# The Single-Mindedness Theory: Micro-foundation and Applications to Social Security Systems

Emanuele Canegrati

Universita Cattolica del Sacro Cuore, Milano

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**Abstract**

The central purpose of this paper is to introduce a new political economy approach which explains the characteristics of Social Security Systems. This approach is based on the Single-Mindedness Theory (SMT), which assumes that the more single-minded groups are able to exert a greater power of influence on Governments and eventually obtain what they ask. Governments are seen as voting-maximizer policy-makers, whose unique goal is winning elections. Using an OLG model and a probabilistic voting approach, I analyse a society divided into two groups, the old and the young, which only differ for their preferences for leisure. I show that, to win elections, the Government sets the optimal policy vector taking into account the preferences for leisure of both groups; eventually, the young gain a fiscal benefit, whilst the old have such an high marginal tax rate that they prefer to retire and spend all their time in leisure, a fraction of which is used in undertake political activities whose aim is the capture of politicians.

*JEL Classification*: D31, D72, J22, J26

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[1]DEFAP - Universita' Cattolica del Sacro Cuore - Milan; e-mail address: emanuele.canegrati@unicatt.it

*We work in order to have leisure* (Aristotle)

## 1 Introduction

The stylized facts which refer to the workers' behavior in the U.S. labour market show that the participation to the labour force of the older persons has been increasingly declining over the last century. If the labour force participation of men age 65-69 was around 60% in the 50's, the same figure had fallen to 26% in the 90's. In many OECD countries, workers withdraw from the labour market well before the official retirement age. Eventually, this long-term decline associated with an increase in the life expectation has led to a considerable increase in the retirement years. Otherwise, the Government expenditure for Social Security has been skyrocketing and so has been the percentage of workers covered by the System. This situation runs into risk to become financially unsustainable over the next years, unless Governments undertake the structural reforms of Social Security Systems as suggested by many economists (see Feldstein & Liebman [15] amongst the others).

Over the last few years, the economic literature has been trying to give plausible explanations to this strong change in the old workers' lifestyle. According to an OECD survey [34] financial incentives embedded into public pensions and other assistance schemes pull old workers into retirement. Nevertheless, the OECD makes a distinction between *pull factors of retirement* and the *push factors of retirement*. The former include all those financial benefits that incentive workers to anticipate their retirement age, whilst the latter refer to negative perceptions by old workers about their capacity or productivity and to socio-demographic characteristics.

In this paper I take the distance from the OECD's vision, which considers financial benefits as a *pull factor* to reduce the amount of work. Otherwise, in accordance with the SMT, I suggest that preferences of workers (especially the old) for leisure shape the charactertistics of modern Social Security Systems. Thus, behind the generosity of the transfers by Governments there is a precise political mechanism, driven by individuals who use their power of influence over the Government to obtain what they need to finance their leisure.

I use an OLG model which considers a society divided into two groups of workers: the old and the young. Furthermore, I assume that there is a political competition amongst two parties, which aim to maximize the share of votes and must choose an optimal policy vector which encompasses the effective marginal tax rates on labour.

The core assumption of the model is based on the idea of "single-mindedness", defined as the ability of a social group to be more focused on a single issue rather than many. The theory was introduced by Mulligan & Sala-i-Martin

[32] who assumed that the old have more needs for leisure than the young and this necessity would explain why the the old require (and eventually obtain) generous transfers by the Government and why the Social Security expenditures in the U.S. have been increased so much over the last decades. They adopted an OLG model with a society divided into old and young workers and showed that

> retired elderly can concentrate on issue that relate only to their age such as the pension or the health system

while the young have to choose among

> age-related and occupation issues

Eventually, they concluded,

> the elderly are politically powerful because they are more single-minded and (...) more single-minded groups tend to vote for larger social security programs that benefit them

Thus, according to this theory, there would exist in the economy a group, the old workers, which has a sort of political superpower and that enables it to dictate the optimal taxation (a sort of tyranny of the elder or "Gerontocracy", to quote the author).

Indeed, neither Demographics nor the need for an assistance would explain the skyrocketing increase in the Governments' expenditure for Social Security Systems and the broad reduction in retirement age over the last decades, but preferences of the old for leisure would provide a more suitable explanation to this upward trend. In a recent work, Diamond [12], in an attempt to describe the linkage between the Social Security System and the retirement in the U.S., wrote in his conclusions:

> there is clear evidence from both previous work (...) that the broad structure of the SS program influences retirement timing. Evidence on the effects of variation in the benefits provided by this program is less clear, however.

Over the recent years, economists like Profeta [35] and Mulligan & Sala-i-Martin [29] have attempted to formalize models involving the SMT but they all seem to be affected by a fundamental problem due to the use of lump sum transfers amongst cohorts; in Mulligan & Sala-i-Martin "an interest group may tax its members with a labour income tax and distribute the proceeds to them in a lump sum fashion"; Profeta used a lump sum system to transfer wealth both within the cohort and amongst different cohorts. Finally, also Linbeck and Weibull [27] study a redistributive model with political competition where gross incomes are fixed and known and, hence, "first-best (individual) lump-sum redistributions are in principle feasible". Their model represent a remarkable application in economic theory of Hinich [21] studies on multi-dimensionality of policy space and the first step to overcome the limitations that previous analysis suffered due to the use of very restrictive instruments such as the Median Voter Theorem. Neverthless, the redistributive system these models take into account, with lump-sum taxation, does not seem to exist in the real world. For instance, Diamond found out that "The Social Security system in the U.S. today is financed by a payroll tax which is levied on workers and firms equally", whilst Mulligan and Sala-i-Martin, adopting a cross-section analysis of 89 countries, discovered that the 96% of Social Security Programs are financed with payroll taxes.

In this paper I will analyse an economic framework where there is a political competition amongst two candidates which has to choose the optimal taxation on two social groups, the old and the young. Unlike the previous models, I will assum that the intergenerational transfer do not take place via lump sum taxes, but via a more realistic labour taxation. In particular, I will assume that the Government has to decide how to divide the revenues generated by the taxation of the two distinct groups. Eventually, I will demonstrate that the young obtain a positive tax allowance (or a reduction of the effective marginal tax rate), whilst a negative tax allowance (or an increase in the effective marginal tax rate) is levied on the old. This higher level of taxation on the old provokes a reduction in the labour supply (and eventually forces the old to retire); a situation which is consistent with the old needs, since their preferences are more oriented towards leisure than towards work.

The paper is organized as follows: section 2 presents the basic model; section 3 presents a discussion of the numerical simulations; section 4 provides some empirical evidence and section 5 concludes.

## 2 The basic model

I consider an OLG model, where each generation lives only for two periods, the *youth* and *old* age (see Figure 1).
[FIGURE 1 HERE].
At any period of time, the generation of youths coexists with the generation of the elderly. At the beginning of the next period, the elderly die, the youths become elderly and a new generation of youths is born. As a consequence, there are two overlapping generations of people living at any one time. Generations are unlinked, meaning that there is no possibility to leave any bequest. Individuals consume all the available income earned at a given period of time; thus, it is not possible neither to save nor to borrow money.

Then, at time $t$, let a population of size one be partitioned into two groups of workers, the *young*, representing the generation born at time $t$ and denoted by $T$, and the *old*, representing the generation born at time $t-1$ and who denoted by $T-1$. I will use capital letters to indicate the group and small letters to indicate single individuals belonging to a group. The size of a group does not change over time.

Each worker has to decide how to divide his total amount of time $\bar{t}$ between work and leisure (denoted by $l$). If the level of leisure reach 100%, I assume that the worker retires and gets a benefit equal to $p_t^{\tau-1}$. I assume also that leisure is employed to attend several activities, such as relaxing, taking care of family, taking part in political activities and many others. Thus, leisure can be seen as a vector of $N$ activities $l = l(l_1, l_2, ..., l_N)$, where $l_n \geq 0$.

Furthermore, I introduce the core assumptions of the model. I assume that the old and the young are identical in every respect except one: *the intrinsic value of the old workers for leisure is assumed to be strictly greater than the same value of the young workers.* That is, $\psi^{\tau-1} >> \psi^{\tau}$, where Greek letter *psi* denotes the intrinsic value for leisure. Thus, the two social groups have different preferences with respect to the choice between work and leisure.

This assumption is supported by the empirical evidence. The economic science has produced many works which provide possible explanations to the existence of a difference in preferences for leisure. Moreover, over the last years, other social sciences like Sociology and Psychology have added some very useful contributions. This is why I will distinguish the *economic reasons* from the *non-economic reasons*. The economic reasons are summarized in the work by Mulligan and Sala-i-Martin (1999).

- *Differences in labour Productivity.* Since the labour productivity is declining in age, the old are less productive than the young and, as a consequence, they earn a lower wage. This idea would explain the willingness by the old to retire: less productive workers in the labour market find profitable to devote relatively more of their time and effort to the political sector as to gain benefits that they would not get if they relied only on labour market. Nevertheless, for the theory to hold it is important to assume that leisure devoted to political activities is a *normal good*. That is, an increase in the total leisure time entails an increase in leisure devoted to political activities, due to the income effect.

