

Social security, income taxation and poverty alleviation

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Abstract. In this paper I consider the normative arguments that justify a public social security system as a redistributive device when government is concerned with individual utility and poverty. Redistribution can be done using social security, income taxation or both. The main objective of this paper is to show how the consideration of a planner that cares about poverty and utility increases the desirability of social security with respect to the case when the planner only cares about utility.

Key words: welfarism, poverty, income taxation, social security.

JEL classification: H21, H23, H51, H55.

Resumen. En este artículo considero los argumentos que justifican el uso del sistema de seguridad social como parte de un sistema para la redistribución. Asumiendo que el gobierno se preocupa por la desigualdad del ingreso y por la pobreza, estudio el diseño del sistema de seguridad social conjuntamente con el del impuesto sobre el ingreso laboral. El objetivo principal del artículo es mostrar que la seguridad social adquiere mayor importancia como instrumento para la redistribución cuando el planificador se preocupa por la utilidad individual y la pobreza, que cuando sólo se preocupa por la utilidad.

Palabras clave: bienestar, pobreza, impuestos a la renta, seguridad social.

Clasificación JEL: H21, H23, H51, H55.

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1. Introduction

The problem of redistribution can be seen from three different domains: positive, normative, and political. From the positive domain the concern is to provide potential explanations of inequality. From the normative domain one looks for explanations about why redistribution should occur and which are the best instruments for redistribution. Lastly, the political domain attempts to understand how the decisions regarding redistribution are taken in a society. This paper focuses on the normative domain of redistribution; naturally, the positive domain must also be considered since it is needed as a framework to study the reaction of workers to policies.

The positive domain is taken as given. Individuals are assumed to differ in wage and probability of getting sick, both of which affect consumption. Since I will assume that individuals' welfare is fulfilled through consumption, heterogeneity generates inequalities that may justify government intervention. Individuals with a low wage will have a low labor income and hence a lower consumption level. Heterogeneity in the probability of sickness affects welfare since it also affects consumption. If individuals are risk averse, and insurance markets are complete, they will buy full insurance. This means high-risk individuals (those with high probability of illness) will face a higher cost of insurance and will have a lower consumption than low-risk individuals.

The setting in this paper is one in which the social planner has a plurality of objectives. In economics, it is traditionally assumed that the central planner determines the optimal allocations in a way that only considers the utility level of the agents in the economy. Generally welfare is measured through some aggregation of the utility of the population. This approach has been criticized for being limited in terms of information; indeed, Atkinson (1995) and Sen (1999) have argued that welfarism (as they call the traditional approach in Economics) leaves aside information that may be important for policy making. In this paper I will deal with the case in which the planner cares about individual utility levels but also about the poverty level.

My objective in this paper is to examine under which conditions social insurance is a useful mechanism to alleviate poverty when the central planner is not only concerned about income distribution but also about poverty. The distinction between income distribution and poverty is important. Usually, the introduction of concerns about income distribution is done respecting individuals' own perception of wellbeing; this can be regarded as a subjective measure of wellbeing. However, wellbeing may also have objective dimensions. The introduction of poverty concerns aims at considering these alternative dimensions. Since the economic literature recognizes taxation as a powerful instrument to redistribute, attention is centered in what can be done by social security in terms of redistribution (besides what it is already done by optimal taxation).

To the best of my knowledge, this problem has not been treated extensively in the literature. Blomqvist and Horn (1984), Rochet (1991), Cremer and Pestieau (1996) and Henriet and Rochet (1998) have looked for the justification

of social security in an optimal taxation context. All these authors work on welfarist grounds and in their works individuals differ in two aspects: wage and the probability of falling ill.

Earlier works dealing with problems of taxation in non-welfarist settings include Kanbur, Keen and Tuomala (1994) and Wayne (2001). The first solve the non-linear income taxation problem for a planner that is concerned only about the poverty level. Wayne (2001) uses the approach suggested by Atkinson (1995), in which the social planner is concerned about both types of objectives: welfarist and non-welfarist. This is the approach followed in this paper.

