is to use u(c)=log(c), which will be explored by us soon.

10) $U_i(c, 1-l) = \mathrm{c} - \alpha_i \frac{{l_i}^{1+k}}{1+k} - q.1\;(l > 0)$

$c_i = T_0 + \beta_i w_i l_i$

The upper bound on the fixed cost is

$q_i = c_i - c_0 - \alpha_i v(l_i)$

The Lagrange multipliers are:

$$(L)c_i = c_i - \alpha_i \frac{{l_i}^{1+k}}{1+k} + \lambda\,(T_0 + \beta_i w_i l_i - c_i)$$

$(L_l) \rightarrow \alpha_i\, {l_i}^k = \lambda\, \beta_i w_i$

$(L_c) \rightarrow 1 = \lambda$

Solving for c we receive:

$$\rightarrow 1 = \frac{\alpha_i\, {l_i}^k}{\beta_i w_i}$$

$$\rightarrow l_i = \left(\frac{\beta_i w_i}{\alpha_i}\right)^{\frac{1}{k}}$$

Plugging the solution in the utility function derives in equation 11:

$$U_i(c, 1-l) = \mathrm{c} - \alpha_i \frac{\left(\frac{\beta_i w_i}{\alpha_i}\right)^{\frac{1+k}{k}}}{1+k} - q > 0$$

$$\rightarrow U_i(c, 1-l) = \beta_i w_i \cdot \left(\frac{\beta_i w_i}{\alpha_i}\right)^{\frac{1}{k}} - \alpha_i \frac{\left(\frac{\beta_i w_i}{\alpha_i}\right)^{\frac{1+k}{k}}}{1+k} - q > 0$$

$$\rightarrow U_i(c, 1-l) = {\alpha_i}^{\frac{-1-k}{k}} \beta_i {w_i}^{\frac{1+k}{k}} - \frac{{\alpha_i}^{\frac{-1}{k}} \cdot \beta_i {w_i}^{\frac{1+k}{k}}}{1+k} - q > 0$$

$$\rightarrow U_i(c, 1-l) = \beta_i {w_i}^{\frac{1+k}{k}} ({\alpha_i}^{\frac{-1-k}{k}} - \frac{{\alpha_i}^{\frac{-1}{k}}}{1+k}) - q > 0$$

11) $U_i(c, 1-l) = {\alpha_i}^{\frac{-1}{k}} \beta_i {w_i}^{\frac{1+k}{k}} (\frac{1}{\alpha_i} - \frac{1}{1+k}) - q > 0$

This equation will be later used in our simulations. As explained in Saez (2002) and Dahan and Strawczynski (2012), a drawback of this solution is that the labor supply tends to infinity. As explained later, we will deal with this undesired characteristic in our simulation.

3.2 Israel vs. US

With the goal of characterizing the above model, we compare a possible implication of working poor's participation in Israel versus the US. According to existing empirical evidence a significant group among the poor hardly participates in Israel. This group includes Arab women and Ultraorthodox men (Figures 1 and 2). We stress that these groups constitute a substantial share of the working poor population in Israel.

FIGURE 1

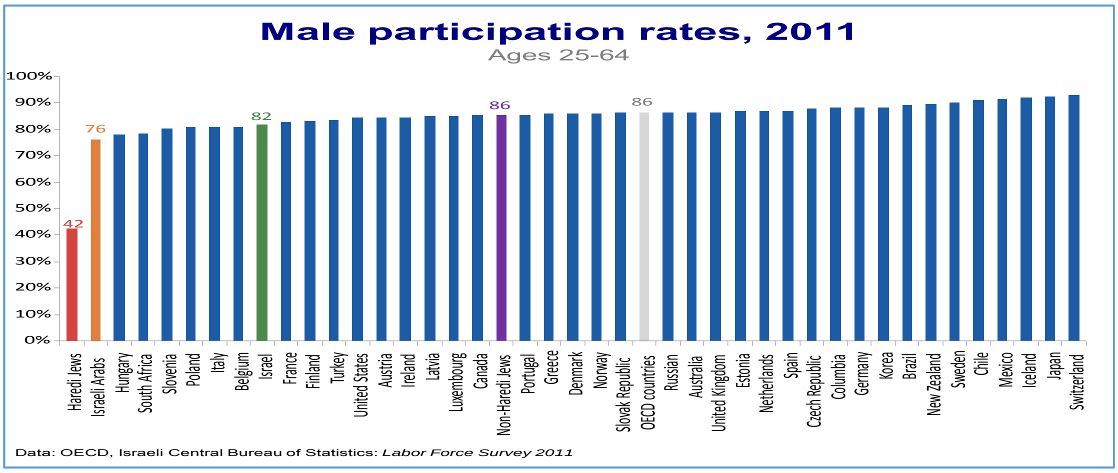
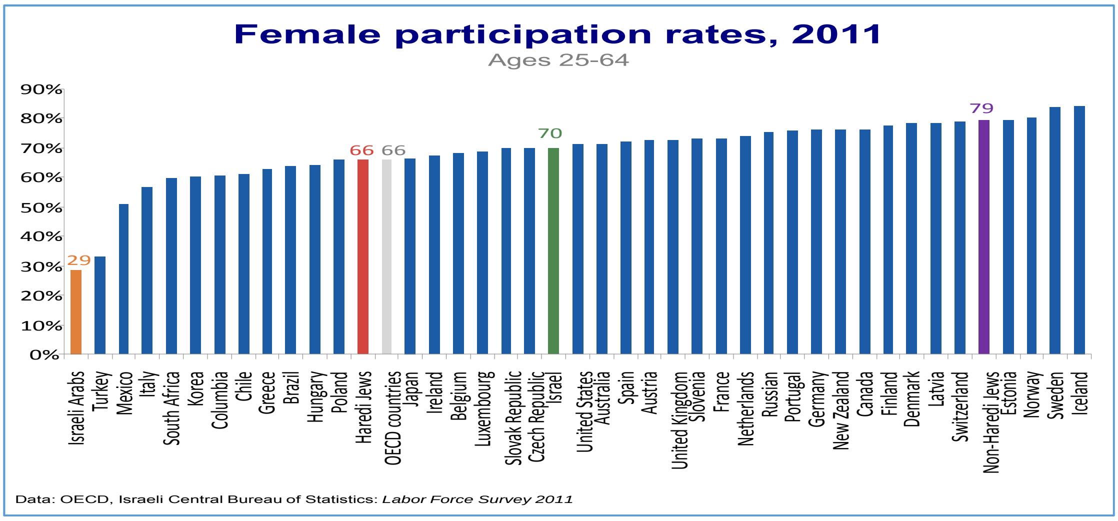


FIGURE 2



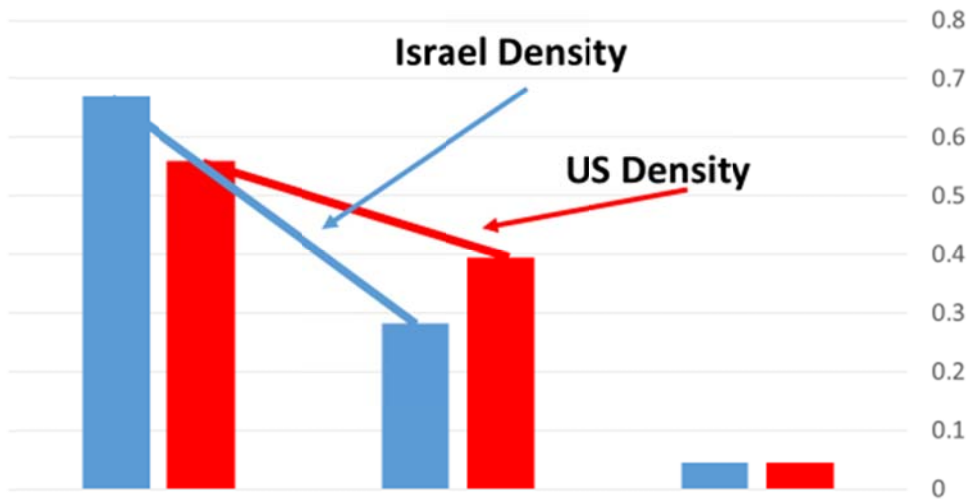
In order to characterize the implications of our model, we show now how this phenomenon is reflected. According to our model, this characteristic is represented by a high density among people with a high α and a low w; in other words, $f(w_1^* - w_1)$ is high. In terms of our model, this fact means that Israel has a steep density function: when compared to the US, it declines more rapidly. Assuming that this abnormality is balanced through the middle group, a possible way to model this fact in our framework is:

$$\theta_1^{Israel} > \theta_1^{US}$$

$$\theta_2^{Israel} < \theta_2^{US}$$

We show in Figure 3 the result of this asymmetry.

Figure 3 - Density Functions with Leisure Preferences: Israel vs. the US



3.3 Long-Run Government Policy

Governments impose the EITC with the purpose of subsidizing wages at low income levels, subject to participation at the labor market. The conditioning of the subsidy upon participation has driven policy-makers to classify the EITC as one of the main tools within the approach known as "from welfare to work".

Beyond the EITC, the additional available tools for governments for incentivizing participation in the long-run include both "advertising" and training courses. Advertising means stressing the importance of participation at the labor market, f.e., because the importance of the example provided to the next generation. Training courses enhance the hourly wage that can be attained by low-wage individuals.

3.3.1 The EITC

Equation 6' allows us to analyze the effect of the EITC. One important question, that will be analyzed in the next section, is what are the groups that will receive at the optimum an EITC subsidy. In the next section we solve the optimal EITC and show that it is optimal to give transfers to the working poor.

If in the above model the first group represents the unemployed, according to 6' this means that for the first group the difference between the threshold wage and the wage is reduced, and for the second group the EITC can make the difference between participating and not participating; i.e., for a $\beta_2 > 1$, we obtain:

$$(6'')\ g(\alpha_2) = f(w_2^* - w_2) = \theta_2 \left(\frac{\alpha_2}{\beta_2(1-\alpha_2)}A - w_2\right) < 0$$

In words, the EITC transfer implies that the threshold wage goes down and thus the individual is willing to participate at the labor market. Clearly in this case also θ_2 will become negative, and these individuals will persistently participate at the labor market.

Our analysis is aimed at assessing the long-term impact of this policy. Since the second group now participates, it is plausible to assume that these individuals will now experience the labor market, which in the long-run will have an impact on α_2, that will be reduced. This reduction will further imply participation by members of this group. Since the difference between the threshold and actual wage for the third group is reduced by the EITC, it is plausible to assume that the reduction of α_2 is at the expense of α_1; i.e., people that did not participate in the past will now participate. The translation in terms of our model is that θ_1 goes down and θ_2 goes up. The implication for the long-run density of α is the same as in advertising as a policy tool, which is analyzed in the next sub-section.

3.3.2 "From Welfare to Work" Program

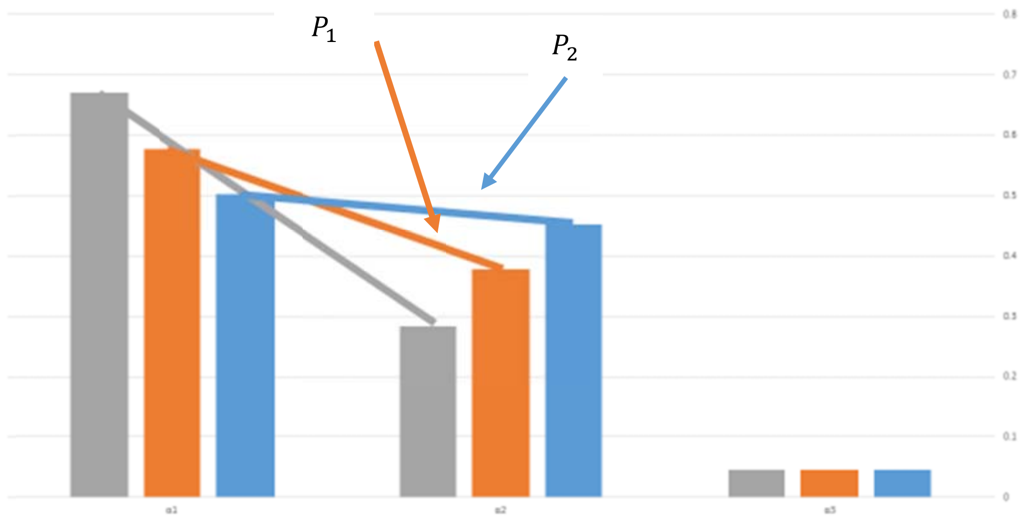
From Welfare to Work programs are aimed at achieving a persistent participation of low-wage workers in the labor market, which will increase their capabilities through on the job training and by escalating in the wage scales of jobs. In terms of our model this tool is characterized by reducing α for some for low-wage earners, which in our three-point distribution would translate into a reduction of the density of individuals with α_3. The reduction of this density is compensated by an increase in the number of individuals that become indifferent about participation. That is, θ_1 goes down and θ_2 goes up.

A way to include this policy in our model would be to look at the reaction of θ_1 when a successful program (P_2) is pursued, in comparison with a less effective policy P_1 :

$$\theta_1(P_2) < \theta_1(P_1)$$

In Figure 4 we show what happens to the long-run density function when the government acts through this tool.

Figure 4 – Long-Run Density function with labor advertising



We see that the long-run government policy drives the density function from an decreasing function to a uniform density function.

3.3.3 Training Courses as a long-run policy tool

Training courses allow low-wage earners to increase their hourly wage, and thus, in practical terms, it implies transferring individuals from the poorest group to the middle group. In fact, Pavoni and Violante (2007) show that these courses make the difference between a working poor lifetime, and the transition to a middle class.