- *Differences in Human Capital Accumulation.* The young are more engaged in self-financed human capital accumulation while they work than the old. As a consequence, the value of time for the young may be higher than their average hourly wage (see Stafford and Duncan [39]).
- *Long-term employment contracts.* The empirical evidence shows that due to the Lazear-type contracts, labour productivity for workers aged 60+ is significantly lower than wages.

As for the non-economic reasons, I refer to a work by Hershey, Henkens and Van Dalen [20]. In comparing the Dutch with the U.S. Social Security System, the authors discovered that "the Americans had significantly longer future time perspectives, higher level of retirement goal clarity and they tended to be more engaged in retirement planning activities". Thus, these findings are able to explain the existence of socio-cultural differences in the preferences for retirement. They go on affirming that "American workers think, prepare and save more for retirement... beginning in early adulthood", focalizing on the difference among societies, where there exists a major difference in financial responsibility, different level of uncertainty for future pension payouts and different psychological pressures. Finally, in concluding that the success of political initiatives depends in part on "changing the dimensions of the psyche that motivate individuals to adaptively prepare for old age", they implicitly recognize that the preferences of individuals for leisure may endogenously change over time, again due to cultural and psychological issues.

Old workers' preferences can be represented by a quasi-linear utility function[2]. A representative young worker at time $t$ has the following lifetime utility function:

$$U^{\tau-1} = c_t^{\tau-1} + \psi^{\tau-1} \log l_t^{\tau-1} \tag{1}$$

$\forall\ \tau - 1 \in T - 1$

where $c_t^{\tau-1}$ is the consumption at time $t$, $l_t^{\tau-1}$ is the leisure at time $t$ and $\psi^{\tau-1}$ is a parameter representing the intrinsic preference of the old worker for leisure ($\psi^{\tau-1} \in [0, 1]$).

[2] A quasi-linear utility function entails the non existence of the income effect

The old worker consumes all his income:

$$c_t^{\tau-1} = (w^{\tau-1}(1-\tau_L) + a_t^{\tau-1}\tau_L)(\bar{t} - l_t^{\tau-1}) \tag{2}$$

where $w^{\tau-1}$ is the unitary wage per hour worked, $\tau_L$ is the tax rate on labour income (equal for every group and steady over time) and $a_t^{\tau-1}$ the level of tax allowance.

Similarly, the preferences of a representative young worker $\tau$ are given by the following lifetime utility function:

$$U^\tau = c_t^\tau + \psi^\tau \log l_t^\tau + \beta^\tau(c_{t+1}^\tau + \psi^\tau \log l_{t+1}^\tau) \tag{3}$$

$\forall \tau \in T$

where $c_t^\tau$ and $c_{t+1}^\tau$ represent the consumption at time $t$ and $t+1$, $l_t^\tau$ and $l_{t+1}^\tau$ the leisure at time $t$ and $t+1$, $\beta^\tau$ is the time preference discount factor of the young worker, $\psi^\tau$ is the intrinsic preference of the young worker for leisure ($\psi^\tau \in [0,1]$). Since the young know that at time $t+1$ will be old, their utility function includes the leisure of the next period, weighted by a discount factor $\beta^\tau \in [0,1]$.

The young worker's inter temporal budget constraint is given by:

$$\begin{aligned} c_t^\tau + \beta^\tau c_{t+1}^\tau &= (w_t^\tau(1-\tau_L) + a_t^\tau \tau_L)(\bar{t} - l_t^\tau) \\ &+\beta^\tau((w_{t+1}^\tau(1-\tau_L) + a_{t+1}^\tau \tau_L)(\bar{t} - l_{t+1}^\tau)) \end{aligned} \tag{4}$$

### 2.1 The Government

The literature has used different formulation for the Government's objective function. A typical normative approach considers a benevolent Government which aims to maximize a Social Utility Function by choosing the optimal tax rate on labour, subject to a budget constraint where tax revenues are equal to public good expenditures. Otherwise, some authors such as Edwards and Keen considers a Leviathan model where, referring to the famous milestone paper by Brennan and Buchanan [5], they examine a Government which is in part concerned with maximizing the size of the public sector. Furthermore, the Edwards and Keen model assumes that the Government retains some degree of benevolence, perhaps because it has re-election concerns. Nevertheless, these concerns were not formally modeled. In this paper, I provide a possible explanation to this issue, introducing a political economy model where politicians act in order to maximize the probability of being re-elected. The policy vector the Government has to choose is given by:

$$\vec{q} = (a^{\tau-1}, a^\tau)$$

encompassing the two tax allowances.

Furthermore, I introduce the budget constraints of the Government:

$$n^{\tau-1}\tau_L(\bar{t}-l_t^{\tau-1})(w_t^{\tau-1}-a_t^{\tau-1})+n^{\tau}\tau_L(\bar{t}-l_t^{\tau})(w_t^{\tau}-a_t^{\tau})=0 \qquad (5)$$

Since revenues are proportional to the amount of labour supplied, the taxation entails inefficiencies, since it distorts workers' decisions on the amount of labour supplied. I assume also that a contingent budget surplus is entirely used to pay pensions to the retirees.

$n^{\tau-1}\tau_L(\bar{t}-l_t^{\tau-1})(w_t^{\tau-1}-a_t^{\tau-1})$ represents total revenues generated by the taxation of the old at time $t$, whilst $n^{\tau}\tau_L(\bar{t}-l_t^{\tau})(w_t^{\tau}-a_t^{\tau})$ the total revenues generated by the taxation of the young. As suggested by Lindbeck and Weibull, I assume the existence of a *balanced-budget redistribution* where the government cannot redistribute more money than is available in the economy (in another model I will assume that it is possible to issue debt instead), and cannot use tax revenues for any purpose other than redistribution so that the condition $n^{\tau-1}\tau_L(\bar{t}-l_t^{\tau-1})(w_t^{\tau-1}-a_t^{\tau-1})+n^{\tau}\tau_L(\bar{t}-l_t^{\tau})(w_t^{\tau}-a_t^{\tau})=0$ says that the revenues obtained via labour taxation are used to redistribute wealth amongst cohorts. To avoid the case in which a difference in wage levels is the solely responsible for the existence of retirement I impose that wages are exogenously determined: $w_t^{\tau-1}=w_t^{\tau}=w$. Furthermore, without loss of generality, I normalize the wage rate to the unity.

## 2.2 The Density Function in a Probabilistic Voting Model with Single-Mindedness

### 2.2.1 The Lindbeck & Weibull framework

As in Lindbeck and Weibull the component of every voter's welfare depends on fiscal policies chosen by candidates which affect his consumption and which is known by both parties, whilst the other component of welfare, which derives from personal attributes of the candidates, is only imperfectly observed by the parties. In other words, we are assuming that consumers' preferences for consumption are perfectly visible, whilst other political aspects such as ideology are not (Linbeck & Weibull's *stochastic heterogeneity*). The presence of uncertainty is fundamental for the existence of an equilibrium, since in the absence of this assumption, candidates would be able to perfectly observe workers' preferences and then we would have a discontinuous function. In such a case, no equilibrium would exist, for any policy suggested by a candidate would be beaten by another policy. Indeed, suppose that overall preferences of voter $i \in I$ may be written as:

$$U^i = V^i(\vec{q}) + \pi_A(\xi^i + \zeta)$$

where $\pi_A = 1$ if candidate A wins the elections and $\pi_A = 0$ if he loses. The term $\zeta$ reflects the candidate A's general popularity amongst the electorate. It is not idiosyncratic and it is uniformly distributed on the interval $(-\frac{1}{2h}, \frac{1}{2h})$ with mean zero and density $h$. Hence, the voter's choice is deterministic, and it is a discontinuous function of the utility differential between the two party vector of policies. Otherwise, the term $\xi^i$ represents an idiosyncratic component of voter's preferences for candidate A and, assuming that it cannot be exactly observed by parties and that voters are uniformly distributed on $(-\frac{1}{2s^I}, \frac{1}{2s^I})$, again with mean zero and density $s^I$. Thus, each voter in group $I$ votes for candidate A if and only if the candidate A's policy vector provides him with a greater utility than that provided by the candidate B's policy vector. That is:

$$V^i(\vec{q}^A) + \zeta + \xi^i > V^i(\vec{q}^B) \tag{6}$$

The assumption that voters care not only about transfers but also have unobserved exogenous preferences for one candidate assure the existence of a Nash equilibrium to the electoral-competition in a multi-dimensional model, according to Lindbeck & Weibull and Dixit & Londregan [13]. The traditional social choice theory states a negative result when affirms that any division of resources among cohorts can be beaten in a pairwise vote by some other division. The existence of preferences with respect to policies over which the parties cannot easily change position from election to election, or evaluations of the parties with respect to characteristics such as honesty and leadership which are valued by all voters (the so called *valence* issues) rules out the non-existence of an equilibrium.