I will proceed as follows: the second section establishes the framework for the analysis of the normative problem; particular attention is given here to how poverty is understood and why a central planner should care about it. The third section provides a general discussion about redistributive policy based on a general overview of the related literature. The fourth section works along the lines of Cremer and Pestieau (1996) and Wayne (2001) to show that social security is justified (in the presence of an optimal income taxation system) when the planner has a plurality of objectives.. Two types of settings are established for the social security system. In the first one, social security is universally provided by a planner who chooses the rate of coverage of the system that is equal for all the population; in the second one the planner has the possibility to offer different coverage to poor and non-poor. The fifth section concludes.

2. Poverty and welfare issues

The standard approach in the economic literature is welfarist. According to this approach, the central planner aims to maximize a welfare function that depends upon individuals' utility levels. Generally, social welfare is measured through the Bergson-Samuelson welfare function that aggregates individual's utility functions into one measure of social welfare. This function is assumed to satisfy non-paternalism, Paretian property and aversion to inequality. The non-paternalism features of this function are introduced through the fact that the function only takes into account utility levels, in particular no other information that may be important from the social planner's viewpoint is taken into account. The Paretian property states that if every individual prefers one of two alternatives, the social planner should also prefer that alternative. This is recognized by using social welfare functions that are increasing in all the arguments. The aversion to inequality is introduced by using concave social welfare functions, where the degree of concavity reflects the degree of aversion to inequality.

The central planner is thus worried only with the perception that individuals have about their own welfare. In a society consisting of I individuals, the central planner's objective function is of the type $W(U_1, U_2, \dots, U_I)$, where U_i is the utility function of individual i . A particularly important social welfare function that has been extensively used in the economic literature is the utilitarian social welfare function, which is the sum of individual utilities. This

last type of social welfare function serves to illustrate an important point. The planner can be concerned about inequality of different variables. If the planner is utilitarian, it is not concerned with inequality of utility (or welfare) but it may still be concerned with inequality of consumption if utility is concave.

Several criticisms can be made to this welfarist approach. Perhaps, the most relevant here is that of Sen (1999) and Atkinson (1995). These authors say that the welfarist approach has informational problems, as the concentration on individual's perception leaves aside information that may be relevant for policy making. One example of the type of information that could be important for policy decision-making and is not taken into account by the welfarist literature is that of freedom. Another example, the one on which attention is concentrated here, is the limitations of the welfarist case when the existence of poverty is recognized.

Another criticism usually made to the welfarist approach is that it neglects inequality in other dimensions or variables (Sen, 1980 and 1983). Well known examples about the consequences of welfarism when individuals differ in marginal utility of consumption illustrate this type of concerns. The welfarist approach may end up justifying repugnant conclusions like justifying very unequal societies just because there is a group of individuals that has a higher marginal utility of consumption. Regarding this line of critique, I must say that viewing the problem as that of the correct information for social evaluation can lead to clearer conclusions than regarding it as that of the right dimension for the concern about inequality.

There are several arguments that provide a justification of why a central planner should worry about poverty. The two most important are those that see poverty as a problem of subsistence as well as an externality over the society as a whole. Seeing poverty as the lack of subsistence means is the most common approach. The subsistence concept has to be understood in a wider sense than the biological one. This is something that has been recognized for quite a long time. Sen (1997), citing Adam Smith, introduces the linen shirt argument, that states that the poor are not only those whose income is so low that they do not have the means to survive, but also those who can not acquire other goods seen by society as indispensable to actively take part of this society's activities.

This argument calls for a planner that takes care of the consumption of the poor independently on how they perceive their own welfare. The argument is criticized as paternalistic since it includes in the measure of welfare, elements that no one in the society cares about. Moreover, it can be said that the planner is concerned about the consumption level of some members in the society even if they "feel well" with their consumption level. To defend the concern about poverty, Sen (1999) argues that the causes of poverty may distort people's perception about their own welfare, and as a consequence a social planner must indeed care about people whose conditions are very bad, even if they do not feel they are so.