In terms of equation 6 we assume that the courses are taken by the poorest group, and thus when w_1 goes up the term in parenthesis at the right hand side of (5), representing $(w_1^* - w_1)$ goes down, reducing the density of this group. We assume that these low wage earners go to the middle group, increasing its density (by increasing θ_2).

In order to do the analysis let us assume that Policy 2 includes more training courses than Policy 1; that means:

$$w_1(P_2) > w_1(P_1)$$
$$\theta_2(P_2) > \theta_2(P_1)$$

Clearly the density function associated to Policy 2 is less steep than the one associated to Policy 1. Increasing even further the training courses would drive the density function to a uniform distribution. Thus, also for this tool we get the result that in the long-run the density tends to a uniform distribution.

We conclude that if the government operated to incentivize low-wage earners by advertisement or training courses the density function changes from an increasing function to a uniform distribution.

In the next section we will analyze what is the optimal EITC in the short run (i.e., under an increasing density function) and in the long-run (i.e., under a uniform distribution).

4. The Optimal Piecewise linear EITC with endogenous tastes for leisure

4.1 Optimal EITC

In this sub-section we use the model introduced by Saez (2002) in order to characterize the optimal EITC. According to his model there are I branches with a weight that equals to h_i ($\sum_1^I h_i = 1$), each of them representing a different wage level. Each branch is associated by the government with a welfare weight g_i, that altogether average to 1; i.e., for low income levels $g_i > 1$ and for high income levels $g_i < 1$. Saez (2002) calculated the optimal combination of transfers to the unemployed and EITC when individuals' response is based on both the extensive and the intensive margins. The extensive-margin elasticity is represented by η, and the intensive-margin elasticity is represented by ζ. The intensive-margin elasticity responds to the case in which individuals switch branches – i.e., an increase in taxation may cause an individual to switch from branch I to branch (i-1).

His solution for optimal marginal taxes/subsidies (represented by T), for the I industries is the following (note that c represents consumption):

(7) $$\frac{T_i - T_{i-1}}{c_i - c_{i-1}} = \frac{1}{\zeta_i h_i} \sum_{j=i}^{I} h_j \left[1 - g_j - \eta_j \frac{T_j - T_0}{c_j - c_0}\right]$$

Assuming that the participation elasticity (i.e., at the extensive margin) for the third industry onwards equals zero[6], and turning to optimal average tax rates (represented by t), we obtain the following solution (see Appendix A):

(8)

$$t_1 = t_2 \frac{w_2}{w_1} - \frac{w_2 - w_1}{w_1} \cdot \left[1 - \frac{h_2 \zeta_2}{h_2 \zeta_2 + (g_0 - 1) h_0 + (g_1 - 1) h_1 - h_2 \eta_2 \cdot \frac{t_2}{1 - t_2}}\right]$$

$$t_2 = 1 - \frac{h_2 \eta_2}{h_2 \eta_2 + (g_0 - 1) h_0 - h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1}}$$

[6] This assumption was adopted also by Saez (2002). We later show that in our model the zero participation elasticities for branch 3 onwards is obtained endogenously; i.e., the participation decision of individuals from these branches are consistent with a zero participation elasticity .

$$\forall i > 2,\ \ t_i = t_{i-1}\frac{w_{i-1}}{w_i} + \frac{(w_i - w_{i-1})}{w_i}\cdot\left[1 - \frac{\zeta_i h_i}{\zeta_i h_i + \sum_{j=i}^{I} h_j\left[1 - g_j\right]}\right]$$

Note that most parameters appear in both t_1 and t_2 with an impact that goes both up and down, which means that the relationship between the variables is not immediate. Since g_0 is higher than 1, one clear result is that if an EITC is optimal for the first group ($t_1 < 0$), then it will be optimal to impose a tax on the second group ($t_2 > 0$). This is so since the second term in the right hand side of the second equation is lower than 1. Another clear result is that if g_1 goes up, the plausibility of obtaining an optimal EITC transfer for the first group ($t_1 < 0$) increases. Concerning other variables the relationship is not trivial: f.e., increasing g_0 increases the plausibility of obtaining a negative t_1 through the first equation, but it reduces it through the second equation (i.e., t_2 goes up which according to the first equation reduces the plausibility of $t_1 < 0$).

A simpler interpretation of this formula that confirms these results is obtained when $\zeta_2 = 0$. In this case the optimal EITC is:

$$t_1 = t_2\frac{w_2}{w_1} - \frac{w_2 - w_1}{w_1}$$

$$t_2 = 1 - \frac{h_2\eta_2}{h_2\eta_2 + (g_0 - 1)h_0 - h_1(\zeta_1 + \eta_1)\frac{t_1}{1 - t_1}}$$

Note that for the case in which $t_1 < 0$, the denominator of the right hand side of the t_2 formula is positive, and the quotient is lower than one; i.e., $t_2 > 0$. Note also that a higher participation elasticity of the second branch reduces t_2, which in turn reduces the first term of the right hand side of the $t_1$formula, and thus it increases the optimal EITC for the first branch.

Since for most variables the relationship is not trivial, we will proceed by performing simulations. Before doing so we shall stress two issues.

First, the peculiarity of our model compared to Saez's analysis, is that we emulate the extensive-margin and the intensive-margin elasticities using the model presented in section 3. Optimally, we would like to solve an optimal social planner problem that plugs the optimal individual's decision shown in equation (3) into the social welfare function, to be maximized subject to the government budget constraint. However, the solution of such a model implies a multiplicity of optimal taxes, which makes it intractable. In fact, this model can be solved analytically only in restricted cases.[7]

Second, in equation 13,[8] Saez (2012) shows that it is possible to change the interpretation of the intensive-margin elasticity, that is associated in his model to switching branches. This equation allows the use of the standard interpretation for the intensive-margin elasticity; i.e., it represents changes in effort (or job partiality). Similarly to equation 13 in Saez (2012), we adopt this interpretation by using ε instead of ζ, where the former is the standard labor intensive-margin elasticity.

[7] One tractable case would be to consider three groups and a Rawlsian planner that maximizes the transfer to the unemployed, as in Strawczynski (2014). However, in the present context this case is not relevant because it excludes ex-ante the optimality of an EITC transfer, which is the focus of this paper.

[8] See Saez (2002), page 1070.

4.2 Simulations Methodology

4.2.1 Simulation population

In the logarithmic case, the simulation was comprised of 28,000 virtual individuals, who were divided into 11 wage groups, corresponding to the following maximum group sizes (which is obtained if all individuals with a given wage level actually work): max(N_1)=6,000, max(N_2)=4,000, max(N_j)=2,000 $\forall j \in [3,4,\ldots,11]$. The (endogenous) number of individuals who are not employed is denoted by N_0 $\left(N_0 = 28{,}000 - \sum_{j=0}^{11} N_j\right)$. In the constant labor elasticity case we performed a different grouping (explained below) and consequently the sample is smaller – 26,000 virtual individuals.

According to the model shown above, each individual decides whether or not to work, and for what portion of his time, according to the government guaranteed income, his individual leisure preferences, wages, and tax rates. As in the Saez model the (endogenous) relative size of each group h_i is defined as $h_i = \frac{N_j}{\sum_{j=0}^{11} N_j}$. It thus follows that $\sum_{j=0}^{11} h_j = 1$.

4.2.2 Choice of wage groups

Wage groups were chosen in accordance with the estimated wage distribution in Israel in 2012 – which was computed from the Israeli CBS' 2012 Expenditures & Income survey. Employed individuals in the survey were divided (in ascending order) into 14 groups of equal size, and the average wage for each of these groups was then computed. The combined average wage for the 3 bottom groups corresponds to W1; the combined average wage for groups 4-5 corresponds to W2; the average wages of groups 6-14 correspond (respectively) to W3-W11.

In the constant labor elasticity case the inexistence of income effects implies that the choice of q makes the difference between labor market participating and non-participating individuals. In order to have a realistic range for the EITC we re-arranged the groups so as to allow non-participation at the range between 2000 and 4300 NIS, as compared to 0-4500 NIS in the logarithmic case. Roughly this new arrangement implies that working groups 1 remains alone, and groups 2 until 6 were set together as W2, while 6 until 14 correspond to W3-W11.

4.2.3 Range of leisure preferences α_i in each wage group

We assume that individuals in each (potential) wage group w_j vary in their leisure preferences, α_i. This means that in each group some individuals are more leisure-loving than others. For simplicity, we assume that α_i is distributed uniformly in each group (but the distribution range can differ in different groups). In the simulations we assume that for (potential) wage groups $w_3 - w_{11}$, the middle, and the higher income groups, $\alpha_i \sim [0,0.5]$. For the lower income groups, w_1, w_2 we initially assume that $\alpha_i \sim [0.5,1]$, and then introduce several sensitivity analyses, in which the α_i range of these groups gradually shifts to a less leisure-loving composition: $\alpha_i \sim [0.1,0.9]$. This sensitivity analysis is designed to imitate a learning process, in which low income individuals gradually become less leisure-loving and more inclined to work.

4.2.4 The government's redistributive tastes

As in the Saez Model, the function $g(\cdot)$ is taken as exogenous and reflects the absolute redistributive tastes of the government. $g_j = \frac{1}{0.79 \cdot {w_j}^v}$, where v is an exogenous parameter that represents the magnitude of the government's redistributive tastes. Saez (2002) multiplies the welfare weights (that appear in the denominator) by the shadow price of public funds, according to a simulation using US data. In our case, we use the share of funds available to the government from every dollar (or Shekel) collected in taxes (i.e. collection costs are 21 cents for every dollar); thus, we multiply by 0.79, which in our case, serves as an estimate of the shadow price of government intervention. In the simulations we use three values for v: 0.15, 0.2 and 0.25.

4.2.4 Level of guaranteed income

As in Saez (2002), the level of guaranteed income is determined endogenously, subject to the budget constraint. For this purpose we used Israeli data for 2012, by looking at the direct tax revenues in Israel, including the income tax, the corporate tax and the capital tax. Like Saez, we assume that the government wants to collect the same amount that is actually collected with the income tax (state and federal) net of redistribution done with the earned income tax credit, and other cash transfers. Thus, we also excluded the National insurance institute tax revenues. The more taxes are collected, the higher is the level of guaranteed income. The level of guaranteed income therefore depends on the (optimal) tax scheme that is in place. However, as we shall demonstrate, when income effects are factored in, the optimal tax scheme also depends on the level of guaranteed income (a two way relationship).

4.2.5 The Extensive elasticity

Unlike in Saez (2002), the extensive elasticity in our model is endogenous, as income effects are factored in. The extensive elasticity η_i is defined in our model as the ratio between the percentage change in the size of a group N_i given a one percent change in w_i. For the purpose of the simulations at the logarithmic case, and given that this is a realistic estimate that produces stable results, we plugged in a 15 percent change in income which roughly corresponds to the optimal EITC obtained in the simulations. Recall that in this case the individual's labor decision depends on the ratio between guaranteed unemployed income and wages, $\frac{T_0}{w_i}$, as well as on the individual's leisure preferences α_i, as demonstrated in equation (4) $l_i = 1 - \alpha\left(1 + \frac{T_0}{\beta_j w_j}\right)$. Deriving (4) with respect to w_i provides better insight regarding the factors that determine the magnitude of the (endogenous) extensive elasticity: $\frac{\partial l_i}{\partial w_j} = \frac{\alpha_i T_0}{\beta_i {w_j}^2}$. Thus the magnitude of the endogenous extensive elasticity increases with T_0 and α_i and diminishes with w_j. In other words, people with low wages, high leisure preferences, and high levels of guaranteed income, have the highest participation elasticity (provided that they are close enough to entry wages). Note that when the average α in a group is high, a rise in the level of guaranteed income T_0 rises, the extensive elasticity η_i goes up due to the rise in the $\frac{T_0}{\beta_i w_i}$ ratio. But since individuals in each wage group vary in their leisure preferences (within the group specified α range), when T_0 rises leisure-loving individuals leave the workforce, and the entry-level α_i drops (i.e. only workers with lower leisure preferences work), and this slightly offsets the rise in η_j.

In the constant labor supply elasticity case there are no income effects and participation depends on the choice of q. Since we assume different elaticities for the low and high income groups, we choose accordingly two different levels for q (q_H and q_L).

4.2.6 The intensive elasticity

Endogenous intensive elasticity: Similar to the extensive margin case, the intensive elasticity in our model is endogenous, as income effects are factored in. For a given wage group N_i the intensive elasticity ε_j is defined in our model as the ratio between the percentage change in the average income from work in a given group $\overline{l_i}w_j$ given a one percent change in w_j. For consistency we also used here a 15 percent change in income. It is worth stressing that changes in this number do not produce a substantial change in both extensive and intensive elasticities.

As in the case of the extensive margin, the individual's labor decision is defined by equation (4) $l_i = 1 - \alpha\left(1 + \frac{T_0}{\beta_j w_j}\right)$. And as noted, deriving (4) with respect to w_i yields $\frac{\partial l_i}{\partial w_i} = \frac{\alpha_i T_0}{\beta_i {w_i}^2}$. Thus the magnitude of the endogenous intensive elasticity increases with T_0 and α_i and diminishes with w_j. In other words, people with low wages, high leisure preferences, and high levels of guaranteed income, have the highest intensive elasticity (provided that they work). Note that when the average α in a group is high, a rise in the level of guaranteed income T_0, induces a significant rise in the intensive elasticity ε_j, due to the higher $\frac{T_0}{\beta_i w_i}$ ratio, but leisure-loving individuals leave the workforce, and the entry-level's α_i drops (i.e. only workers with lower leisure preferences work), and this slightly offsets the rise in ε_j. However, when the average α is low, a rise in T_0 induces only a small decrease in the average job partiality in each group: the decline in job partiality of the less leisure loving workers who remain in the workforce is offset by the fact that the workers with lower job partiality leave the workforce altogether – and by doing so they improve the average.