### 2.2.2 The role of swing voters

In each social group there are some *swing voters*, who are those individuals that do not have any particular preference for one of the two candidates. This category of voters is fundamental to evaluate the effect of a change in the equilibrium policy vector. In fact, suppose to start from a situation of equilibrium, where the candidate A's policy, $\vec{q}^A$ is exactly equal to the candidate B's policy, $\vec{q}^B$; a candidate knows that, should it deviate from that policy some swing voters will be better off (and vote for him) whilst some other will be worse off (and vote against him). Thus, in choosing a policy, a candidate should calculate the number of swing voters which he would gain and compare it with the number of swing voters he would lose; intuitively, a change in a policy should be made if and only if a candidate evaluates that the number of swing voters gained is greater than the number of swing voters lost. Swing voters in group $I$ are identified by the following expression:

$$\xi^i = V^i(\vec{q}^B) - V^i(\vec{q}^A) - \zeta \tag{7}$$

This expression affirms that a swing voter is indifferent between candidate A and candidate B; otherwise, all the voters with $\xi^{jI} < \xi^{I}$ vote for candidate B and all the voters with $\xi^{jI} > \xi^{I}$ vote for candidate A. I indicate the share of votes of candidate $A$ in group $I$ with:

$$\pi^A = \sum_I n^I s^I [\xi^i + \frac{1}{2s^I}] \tag{8}$$

and substituting (7) into (8) I obtain:

$$\pi^A = \frac{h}{s} \sum_I n^I s^I [V^i(\vec{q}^B) - V^i(\vec{q}^A) - \zeta] + \frac{1}{2} \tag{9}$$

where $s \equiv n^I s^I$. Notice that $\pi^A$ is a random variable since it depends on $\zeta$ which is also random. Thus, the candidate A's probability of winning is:

$$\overset{A}{\Pr} = \Pr[\pi^A \geq \frac{1}{2}] = \Pr[\frac{h}{s} \sum_I n^I s^I [V^i(\vec{q}^B) - V^i(\vec{q}^A) - \zeta] + \frac{1}{2} \geq \frac{1}{2}]$$

and rearranging the terms I obtain:

$$\overset{A}{\Pr} = \Pr[\pi^A \geq \frac{1}{2}] = \Pr[\frac{h}{s} \sum_I n^I s^I [V^i(\vec{q}^B) - V^i(\vec{q}^A)] \geq \sum_I n^I s^I \zeta]$$

Similarly, candidate B wins with probability $\Pr^B = 1 - \Pr^A$. In this model, the probability of winning is thus a function of the distance between the two electoral platforms.

**Definition 1** *A pair $(q^{A*}, q^{B*})$ is called a (pure strategy) Nash equilibrium (NE) in the expected-plurality game if $E(\pi^A - \pi^B | q^A, q^{B*}) \leq E(\pi^A - \pi^B | q^{A*}, q^{B*}) \leq E(\pi^{A*} - \pi^B | q^A, q^B)$ for all $q^A, q^B$ which satisfy the budget constraint.*

### 2.2.3 An endogenous density function

The core assumption of a Single-Mindedness model affirms that *the density function which depicts the distribution of preferences of social groups for political parties is endogenously determined and depends on some issues.* In other words, it must be the case where over a single issue, different social groups have different preferences for political parties. In this model the issue is represented by the total amount of leisure. I assume that on this issue the two social groups have different visions and preferences for the parties A,B. For instance, the old may have a ticker distribution function of preferences than the young. A greater level of Single-Mindedness entails higher values of the density function which, in this case, tends to assume a ticker shape. From a statistical point of view, a more single-minded group should have

a distribution with higer levels of Kurtosis, with respect to a less single-minded groups. That is the distribution is more "leptokurtic "[3]. Figure 2 shows an example of different distributions in a two-issue problem. There are two groups (red and orange), and two issues (x and y).
[FIGURE 2 HERE]
The figure shows how the distributions of the two groups depend on the issue and that the red group has a ticker distribution for both the two issues, that is more single-minded. In this simple case the distribution is uniform in a closed interval. The broadness of the interval $(-\frac{1}{2s^I}, \frac{1}{2s^I})$ is endogenously determined: since $s$ is a monotonically increasing function of the two issues, higher level of the isses increase $s$ and thus reduce the broadness of the interval. As a result we have an higher level of concentration of the swing voters around the parameter $\zeta$. Summarizing the previous concept in a formula, I write the endogenous density function of leisure in a Single-Mindedness models as:

$$s^I = s(l^I) \tag{10}$$

### 2.3 The allocation of time amongst different activities

Another core assumption of the model is that social groups devote a fraction of their time to political activities and that the higher the amount of leisure spent in political activities, the higher the probability the group is able to capture politicians and, as a consequence, the higher the probability of being successful. The main idea that individuals allocate time between different activities dates back to Gary Becker's works ([3]) where households are seen both as consumers and as producers and the amount of activities undertaken are determined by maximising a utility function subject to prices and constraints on resources. The great idea by Becker was considering that consumption activities full cost is equal to the sum of market prices and the forgone value of the time used up. Thus, a representative consumer solves the following maximization problem:

$$\max U = U(l_i, ..., l_n) = Z(x_1, ..., x_n; T_1, ..., T_n)$$

subject to

$$g(l_1, ..., l_n) = l$$

where $g$ is an expenditure function of $l_i$ and $l$ is the bound on resources. The goods constraint is:

$$\sum_{i=1}^{n} p_i x_i = I = V + T_w \bar{w} \tag{11}$$

[3]Examples of leptokurtic distributions include the Laplace distribution and the logistic distribution

where $p_i$ is a vector of unit prices, $T_w$ is a vector of hours spent in working and $\bar{w}$ is the wage rate per unit of $T_w$. We have also a time constraint which can be written as:

$$\sum_{i=1}^{n} T_i = T_c = T - T_w \tag{12}$$

In other words the total available time $T$ may be seen as the sum of total time devoted to work $T_w$ and total time devoted to consumption activities $T_c$ which is the sum of time devoted to single consumption activities $T_i$. Let us assume now that

$$T_i \equiv t_i l_i \tag{13}$$

$$x_i \equiv b_i l_i \tag{14}$$

where $t_i$ is a vector giving the input of time per unit of $l_i$ and $b_i$ is a similar vector for market goods. Substituting (13) into (12), (12) and (14) into (11) we obtain:

$$\sum_{i=1}^{n} \underbrace{(p_i b_i + t_i \bar{w})}_{\pi_i} l_i = \underbrace{V + T\bar{w}}_{S} \tag{15}$$

$\pi_i$ represents the sum of the unitary prices of the goods and of the time spent for $l_i$. Let us now denote the *full income* (the maximum money income achievable) by $S$; this can be seen as the sum of the total labour earnings $I$ and the total earnings forgone in devoting time to consumption activities $L$. Thus:

$$L(l_1, ..., l_n) \equiv S - I(l_1, ..., l_n)$$

which can also be re-written as:

$$\sum_{i=1}^{n} p_i b_i l_i + L(l_1, ..., l_n) \equiv S \tag{16}$$

The equilibrium conditions resulting from maximising the utility function subject to (16) are:

$$U_i = T(p_i b_i + L_i) \tag{17}$$

where $p_i b_i$ is the direct and $L_i$ the indirect component of the total marginal price $p_i b_i + L_i$.

Describing more in details the basic elements of the workers' decision problem in this model, I assume that leisure is a vector $\vec{l}$ of N activities which can be undertaken in the spare time (indexed by $n = 1, ..., N$). One of these activities is lobbying politicians, which I will denote with $l_p$. In order to undertake such an activity some inputs such as knowledge of political situation, telephone calls and time are required. Suppose now to denote all the other consumption activities apart from lobbying with $l_{-p}$. Figure 3 shows the equilibrium we find (denoted with $k$), where the slope of the full income opportunity curve, which is equal to the marginal prices and would be equal to slope of an indifference curve (equals to marginal utilities). [FIGURE 3 HERE]

If we analyse the problem from a microeconomic perspective, the consumption set of activities that can be undertaken may be written as: $L = \Re_+^N = l \in \Re^N : l_n \geq 0$ for *n=1,...,N* where L is *convex set.* Each activity can be written as:

$$l_i = f_i(x_i, T_i) \tag{18}$$

where $x_i$ is a vector of inputs which are necessary to undertake the activity and $T_i$ a vector of time inputs using in performing the activity. The partial derivatives of $l_i$ with respect to both $x_i$ and $T_i$ are non-negative, that is $\frac{\partial l_i}{\partial x_i} \geq 0$ and $\frac{\partial l_i}{\partial T_i} \geq 0$.