Another way to defend the concern about poverty is to understand it as an externality to society as a whole. The externality concept refers to the idea

that poverty can be seen as a public bad for society; society as a whole may not want to see a group of people that cannot make active part of it because they lack the economic means. Poverty can affect society's welfare in many ways. One can start thinking simply that the non-poor may not be indifferent about the others' consumption and so their own welfare maybe affected by the existence of a group whose income is so low they cannot make active part of society. A second argument appears with the idea that poverty can increase criminality, which affects the non-poor. A third argument appears if one thinks that poverty affects the production possibilities of the society by lowering the productivity of a portion of the working force. Poverty thus generates an externality on the society's welfare making it necessary for the planner to take care about it.

A different problem arises when one thinks on how a central planner must take into account the problem of poverty. One possibility is to say that the planner must only take care of that part of the society that is worse off, which may be in line with the Rawlsian arguments commonly found in the economic literature. As indicated in the introduction, the work of Kanbur, Keen and Tuomala (1994) solves the optimal non-linear taxation problem when the social planner is concerned only about poverty alleviation. In any case, this approach has the same problem as the welfarist literature as it also ignores other information that may be important for policy making.

A more appealing possibility is to say that the planner should take into account more than one objective, as suggested by Atkinson (1995). Atkinson suggests two types of procedures to include this extra information in the policy formulation problem: the first one is a hierarchy of principles procedure, in which some of the information is used as a restriction when trying to fulfill another objective. In this case a minimum level of utility for all members of society can be used as a restriction looking for the optimal policy in terms of reducing poverty that gives the non-poor at least this minimum level of utility. Doing a similar exercise but setting a minimum level of consumption for the poor and maximizing the welfare of society such that this minimum level is attained is another possibility.

The second procedure, the one which is used here, is called Higher Order Maximand, and it trades off the several objectives that the planner may have. It establishes a new objective function in which elements of the several objectives are included. Wayne (1999) uses this approach and formulates an objective function that is a weighted sum of society's welfare in terms of its members' utility, and a poverty measure that only depends on the consumption of the poor. This procedure fits any of the two ways to consider poverty mentioned above.

Literature about poverty typically focuses on two problems: identification and aggregation. The first one relates to finding a way to know who the poor are in a society; one form of doing so is to establish a poverty line that classifies as poor all people whose income (or consumption) is below the poverty line. Although there are difficulties involved in defining the poverty line, this

parameter is taken as given for the purposes of this paper.

The issue of aggregation, on the contrary, is a more important problem since the results may depend on the poverty measure chosen. In general the economic literature offers an axiomatic approach to the definition of poverty measures. After setting some requirements about poverty measures, the literature looks for an appropriate measure that satisfies them. In this paper the general additive separable poverty measure proposed by Atkinson (1987) is used. The poverty measure is $E[G(C_i, Z)]$, where $G(C_i, Z)$ is an individual poverty measure and E is the expectation operator. The function G depends on individual consumption C_i , and on the poverty line Z . $G(C_i, Z)$ is strictly decreasing and strictly convex in C_i and equal to zero when $C_i > Z$; this means that an individual with consumption above Z is not considered as poor and that the severity of poverty decreases in consumption.

If we let U be the utility level, the central planner will have an objective function of the type $E[U - \gamma G]$ where γ is the weight that the planner gives to poverty. A useful property of this formulation is that it includes as special cases the pure welfarist ($\gamma = 0$) planner.

Until now only the problem of inadequacy of income related to poverty has been considered. Although it is recognized that there are many other issues related to poverty, one that is central for the present work is the problem of vulnerability. Although there will be no reference to the dynamic issues of poverty, the distinction between chronic poverty and transitory poverty, as defined in Morduch (1994), is useful to introduce the concept of vulnerability. A person is classified as chronically poor if her consumption or income is always below the poverty line. A person is transitorily poor if her consumption or income is below the poverty line only because of the influence of some transitory factor that affects her earnings. These concepts suggest the idea that a person can be poor not only because she has a low wage (and thus a low income) but also because she is exposed to some risk with more intensity than the non-poor. Thus, vulnerability is the idea that poor people can be more exposed to risk than non-poor. The existence of vulnerability does not affect the way the concept of poverty is measured and used in this paper, since risk averse individuals and complete insurance markets are assumed, but it does open the spectrum of policy issues related to the alleviation of poverty.