Exogenous intensive elasticity: In order to obtain a better understanding of the mechanism that determines the optimal tax scheme in a fully endogenous model, we also run simulations with a semi-endogenous model, in which the extensive elasticity η_j is endogenous, but the intensive elasticity ε_j is exogenous. Since we are interested in the scenarios which yield EITC for the low income groups (w_1, w_2), we use for these groups the exogenous ε_j value used in Saez's simulations, i.e., $\varepsilon_j = 0$, that yielded the highest rates of EITC . For the higher income groups $(w_3 - w_{11})$, we use the two ε_j values used by Saez: $\varepsilon_j = 0.25, \varepsilon_j = 0.5$. The use of a higher exogenous elasticity for high-income individuals relatively to low-income ones is in line with the empirical findings of Gruber and Saez (2002).

Computation of average job partiality when ε_j is exogenous: It is important to note that when exogenous intensive elasticity is assumed, the average job partiality in the logarithmic case is computed differently from the fully endogenous case. While in the fully endogenous case, the average job partiality is derived directly from the virtual individuals' labor choices, given the tax rate and the level of guaranteed income; in the semi-endogenous case, the average job partiality is computed in two stages. In the first stage, only income effects are factored in (i.e. only the guaranteed income affects job partiallity), and the before-tax average job partiality is computed. This first-stage average job partiality is then multiplied by $(1 - t_j \varepsilon_j)$. This means, for example, that a 30% marginal tax rate and an exogenous intensive elasticity of 0.5, reduce the average job partiality by 15%. Thus the average after-tax job partiality would be 85% of the before-tax job-partiality. It is important to note that these differences in the manner of computation of the average job partiality also affect the (computed) sum of tax revenues in each of these scenarios.

4.3 Results

4.3.1 Logarithmic utility function

In Table 1 we show the simulation results for the case in which utility is logarithmic, and the intensive margin elasticity is exogenous: ε_{low}=0, $\varepsilon_{\text{high}}$=0.25. This case is based on the benchmark assumption concerning the funds used for public good finance. Three sensitivity analyses, concerning the starting value of α and the budget constraint[9], are shown in tables B.1, B.2 and B.3 in Appendix B.

Two interesting results arise from Table 1. First, the optimal EITC starts from high values, 8.5 percent, but it vanishes as the income inequality aversion goes up (i.e., higher v values). For a medium value of income inequality aversion the optimal EITC goes down to 2.2 percent, and it turns to a tax for v=0.25. This result is similar to the one obtained by Saez: for a liberal government ($g_0 > g_1$), the higher is the inequality aversion, the higher is the transfer for the unemployed which implies an optimal negative income tax as opposed to an EITC. Second, as the range of α increases, the extensive margins of the working poor are reduced, causing a decrease of the optimal EITC. This result is new and has an important implication: if the policy maker aims at increasing participation by using an EITC, the more successful this policy is, causing a persistent increase in participation which reduces long-run labor aversion, the lower is the EITC transfer in the long-run. Similar results, which include an optimal EITC that is reduced (and even turning into a tax) as long as inequality aversion goes up, and as long as the range for α increases, can be seen at appendix B for different values of the budget constraint and the starting α, in tables B.1, B.2 and B.3. Note that a lower amount used for the public good (20,000 instead of 25,050 as in Table 1) implies a higher amount available for transfers, which implies that the transfer that is given to the unemployed is higher, reducing the optimal EITC.

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[9] In the simulations the benchmark figure for the public good (25,050), reflects a transformation from annual direct tax revenues in Israel, into monthly terms, as used in the simulation. Thus the tax annual revenue figure of 95.15 billion NIS was divided by (12*121.3*2609.9), where 12 is the number of months in a year, 121.3 is the ratio between the Israeli 2012 workforce and the simulation population, and 2609.9 is the actual monthly wage of the bottom wage group (which in the simulations was normalized to 1).

Table 1: Optimal EITC with a 0.25 intensive-margin elasticity

(Public Good=25,050, ε_{low}=0, $\varepsilon_{\text{high}}$=0.25, lowest α_i for low incomes = 1)

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	6700-40000	0-4500	4500-10000	6700-40000	0-4500	4500-10000	6700-40000
α_i ~ U(1,0.5)	Average tax rate	-8.5%	54.4%	58.8%	-2.2%	58.4%	63.9%	3.8%	61.7%	67.7%
	Average m.t. rate	-8.5%	83.4%	53.8%	-2.2%	86.8%	60.1%	3.8%	89.0%	64.7%
	avg. job partiality	16.7%	57.9%	71.3%	14.3%	57.4%	69.9%	12.3%	56.9%	68.7%
	normalized partiality	29.6%	103.0%	126.8%	25.5%	102.1%	124.3%	21.8%	101.2%	122.1%
	h	10.71%	36%	36%	8.62%	34%	36%	6.98%	33%	36%
	avg. η	0.937	0.086	-	1.202	0.088	-	1.433	0.083	-
	Non-Employment %	17.9%			21.4%			24.1%		
	Guaranteed income (% of lowest income)	36.2%			43.6%			49.0%		
α_i ~ U(1,0.4)	Average tax rate	-8.3%	54.1%	58.7%	-1.9%	58.2%	63.9%	4.1%	61.5%	67.6%
	Average m.t. rate	-8.3%	83.2%	53.7%	-1.9%	86.6%	60.0%	4.1%	88.9%	64.5%
	avg. job partiality	23.2%	58.1%	71.3%	21.3%	57.1%	69.9%	19.7%	56.2%	68.6%
	normalized partiality	41.3%	103.3%	126.7%	37.9%	101.6%	124.2%	35.0%	99.8%	121.9%
	h	12.41%	37%	36%	10.64%	36%	36%	9.26%	35%	36%
	avg. η	0.662	0.076	-	0.805	0.080	-	0.916	0.081	-
	Non-Employment %	15.0%			18.0%			20.3%		
	Guaranteed income (% of lowest income)	36.6%			44.1%			49.6%		
α_i ~ U(1,0.3)	Average tax rate	-8.2%	53.9%	58.6%	-1.8%	57.9%	63.8%	4.4%	61.3%	67.6%
	Average m.t. rate	-8.2%	83.1%	53.6%	-1.8%	86.5%	59.9%	4.4%	88.8%	64.4%
	avg. job partiality	29.9%	58.9%	71.2%	28.4%	57.6%	69.8%	27.1%	56.4%	68.5%
	normalized partiality	53.1%	104.7%	126.6%	50.5%	102.5%	124.1%	48.2%	100.3%	121.8%
	h	13.63%	38%	36%	12.09%	37%	36%	10.88%	36%	36%
	avg. η	0.516	0.067	-	0.610	0.073	-	0.677	0.074	-
	Non-Employment %	13.0%			15.6%			17.6%		
	Guaranteed income (% of lowest income)	37.0%			44.7%			50.3%		
α_i ~ U(1,0.2)	Average tax rate	-7.9%	53.7%	58.6%	-1.5%	57.7%	63.7%	4.7%	61.1%	67.6%
	Average m.t. rate	-7.9%	83.0%	53.5%	-1.5%	86.4%	59.8%	4.7%	88.7%	64.3%
	avg. job partiality	36.5%	60.0%	71.2%	35.5%	58.6%	69.7%	34.6%	57.3%	68.4%
	normalized partiality	64.9%	106.7%	126.5%	63.2%	104.3%	124.0%	61.6%	101.8%	121.6%
	h	14.51%	38%	36%	13.15%	37%	36%	12.08%	37%	36%
	avg. η	0.424	0.060	-	0.492	0.066	-	0.539	0.068	-
	Non-Employment %	11.5%			13.8%			15.6%		
	Guaranteed income (% of lowest income)	37.6%			45.4%			51.1%		

In Table 2 the intensive-margin elasticity is 0.5 (instead of 0.25 in Table 1), which implies that the taxes must be lower, since high-income individuals reduce labor with a higher intensity as a reaction to the imposition of taxes. Consequently, the optimal EITC is lower, since lower resources are available for redistribution. Note that despite this fact the two main results obtained above are still valid: there is an optimal EITC for v=0.15 and v=0.2, and it goes down as the range for α increases. While these results remain similar for lower amounts of the public good when the starting α is either 1 or 0.9 (Table B.5 and B.6), in the case of a lower starting value of α (0.9 instead of 1) with the benchmark level of the public good (25,050), an optimal EITC is obtained only for v=0.15; for the other two values of v (v=0.2 and v=0.25) it is optimal to impose a tax on the working poor (Table B.4).

An interesting result is obtained when we allow the intensive-margin elasticity to be endogenous – an assumption that departs from Saez's simulations. In this case, which is shown in Table 3, the pattern of the optimal EITC is the opposite: as the working poor increases his labor aversion, represented by an increase in the range of α, *the optimal EITC increases*. This pattern is related to the interaction between the public good budget requirement and the other variables: it was obtained when the resources used for the public good are equal to 40,000; i.e., there are limited resources for redistribution, which

Table 2 : Optimal EITC with a 0.5 intensive-margin elasticity

Public Good=25,050, ε_{low}=0, $\varepsilon_{\text{high}}$=0.5, lowest α_i for low incomes = 1

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	6700-40000	0-4500	4500-10000	6700-40000	0-4500	4500-10000	6700-40000
α_i ~ U(1,0.5)	Average tax rate	-7.8%	49.0%	46.4%	-2.6%	53.0%	52.0%	2.5%	56.5%	56.4%
	Average m.t. rate	-7.8%	72.8%	36.8%	-2.6%	77.3%	43.0%	2.5%	80.5%	47.8%
	avg. job partiality	23.3%	58.4%	74.4%	21.8%	58.4%	73.8%	20.6%	58.4%	73.3%
	normalized partiality	41.5%	103.9%	132.3%	38.8%	103.9%	131.3%	36.7%	103.8%	130.3%
	h	18.75%	41%	36%	16.63%	40%	36%	15.05%	39%	36%
	avg. η	0.169	0.026	-	0.304	0.042	-	0.401	0.052	-
	Non-Employment %	4.5%			8.0%			10.6%		
	Guaranteed income (% of lowest income)	7.2%			13.0%			17.0%		
α_i~ U(1,0.4)	Average tax rate	-7.9%	48.8%	46.4%	-2.8%	52.8%	52.0%	2.7%	56.4%	56.3%
	Average m.t. rate	-7.9%	72.8%	36.8%	-2.8%	77.2%	43.0%	2.7%	80.4%	47.7%
	avg. job partiality	28.6%	59.8%	74.4%	27.4%	59.6%	73.8%	26.4%	59.3%	73.2%
	normalized partiality	50.8%	106.4%	132.3%	48.7%	105.9%	131.2%	46.8%	105.4%	130.2%
	h	19.05%	41%	36%	17.29%	40%	36%	15.92%	39%	36%
	avg. η	0.146	0.023	-	0.251	0.037	-	0.326	0.045	-
	Non-Employment %	4.0%			6.9%			9.2%		
	Guaranteed income (% of lowest income)	7.7%			13.5%			17.8%		
α_i ~ U(1,0.3)	Average tax rate	-7.9%	48.8%	46.4%	-2.5%	52.8%	52.0%	2.9%	56.3%	56.3%
	Average m.t. rate	-7.9%	72.8%	36.8%	-2.5%	77.2%	42.9%	2.9%	80.4%	47.7%
	avg. job partiality	33.9%	61.3%	74.4%	32.9%	60.9%	73.7%	32.1%	60.4%	73.2%
	normalized partiality	60.2%	109.0%	132.2%	58.5%	108.2%	131.1%	57.2%	107.5%	130.1%
	h	19.26%	41%	36%	17.71%	40%	36%	16.53%	40%	36%
	avg. η	0.130	0.021	-	0.217	0.033	-	0.277	0.041	-
	Non-Employment %	3.6%			6.2%			8.2%		
	Guaranteed income (% of lowest income)	8.2%			14.2%			18.5%		
α_i ~ U(1,0.2)	Average tax rate	-7.7%	48.8%	46.4%	-2.3%	52.8%	52.0%	2.8%	56.1%	56.3%
	Average m.t. rate	-7.7%	72.8%	36.8%	-2.3%	77.2%	42.9%	2.8%	80.3%	47.7%
	avg. job partiality	39.2%	62.8%	74.3%	38.6%	62.3%	73.7%	38.0%	61.8%	73.1%
	normalized partiality	69.7%	111.7%	132.1%	68.5%	110.8%	131.0%	67.6%	109.9%	130.0%
	h	19.42%	42%	36%	18.04%	41%	36%	17.01%	40%	36%
	avg. η	0.120	0.019	-	0.193	0.030	-	0.241	0.037	-
	Non-Employment %	3.4%			5.7%			7.4%		
	Guaranteed income (% of lowest income)	8.7%			14.9%			19.2%		

Table 3: Optimal EITC with an endogenous intensive-margin elasticity

(Public Good=40,000, lowest α_i for low incomes = 0.9)