If we look at leisure as a vector of activities, then (10) may be written as:

$$\vec{s} = s(\vec{l}(l_1, l_2, ..., l_N)) \tag{19}$$

Furthermore calculating derivatives:

$$\frac{\partial s^{l(l_1,l_2,...,l_N)}}{\partial l(l_1, l_2, ..., l_N)} \frac{\partial l(l_1, l_2, ..., l_N)}{\partial l_n} > 0 \tag{20}$$

Equation (20) says that the density function is monotonically increasing in leisure devoted to political activities. By the meaning of the chain rule we can divide the expression in two terms. The first term $\frac{\partial l(l_1,l_2,...,l_N)}{\partial l_n}$ represents the effect of an increase in leisure devoted to political activities on total leisure and it is positive. Otherwise, the term $\frac{\partial s^{l(l_1,l_2,...,l_N)}}{\partial l(l_1,l_2,...,l_N)}$ represents the effect of an increase in total leisure on the density function, which represents an indicator for the group cohesion and for the group political power. Also this term is positive, since an increase in time devoted to political activities is likely to increase the power of influence of a group. In this view the leisure spent by individuals in political activities can be seen as an investment in time, whose return is represented by the benefit they get from politicians.

In turn, the endogenous density may be seen as a measure of the group's single-mindedness; the higher the density of the group, the higher the single-mindedness and vice versa. This assumption would explain why those issues or preferences that are more commonly shared by individuals are politically more successful.

## 2.4 A three-stage game

I consider a three-stage game where two candidates, say A and B, wish to maximize their number of votes to win elections [4]. Both of them have an ideological label (for instance they are seen as "Democrats"or "Republicans "). I assume that this label is exogenously given.

In the first stage of the game, the two candidates, simultaneously and independently, announce (and committ to) a policy vector, $\vec{q}^A$ and $\vec{q}^B$.

In the second stage of the game elections take place. A candidate wins elections if and only if it obtains the majority of votes; in the case of a tie a coin is tossed as to choose the Government which will come to power. Furthermore, I assume that each party prefers to stay out from the competition than to enter and lose, that prefers to tie than stay out and it prefers to win than to tie.

Finally, in the third stage of the game, workers choose their work and leisure level, given the level of allowances chosen by the Government.

## 2.5 The equilibrium

I solve the game by backward induction, starting from the final stage.

A representative old worker solves the following optimization problem:

$$maxU^{\tau-1} = c_t^{\tau-1} + \psi^{\tau-1} \log l_t^{\tau-1}$$

$$s.t.\ c_t^{\tau-1} = ((1-\tau_{Lt}^{\tau-1}) + a_t^{\tau-1}\tau_{Lt}^{\tau-1})(\bar{t} - l_t^{\tau-1})$$

Solving with respect to $l_t^{\tau-1}$ I obtain an expression for the optimal labour supply:

$$l_t^{\tau-1*} = \frac{\psi^{\tau-1}}{(1-\tau_{Lt}^{\tau-1}) + a_t^{\tau-1}\tau_{Lt}^{\tau-1}} \tag{21}$$

and substituting into (1) I obtain an expression for the Indirect Utility Function:

$$V_t^{\tau-1} = \bar{t}((1-\tau_{Lt}^{\tau-1})+a_t^{\tau-1}\tau_{Lt}^{\tau-1})-\psi^{\tau-1}+\psi^{\tau-1}\log\psi^{\tau-1}-\psi^{\tau-1}\log((1-\tau_{Lt}^{\tau-1})+a_t^{\tau-1}\tau_{Lt}^{\tau-1}) \tag{22}$$

I do the same for the representative young worker:

$$\max\ U^{\tau} = c_t^{\tau} + \psi^{\tau}\log l_t^{\tau} + \beta^{\tau}(c_{t+1}^{\tau} + \psi^{\tau}\log l_{t+1}^{\tau})$$

$$s.t.\ c_t^{\tau} + \beta^{\tau}c_{t+1}^{\tau} = ((1-\tau_{Lt}^{\tau})+a_t^{\tau}\tau_{Lt}^{\tau})(\bar{t}-l_t^{\tau})+\beta^{\tau}((\bar{t}-l_{t+1}^{\tau})((1-\tau_{Lt+1}^{\tau})+a_t^{\tau}\tau_{Lt}^{\tau}))$$

$$l_t^{\tau*} = \frac{\psi^{\tau}}{(1-\tau_{Lt}^{\tau}) + a_t^{\tau}\tau_{Lt}^{\tau}} \tag{23}$$

[4]Lindbeck and Weibull 1987 and Dixit and Londregan 1996 demonstrated that the Nash equilibrium obtained if candidates maximize their vote share is identical to that obtained when candidates maximize their probability of winning

$$V^\tau = \bar{t}((1-\tau_{Lt}^\tau) + a_t^\tau \tau_{Lt}^\tau) - \psi^\tau + \psi^\tau \log \psi^\tau - -\psi^\tau \log((1-\tau_{Lt}^\tau) + a_t^\tau \tau_{Lt}^\tau) + a_t^\tau \tau_{Lt}^\tau) + \beta^\tau(\bar{t} - \psi^\tau)((1-\tau_{Lt+1}^\tau) + a_t^\tau \tau_{Lt}^\tau) + \beta^\tau \psi^\tau (\log \psi^\tau) \quad (24)$$

In the second stage of the game elections take place. It is easy to verify that the elections' outcome is a tie. The proof arises from the resolution of the first stage, where it will be demonstrated that in equilibrium, both parties choose an identical policy vector.

In the first stage, the two candidates choose their policy vectors. They face exactly the same optimization problem and maximize their share of votes or, equivalently, the probability of winning. The resolution is made for candidate A, but it also holds for candidate B.

$$\max\ \pi^A = \frac{1}{2} + \frac{h}{s} \sum_{I=\{T-1,T\}} n^I s^I [V^i(\vec{q}^A) - V^i(\vec{q}^B)]$$

$$n^{\tau-1}\tau_L(\bar{t} - l_t^{\tau-1})(w_t^{\tau-1} - a_t^{\tau-1}) + n^\tau \tau_L(\bar{t} - l_t^\tau)(w_t^\tau - a_t^\tau) = 0$$

I provide a complete resolution to the problem in the Appendix.

**Proposition 1** *In equilibrium both candidates' policy vectors converge to the same platform; that is $\vec{q}^A = \vec{q}^B = \vec{q}^*$.*

*Proof*: $\vec{q}^*$ represents the policy which captures the highest number of swing voters. Instead, suppose there exists other two policies $\vec{q}'$ and $\vec{q}''$; in moving from $\vec{q}^*$ to $\vec{q}'$ (or $\vec{q}''$) a candidate loses more swing voters than those it is able to gain. Thus, suppose a starting point where candidate A chooses $\vec{q}'$ and candidate B chooses $\vec{q}''$ such that in choosing $\vec{q}'$ and $\vec{q}''$ the elections outcome is a tie. If one candidate moved toward $\vec{q}^*$, it would be able to gain more swing voters than those it loses and thus, it would win the elections. So, choosing any policy but $\vec{q}^*$ cannot be an optimal answer. The only one policy which represents a Nash Equilibrium is $\vec{q}^*$ since it is the intersection between the optimal answers of the two candidates and no one candidate has an incentive to deviate. Since each candidate maximizes its share of votes, in equilibrium the two candidates receive both one half of votes; if one candidate should receive less than one half of votes it would always have the possibility to adopt the platform chosen by the other candidate and get the same number of votes. Notice that what we found here is the multidimensional analogue of Hotelling's principle of minimum differentiation.

**Corollary 1** *The utility levels reached by workers are the same; that is: $V^{iA} = V^{iB}$.*

**Proposition 2** *The marginal tax rate on labour is equal for both groups but the tax allowance is more beneficial for the group of the young.*

*Proof*: obtained via numerical simulations. See Table 2 and 3 and 4in Appendix 1.

**Proposition 3** *The optimal allowances are a function of the numerosity and density of both groups, of the marginal tax rate, of the total amount of time and the parameters representing the preferences of groups for leisure. That is* $a_t^I = a(s^I, s^{-I}, n^I, n^{-I}, t, \psi^I, \psi^{-I})$.

*Proof*: see Appendix 1.

Thus, the political economy framework suggests that tax rates should be differentiated, as stated by Proposition 2. Indeed, if the traditional normative approach suggests that a benvolent Governments *should tax* less the poorest social groups, the political economy approach suggests that in a real world vote-seeker Governments *tax* groups according to their ability to threat politicians in the electoral competition.

**Proposition 4** *All the old retire, whilst the young have a positive labour supply.*

*Proof*: see Appendix 1.

**Corollary 2** *Tax revenues collected via the labour taxation on the young are positive; tax revenues generated via the labour taxation on the old are equal to zero.*

*Proof*: It derives from Proposition 2 and 4.

Thus, even though the tax allowances favour the young, the fiscal system forces the old to pay such an high tax rate that they decide to retire. As a consequence, the revenues on the old cannot be other than zero, whilst the the tax revenues on the young are positive and the magnitude represent the total amount of pensions the old receive.