3. Policy issues: general discussion and related literature

The preceding section was concerned with the question of why a central planner should worry about poverty. This section and the following deal with the issues of the appropriate instruments to redistribute. I start off by proposing answers to the questions of how poverty can be alleviated and the economic effects of the poverty alleviation programs. In this section there is no use of mathematical tools or formulations; this type of analysis is postponed to the next section where these issues are formally treated.

The broad question that is dealt with here is how to redistribute. Two

different issues can be distinguished in this question, both of which have been treated separately in the economic literature and the difference between them depends on the constraints that are recognized.

One of the issues answers the question of who the recipients of redistribution must be. It depends on the type of inequality, the reasons for the existence of this inequality, and on the budget available for poverty alleviation. The question is particularly important when dealing with poverty issues, and consists in determining the best way to spend an antipoverty budget in a way that poverty is minimized.

Bourguignon and Fields (1990) look at whether the anti-poverty policy should be spent in the less poor of the poor, in the poorer of the poor or in both groups. Their answer depends on the way poverty is measured, the optimal allocation can go from taking the entire budget to the poorest of the poor to taking it all to the less poor of the poor, with the possibility of mixed policy allocations.

A drawback of this type of analysis is that it does not take into account the way the anti-poverty budget is financed or the incentive problems generated by redistribution. This calls for the second issue in the problem of how to redistribute. This problem is considered by the optimal redistributive taxation literature. Although in general this literature is not concerned with poverty but just with income distribution, it does take into account the incentive problems generated by financing the redistributive policies through taxation.

The literature on optimal redistributive taxation has recognized that the way the government finances its budget may have effects on the individuals' consumption and labor supply (Stiglitz, 1987). In general these effects are undesirable; the government does not want to distort individuals' decisions (the Second Welfare Theorem of Economics). The incentives literature has developed an intuitive way to see this problem. A social planner may face the problem that agents may not be willing to correctly reveal information needed to implement the desired policy. To gather this information the government must give incentives to individuals; it must make individuals find optimal to reveal truthful information. This generates a need to depart from first-best allocations relying on second-best allocations.

As an intuitive statement of the problem, consider a two goods setting, labor and consumption, in which individuals differ in wage, and the social planner is worried about distribution. The planner looks for the best combination of consumption and labor among individuals. In doing so it can find that high-wage individuals may not be interested in revealing their true wage since this could imply a higher labor supply than that of the individuals with lower wage, but the difference in consumption may not be enough to compensate for this difference in labor supply. Under this problem the social planner must set an allocation in which high-wage individuals not only work more but also have a higher consumption than low-wage individuals. The first type of allocation mentioned, that in which individuals have incentives to misrepresent their wage is not implementable and is called the first best allocation. The allocation

where the incentives problem is solved is the second best allocation and involves distortions in the balance between consumption and labor supply.

The incentive problem may be more or less complicated depending on the instruments the social planner will use, on the problems the social planner is concerned about, and on the type of heterogeneity between individuals. The instruments problem refers to whether the planner wants to discriminate among individuals or not (Stiglitz, 1987). If the government wants to discriminate, charging different marginal tax rates and giving different transfers the problem is one of non-linear taxation. Otherwise, when all individuals face the same marginal tax rate and receive the same cash-transfer, the problem is a linear tax one. The incentives problem also depends on the objective of the government. The problem is not the same when the planner is concerned about poverty besides or instead of utility (Kanbur, Keen and Tuomala, 1994). The incentive problem becomes more complex when individuals differ in more than one characteristic; for example when there is some risk and individuals differ not only in their wage but also in their probability of loss (Cremer and Pestieau, 1996). These three issues are examined now.