Distribution of αi in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	6700-40000	0-4500	4500-10000	6700-40000	0-4500	4500-10000	6700-40000
αi ~ U(0.9,0.4)	Average tax rate	-1.6%	47.4%	76.9%	0.5%	50.7%	78.6%	2.6%	53.5%	79.9%
	Average m.t. rate	-1.6%	79.9%	95.9%	0.5%	82.9%	96.5%	2.6%	85.2%	97.0%
	avg. job partiality	24.0%	56.8%	70.5%	23.2%	56.5%	69.6%	22.6%	56.2%	68.9%
	normalized partiality	42.6%	100.9%	125.3%	41.3%	100.4%	123.8%	40.2%	99.8%	122.5%
	h	15.77%	41%	36%	14.88%	40%	36%	14.15%	39%	36%
	avg. η	0.557	0.085	-	0.610	0.089	-	0.653	0.092	-
	avg. ε	0.302	0.070	0.020	0.341	0.077	0.022	0.371	0.081	0.023
	Non-Employment %	7.8%			9.4%			10.7%		
	Guaranted income (% of lowest income)	30.7%			33.7%			36.0%		
αi ~ U(0.9,0.3)	Average tax rate	-3.4%	49.3%	77.7%	-1.2%	52.6%	79.4%	1.1%	55.3%	80.7%
	Average m.t. rate	-3.4%	83.1%	95.6%	-1.2%	86.0%	96.3%	1.1%	88.2%	96.8%
	avg. job partiality	30.2%	58.1%	70.0%	29.7%	57.6%	69.1%	29.3%	57.2%	68.3%
	normalized partiality	53.8%	103.2%	124.4%	52.8%	102.4%	122.8%	52.0%	101.7%	121.5%
	h	16.40%	41%	36%	15.69%	40%	36%	15.13%	40%	36%
	avg. η	0.463	0.074	-	0.499	0.077	-	0.525	0.079	-
	avg. ε	0.192	0.059	0.021	0.212	0.064	0.023	0.227	0.068	0.025
	Non-Employment %	7.2%			8.5%			9.5%		
	Guaranted income (% of lowest income)	32.8%			35.7%			37.8%		
αi ~ U(0.9,0.2)	Average tax rate	-6.1%	51.3%	78.4%	-3.9%	54.5%	80.1%	-1.0%	57.0%	81.4%
	Average m.t. rate	-6.1%	86.5%	95.4%	-3.9%	89.3%	96.2%	-1.0%	91.1%	96.7%
	avg. job partiality	36.7%	59.4%	69.5%	36.4%	58.9%	68.6%	36.1%	58.4%	67.8%
	normalized partiality	65.3%	105.6%	123.6%	64.7%	104.6%	121.9%	64.2%	103.8%	120.5%
	h	16.94%	41%	36%	16.37%	40%	36%	15.90%	40%	36%
	avg. η	0.397	0.066	-	0.422	0.069	-	0.439	0.070	-
	avg. ε	0.112	0.050	0.023	0.122	0.054	0.024	0.129	0.057	0.026
	Non-Employment %	6.7%			7.8%			8.6%		
	Guaranted income (% of lowest income)	34.7%			37.5%			39.4%		
αi ~ U(0.9,0.1)	Average tax rate	-10.1%	53.2%	79.1%	-7.4%	56.1%	80.8%	-3.8%	58.3%	82.0%
	Average m.t. rate	-10.1%	90.4%	95.2%	-7.4%	92.7%	96.0%	-3.8%	94.0%	96.5%
	avg. job partiality	43.3%	60.8%	69.0%	43.2%	60.2%	68.1%	43.0%	59.7%	67.3%
	normalized partiality	77.1%	108.1%	122.7%	76.8%	107.1%	121.0%	76.5%	106.2%	119.6%
	h	17.44%	41%	36%	16.98%	40%	36%	16.56%	40%	36%
	avg. η	0.348	0.059	-	0.364	0.062	-	0.377	0.063	-
	avg. ε	0.049	0.044	0.024	0.054	0.046	0.025	0.056	0.049	0.027
	Non-Employment %	6.3%			7.1%			7.9%		
	Guaranted income (% of lowest income)	36.5%			39.0%			40.8%		

implies a low transfer to the unemployed (T_0). According to our simulations, a low transfer to the unemployed increases the plausibility of an EITC.[10] By looking at the different scenarios of Table 3 it is possible to see that the intensive-margin elasticity declines as the ranges for α increase: i.e., the average intensive-margin demand for labor of the first and second groups becomes more rigid (ε_1 and ε_2 are low).[11] By looking at equation 8, it is clear that a reduction of the intensive-margin second-group elasticity increases the optimal EITC. The intuition is the following: as the demand for labor of the second group becomes more rigid, it is optimal for the social planner to give an EITC to the first group, which enhances the probability that this group participates at the labor market.

One of the drawbacks of the results above is that the cases of exogenous intensive elasticity are not aligned to the individuals elasticities because under a logarithmic utility function the labor elasticity is not constant. In order to deal with this issue we turn to the constant labor elasticity case.

4.3.2 Constant labor supply elasticity

The simulations are based on equation 11. Interestingly, as shown in tables 4 to 7, this case derived on an increasing EITC as a reaction to learning, but the mechanism explaining the result is different. While in the logarithmic case the increase in EITC was related to the elasticity of the second group, in this case it is related to the increase in the size of the first group (h_1), that interacts in a particular way with ε_1 and η_1. Since the labor supply in this case is very sensitive, the reduction of labor aversion implies that a higher portion of individuals enter the labor market, in an increasing pace and from a low level.

[10] In our simulations this case is characterized by low values of the intensive-margin elasticities of high income individuals, which implies a high level of tax revenues – allowing for a higher allocation for both the public good and redistribution.

[11] A reduction in labor aversion implies that the average working poor's α decreases, causing a decline in his/her intensive-margin elasticity. At the same time working poor individuals participate more at the labor market. This process implies that leisure-loving individuals account for a smaller share of those who work, and have a smaller effect on the average working poor's intensive-margin elasticity.

Table 4

(Public Good=3,650, ε_{low}=0.05, $\varepsilon_{\text{high}}$=0.25, lowest α_i for low incomes = 0.9)

Distribution of αi in low income groups		v=0.15			v=0.30			v=0.45		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		2000-4300	4300-10000	10000-40000	2000-4300	4300-10000	10000-40000	2000-4300	4300-10000	10000-40000
αi ~ U(0.9,0.4)	Average tax rate	-2.7%	23.8%	45.5%	-4.9%	31.6%	57.5%	-5.9%	37.0%	63.7%
	Average m.t. rate	-2.7%	54.1%	51.0%	-4.9%	69.8%	65.5%	-5.9%	78.8%	72.3%
	avg. job partiality	48.3%	88.5%	100.0%	50.4%	87.1%	100.0%	51.3%	85.9%	100.0%
	normalized partiality	85.8%	157.4%	177.8%	89.7%	154.8%	177.8%	91.3%	152.7%	177.8%
	h	5.49%	39%	38%	5.89%	31%	36%	6.08%	26%	33%
	avg. η	3.689	0.882	-	3.689	0.926	-	3.689	0.945	-
	avg. ε	0.016	0.181	0.250	0.016	0.177	0.250	0.016	0.175	0.250
	Non-Employment %	17.4%			26.3%			34.7%		
	Guaranted income (% of lowest income)	31.6%			47.2%			48.3%		
αi ~ U(0.9,0.3)	Average tax rate	-4.5%	24.0%	45.7%	-7.8%	31.9%	57.8%	-8.9%	36.9%	64.0%
	Average m.t. rate	-4.5%	55.7%	51.0%	-7.8%	72.3%	65.5%	-8.9%	81.2%	72.3%
	avg. job partiality	67.3%	90.5%	100.0%	68.1%	89.4%	100.0%	68.4%	88.5%	100.0%
	normalized partiality	119.7%	160.9%	177.8%	121.1%	158.9%	177.8%	121.6%	157.4%	177.8%
	h	7.41%	38%	38%	7.92%	31%	36%	8.09%	27%	32%
	avg. η	2.284	0.784	-	2.284	0.831	-	2.284	0.857	-
	avg. ε	0.022	0.180	0.250	0.022	0.174	0.250	0.022	0.171	0.250
	Non-Employment %	15.6%			24.6%			32.7%		
	Guaranted income (% of lowest income)	32.2%			47.3%			48.2%		
αi ~ U(0.9,0.2)	Average tax rate	-6.1%	24.3%	45.9%	-10.1%	32.1%	58.0%	-10.8%	36.7%	64.1%
	Average m.t. rate	-6.1%	57.2%	50.9%	-10.1%	74.3%	65.5%	-10.8%	82.7%	72.3%
	avg. job partiality	75.8%	91.9%	100.0%	76.1%	91.0%	100.0%	76.1%	90.4%	100.0%
	normalized partiality	134.8%	163.4%	177.8%	135.2%	161.8%	177.8%	135.3%	160.7%	177.8%
	h	8.76%	38%	38%	9.28%	31%	36%	9.37%	27%	32%
	avg. η	1.641	0.710	-	1.641	0.755	-	1.641	0.783	-
	avg. ε	0.026	0.179	0.250	0.026	0.172	0.250	0.026	0.168	0.250
	Non-Employment %	14.5%			23.5%			31.3%		
	Guaranted income (% of lowest income)	32.6%			47.4%			48.0%		
αi ~ U(0.9,0.1)	Average tax rate	-7.7%	24.5%	46.0%	-12.1%	32.1%	58.1%	-12.3%	36.4%	64.2%
	Average m.t. rate	-7.7%	58.5%	50.9%	-12.1%	75.7%	65.4%	-12.3%	83.7%	72.3%
	avg. job partiality	80.7%	92.9%	100.0%	80.6%	92.2%	100.0%	80.6%	91.7%	100.0%
	normalized partiality	143.4%	165.2%	177.8%	143.3%	163.9%	177.8%	143.3%	163.1%	177.8%
	h	9.77%	38%	38%	10.27%	31%	36%	10.30%	27%	32%
	avg. η	1.254	0.660	-	1.254	0.703	-	1.254	0.730	-
	avg. ε	0.029	0.178	0.250	0.029	0.171	0.250	0.029	0.165	0.250
	Non-Employment %	13.6%			22.4%			30.0%		
	Guaranted income (% of lowest income)	32.8%			47.3%			47.9%		

Table 5

(Public Good=3,650, ε_{low}=0.05, $\varepsilon_{\text{high}}$=0.25, lowest α_i for low incomes = 1)

Distribution of αi in low income groups		v=0.15			v=0.30			v=0.45		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		2000-4300	4300-10000	10000-40000	2000-4300	4300-10000	10000-40000	2000-4300	4300-10000	10000-40000
αi ~ U(0.9,0.4)	Average tax rate	-0.6%	26.5%	46.4%	-0.7%	35.9%	58.7%	0.0%	42.6%	65.2%
	Average m.t. rate	-0.6%	55.1%	51.4%	-0.7%	70.6%	65.9%	0.0%	79.5%	72.6%
	avg. job partiality	4.9%	87.3%	100.0%	5.0%	85.1%	100.0%	4.6%	82.9%	100.0%
	normalized partiality	8.8%	155.2%	177.8%	8.9%	151.3%	177.8%	8.1%	147.3%	177.8%
	h	2.03%	34%	38%	2.05%	26%	36%	1.92%	20%	31%
	avg. η	9.581	0.926	-	9.581	0.946	-	9.581	0.927	-
	avg. ε	0.006	0.190	0.250	0.006	0.189	0.250	0.006	0.192	0.250
	Non-Employment %	25.3%			36.4%			46.5%		
	Guaranted income (% of lowest income)	33.4%			47.3%			46.3%		
αi ~ U(0.9,0.3)	Average tax rate	-2.4%	26.4%	46.5%	-3.8%	35.7%	59.0%	-3.2%	41.8%	65.5%
	Average m.t. rate	-2.4%	56.7%	51.3%	-3.8%	73.2%	65.8%	-3.2%	82.1%	72.6%
	avg. job partiality	48.0%	89.7%	100.0%	49.4%	88.1%	100.0%	48.8%	86.6%	100.0%
	normalized partiality	85.3%	159.4%	177.8%	87.8%	156.6%	177.8%	86.7%	153.9%	177.8%
	h	4.53%	35%	38%	4.75%	27%	35%	4.65%	21%	31%
	avg. η	3.598	0.823	-	3.598	0.862	-	3.598	0.878	-
	avg. ε	0.014	0.187	0.250	0.014	0.183	0.250	0.014	0.182	0.250
	Non-Employment %	22.4%			33.4%			43.2%		
	Guaranted income (% of lowest income)	33.9%			47.7%			46.4%		
αi ~ U(0.9,0.2)	Average tax rate	-4.0%	26.6%	46.7%	-6.1%	35.6%	59.2%	-5.0%	41.3%	65.6%
	Average m.t. rate	-4.0%	58.1%	51.2%	-6.1%	75.2%	65.7%	-5.0%	83.7%	72.5%
	avg. job partiality	67.2%	91.3%	100.0%	67.7%	90.1%	100.0%	67.5%	89.1%	100.0%
	normalized partiality	119.5%	162.3%	177.8%	120.4%	160.2%	177.8%	119.9%	158.3%	177.8%
	h	6.30%	35%	38%	6.56%	27%	35%	6.42%	22%	31%
	avg. η	2.265	0.743	-	2.265	0.789	-	2.265	0.816	-
	avg. ε	0.019	0.185	0.250	0.019	0.179	0.250	0.019	0.175	0.250
	Non-Employment %	20.4%			31.3%			40.8%		
	Guaranted income (% of lowest income)	34.4%			47.9%			46.5%		
αi ~ U(0.9,0.1)	Average tax rate	-5.7%	26.6%	46.8%	-8.1%	35.4%	59.3%	-6.4%	40.7%	65.6%
	Average m.t. rate	-5.7%	59.4%	51.2%	-8.1%	76.7%	65.7%	-6.4%	84.5%	72.5%
	avg. job partiality	75.8%	92.5%	100.0%	76.0%	91.5%	100.0%	75.9%	90.8%	100.0%
	normalized partiality	134.8%	164.5%	177.8%	135.0%	162.7%	177.8%	134.9%	161.4%	177.8%
	h	7.62%	35%	38%	7.89%	27%	35%	7.70%	23%	31%
	avg. η	1.600	0.688	-	1.600	0.736	-	1.600	0.767	-
	avg. ε	0.023	0.183	0.250	0.023	0.175	0.250	0.023	0.170	0.250
	Non-Employment %	18.9%			29.6%			38.7%		
	Guaranted income (% of lowest income)	34.7%			48.0%			46.7%		