**Corollary 3** *The old workers are more single-minded than the young* ($s^{\tau-1} > s^{\tau}$).

*Proof*: The results derive from the assumption that the density function is a monotonically increasing one in leisure ($s = s(l)$). Since the old obtain more leisure in equilibrium, the density is higher and, by definition, the group is more single-minded.

Finally, the *Lagrange multiplier* has a political meaning: it represents the increase in the probability of winning for a candidate, if it had an additional dollar available to spend on redistribution.

# 3 Numerical Simulations

Numerical simulations was made since an analitical solution for the system to be solved is hard to achieve. Indeed, to get the optimal policy vector we have to solve a system of three equations with three unknonwns (the two tax allowances and the Lagrange multiplier). Nevertheless, also this process suffers from some problems. First of all, the *simultaneity.* We have assumed that the density function is endogenous in leisure; this implies that we should know the value of the density only after having calculated the optimal level of leisure which depends on the level of taxation which is what we want to evaluate. A possible way out for this problem is to guess a value for the density function and assess that the level of leisure is compatible with the value of the density only once the system was solved; in other words, if we assume that the density is monotonically increasing in the level of leisure, we have to find higher levels of leisure for the group of the old on which we have attributed an higher level of density. If this did not happen it would mean that our guess is wrong and the SMT fails. Secondly, the value of exogenous variable should be realistic, but unfortunatly it is difficult to attribute a real value to some parameters such as the preferences of workers for leisure. Furthermore, given the levels of tax allowance of the young, the tax allowance of the old comes from a second-order equation and thus we must exclude some solutions from the set of total solutions.

## 3.1 Main Findings

Main results are reported in table 1-3. Tables 1.a, 2.a and 3.a report the matrix of inputs, whilst tables 1.b, 2.b and 3.b the matrix of outcomes. We may see two important results: the tax allowance for the young is greater than the tax allowance for the old (compare the last column of tables x.a with the first column of tables x.b) and the leisure of the old is greater than the leisure of the young (compare the second and the third columns of tables x.b). Finally, the revenues genrated by the taxation of the young are always higher than the revenues generated by the taxation of the old (compare the fourth and fifth columns of tables x.b). These results are rather obvious if we consider that taxation of labour is the only instrument the Government has to force workers to reduce or increase their labour offer. In this case, since the old prefer to reduce labour more than the young, the Government imposes a taxation system which entails higher fiscal benefits for the young. Nevertheless, the taxation system is not the only reason why the old offer less labour; also the parameter of preference for leisure $\psi$ is fundamental to determine the labour supply. In the simulation this parameter is supposed to be greater than $\frac{1}{2}$ for the old and less than $\frac{1}{2}$ for the young. The fact that the revenues generated by the taxation on the young are always higher that those generated by the taxation on the old (which eventually will be equal to zero since all the old will be retired), even though the young gain a fiscal benefit, is mainly due to the value assumed by the parameter representative of worker preferences for leisure. This results do not intend, obsviously, to replicate exactly the right number we may find in reality, as for tax rates, allowances and so on. For instance, it appears not realistic to adopt high tax rates or so high levels of taxation to force all the workers to retire.

# 4 Theory and evidence: a review

In this section I review some of the empirical evidence found in the literature which may support the SMT. I remind that if the SMT was right, we should observe in reality high levels of retirement within the old workers accompanied by high marginal tax rates on labour. I will mainly focus on the U.S. case referring to recent works by Peter Diamond (1997) and Mulligan & Sala-i-Martin (1999).

## 4.1 The Unceasing Decrease in labour Market Participation Around the World

According to Diamond, the stylized facts would show that the participation of the older persons in the labour market has been gradually declining over the 20th century. For instance, in 1950 almost 60% of men age 65-69 partecipated in the labour force, while by 1990 this figure had fallen to 26%. Otherwise, the percentage of workers covered by SS System has significantly rose over the same period. There has been also a dramatic increase in the share of the older population receiving payments from public schemes. Thus, it seems there would exist a strong linkage between SS System and incentive to retirement. To verify this linkage he analysed the *hazard rate*, defined as the increase in the rate of labour force leaving from the previous age, relative to the stock of workers participating at the previous age. The trend, both for males and females, shows the suggestive existence of two spikes around age 62, the age of eligibility for early retirement under Social Security and age 65, which is the legal retirement age. Trying to give an explanation to this phenomenon, Mulligan and Sala-i-Martin note that the Government retirement ages have not risen with an augmented life expectancy and a bettering in health, since we would expect the fraction of GDP devoted to public programs for the old to increase less than one-for-one, because the deadweight losses associated with SS taxes presumably increases with respect to an increasing rate, while in the real world this ratio varies exactly one-for-one with the fraction of the population over age 60. Secondly, the Social Security have mostly pay-as-you-go features, which means that an intergenerational transfer always exists. Identical results were achieved by Ruzik [38], which analised the retirement bahaviour in Poland, Hungary and Lithuania; the main result of the econometric analysis was that becoming unemployed at older age is a strong factor increasing probability of retirement and that there exists a strong linkage between retirement and the right to get a social security benefit in advanced age. Aguiar [1] tried to go more in details in anlasying the allocation of time; he confirmed results obtained by previous literature that time devoted to leisure has increased significantly in the United States over the last five decades, but he made a further effort to disaggregate uses of household time into specific categories, namely *market work time*, *non-market time* and *leisure time*. The market work time is represented by a core market work (main jobs, second jobs, overtime, time spent working at home) plus time spent commuting to/from work and time spent on ancillary work activities (i.e. eating a meal); the study shows that this category has been remaining costant between 1965 and 2003, even though with a difference between men and women work. The non-market work encompasses activities such as household activities (i.e. cleaning, ironing, vacuuming), time spent obtaining goods and services (i.e. shopping) and time spent on other home production (i.e. gardening, vehicle repair). In this case, time spent in these activities has fallen sharply over the same period of time. Otherwise, leisure time, consisiting in the residual of work activities has been increased significanlty. Huovinen and Piekkola [22], in a study on early retirement and use of time by older Finns, argued that factors related to labour demand, in addition to personal financial incentives and health, are very important in determining the early retirement in Finland and that changes in how leisure time is valued explain the level of withdrawal from labour market. Finally Dorn & Sousa-Poza [9], analysing early retirement in Switzerland, discovered that early retirement positively depends on the level of wealth, the level of education, a negative attitude toward the job, preferences toward leisure and retirement incentives provided by firms. Thus, it seems that an hihg level of accomulated wealth entails a higher probability to retire. Table 1 shows the dramatic decline in the employment of older workers as a fraction of male populations which occured in some OECD countries over the last five decades. Except Japan, partecipation rates have been declining from above 80 percent to below 50 percent.

**Table 1** - Employment of male workers at age 55 to 64 as a percentage of male populations of the same age

| | 1980 | 1990 | 1995 | 2000 |
|---|---|---|---|---|
| *Belgium* | 47.7 | 34.3 | 34.5 | 35, 1 |
| *Canada* | 71.3 | 60.3 | 53.7 | 57.7 |
| *France* | 65.3 | 43.0 | 38.4 | 38.5 |
| *Germany* | 64.1 | 52.0 | 48.2 | 48.2 |
| *Japan* | 82.2 | 80.4 | 80.8 | 78.4 |
| *United Kingdom* | 62.6 | 62.4 | 56.1 | 59.8 |
| *United States* | 69.7 | 65.2 | 63.6 | 65.6 |

*Source*: Fenge & Pestieau (2005)

### 4.1.1 Early Retirement: Free Choice or Forced Decision?

As we have demonstrated in the previous point, data referring to retirement show a clear downward trend in labour market participation. Then, a natural question arises: do people voluntarely retire earlier or are they forced to retire from labour market conditions? This question still has not found a robust answer, since it would require a perfect knowledge about individual preferences for retirement which we do not actually have. Nevertheless, find an answer to this question would be fundamental to understand how workers react to a change in social security system variables, such as an increase in the legal retirement age, the transition from a PAYG System to a Fully Funded System or any other pension reform. The imporance of being able to answer this question is highlighted by the following example: imagine to introduce a policy which aims to supply education to the elder workers; if their preferences are such that they only desire to retire to enjoy more leisure rather than to work, probably these measures would not be much effective; otherwise, suppose retirements take place due to labour market reasons (i.e. a negative economic trend which forces firms to incentive workers exodous, bad perception the old have about their ability to permorm a job, and so forth); in this case a good intervention by Governments in Social Security policies would stimulate workers to withdraw from earlier retirement. Strange enough, the economic literature has not been focusing so much over this issue. The main stream of literature on early-retirement believes that to understand workers' retirement decisions, we must focus on the *labour-supply side*; the main evidence this theory achieved is that earlier and more generous availability of public old-age benefits (or more generous early retirement regulations) tend to increase early exits from the labour market, since early retirement becomes a more attractive choice for individuals. Thus, labour-supply economists believe that early retirement is more a free choice than a forced decision. Empirical evidence about the retirement incentives (see Fenge & Pastieu [17], Coile & Gruber [6] and Gruber & Wise [19]) found that retirement incentives are strongly related to early retirement, that most wealthy people, that is people who would have more opportunities to continue to work, are more likely to retire earlier, and that workers are more likely to prefer retirement to work as they get old. Otherwise, the *labour-demand side* perspective has not received the same attention and only in more recent years has gained interest among economists. In this case, early retirement is seen more as a forced decision than a free choice.