The difference between linear and non linear taxation highlights the two different issues about incentives that have been mentioned. The first is the effect on labor supply of redistributive policies. It is clear that changes in income (endogenous or exogenous) change individuals' optimal choices. Labor income taxation changes effective wage rates; depending on the magnitudes of income and substitution effects, this may result in an increase or in a reduction of labor supply. If taxation has some redistributive purposes the government will give an exogenous transfer to all individuals in the economy. This change in exogenous income also has effects on labor supply, if labor (leisure) is a normal good the subsidy will generate a decrease in labor supply. These two effects on labor supply are recognized in this problem; the tax rate would be inversely proportional to the compensated elasticity of labor supply (this is always negative if labor affects negatively the utility) since it generates reductions in compensated labor supply. The effect of the subsidy is recognized through the social gain of an increase in exogenous income, the subsidy reduces this gain since it affects negatively labor supply and thus labor income. Generally it is said that the lump-sum subsidy should be set as to equate its social marginal gain to its social marginal cost. This type of problem presents no adverse selection difficulties since the government is treating every agent equally.

The adverse selection problem appears when the government tries to discriminate among individuals. In this case the optimal policy is to give every agent a consumption quantity and ask from them a determinate amount of work (in general increasing with wage). The problem arises because individuals would try to behave strategically. Since high-wage individuals could prefer the allocations intended for low-wage individuals, they would try thus to mimic low-wage individuals. To circumvent this incentive problem the social planner must make sure that the utility of the second best optimal solution increases with wage. The most relevant conclusions of this analysis are that under some

conditions the marginal tax rate is non negative over all the range of the population, that the individual with the highest wage has a zero marginal tax rate (if wage is bounded above) and that consumption is increasing with pre-tax labor income (Stiglitz, 1987).

In the cases in which the social planner has additional or different objectives to maximizing social welfare the adverse selection problem can have other dimensions. Kanbur, Keen and Tuomala (1994), work on this incentive problem when the social planner is only concerned about poverty. The important remark they make is that a perfectly targeted system that transfers money to the poor (for example in the policies considered in Bourguignon and Fields, 1990) acts as a 100% marginal tax rate on the income of those who receive the transfers. The problem posed by this high marginal tax rates is that the ones that receive the transfer have less incentives to work implying lower resources for the overall economy and higher costs of the alleviation programs. This case shows the trade off that arises with redistributive taxation policies. On the one hand taxation on labor income is a powerful mean to collect resources to redistribute, but on the other hand taxation reduces labor supply and induces strategic behavior.

Besides Kanbur, Keen and Tuomala (1994), Atkinson (1995) and Wayne (2001) have considered the redistributive taxation problem in a setting where the planner has broader objectives than the traditional welfarist planner. Atkinson (1995) is concerned with a planner that besides the traditional welfarist objective is worried about liberty. And Wayne (2001) considers a central planner who is concerned with the traditional utilitarian welfare measure and with the alleviation of poverty. For my purposes only the two in which there is a concern for poverty are relevant. The paper of Kanbur, Keen and Tuomala (1994) can be seen as a special case of Wayne (2001). Moreover, this last one establishes the framework used in this work.

In the previous section it was said that the objective function of the poverty-concerned welfarist planner has been borrowed from Wayne (2001). In his paper he solves the linear income taxation and the non-linear income taxation problem. The main contribution of his solution to the linear income taxation problem is to show that when poverty is taken into account the planner has a special interest in the poor's labor supply response to the marginal income taxation. Generally with a constant marginal income tax, the marginal tax rate is inversely related to the elasticity of labor supply. In the case where there is a concern for poverty this effect is taken further giving special weight to the poor's labor supply elasticity.

Wayne's (2001) main conclusion is that the marginal tax rate will be negative for the lowest income individuals. Kanbur, Keen and Tuomala (1994) find that when the planner is concerned only with poverty the marginal tax rate for the lowest income group must be negative. The result contrasts with the conclusion, when the government is utilitarian and when the marginal tax rate is always non-negative.

When individuals are allowed to differ in more than one characteristic the

incentive problem also changes, now the sign of the correlation and the size of the magnitude of the differential in the characteristics are important, the incentives to mimic other type of individual can be reversed. Cremer and Pestieau (1996) show this happens in a setting in which individuals can be of two types and they can differ in wage and in the probability of falling ill.