Table 6

(Public good=3,650, ε_{low}=0.05, $\varepsilon_{\text{high}}$=0.5, lowest α_i for low incomes = 0.9**)**

Distribution of αi in low income groups		v=0.15 w1 2000-4300	v=0.15 w2-w6 4300-10000	v=0.15 w7-w11 10000-40000	v=0.30 w1 2000-4300	v=0.30 w2-w6 4300-10000	v=0.30 w7-w11 10000-40000	v=0.45 w1 2000-4300	v=0.45 w2-w6 4300-10000	v=0.45 w7-w11 10000-40000
αi ~ U(0.9,0.4)	Average tax rate	-2.7%	19.2%	33.4%	-4.9%	28.7%	46.5%	-5.9%	34.7%	53.8%
	Average m.t. rate	-2.7%	42.6%	34.7%	-4.9%	60.6%	49.3%	-5.9%	71.4%	57.2%
	avg. job partiality	48.3%	89.3%	100.0%	50.4%	88.3%	100.0%	51.3%	86.8%	100.0%
	normalized partiality	85.8%	158.8%	177.8%	89.7%	157.0%	177.8%	91.3%	154.4%	177.8%
	h	5.49%	42%	38%	5.89%	35%	38%	6.08%	28%	37%
	avg. η	3.689	0.600	-	3.689	0.621	-	3.689	0.657	-
	avg. ε	0.016	0.356	0.500	0.016	0.352	0.500	0.016	0.343	0.500
	Non-Employment %	14.5%			20.9%			28.2%		
	Guaranted income (% of lowest income)	1.4%			18.6%			23.5%		
αi ~ U(0.9,0.3)	Average tax rate	-4.5%	19.6%	33.6%	-7.8%	29.1%	46.7%	-8.9%	34.7%	54.1%
	Average m.t. rate	-4.5%	44.2%	34.7%	-7.8%	63.1%	49.2%	-8.9%	73.8%	57.2%
	avg. job partiality	67.3%	91.2%	100.0%	68.1%	90.4%	100.0%	68.4%	89.3%	100.0%
	normalized partiality	119.7%	162.1%	177.8%	121.1%	160.7%	177.8%	121.6%	158.7%	177.8%
	h	7.41%	41%	38%	7.92%	35%	38%	8.09%	29%	37%
	avg. η	2.284	0.511	-	2.284	0.541	-	2.284	0.585	-
	avg. ε	0.022	0.355	0.500	0.022	0.346	0.500	0.022	0.333	0.500
	Non-Employment %	12.6%			19.1%			26.2%		
	Guaranted income (% of lowest income)	2.1%			19.0%			23.7%		
αi ~ U(0.9,0.2)	Average tax rate	-6.1%	20.0%	33.8%	-10.1%	29.4%	46.9%	-10.8%	34.7%	54.2%
	Average m.t. rate	-6.1%	45.7%	34.7%	-10.1%	65.1%	49.2%	-10.8%	75.3%	57.1%
	avg. job partiality	75.8%	92.5%	100.0%	76.1%	91.8%	100.0%	76.1%	91.0%	100.0%
	normalized partiality	134.8%	164.5%	177.8%	135.2%	163.2%	177.8%	135.3%	161.7%	177.8%
	h	8.76%	41%	38%	9.28%	34%	38%	9.37%	29%	37%
	avg. η	1.641	0.442	-	1.641	0.478	-	1.641	0.523	-
	avg. ε	0.026	0.353	0.500	0.026	0.341	0.500	0.026	0.326	0.500
	Non-Employment %	11.4%			17.9%			24.7%		
	Guaranted income (% of lowest income)	2.6%			19.4%			23.8%		
αi ~ U(0.9,0.1)	Average tax rate	-7.7%	20.3%	33.9%	-12.1%	29.5%	47.0%	-12.3%	34.5%	54.2%
	Average m.t. rate	-7.7%	47.0%	34.6%	-12.1%	66.5%	49.2%	-12.3%	76.2%	57.1%
	avg. job partiality	80.7%	93.5%	100.0%	80.6%	92.9%	100.0%	80.6%	92.2%	100.0%
	normalized partiality	143.4%	166.2%	177.8%	143.3%	165.2%	177.8%	143.3%	164.0%	177.8%
	h	9.77%	41%	38%	10.27%	35%	38%	10.30%	29%	37%
	avg. η	1.254	0.397	-	1.254	0.435	-	1.254	0.478	-
	avg. ε	0.029	0.352	0.500	0.029	0.337	0.500	0.029	0.321	0.500
	Non-Employment %	10.4%			16.8%			23.4%		
	Guaranted income (% of lowest income)	2.9%			19.4%			23.8%		

Table 7 (Public Good=3,650, $\varepsilon_{\mathrm{low}}$=0.05, $\varepsilon_{\mathrm{high}}$=0. 5, lowest α_i for low incomes = 1)

Distribution of αi in low income groups		v=0.15			v=0.30			v=0.45		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		2000-4300	4300-10000	10000-40000	2000-4300	4300-10000	10000-40000	2000-4300	4300-10000	10000-40000
αi ~ U(0.9,0.4)	**Average tax rate**	-0.6%	21.7%	34.4%	-0.7%	32.6%	47.7%	0.0%	39.9%	55.4%
	Average m.t. rate	-0.6%	43.7%	35.1%	-0.7%	61.7%	49.7%	0.0%	72.3%	57.6%
	avg. job partiality	4.9%	88.4%	100.0%	5.0%	86.6%	100.0%	4.6%	84.0%	100.0%
	normalized partiality	8.8%	157.2%	177.8%	8.9%	153.9%	177.8%	8.1%	149.3%	177.8%
	h	2.03%	37%	38%	2.06%	29%	38%	1.92%	22%	36%
	avg. η	9.581	0.610	-	9.581	0.610	-	9.581	0.608	-
	avg. ε	0.006	0.381	0.500	0.006	0.381	0.500	0.006	0.381	0.500
	Non-Employment %	22.1%			30.6%			40.1%		
	Guaranted income (% of lowest income)	3.3%			19.9%			23.0%		
αi ~ U(0.9,0.3)	**Average tax rate**	-2.4%	21.9%	34.5%	-3.8%	32.6%	48.0%	-3.2%	39.4%	55.6%
	Average m.t. rate	-2.4%	45.2%	35.0%	-3.8%	64.2%	49.6%	-3.2%	74.9%	57.5%
	avg. job partiality	48.0%	90.6%	100.0%	49.4%	89.2%	100.0%	48.8%	87.4%	100.0%
	normalized partiality	85.3%	161.1%	177.8%	87.9%	158.6%	177.8%	86.7%	155.4%	177.8%
	h	4.53%	38%	38%	4.75%	29%	38%	4.65%	23%	36%
	avg. η	3.598	0.521	-	3.598	0.550	-	3.598	0.584	-
	avg. ε	0.014	0.374	0.500	0.014	0.367	0.500	0.014	0.359	0.500
	Non-Employment %	19.0%			27.5%			36.8%		
	Guaranted income (% of lowest income)	4.0%			20.6%			23.4%		
αi ~ U(0.9,0.2)	**Average tax rate**	-4.0%	22.1%	34.6%	-6.1%	32.7%	48.2%	-5.0%	39.1%	55.8%
	Average m.t. rate	-4.0%	46.7%	34.9%	-6.1%	66.2%	49.5%	-5.0%	76.4%	57.4%
	avg. job partiality	67.2%	92.1%	100.0%	67.7%	91.0%	100.0%	67.5%	89.7%	100.0%
	normalized partiality	119.5%	163.7%	177.8%	120.4%	161.8%	177.8%	119.9%	159.4%	177.8%
	h	6.29%	38%	38%	6.57%	30%	38%	6.42%	23%	36%
	avg. η	2.265	0.452	-	2.265	0.494	-	2.265	0.542	-
	avg. ε	0.019	0.369	0.500	0.019	0.357	0.500	0.019	0.343	0.500
	Non-Employment %	16.9%			25.4%			34.4%		
	Guaranted income (% of lowest income)	4.6%			21.0%			23.7%		
αi ~ U(0.9,0.1)	**Average tax rate**	-5.6%	22.3%	34.7%	-8.1%	32.6%	48.2%	-6.4%	38.6%	55.7%
	Average m.t. rate	-5.6%	47.9%	34.9%	-8.1%	67.6%	49.4%	-6.4%	77.2%	57.3%
	avg. job partiality	75.8%	93.2%	100.0%	76.0%	92.3%	100.0%	75.9%	91.3%	100.0%
	normalized partiality	134.8%	165.7%	177.8%	135.0%	164.1%	177.8%	134.9%	162.3%	177.8%
	h	7.62%	39%	38%	7.89%	30%	38%	7.70%	24%	36%
	avg. η	1.600	0.407	-	1.600	0.454	-	1.600	0.506	-
	avg. ε	0.023	0.365	0.500	0.023	0.349	0.500	0.023	0.332	0.500
	Non-Employment %	15.3%			23.6%			32.3%		
	Guaranted income (% of lowest income)	4.9%			21.1%			24.0%		

According to the optimal formula, when a high h is multiplied by low extensive and intensive elasticities, the higher is the EITC. Thus, we obtain that the EITC goes up but for a different reason compared to the logarithmic case: the decreasing labor aversion drives the working poor to the labor market, and it is desirable to assure that these workers persistently stay at this market.

5. Summary and conclusions

This paper studies the optimal EITC schedules when the government achieves its long-run policy by reducing the labor aversion of the working poor with the goal of allowing a persistent participation at the labor market. First we show that when the government implements policies aimed at keeping the working poor at the labor market, it achieves a reduction of his labor aversion. Then, we show that a decrease in labor aversion by the working poor implies a transition from an asymmetric density of tastes toward leisure, to a uniform density, in which all individuals tend to have similar tastes concerning labor aversion. Finally, we calculate the optimal EITC transfers that are related to the labor aversion of individuals through their impact on the intensive and extensive margin elasticities of the working poor, as shown by Saez (2002). The main difference between Saez's model and ours is that the elasticities in our case are related to the working poor's participation decision, which in turn is related to his labor aversion tastes and to the level of guaranteed income.

In order to understand the implications of the reduction of labor aversion in the long-run we performed simulations, based on different values of five parameters: public good budget requirements, the intensive-margin elasticities, the starting working poor's labor aversion parameter, working poor's range of labor aversion parameters and government's inequality aversion. In all cases we use endogenous extensive-margin elasticities, coming from our model of heterogenous tastes for leisure.

The simulations show that when the inequality aversion is low, it is optimal to impose an EITC for the working poor. This result is resilient to different amounts of resources spent on the public good, and for different values of the intensive-margin elasticity.

Another interesting result obtained when we emulate participation with a logarithmic utility and using an exogenously given intensive-margin elasticity, is that as the labor aversion goes down, it is optimal to reduce the EITC for the working poor. This is so since in this case the extensive-margin elasticities decline as a reaction to labor aversion, implying a lower desired value for the EITC. However, there are cases in which the opposite result holds: the optimal EITC transfer goes up as long as labor aversion goes down. This result was obtained for: i) an endogenous intensive-margin elasticity under a logarithmic utility; the intuition of this result is that a reduction in labor aversion implies a reduction of the intensive-margin elasticity, which makes attractive for the policy maker to keep the working poor at the labor market, by giving him an EITC transfer; and ii) a constant labor supply elasticity; the intuition in this case is different: it derives from the fact that at the initial stage there is a thin group of working poor individuals that enter the labor market as labor aversion goes down, increasing policy maker's incentive for keeping them at the labor market through a higher EITC.