### 4.1.2 Are preferences for leisure of the old higher than those of the young?

In the model I assumed that the intrinsic preference for leisure of the old were higher than that of the young ($\psi^{\tau-1} > \psi^{\tau}$). This assumption is the most difficult to verify, since it entails a complete knowledge about preferences of individuals which actually we do not have. Thus, this evaluation must take place adopting indirect proxies. A study by McGrattan & Rogerson [28] analysed changes in hours worked since 1950 for different demographic groups. They discovered that despite the average weekly hours worked per person at the aggregate level has not substantially changed over the period and college enrollments over the monitored period increased, the number of weekly hours worked by individuals aged 15-24 increased nearly 10 percent and the number of hours worked by individuals aged 25-54 increased about 20 percent; otherwise, hours worked by workers aged 55-64 fell 6.5 percent and those of workers aged 65-74 fell 57 percent. Thus, it seems that U.S. labour market has experimented a reallocation of hours worked among cohorts[5]. This result seems to confirm our assumption: the young prefer to work, although they have to invest in human capital while they are under 30, whilst the old over 50 prefer to retire. Despite the classical motivations the literature has brought to explain this phenomenon, it seems there also exist a “natural”tendency to retire soon after the middle age due to biological reasons.

### 4.1.3 How do retirees use their leisure?

In the model I assumed that the the old have a higher level of preference for leisure than the young ($\psi^{\tau-1} >> \psi^{\tau}$) and I provided some theories which may support this hypothesis. The empirical evidence seems to confort theoretical results. Huovinen and Piekkola suggest that leisure allocation is a highly significant factor explaining retirement decisions and that not only the overall increase in leisure makes retirement more attractive but also the way this increased leisure is allocated. Results of the survey shown that the share of more active activities is higher amongst the non-employed, while passive activities (i.e. watching television, reading books and so forth) is higher amongst the empoloyed. In my opinion, an interesting consideration stated in this study is that *the actively used leisure time works a substitute for decreased income to work.*

[5] monitoring disaggregate data among cohorts was essential to challange the classical theory by Prescott, who sustained looking at aggregate values that elasticity of substitution between consumption and leisure was near 1

### 4.2 SS System and Marginal Tax Rates

According to Mulligan and Sala-i-Martin, if we take into account the time pattern of tax/subsidy rates across earning groups, we would see that before age 62 the tax rate is higher, the higher is the wage earned by workers. For instance, consider a single worker with a last year of work equal to 55; the calculated tax rate is equal to 4.3%. Consider again a single worker, but this time with a last year of work equal to 69; this time, the tax rate is equal to 44.2%. Finally, to discourage working, some countries tax the labour income of the elderly at 100% rates. Some example are derived from Spain and Belgium where "elderly are not allowed to collect their government pension if they earn any labour income at all and those benefits are typically close to or more than what the pensioner would have earned after taxes if he had kept working ". Otherwise, France "allows pensioners to receive labour income, but not from their preretirement occupation ". Furthermore, the authors evaluate that the size of the public pension benefits in some countries are nearly the size of the average worker's earnings and thus the range of income to which the 100% implicit tax rate is very large. But the most effective explanation about the high tax rate applied on the old refers to the free riding problem within a group. In this view, considering selfish individuals who does not care about interests of other members, the existence of high tax rates on labour income could be seen as a measure undertaken by the group itself to overcome a free-riding threat; thus, it would be the group itself which forces the Government to impose high tax rates in order to induce members to retire so that they can spend part of their leisure in political activities in order to protect the group's interests.

### 4.3 The Political Economy of Early Retirement

The recent trend which refers to early retirement is something of unacceptable from a normative perspective. How can we justify policies which favour early retirement, when due to demographical causes and financial troubles the actual social security systems are universally considered unsustainable? The normative theory states that to meet financial problems and improvements in longevity the retirement age should be raised. Actually answers should be found in the political economy. According to recent studies (see Jacobs and Shapiro [23], Ferrera [14], and Boeri, Borsch-Supan & Tabellini [4]) it seems that both in the U.S. and in Europe the majority of people are against higher payroll taxes, lower benefits, and a higher retirement age. Surveys show that European citizens are neither happy with the existing programs nor willing to reform the welfare state. Even though the evidence about the political economy of early retirement seems to be clear and robust, we still lack of models which are able to explain the phenomenon. Even recent models (see Fenge & Pestieau [17]) seem to suffer from mispecification problems; indeed, in the model of political choice, individuals vote on a mandatory age of retirement, maximising a lifetime utility function where the age of retirement negatively affects the utility of voters. This seems incorrect, because an higher retirement age increases the monetary value of consumption; that is, consumption is a function of time spent in working. Furthermore, consumption is a monetary variable while the age of retirement is a time variable and, again, it seems quite incorrect to sum a monetary variable with a time variable. Finally, the model does not take into account the value of leisure, which is, in my opinion, the key point to understand the political economy of early retirement. In fact, an higher age of retirement *increases* the monetary value of total consumption, but *decreases* the value of total leisure. To understand why voters seem to be unwilling to increase the retirement age we have to find answers in individual preferences. If we assume that working more means to have less leisure, as it is obvious, then people do not accept to work more simply because the monetary value of the consumption due to an increase in working time is lower than the monetary value of leisure. It is not the age of retirement *per se* which reduces the individual's utility but the reduced values of total leisure which an increase in the retirement age produces, instead.

# 5 Conclusions

I introduced a political economy model which analysis the optimal taxation problem when candidates are supposed to be voter-seekers which aim to maximize the probability to win elections in a society characterized by different social groups. I derived the optimal taxation structure in a framework characterized by overlapping generations; I demonstrated that the optimal taxation on labour depends on the preferences of a group towards leisure, which must be used as a proxy for the single-mindedness of that group. One of the most interesting conclusion the model achieves states that eventually the young receive a positive fiscal benefit, even though they have to pay higher tax revenues. Finally, I demonstrated that, due to the features of fiscal system, the leisure of the old is so high that it also induce all the old to retire; this result is not only theoretical by also holds in reality; the situation around the OECD countries shows that the retirement age has increasingly reduced over the last decades and this is due to the generosity of social security services and the strucure of fiscal systems. Nevertheless, studies on the application of the SMT to the labour market are at the very beginning and they open new interesting fields of research. This model is far from being able to explain the relationship between social groups' behavior and labour market characteristics. For instance, it would be interesting to analyse more in details the role of institutions, such as labour unions or association of retirees on the political outcome; another field of research could study the conflicts among unions and employers endogenizing the bargaining power of the two social groups according to the single mindedness theory's assumptions. Finally, this model does not take into account any issue which refers to savings; it would be useful to analyse the effect of savings in different pensions schemes, such as the PAYG or the Fully-Funded systems. I hope that these issues could be analyzed in future works.

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# 7 Appendix 1

In this Appendix I provide a complete resolution to the candidates' problem. The two candidates face exactly the same optimization problem; they maximize their share of votes or, equivalently, the probability of winning. The resolution is made for candidate A, but it also holds for candidate B.

$$\max\ \pi^A = \frac{1}{2} + \frac{h}{s} \sum_{I=\{T-1,T\}} n^I s^I [V^i(\vec{q}^A) - V^i(\vec{q}^B)]$$

$$T_1 \equiv n^{\tau-1}\tau_L(\bar{t} - l_t^{\tau-1})(1-a_t^{\tau-1}) + n^\tau \tau_L(\bar{t} - l_t^\tau)(1-a_t^\tau) = 0$$

I write the Lagrangian function:

$$L = \frac{1}{2} + \sum_{I=\{T-1,T\}} n^I s^I [V^i(\vec{q}^A) - V^i(\vec{q}^B)] + \lambda\,(T_1)$$

I obtain the following first order conditions which may be seen as a modified version of the original Lindbeck and Weibull first order conditions:

(1) $\frac{\partial L}{\partial a_t^{\tau-1}} \equiv n^{\tau-1}\frac{\partial s^{\tau-1}}{\partial l_t^{\tau-1}}\frac{\partial l_t^{\tau-1}}{\partial a_t^{\tau-1}}(V^{\tau-1A} - V^{\tau-1B}) + n^{\tau-1}s^{\tau-1}(\frac{\partial V^{\tau-1}}{\partial a_t^{\tau-1}}) = \lambda\frac{\partial T(1)}{\partial a_t^{\tau-1}}$