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Appendix A – Optimal EITC

In this appendix we obtain the optimal EITC shown in equation 8. The optimal taxes according to Saez (2002) are:

A.1) $\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\zeta_i h_i} \cdot \sum_{j=i}^{I} h_j \left[1 - g_j - \eta_j \frac{T_j - T_0}{C_j - C_0}\right]$

We assume now that $\eta_i = 0 \;\forall\; i > 2$. Consequently, we obtain the following formula for the average tax rate, represented by t:

$$\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\zeta_i h_i} \cdot \sum_{j=i}^{I} h_j \left[1 - g_j\right]$$

$$\frac{t_i w_i + T_0 - t_{i-1} w_{i-1} - T_0}{(1 - t_i) w_i + T_0 - (1 - t_{i-1}) w_{i-1} - T_0} = \frac{1}{\zeta_i h_i} \cdot \sum_{j=i}^{I} h_j \left[1 - g_j\right]$$

$$\frac{t_i w_i - t_{i-1} w_{i-1}}{(1 - t_i) w_i - (1 - t_{i-1}) w_{i-1}} = \frac{1}{\zeta_i h_i} \cdot \sum_{j=i}^{I} h_j \left[1 - g_j\right]$$

$$\frac{t_i w_i - t_{i-1} w_{i-1}}{w_i - t_i w_i - w_{i-1} + t_{i-1} w_{i-1}} = \frac{1}{\zeta_i h_i} \cdot \sum_{j=i}^{I} h_j \left[1 - g_j\right]$$

$$\frac{w_i - t_i w_i - w_{i-1} + t_{i-1} w_{i-1}}{t_i w_i - t_{i-1} w_{i-1}} = \frac{\zeta_i h_i}{\sum_{j=i}^{I} h_j \left[1 - g_j\right]}$$

$$\frac{w_i - w_{i-1}}{t_i w_i - t_{i-1} w_{i-1}} = \frac{\zeta_i h_i}{\sum_{j=i}^{I} h_j \left[1 - g_j\right]} + 1$$

$$\frac{w_i - w_{i-1}}{t_i w_i - t_{i-1} w_{i-1}} = \frac{\zeta_i h_i + \sum_{j=i}^{I} h_j \left[1 - g_j\right]}{\sum_{j=i}^{I} h_j \left[1 - g_j\right]}$$

$$\frac{t_i w_i - t_{i-1} w_{i-1}}{w_i - w_{i-1}} = \frac{\sum_{j=i}^{I} h_j \left[1 - g_j\right]}{\zeta_i h_i + \sum_{j=i}^{I} h_j \left[1 - g_j\right]}$$

$$t_i w_i - t_{i-1} w_{i-1} = (w_i - w_{i-1}) \cdot \left[1 - \frac{\zeta_i h_i}{\zeta_i h_i + \sum_{j=i}^{I} h_j \left[1 - g_j\right]}\right]$$

A.2) $t_i = t_{i-1} \frac{w_{i-1}}{w_i} + \frac{(w_i - w_{i-1})}{w_i} \cdot \left[1 - \frac{\zeta_i h_i}{\zeta_i h_i + \sum_{j=i}^{I} h_j [1 - g_j]}\right]$

Our assumption of an endogenous decision about participation at the labor market implies that $\eta_i > 0 \;\; \forall \;\; i < 3$. Thus, we obtain the following formulae.

For $i = 1$:

$$\frac{T_1 - T_0}{C_1 - C_0} = \frac{1}{h_1 \zeta_1} \cdot \left[(g_0 - 1) h_0 - h_1 \eta_1 \cdot \frac{T_1 - T_0}{C_1 - C_0} - h_2 \eta_2 \cdot \frac{T_2 - T_0}{C_2 - C_0}\right]$$

$$\frac{t_1}{1 - t_1} = \frac{1}{h_1 \zeta_1} \cdot \left[(g_0 - 1) h_0 - h_1 \eta_1 \cdot \frac{t_1}{1 - t_1} - h_2 \eta_2 \cdot \frac{t_2}{1 - t_2}\right]$$

$$h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1} = (g_0 - 1) h_0 - h_2 \eta_2 \cdot \frac{t_2}{1 - t_2}$$

$$h_2 \eta_2 \cdot \frac{t_2}{1 - t_2} = (g_0 - 1) h_0 - h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1}$$

$$\frac{t_2}{1 - t_2} = \frac{(g_0 - 1) h_0 - h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1}}{h_2 \eta_2}$$

$$\frac{1}{1 - t_2} = \frac{h_2 \eta_2 + (g_0 - 1) h_0 - h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1}}{h_2 \eta_2}$$

$$1 - t_2 = \frac{h_2 \eta_2}{h_2 \eta_2 + (g_0 - 1) h_0 - h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1}}$$

A.3) $t_2 = 1 - \frac{h_2 \eta_2}{h_2 \eta_2 + (g_0 - 1) h_0 - h_1 (\zeta_1 + \eta_1) \frac{t_1}{1 - t_1}}$

For $i = 2$:

$$\frac{T_2 - T_1}{C_2 - C_1} = \frac{1}{h_2 \zeta_2} \cdot \left[(g_0 - 1) h_0 + (g_1 - 1) h_1 - h_2 \eta_2 \cdot \frac{T_2 - T_0}{C_2 - C_0}\right]$$

$$\frac{t_2 w_2 - t_1 w_1}{(1 - t_2) w_2 - (1 - t_1) w_1} = \frac{\left[(g_0 - 1) h_0 + (g_1 - 1) h_1 - h_2 \eta_2 \cdot \frac{t_2}{1 - t_2}\right]}{h_2 \zeta_2}$$

$$\frac{t_2 w_2 - t_1 w_1}{w_2 - t_2 w_2 - w_1 + t_1 w_1} = \frac{\left[(g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}\right]}{h_2\zeta_2}$$

$$\frac{w_2 - t_2 w_2 - w_1 + t_1 w_1}{t_2 w_2 - t_1 w_1} = \frac{h_2\zeta_2}{\left[(g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}\right]}$$

$$\frac{w_2 - w_1}{t_2 w_2 - t_1 w_1} = \frac{h_2\zeta_2 + (g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}{(g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}$$

$$\frac{t_2 w_2 - t_1 w_1}{w_2 - w_1} = \frac{(g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}{h_2\zeta_2 + (g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}$$

$$t_1 w_1 = t_2 w_2 - (w_2 - w_1)\frac{(g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}{h_2\zeta_2 + (g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}$$

A.4) $t_1 = t_2 \frac{w_2}{w_1} - \frac{w_2 - w_1}{w_1} \cdot \left[1 - \frac{h_2\zeta_2}{h_2\zeta_2 + (g_0 - 1)h_0 + (g_1 - 1)h_1 - h_2\eta_2 \cdot \frac{t_2}{1 - t_2}}\right]$

Appendix B: Sensitivity Analysis

Table B.1: Public Good=25,050, ε_{low}=0, $\varepsilon_{\text{high}}$=0.25, lowest α_i for low incomes = 0.9

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
α_i ~ U(0.9,0.4)	Average tax rate	-17.9%	50.3%	57.0%	-12.3%	54.1%	62.1%	-6.8%	57.3%	65.9%
	Average m.t. rate	-17.9%	82.7%	53.3%	-12.3%	86.2%	59.6%	-6.8%	88.5%	64.2%
	avg. job partiality	24.5%	56.9%	71.9%	22.9%	56.3%	70.6%	21.5%	55.6%	69.5%
	normalized partiality	43.5%	101.2%	127.8%	40.6%	100.0%	125.6%	38.2%	98.8%	123.6%
	H	16.46%	40%	36%	14.44%	38%	36%	12.89%	37%	36%
	avg. η	0.588	0.084	-	0.729	0.093	-	0.837	0.097	-
	Non-Employment %	8.3%			11.7%			14.2%		
	Guaranteed income (% of lowest income)	32.5%			40.1%			45.6%		
α_i ~ U(0.9,0.3)	Average tax rate	-17.8%	50.1%	57.0%	-12.1%	53.9%	62.1%	-6.5%	57.1%	65.9%
	Average m.t. rate	-17.8%	82.7%	53.2%	-12.1%	86.2%	59.6%	-6.5%	88.5%	64.1%
	avg. job partiality	30.8%	58.3%	71.8%	29.6%	57.4%	70.6%	28.5%	56.5%	69.4%
	normalized partiality	54.8%	103.6%	127.7%	52.6%	102.0%	125.5%	50.6%	100.4%	123.4%
	H	17.21%	40%	36%	15.50%	39%	36%	14.19%	38%	36%
	avg. η	0.464	0.072	-	0.559	0.081	-	0.627	0.085	-
	Non-Employment %	7.0%			9.9%			12.1%		
	Guaranteed income (% of lowest income)	32.8%			40.6%			46.3%		
α_i ~ U(0.9,0.2)	Average tax rate	-17.5%	49.9%	57.0%	-11.9%	53.6%	62.1%	-6.3%	56.8%	65.8%
	Average m.t. rate	-17.5%	82.7%	53.2%	-11.9%	86.1%	59.5%	-6.3%	88.4%	64.1%
	avg. job partiality	37.2%	59.9%	71.8%	36.3%	58.8%	70.5%	35.6%	57.7%	69.3%
	normalized partiality	66.1%	106.4%	127.6%	64.6%	104.5%	125.4%	63.3%	102.7%	123.3%
	H	17.74%	40%	36%	16.27%	39%	36%	15.12%	39%	36%
	avg. η	0.384	0.062	-	0.454	0.071	-	0.503	0.075	-
	Non-Employment %	6.1%			8.6%			10.5%		
	Guaranteed income (% of lowest income)	33.3%			41.1%			46.9%		
α_i ~ U(0.9,0.1)	Average tax rate	-17.8%	49.6%	56.9%	-11.8%	53.4%	62.1%	-6.0%	56.6%	65.8%
	Average m.t. rate	-17.8%	82.6%	53.2%	-11.8%	86.1%	59.5%	-6.0%	88.4%	64.1%
	avg. job partiality	43.6%	61.6%	71.8%	43.1%	60.4%	70.5%	42.8%	59.3%	69.3%
	normalized partiality	77.5%	109.5%	127.6%	76.7%	107.4%	125.3%	76.0%	105.4%	123.1%
	H	18.18%	41%	36%	16.84%	40%	36%	15.81%	39%	36%
	avg. η	0.326	0.056	-	0.384	0.064	-	0.422	0.068	-
	Non-Employment %	5.4%			7.6%			9.4%		
	Guaranteed income (% of lowest income)	33.5%			41.6%			47.6%		

Table B.2: Public Good=20,000, ε_{low}=0, $\varepsilon_{\text{high}}$=0.25, lowest α_i for low incomes = 0.9

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
αi ~ U(0.9,0.4)	Average tax rate	-15.4%	51.6%	57.6%	-9.6%	55.5%	62.7%	-3.8%	58.7%	66.5%
	Average m.t. rate	-15.4%	83.1%	53.6%	-9.6%	86.5%	59.9%	-3.8%	88.8%	64.4%
	avg. job partiality	21.3%	55.9%	70.0%	19.5%	54.9%	68.6%	17.8%	54.0%	67.2%
	normalized partiality	37.8%	99.3%	124.5%	34.6%	97.6%	121.9%	31.7%	95.9%	119.5%
	h	12.71%	37%	36%	10.93%	36%	36%	9.50%	35%	36%
	avg. η	0.934	0.105	-	1.094	0.107	-	1.228	0.104	-
	Non-Employment %	14.5%			17.5%			19.9%		
	Guaranteed income (% of lowest income)	50.3%			57.7%			63.2%		
α_i ~ U(0.9,0.3)	Average tax rate	-15.4%	51.3%	57.5%	-9.3%	55.2%	62.7%	-3.6%	58.4%	66.4%
	Average m.t. rate	-15.4%	83.0%	53.5%	-9.3%	86.4%	59.8%	-3.6%	88.7%	64.3%
	avg. job partiality	28.4%	56.7%	70.0%	27.0%	55.5%	68.5%	25.8%	54.3%	67.1%
	normalized partiality	50.5%	100.9%	124.5%	48.0%	98.6%	121.8%	45.8%	96.5%	119.4%
	h	14.12%	38%	36%	12.59%	37%	36%	11.39%	36%	36%
	avg. η	0.681	0.092	-	0.775	0.095	-	0.844	0.096	-
	Non-Employment %	12.2%			14.7%			16.7%		
	Guaranteed income (% of lowest income)	50.6%			58.2%			63.8%		
α_i~ U(0.9,0.2)	Average tax rate	-15.4%	51.0%	57.5%	-9.2%	54.9%	62.6%	-3.2%	58.2%	66.4%
	Average m.t. rate	-15.4%	82.9%	53.4%	-9.2%	86.3%	59.7%	-3.2%	88.6%	64.3%
	avg. job partiality	35.6%	58.1%	70.0%	34.6%	56.6%	68.5%	33.7%	55.3%	67.1%
	normalized partiality	63.3%	103.3%	124.4%	61.5%	100.7%	121.7%	60.0%	98.3%	119.2%
	h	15.11%	39%	36%	13.78%	38%	36%	12.72%	37%	36%
	avg. η	0.538	0.081	-	0.599	0.085	-	0.642	0.086	-
	Non-Employment %	10.5%			12.7%			14.5%		
	Guaranteed income (% of lowest income)	51.0%			58.8%			64.5%		
α_i ~ U(0.9,0.1)	Average tax rate	-15.2%	50.8%	57.4%	-9.0%	54.7%	62.6%	-3.0%	57.9%	66.4%
	Average m.t. rate	-15.2%	82.9%	53.4%	-9.0%	86.3%	59.7%	-3.0%	88.5%	64.2%
	avg. job partiality	42.8%	59.7%	69.9%	42.3%	58.2%	68.4%	41.8%	56.7%	67.0%
	normalized partiality	76.0%	106.1%	124.3%	75.2%	103.4%	121.6%	74.4%	100.9%	119.1%
	h	15.83%	39%	36%	14.66%	38%	36%	13.73%	38%	36%
	avg. η	0.444	0.072	-	0.490	0.076	-	0.519	0.078	-
	Non-Employment %	9.3%			11.3%			12.8%		
	Guaranteed income (% of lowest income)	51.5%			59.4%			65.2%		

Table B.3: Public Good=20,000, ε_{low}=0, $\varepsilon_{\text{high}}$=0.25, lowest α_i for low incomes = 1

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
α_i~ U(1,0.5)	Average tax rate	-8.4%	54.7%	59.0%	-1.8%	58.8%	64.2%	4.5%	62.2%	68.0%
	Average m.t. rate	-8.4%	83.7%	54.1%	-1.8%	87.0%	60.4%	4.5%	89.2%	64.9%
	avg. job partiality	12.8%	57.4%	69.5%	10.2%	56.7%	67.9%	7.8%	55.9%	66.4%
	normalized partiality	22.7%	102.1%	123.6%	18.1%	100.7%	120.7%	13.9%	99.4%	118.1%
	h	7.37%	33%	36%	5.48%	32%	36%	3.97%	31%	36%
	avg. η	1.629	0.095	-	2.095	0.086	-	2.538	0.071	-
	Non-Employment %	23.4%			26.6%			29.1%		
	Guaranteed income (% of lowest income)	52.9%			60.3%			65.7%		
α_i~ U(1,0.4)	Average tax rate	-8.2%	54.5%	58.9%	-1.2%	58.7%	64.1%	5.1%	62.1%	67.9%
	Average m.t. rate	-8.2%	83.5%	53.9%	-1.2%	86.8%	60.2%	5.1%	89.0%	64.7%
	avg. job partiality	20.1%	56.8%	69.5%	18.0%	55.5%	67.9%	16.0%	54.2%	66.3%
	normalized partiality	35.8%	100.9%	123.6%	31.9%	98.6%	120.6%	28.5%	96.3%	117.9%
	h	9.64%	35%	36%	8.01%	34%	36%	6.75%	33%	36%
	avg. η	0.996	0.089	-	1.173	0.087	-	1.310	0.082	-
	Non-Employment %	19.6%			22.4%			24.5%		
	Guaranteed income (% of lowest income)	53.3%			60.9%			66.3%		
α_i ~ U(1,0.3)	Average tax rate	-8.0%	54.2%	58.8%	-0.9%	58.5%	64.0%	5.5%	61.9%	67.8%
	Average m.t. rate	-8.0%	83.4%	53.8%	-0.9%	86.7%	60.1%	5.5%	88.9%	64.6%
	avg. job partiality	27.5%	57.2%	69.5%	25.9%	55.5%	67.8%	24.4%	54.0%	66.3%
	normalized partiality	49.0%	101.6%	123.5%	46.0%	98.7%	120.6%	43.3%	95.9%	117.8%
	h	11.26%	36%	36%	9.85%	35%	36%	8.73%	34%	36%
	avg. η	0.719	0.081	-	0.813	0.082	-	0.885	0.080	-
	Non-Employment %	16.9%			19.3%			21.2%		
	Guaranteed income (% of lowest income)	53.7%			61.4%			67.0%		
α_i~ U(1,0.2)	Average tax rate	-7.9%	54.0%	58.7%	-0.7%	58.2%	64.0%	5.8%	61.7%	67.8%
	Average m.t. rate	-7.9%	83.3%	53.7%	-0.7%	86.6%	60.0%	5.8%	88.8%	64.5%
	avg. job partiality	35.0%	58.1%	69.4%	33.8%	56.3%	67.7%	32.8%	54.6%	66.2%
	normalized partiality	62.2%	103.3%	123.5%	60.2%	100.1%	120.4%	58.3%	97.1%	117.6%
	h	12.47%	37%	36%	11.22%	36%	36%	10.22%	35%	36%
	avg. η	0.563	0.073	-	0.624	0.075	-	0.667	0.075	-
	Non-Employment %	14.9%			17.0%			18.7%		
	Guaranteed income (% of lowest income)	54.2%			62.1%			67.8%		

Table B.4: Public Good=25,050, ε_{low}=0, $\varepsilon_{\text{high}}$=0.5, lowest α_i for low incomes = 0.9

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
α_i ~ U(0.9,0.4)	Average tax rate	-0.2%	51.2%	47.2%	7.9%	56.3%	53.1%	5.7%	57.1%	56.4%
	Average m.t. rate	-0.2%	72.3%	36.6%	7.9%	76.8%	42.7%	5.7%	80.0%	47.4%
	avg. job partiality	27.8%	58.0%	74.1%	26.1%	57.7%	73.3%	25.9%	57.5%	73.1%
	normalized partiality	49.4%	103.0%	131.7%	46.5%	102.5%	130.4%	46.1%	102.3%	129.9%
	H	21.40%	43%	36%	18.76%	41%	36%	18.46%	41%	36%
	avg. η	0.210	0.000	-	0.328	0.000	-	0.352	0.009	-
	Non-Employment %	0.0%			4.4%			4.9%		
	Guaranteed income (% of lowest income)	11.2%			17.8%			19.2%		
α_i~ U(0.9,0.3)	Average tax rate	0.9%	51.3%	47.2%	8.6%	56.4%	53.1%	4.0%	56.4%	56.1%
	Average m.t. rate	0.9%	72.0%	36.6%	8.6%	76.7%	42.7%	4.0%	80.0%	47.4%
	avg. job partiality	33.2%	59.8%	74.0%	31.9%	59.2%	73.2%	32.0%	59.1%	73.1%
	normalized partiality	59.0%	106.2%	131.6%	56.7%	105.3%	130.2%	56.8%	105.1%	129.9%
	H	21.14%	43%	36%	18.91%	41%	36%	19.00%	41%	36%
	avg. η	0.187	0.000	-	0.282	0.000	-	0.289	0.010	-
	Non-Employment %	0.4%			4.2%			4.0%		
	Guaranteed income (% of lowest income)	12.0%			18.8%			19.4%		
α_i~ U(0.9,0.2)	Average tax rate	3.1%	52.6%	47.7%	8.4%	55.8%	52.9%	2.7%	55.8%	55.9%
	Average m.t. rate	3.1%	72.6%	36.6%	8.4%	76.1%	42.7%	2.7%	79.9%	47.4%
	avg. job partiality	38.5%	61.4%	73.8%	37.9%	61.0%	73.3%	38.0%	60.9%	73.1%
	normalized partiality	68.5%	109.2%	131.2%	67.5%	108.4%	130.2%	67.5%	108.2%	129.9%
	H	20.58%	42%	36%	19.27%	41%	36%	19.37%	41%	36%
	avg. η	0.185	0.000	-	0.238	0.001	-	0.246	0.010	-
	Non-Employment %	1.4%			3.5%			3.4%		
	Guaranteed income (% of lowest income)	14.2%			18.9%			19.6%		
α_i~ U(0.9,0.1)	Average tax rate	3.3%	52.1%	47.5%	7.3%	55.1%	52.7%	1.2%	55.1%	55.7%
	Average m.t. rate	3.3%	72.1%	36.6%	7.3%	76.0%	42.7%	1.2%	79.9%	47.4%
	avg. job partiality	44.3%	63.3%	73.8%	44.0%	62.8%	73.3%	44.0%	62.7%	73.1%
	normalized partiality	78.7%	112.5%	131.2%	78.2%	111.6%	130.2%	78.2%	111.4%	129.9%
	H	20.65%	42%	36%	19.56%	42%	36%	19.65%	42%	36%
	avg. η	0.163	0.000	-	0.208	0.002	-	0.214	0.011	-
	Non-Employment %	1.3%			3.0%			3.0%		
	Guaranteed income (% of lowest income)	14.4%			18.9%			19.7%		

Table B.5: Public Good=20,000, ε_{low}=0, $\varepsilon_{\text{high}}$=0.5, lowest α_i for low incomes = 0.9

		v=0.15			v=0.20			v=0.25		
Distribution of α_i in low income groups		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
α_i ~ U(0.9,0.4)	Average tax rate	-13.6%	45.7%	45.1%	-16.1%	47.0%	49.5%	-11.6%	51.3%	54.2%
	Average m.t. rate	-13.6%	71.5%	36.7%	-16.1%	75.9%	42.8%	-11.6%	80.3%	47.6%
	avg. job partiality	26.3%	57.7%	73.4%	25.8%	57.5%	73.0%	24.7%	57.1%	72.3%
	normalized partiality	46.7%	102.6%	130.4%	45.9%	102.2%	129.7%	44.0%	101.6%	128.5%
	h	19.01%	41%	36%	18.34%	41%	36%	16.79%	40%	36%
	avg. η	0.385	0.044	-	0.438	0.068	-	0.532	0.077	-
	Non-Employment %	3.9%			5.1%			7.7%		
	Guaranteed income (% of lowest income)	21.1%			24.1%			29.4%		
α_i~ U(0.9,0.3)	Average tax rate	-14.4%	45.3%	45.0%	-15.7%	47.0%	49.6%	-11.4%	51.1%	54.2%
	Average m.t. rate	-14.4%	71.5%	36.7%	-15.7%	75.9%	42.8%	-11.4%	80.2%	47.6%
	avg. job partiality	32.2%	59.3%	73.4%	31.8%	59.0%	72.9%	31.0%	58.5%	72.2%
	normalized partiality	57.3%	105.5%	130.4%	56.5%	105.0%	129.7%	55.1%	104.0%	128.4%
	h	19.43%	42%	36%	18.73%	41%	36%	17.45%	40%	36%
	avg. η	0.313	0.039	-	0.360	0.059	-	0.427	0.067	-
	Non-Employment %	3.3%			4.4%			6.6%		
	Guaranteed income (% of lowest income)	21.2%			24.7%			29.9%		
α_i ~ U(0.9,0.2)	Average tax rate	-15.1%	45.0%	44.9%	-15.3%	46.9%	49.6%	-11.1%	51.1%	54.2%
	Average m.t. rate	-15.1%	71.5%	36.7%	-15.3%	75.8%	42.8%	-11.1%	80.2%	47.5%
	avg. job partiality	38.2%	61.1%	73.4%	37.8%	60.7%	72.9%	37.3%	60.1%	72.2%
	normalized partiality	67.8%	108.6%	130.4%	67.2%	107.9%	129.6%	66.2%	106.8%	128.3%
	h	19.72%	42%	36%	19.00%	41%	36%	17.89%	41%	36%
	avg. η	0.264	0.035	-	0.304	0.051	-	0.357	0.059	-
	Non-Employment %	2.8%			4.0%			5.9%		
	Guaranteed income (% of lowest income)	21.3%			25.2%			30.5%		
α_i ~ U(0.9,0.1)	Average tax rate	-15.7%	44.7%	44.8%	-15.0%	46.9%	49.7%	-10.8%	51.0%	54.3%
	Average m.t. rate	-15.7%	71.5%	36.6%	-15.0%	75.8%	42.8%	-10.8%	80.2%	47.5%
	avg. job partiality	44.1%	62.9%	73.4%	43.9%	62.5%	72.8%	43.6%	61.8%	72.1%
	normalized partiality	78.4%	111.8%	130.4%	78.0%	111.0%	129.5%	77.5%	109.8%	128.2%
	h	19.93%	42%	36%	19.21%	41%	36%	18.22%	41%	36%
	avg. η	0.228	0.032	-	0.266	0.046	-	0.309	0.053	-
	Non-Employment %	2.4%			3.6%			5.3%		
	Guaranteed income (% of lowest income)	21.4%			25.7%			31.2%		

Table B.6: Public Good=20,000, ε_{low}=0, ε_{high}=0.5, lowest α_i for low incomes = 1

Distribution of α_i in low income groups		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
α_i~ U(1,0.5)	Average tax rate	-8.3%	49.2%	46.8%	-2.6%	53.5%	52.4%	3.1%	57.1%	56.8%
	Average m.t. rate	-8.3%	73.4%	37.2%	-2.6%	77.8%	43.4%	3.1%	81.0%	48.1%
	avg. job partiality	19.5%	58.5%	73.1%	17.8%	58.4%	72.3%	16.3%	58.2%	71.6%
	normalized partiality	34.7%	104.0%	129.9%	31.6%	103.8%	128.5%	29.0%	103.4%	127.3%
	H	13.71%	38%	36%	11.83%	36%	36%	10.37%	35%	36%
	avg. η	0.576	0.068	-	0.734	0.076	-	0.856	0.078	-
	Non-Employment %	12.9%			16.0%			18.4%		
	Guaranteed income (% of lowest income)	23.8%			29.6%			33.7%		
α_i ~ U(1,0.4)	Average tax rate	-8.3%	49.1%	46.7%	-2.4%	53.3%	52.3%	3.3%	57.0%	56.7%
	Average m.t. rate	-8.3%	73.3%	37.1%	-2.4%	77.7%	43.3%	3.3%	80.8%	48.0%
	avg. job partiality	25.5%	59.2%	73.0%	24.1%	58.7%	72.3%	22.9%	58.2%	71.6%
	normalized partiality	45.4%	105.3%	129.8%	42.9%	104.4%	128.5%	40.7%	103.5%	127.2%
	H	14.88%	38%	36%	13.31%	37%	36%	12.07%	37%	36%
	avg. η	0.443	0.059	-	0.547	0.067	-	0.621	0.070	-
	Non-Employment %	10.9%			13.5%			15.6%		
	Guaranteed income (% of lowest income)	24.3%			30.1%			34.3%		
α_i~ U(1,0.3)	Average tax rate	-8.1%	49.0%	46.6%	-2.1%	53.3%	52.3%	3.6%	56.9%	56.6%
	Average m.t. rate	-8.1%	73.2%	37.0%	-2.1%	77.6%	43.2%	3.6%	80.7%	47.9%
	avg. job partiality	31.6%	60.3%	73.0%	30.5%	59.6%	72.2%	29.5%	58.9%	71.5%
	normalized partiality	56.1%	107.2%	129.8%	54.2%	106.0%	128.4%	52.5%	104.8%	127.1%
	H	15.73%	39%	36%	14.34%	38%	36%	13.25%	37%	36%
	avg. η	0.360	0.052	-	0.437	0.059	-	0.493	0.063	-
	Non-Employment %	9.5%			11.8%			13.6%		
	Guaranteed income (% of lowest income)	24.8%			30.8%			35.1%		
α_i~ U(1,0.2)	Average tax rate	-8.0%	48.9%	46.6%	-2.2%	53.1%	52.2%	3.8%	56.8%	56.6%
	Average m.t. rate	-8.0%	73.1%	37.0%	-2.2%	77.5%	43.1%	3.8%	80.7%	47.9%
	avg. job partiality	37.7%	61.6%	73.0%	36.9%	60.8%	72.2%	36.3%	60.0%	71.4%
	normalized partiality	66.9%	109.5%	129.7%	65.7%	108.1%	128.3%	64.5%	106.7%	126.9%
	H	16.35%	39%	36%	15.14%	39%	36%	14.15%	38%	36%
	avg. η	0.306	0.046	-	0.366	0.053	-	0.408	0.057	-
	Non-Employment %	8.5%			10.5%			12.1%		
	Guaranteed income (% of lowest income)	25.3%			31.4%			35.9%		