(2) $\frac{\partial L}{\partial a_t^{\tau}} \equiv n^{\tau}\frac{\partial s^{\tau}}{\partial l_t^{\tau}}\frac{\partial l_t^{\tau}}{\partial a_t^{\tau}}(V^{\tau A} - V^{\tau B}) + n^{\tau}s^{\tau}(\frac{\partial V^{\tau}}{\partial a_t^{\tau}}) = \lambda\frac{\partial T(1)}{\partial a_t^{\tau}}$

(3) $T(1) = 0$

According to the result stated in Corollary 1, FOC's can be re-written in the following manner:

(1) $\frac{\partial L}{\partial a_t^{\tau-1}} \equiv n^{\tau-1}s^{\tau-1}(\frac{\partial V^{\tau-1}}{\partial a_t^{\tau-1}}) = \lambda\frac{\partial T(1)}{\partial a_t^{\tau-1}}$

(2) $\frac{\partial L}{\partial a_t^{\tau}} \equiv n^{\tau}s^{\tau}(\frac{\partial V^{\tau}}{\partial a_t^{\tau}}) = \lambda\frac{\partial T(1)}{\partial a_t^{\tau}}$

(3) $T(1) = 0$

and after some easy calculations, I obtain:

(1) $n^{\tau-1}s^{\tau-1}(\bar{t}\tau_L + \frac{\psi^{\tau-1}\tau_L}{(1-(1-a_t^{\tau-1})\tau_L)}) - \lambda(\frac{(1-a_t^{\tau-1})\tau_L^2\psi^{\tau-1}n^{\tau-1}}{(1-(1-a_t^{\tau-1})\tau_L)^2}) - n^{\tau-1}\tau_L(\bar{t} - \frac{\psi^{\tau-1}}{(1-(1-a_t^{\tau-1})\tau_L)})) = 0$

(2) $n^{\tau}s^{\tau}(\bar{t}\tau_L + \frac{\psi^{\tau}\tau_L}{(1-(1-a_t^{\tau})\tau_L)}) - \lambda(\frac{(1-a_t^{\tau})\tau_L^2\psi^{\tau}n^{\tau}}{(1-(1-a_t^{\tau})\tau_L)^2} - n^{\tau}\tau_L(\bar{t} - \frac{\psi^{\tau}}{(1-(1-a_t^{\tau})\tau_L)})) = 0$

(3) $T(1) = 0$

From (1) and (2) obtain:

$$\lambda = \frac{n^{\tau-1}s^{\tau-1}(\bar{t} + \frac{\psi^{\tau-1}}{(1-(1-a_t^{\tau-1}))})}{(\frac{(1-a_t^{\tau-1})\tau_L\psi^{\tau-1}n^{\tau-1}}{(1-(1-a_t^{\tau-1})\tau_L)^2}) - n^{\tau-1}(\bar{t} - \frac{\psi^{\tau-1}}{(1-(1-a_t^{\tau-1})\tau_L)}))} = \frac{n^{\tau}s^{\tau}(\bar{t} + \frac{\psi^{\tau}}{(1-(1-a_t^{\tau}))})}{(\frac{(1-a_t^{\tau})\tau_L\psi^{\tau}n^{\tau}}{(1-(1-a_t^{\tau})\tau_L)^2} - n^{\tau}(\bar{t} - \frac{\psi^{\tau}}{(1-(1-a_t^{\tau})\tau_L)}))}$$

Solving this system of equations analitically is a very difficult task. This is why I performed some numerical simulations instead. In the following tables the main results are reported.

**Table 2.a** - Main results obtained via numerical simulations with *Mathematica 5.2* - Input Matrix ($\tau = 0.3$)

| $n^{\tau-1}$ | $n^{\tau}$ | $\tau_L$ | $t$ | $\psi^{\tau-1}$ | $\psi^{\tau}$ | $s^{\tau-1}$ | $s^{\tau}$ | $a_t^{\tau}$ |
|---|---|---|---|---|---|---|---|---|
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-1$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.9$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.8$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.7$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.6$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.5$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.4$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.3$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.2$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.1$ |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.1 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.2 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.3 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.4 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.5 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.6 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.7 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.8 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.9 |
| 0.5 | 0.5 | 0.3 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 1 |

**Table 2.b** - Main results obtained via numerical simulations with *Mathematica 5.2* - Output Matrix ($\tau = 0.3$)

| $a_t^{\tau-1}$ | $l_t^{\tau-1}$ | $l_t^{\tau}$ | $T_t^{\tau-1}$ | $T_t^{\tau}$ |
|---|---|---|---|---|
| $-0.6666$ | $1(ret)$ | 0.5 | 0 | 0.15 |
| $-0.6740$ | $1(ret)$ | 0.4651 | 0 | 0.1524 |
| $-0.6745$ | $1(ret)$ | 0.4347 | 0 | 0.1526 |
| $-0.6694$ | $1(ret)$ | 0.4081 | 0 | 0.1509 |
| $-0.6596$ | $1(ret)$ | 0.3846 | 0 | 0.1476 |
| $-0.6456$ | $1(ret)$ | 0.3636 | 0 | 0.1431 |
| $-0.6277$ | $1(ret)$ | 0.3448 | 0 | 0.1375 |
| $-0.6062$ | $1(ret)$ | 0.3278 | 0 | 0.131 |
| $-0.581$ | $1(ret)$ | 0.3125 | 0 | 0.1237 |
| $-0.5521$ | $1(ret)$ | 0.2985 | 0 | 0.1157 |
| $-0.5194$ | $1(ret)$ | 0.2857 | 0 | 0.1071 |
| $-0.4824$ | $1(ret)$ | 0.2739 | 0 | 0.0980 |
| $-0.4408$ | $1(ret)$ | 0.2631 | 0 | 0.0884 |
| $-0.3939$ | $1(ret)$ | 0.2531 | 0 | 0.0784 |
| $-0.3408$ | $1(ret)$ | 0.2439 | 0 | 0.068 |
| $-0.28$ | $1(ret)$ | 0.2352 | 0 | 0.0573 |
| $-0.2094$ | $1(ret)$ | 0.2272 | 0 | 0.0463 |
| $-0.1256$ | $1(ret)$ | 0.2197 | 0 | 0.0351 |
| $-0.0224$ | $1(ret)$ | 0.2127 | 0 | 0.0236 |
| 0.1140 | $1(ret)$ | 0.2061 | 0 | 0.0119 |
| 0.3333 | $1(ret)$ | 0.2 | 0 | 0 |

**Table 3.a** - Main results obtained via numerical simulations with *Mathematica 5.2* - Input Matrix ($\tau = 0.4$)

| $n^{\tau-1}$ | $n^{\tau}$ | $\tau_L$ | $t$ | $\psi^{\tau-1}$ | $\psi^{\tau}$ | $s^{\tau-1}$ | $s^{\tau}$ | $a_t^{\tau}$ |
|---|---|---|---|---|---|---|---|---|
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-1$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.9$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.8$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.7$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.6$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.5$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.4$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.3$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.2$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | $-0.1$ |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.1 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.2 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.3 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.4 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.5 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.6 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.7 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.8 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 0.9 |
| 0.5 | 0.5 | 0.4 | 1 | 0.8 | 0.2 | 0.02 | 0.01 | 1 |

**Table 3.b** - Main results obtained via numerical simulations with *Mathematica 5.2* - Output Matrix ($\tau = 0.4$)

| $a_t^{\tau-1}$ | $l_t^{\tau-1}$ | $l_t^{\tau}$ | $T_t^{\tau-1}$ | $T_t^{\tau}$ |
|---|---|---|---|---|
| $imaginaryroot$ | $-$ | $-$ | $-$ | $-$ |
| $imaginaryroot$ | $-$ | $-$ | $-$ | $-$ |
| $imaginaryroot$ | $-$ | $-$ | $-$ | $-$ |
| 0.0704 | $1(ret)$ | 0.9375 | 0 | 0.02124 |
| $-0.0931$ | $1(ret)$ | 0.8333 | 0 | 0.0533 |
| $-0.1737$ | $1(ret)$ | 0.75 | 0 | 0.0749 |
| $-0.2184$ | $1(ret)$ | 0.6818 | 0 | 0.089 |
| $-0.2429$ | $1(ret)$ | 0.625 | 0 | 0.0975 |
| $-0.2542$ | $1(ret)$ | 0.5769 | 0 | 0.1015 |
| $-0.2559$ | $1(ret)$ | 0.5357 | 0 | 0.1021 |
| $-0.2499$ | $1(ret)$ | 0.5 | 0 | 0.1 |
| $-0.2376$ | $1(ret)$ | 0.4687 | 0 | 0.0956 |
| $-0.2194$ | $1(ret)$ | 0.4411 | 0 | 0.0894 |
| $-0.1955$ | $1(ret)$ | 0.4166 | 0 | 0.0816 |
| $-0.1656$ | $1(ret)$ | 0.3947 | 0 | 0.0726 |
| $-0.1293$ | $1(ret)$ | 0.375 | 0 | 0.0625 |
| $-0.0852$ | $1(ret)$ | 0.3571 | 0 | 0.0514 |
| $-0.0314$ | $1(ret)$ | 0.3409 | 0 | 0.0395 |
| 0.0354 | $1(ret)$ | 0.326 | 0 | 0.0269 |
| 0.1228 | $1(ret)$ | 0.3125 | 0 | 0.0137 |
| 0.2499 | $1(ret)$ | 0.3 | 0 | 0 |