Table B.7: Public Good=25,050, endogenous ε_{low} and ε_{high} , lowest α_i for low incomes=0.9

		v=0.15			v=0.20			v=0.25		
		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
Distribution of αi in low income groups		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
αi ~ U(0.9,0.4)	Average tax rate	5.4%	43.8%	72.7%	8.1%	48.1%	75.3%	10.7%	51.6%	77.2%
	Average m.t. rate	5.4%	71.0%	91.8%	8.1%	75.1%	93.3%	10.7%	78.2%	94.2%
	avg. job partiality	16.3%	55.0%	66.8%	15.1%	54.4%	65.5%	14.1%	53.8%	64.3%
	normalized partiality	29.0%	97.8%	118.8%	26.9%	96.7%	116.5%	25.1%	95.6%	114.4%
	h	8.30%	37%	36%	7.43%	36%	36%	6.75%	36%	36%
	avg. η	1.268	0.136	-	1.365	0.134	-	1.437	0.130	-
	avg. ε	0.896	0.148	0.043	0.989	0.154	0.045	1.054	0.157	0.047
	Non-Employment %	18.9%			20.5%			21.8%		
	Guaranted income (% of lowest income)	64.8%			68.5%			70.9%		
αi ~ U(0.9,0.3)	Average tax rate	4.0%	45.9%	73.5%	6.8%	50.3%	76.2%	9.7%	53.9%	78.2%
	Average m.t. rate	4.0%	74.2%	91.6%	6.8%	78.5%	93.0%	9.7%	81.6%	94.1%
	avg. job partiality	24.5%	55.5%	66.3%	23.7%	54.6%	64.8%	22.9%	53.8%	63.6%
	normalized partiality	43.6%	98.7%	117.9%	42.1%	97.1%	115.3%	40.8%	95.6%	113.0%
	h	10.33%	38%	36%	9.62%	37%	36%	9.07%	36%	36%
	avg. η	0.882	0.114	-	0.928	0.113	-	0.956	0.110	-
	avg. ε	0.472	0.122	0.044	0.509	0.128	0.047	0.534	0.131	0.048
	Non-Employment %	16.3%			17.7%			18.8%		
	Guaranted income (% of lowest income)	66.9%			70.5%			72.8%		
αi ~ U(0.9,0.2)	Average tax rate	1.8%	48.3%	74.4%	4.7%	52.7%	77.1%	7.7%	56.2%	79.2%
	Average m.t. rate	1.8%	78.0%	91.3%	4.7%	82.2%	92.8%	7.7%	85.3%	93.9%
	avg. job partiality	33.0%	56.3%	65.7%	32.4%	55.2%	64.1%	31.9%	54.2%	62.7%
	normalized partiality	58.6%	100.1%	116.8%	57.6%	98.1%	114.0%	56.8%	96.3%	111.5%
	H	11.85%	38%	36%	11.27%	37%	36%	10.83%	37%	36%
	avg. η	0.678	0.098	-	0.703	0.097	-	0.717	0.096	-
	avg. ε	0.245	0.104	0.046	0.260	0.110	0.048	0.269	0.112	0.050
	Non-Employment %	14.5%			15.6%			16.5%		
	Guaranted income (% of lowest income)	69.1%			72.5%			74.5%		
αi ~ U(0.9,0.1)	Average tax rate	-2.8%	51.1%	75.4%	0.6%	55.2%	78.1%	4.5%	58.4%	80.1%
	Average m.t. rate	-2.8%	83.1%	91.0%	0.6%	86.9%	92.6%	4.5%	89.3%	93.8%
	avg. job partiality	41.5%	57.2%	65.0%	41.3%	55.9%	63.3%	41.0%	54.9%	61.9%
	normalized partiality	73.8%	101.6%	115.5%	73.4%	99.4%	112.5%	72.9%	97.5%	110.0%
	H	13.13%	38%	36%	12.65%	38%	36%	12.24%	37%	36%
	avg. η	0.551	0.086	-	0.565	0.086	-	0.573	0.084	-
	avg. ε	0.101	0.091	0.047	0.106	0.095	0.049	0.108	0.098	0.051
	Non-Employment %	13.0%			14.0%			14.8%		
	Guaranted income (% of lowest income)	71.4%			74.4%			76.0%		

Table B.8: Public Good=25,050, endogenous ε_{low} and ε_{high} , lowest α_i for low incomes =1

		v=0.15			v=0.20			v=0.25		
Distribution of αi in low income groups		w1	w2-w6	w7-w11	w1	w2-w6	w7-w11	w1	w2-w6	w7-w11
		0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000	0-4500	4500-10000	10000-40000
αi ~ U(1,0.5)	Average tax rate	9.2%	45.2%	73.1%	12.6%	49.5%	75.7%	15.8%	53.1%	77.7%
	Average m.t. rate	9.2%	70.4%	92.0%	12.6%	74.4%	93.4%	15.8%	77.4%	94.3%
	avg. job partiality	7.1%	56.6%	66.7%	5.4%	56.1%	65.3%	3.9%	55.7%	64.1%
	normalized partiality	12.6%	100.6%	118.6%	9.6%	99.8%	116.1%	7.0%	99.0%	114.0%
	H	3.55%	34%	36%	2.59%	33%	36%	1.84%	33%	36%
	avg. η	2.477	0.136	-	2.844	0.128	-	3.134	0.118	-
	avg. ε	2.182	0.173	0.043	2.568	0.176	0.046	2.865	0.175	0.047
	Non-Employment %		26.5%			28.3%			29.7%	
	Guaranted income (% of lowest income)		65.0%			68.6%			70.9%	
αi ~ U(1,0.4)	Average tax rate	8.7%	47.1%	73.8%	12.2%	51.6%	76.5%	15.6%	55.3%	78.6%
	Average m.t. rate	8.7%	73.0%	91.7%	12.2%	77.1%	93.2%	15.6%	80.3%	94.2%
	avg. job partiality	15.4%	56.0%	66.2%	14.0%	55.1%	64.7%	12.8%	54.3%	63.4%
	normalized partiality	27.3%	99.5%	117.7%	24.9%	98.0%	115.1%	22.8%	96.6%	112.7%
	H	6.34%	35%	36%	5.54%	35%	36%	4.93%	34%	36%
	avg. η	1.323	0.115	-	1.422	0.111	-	1.487	0.106	-
	avg. ε	0.943	0.143	0.044	1.037	0.148	0.047	1.098	0.150	0.048
	Non-Employment %		22.7%			24.2%			25.4%	
	Guaranted income (% of lowest income)		66.8%			70.3%			72.5%	
αi ~ U(1,0.3)	Average tax rate	7.7%	49.1%	74.5%	11.4%	53.7%	77.4%	15.0%	57.4%	79.5%
	Average m.t. rate	7.7%	75.9%	91.4%	11.4%	80.2%	93.0%	15.0%	83.2%	94.0%
	avg. job partiality	23.8%	56.0%	65.7%	22.8%	54.8%	64.0%	21.9%	53.8%	62.6%
	normalized partiality	42.4%	99.5%	116.8%	40.5%	97.5%	113.9%	39.0%	95.7%	111.3%
	H	8.36%	36%	36%	7.70%	35%	36%	7.18%	35%	36%
	avg. η	0.906	0.100	-	0.949	0.097	-	0.974	0.093	-
	avg. ε	0.490	0.122	0.046	0.526	0.127	0.048	0.546	0.130	0.049
	Non-Employment %		20.0%			21.2%			22.2%	
	Guaranted income (% of lowest income)		68.7%			72.1%			74.0%	
αi ~ U(1,0.2)	Average tax rate	5.7%	51.3%	75.4%	9.6%	56.0%	78.3%	13.9%	59.6%	80.4%
	Average m.t. rate	5.7%	79.5%	91.2%	9.6%	83.6%	92.8%	13.9%	86.4%	93.9%
	avg. job partiality	32.5%	56.4%	65.0%	31.8%	55.0%	63.3%	31.3%	53.8%	61.8%
	normalized partiality	57.8%	100.2%	115.6%	56.6%	97.8%	112.5%	55.6%	95.7%	109.8%
	H	9.95%	36%	36%	9.39%	36%	36%	8.93%	36%	36%
	avg. η	0.689	0.088	-	0.713	0.086	-	0.725	0.083	-
	avg. ε	0.253	0.106	0.047	0.266	0.111	0.049	0.272	0.114	0.050
	Non-Employment %		17.9%			19.0%			19.9%	
	Guaranted income (% of lowest income)		70.7%			73.8%			75.4%	

Table B.9: Public Good=40,000, endogenous ε_{low} and ε_{high} , lowest α_i for low incomes =1

		v=0.15			v=0.20			v=0.25		
Distribution of αi in low income groups		**w1**	**w2-w6**	**w7-w11**	**w1**	**w2-w6**	**w7-w11**	**w1**	**w2-w6**	**w7-w11**
		0-4500	**4500-10000**	**10000-40000**	**0-4500**	**4500-10000**	**10000-40000**	**0-4500**	**4500-10000**	**10000-40000**
αi ~ U(1,0.5)	**Average tax rate**	5.7%	49.7%	77.5%	8.8%	53.3%	79.3%	11.9%	56.4%	80.8%
	Average m.t. rate	5.7%	78.8%	95.9%	8.8%	81.8%	96.5%	11.9%	84.0%	96.9%
	avg. job partiality	16.6%	57.6%	70.2%	15.5%	57.3%	69.3%	14.6%	57.1%	68.5%
	normalized partiality	29.6%	102.3%	124.8%	27.6%	101.9%	123.2%	25.9%	101.5%	121.7%
	H	10.69%	38%	36%	9.65%	37%	36%	8.80%	36%	36%
	avg. η	0.790	0.090	-	0.885	0.093	-	0.955	0.093	-
	avg. ε	0.543	0.087	0.020	0.622	0.093	0.022	0.687	0.098	0.024
	Non-Employment %	16.0%			17.8%			19.2%		
	Guaranted income (% of lowest income)	31.5%			34.6%			36.8%		
αi ~ U(1,0.4)	**Average tax rate**	4.6%	51.5%	78.2%	7.9%	55.1%	80.1%	11.1%	58.2%	81.5%
	Average m.t. rate	4.6%	81.5%	95.6%	7.9%	84.4%	96.3%	11.1%	86.6%	96.8%
	avg. job partiality	23.0%	58.0%	69.8%	22.1%	57.6%	68.8%	21.3%	57.2%	67.9%
	normalized partiality	40.9%	103.2%	124.0%	39.3%	102.4%	122.3%	37.9%	101.6%	120.7%
	h	12.16%	38%	36%	11.30%	37%	36%	10.63%	37%	36%
	avg. η	0.605	0.078	-	0.661	0.080	-	0.700	0.081	-
	avg. ε	0.338	0.072	0.022	0.377	0.078	0.024	0.406	0.081	0.025
	Non-Employment %	14.0%			15.5%			16.7%		
	Guaranted income (% of lowest income)	33.4%			36.5%			38.6%		
αi ~ U(1,0.3)	**Average tax rate**	3.1%	53.2%	78.9%	6.5%	56.9%	80.8%	10.1%	59.8%	82.2%
	Average m.t. rate	3.1%	84.3%	95.4%	6.5%	87.2%	96.1%	10.1%	89.2%	96.7%
	avg. job partiality	29.5%	58.8%	69.3%	28.9%	58.2%	68.2%	28.3%	57.6%	67.3%
	normalized partiality	52.5%	104.5%	123.2%	51.3%	103.4%	121.3%	50.3%	102.5%	119.6%
	H	13.26%	38%	36%	12.56%	38%	36%	11.99%	37%	36%
	avg. η	0.494	0.069	-	0.530	0.071	-	0.553	0.071	-
	avg. ε	0.209	0.061	0.023	0.229	0.066	0.025	0.244	0.069	0.026
	Non-Employment %	12.6%			13.9%			14.9%		
	Guaranted income (% of lowest income)	35.3%			38.2%			40.1%		
αi ~ U(1,0.2)	**Average tax rate**	1.1%	54.9%	79.5%	4.9%	58.4%	81.4%	9.0%	61.3%	82.9%
	Average m.t. rate	1.1%	87.1%	95.2%	4.9%	89.8%	96.0%	9.0%	91.5%	96.5%
	avg. job partiality	36.3%	59.7%	68.8%	35.8%	59.0%	67.7%	35.4%	58.4%	66.7%
	normalized partiality	64.5%	106.2%	122.4%	63.7%	104.9%	120.4%	63.0%	103.8%	118.6%
	H	14.14%	39%	36%	13.54%	38%	36%	13.04%	38%	36%
	avg. η	0.418	0.061	-	0.441	0.063	-	0.458	0.063	-
	avg. ε	0.120	0.054	0.024	0.131	0.058	0.026	0.136	0.060	0.027
	Non-Employment %	11.5%			12.6%			13.5%		
	Guaranted income (% of lowest income)	37.0%			39.8%			41.6%		