**Table 4.a** - Main results obtained via numerical simulations with *Mathematica 5.2* - Input Matrix ($\tau = 0.15$)

| $n^{\tau-1}$ | $n^{\tau}$ | $\tau_L$ | $t$ | $\psi^{\tau-1}$ | $\psi^{\tau}$ | $s^{\tau-1}$ | $s^{\tau}$ | $a_t^{\tau}$ |
|---|---|---|---|---|---|---|---|---|
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-1$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.9$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.8$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.7$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.6$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.5$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.4$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.3$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.2$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | $-0.1$ |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.1 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.2 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.3 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.4 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.5 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.6 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.7 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.8 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 0.9 |
| 0.5 | 0.5 | 0.15 | 1.5 | 0.85 | 0.15 | 0.02 | 0.01 | 1 |

**Table 4.b** - Main results obtained via numerical simulations with *Mathematica 5.2* - Output Matrix ($\tau = 0.15$)

| $a_t^{\tau-1}$ | $l_t^{\tau-1}$ | $l_t^{\tau}$ | $T_t^{\tau-1}$ | $T_t^{\tau}$ |
|---|---|---|---|---|
| *imaginaryroot* | $-$ | $-$ | $-$ | $-$ |
| *imaginaryroot* | $-$ | $-$ | $-$ | $-$ |
| 0.1333 | $1(ret)$ | $1(ret)$ | 0 | 0 |
| $-0.225$ | $1(ret)$ | $1(ret)$ | 0 | 0.2125 |
| $-0.2986$ | $1(ret)$ | 0.75 | 0 | 0.3 |
| $-0.325$ | $1(ret)$ | 0.6 | 0 | 0.3374 |
| $-0.3333$ | $1(ret)$ | 0.4999 | 0 | 0.3499 |
| $-0.3321$ | $1(ret)$ | 0.4285 | 0 | 0.3482 |
| $-0.325$ | $1(ret)$ | 0.375 | 0 | 0.3375 |
| $-0.3136$ | $1(ret)$ | 0.3333 | 0 | 0.3208 |
| $-0.2986$ | $1(ret)$ | 0.3 | 0 | 0.2999 |
| $-0.2804$ | $1(ret)$ | 0.2727 | 0 | 0.2761 |
| $-0.2590$ | $1(ret)$ | 0.25 | 0 | 0.25 |
| $-0.2341$ | $1(ret)$ | 0.2307 | 0 | 0.2221 |
| $-0.2055$ | $1(ret)$ | 0.2142 | 0 | 0.1928 |
| $-0.1724$ | $1(ret)$ | 0.1999 | 0 | 0.1625 |
| $-0.1339$ | $1(ret)$ | 0.1875 | 0 | 0.1312 |
| $-0.0883$ | $1(ret)$ | 0.1764 | 0 | 0.0992 |
| $-0.0330$ | $1(ret)$ | 0.1666 | 0 | 0.0666 |
| 0.0369 | $1(ret)$ | 0.1578 | 0 | 0.0335 |
| 0.1333 | $1(ret)$ | 0.15 | 0 | 0 |

# 8 Appendix 2

Suppose that individuals' preferences are represented by the following function:

$$\Lambda = U(c) + V(p) \tag{25}$$

with $U_1, V_1 > 0$ and $U_{11}, V_{11} < 0$ $c$ represents a basket of market goods and $p$ represents the political activity non-market good, which is produced according to a CRTS production function

$$p = H(l, d) = dH(\frac{l}{d}, 1) \tag{26}$$

with $H_1, H_2 > 0$ and $H_{11}, H_{22} < 0$. $H$ is a standard function, $d$ represents purchased inputs to undertake political activities and $l$ is time spend in political activities. The fixed quantity of the worker input sells at the price $c$, again measured in terms of time. Suppose now that the worker has a total amount of time $T$ (which I normalize to the unity) he can divide between working in the labour market for a market wage rate equal to $w$ or using to undertake political activities. Define the function:

$$X(l, d) = V(dH(\frac{l}{d}, 1)) \tag{27}$$

Now, according to Paretian definitions, define $l$ and $p$ as complements when $X_{12} > 0$ and substitutes when $X_{12} > 0$. the individual's maximization problem is[6]:

$$\max_{l} U(w(\bar{t} - l) - cw) + X(l, d) \tag{28}$$

First Order Conditions are given by:

$$\overbrace{X_1(l, d)}^{V_1(dH(\frac{l}{d},1))H_1(\frac{l}{d},1)} \qquad -wU_1(w(\bar{t} - l) - cw) = 0 \tag{29}$$

First order conditions state that the gain due to an extra unit of time spent in polical activities ($X_1(l, d) > 0$) is offset by the loss in terms of foregone utility in labour market ($wU_1(w(\bar{t} - l) - cw)$). Figure 2 shows the solution for $l$ when $l$ and $d$ are *complements*, while Figure 3 shows hte solution for $l$ when $l$ and $d$ are *substitutes*. Thus if we suppose that inputs to perform political activities are complements of time spent in these activities, we assist to an increase in leisure time devoted to non-market work. An increase in time spend in political activities requires a decrease in time spent in working. To evaluate whether $l$ and $d$ are complements or substitutes we analyse the following expression:

$$\overbrace{X_1(l, d)}^{marginal benefit of time spent in political activity} =$$

$$\overbrace{V_1(dH(\frac{l}{d}, 1))}^{marginal utility of political activity} \times \overbrace{H_1(\frac{l}{d}, 1)}^{marginal product of time spent in political activity}$$

Notice that $\frac{\partial V_1(dH(\frac{l}{d},1))}{\partial d} < 0$, whilst $\frac{\partial H_1(\frac{l}{d},1)}{\partial d} > 0$. Thus $X_{12} = -V_{11}H_1^2(\frac{l}{d}) - V_1H11\frac{l}{d^2} + V_{11}HH_1$ which depends on whether the elasticity of the marginal product of labour with respect to the time-goods ratio $-(\frac{l}{d})\frac{H_{11}}{H_1}$ is smaller or larger than the elasticity of marginal utility with respect to the political activity $-p\frac{V_{11}}{V_1}$, weighted by share of purchased inputs in output, $\frac{d(H - \frac{H_1 l}{d})}{p}$.

*Example 1*

Suppose:

$$U(c) = \gamma \ln(c)$$

[6] note the second order conditions entails $w^2U_{11} + X_{11} < 0$

$$V(p) = (1-\gamma)\ln(p)$$

The “technology ”used by worker to produce the political activity exploits a CES production function $H(l,d) = (d^\rho + l^\rho)^{\frac{1}{\rho}}$ and the worker's budget constraint is given by $c = w(\bar{t} - l - c)$. Thus, the worker maximization problem can be written as:

$$\max_l \ \gamma \ln w + \gamma \ln(\bar{t} - l - c) + (1-\gamma)\ln(d^\rho + l^\rho)^{\frac{1}{\rho}}$$

which entails the following first order conditions:

$$\frac{\gamma}{1-\gamma} = \frac{\bar{t} - l - c}{d^\rho + l^\rho} l^{\rho - 1}$$

which is independent from the wage rate, since the increased opportunity cost of the political activity *substitution effect*is offset by the fact that higher wages make the worker wealthier *income effect*.

*Example 2 - Effects of labour income taxation*

Take now the setup from Example 1 but now $U(c) = \ln(c - \varsigma)$ and $c = (1-\tau)w(1-l) + t$ where $\tau$ represents the labour income taxation and $t$ a positive lump-sum transfer which is a fraction $\theta$ of taxes collected by Government whose budget is $g + t = \tau w(\bar{t} - l)$. Solving the problem we obtain the following first order condition:

$$\frac{(1-\tau)w}{c - \varsigma} = 1$$

$$c = [1 - \tau(1-\theta)]w(\bar{t} - l)$$

and finally:

$$\bar{t} - l = \frac{1-\tau}{[1-\tau(1-\theta)]} + \frac{\varsigma}{w[1-\tau(1-\theta)]}$$

Three case arise:

1. $\varsigma = 0$ and $\theta = 0 \Rightarrow$ tax rate does not affect hours worked.
2. $\varsigma = 0$ and $\theta = 1 \Rightarrow$ higher tax rates reduce hours worked since only substitution effect holds.
3. $\varsigma > 0$ and $\theta = 0 \Rightarrow$ higher tax rated increrase hours worked since the (negative) income effect more than offset the (positive) substitution effect.

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