Cremer and Pestieau (1996) highlight two possible cases and in each two sub-cases: a negative and a positive correlation between wage and risk and in each of them the risk differential can be large or small with respect to the wage differential. The important fact is that depending on this differential it is possible to find that in a setting where there is no government intervention the relation between income and consumption may differ. In the standard case in the optimal non-linear taxation literature (Stiglitz, 1987), the high-wage individual has a higher income and higher consumption under no government intervention. When individuals differ in more than one parameter this relation between income and consumption does not necessarily hold any more.

Different cases are found when the risk differential is high relative to the wage differential. If wage and risk are negatively correlated consumption is higher for high-wage individuals but labor income is lower. And if both parameters are positively correlated the opposite case is found -high-wage individuals have higher labor income but lower consumption. The important effect that operates here is the income effect of risk associated to the expenditure on insurance. In these cases this effect is so big that the standard relations are reversed. Since this paper introduces social security as a redistributive instrument more will be said about it later.

The main question is how, if in some way at all, social security can foster redistribution over what is done by an optimal taxation system. The literature about the problem is not very extensive, four papers have been found that work the problem: Blomqvist and Horn (1984), Rochet (1991), Cremer and Pestieau (1996) and Henriët and Rochet (1998). The conclusion of the four papers is essentially the same even though the models analyzed have important differences: social security is justified as a redistributive instrument when the probability of illness is negatively correlated with wage even if insurance markets are complete. When it is assumed, as in Henriët and Rochet (1998), that public provision of social insurance is less efficient than private provision, there is still a need for a negative statistical correlation, but it must be low enough. The size necessary to have full social insurance depends on the relative inefficiency of public provision and on the average probability of loss of the society.

The results of these papers also depend on the institutional features of the social security system and particularly in how social security is financed. In the setting of Blomqvist and Horn (1984) and that of Rochet (1991) the government finances social security and the lump-sum transfer through the contributions of individuals, there is no independent prime associated to the social security system. As it was already said, Blomqvist and Horn (1984) use a constant marginal tax rate. Rochet (1991), in the non-linear taxation

problem, uses a personalized tax that depends on individual's labor income and on the social insurance coverage chosen by each individual. In Cremer and Pestieau (1996) the social security system is financed through a lump-sum tax proportional to the average probability of illness. The important fact is that in all these settings the systems differ from the private provision of insurance in that individuals are not contributing according to their specific probability of illness, and this is what permits redistribution through social insurance.

An important result for the problem of redistribution states that when individual preferences are weakly separable in consumption and leisure all redistribution should be done using optimal income taxation (Atkinson and Stiglitz, 1976). As stated by Rochet (1991) this result does not apply when individuals differ in their initial endowments. The difference between individuals risk acts as differences in initial endowments, as is clearly showed by the different possible cases of correlation and magnitude of the differentials in risk and wage in Cremer and Pestieau (1996), opening the possibility of the social planner to use social insurance as a redistributive mechanism.

To conclude this section, some remarks about the possibility of using social insurance to alleviate poverty must be made. The idea that social insurance can be useful for this purpose is related to the concept of vulnerability of the poor mentioned at the end of the previous section. If the poor have a risk higher than the non-poor, then a compulsory social insurance system where individual payments are not related to their own risk may be useful. The social insurance system that is financed through a constant prime to all individuals, through taxes on labor income or through personalized taxes that do not depend on the individual's risk, may alleviate poverty since the way the contributions to the system are organized can be done in a way that poor are better under this system than under private insurance. In a more general setting, in which insurance markets are not complete, or the poor do not insure completely, the usefulness of a social security system may be greater, since the poor will be more vulnerable.

4. The model

The economy is populated by I types of individuals indexed by $i \in [1, I]$, differing in wage, w_i , and their probability of falling sick, p_i . All individuals have the same concave utility function, U , that depends on consumption, C_i , and labor, L_i . Individuals also face the same loss D when ill. The economy has a fair private insurance market in which the individual can buy insurance to cover for a proportion β_i of her loss at a rate $p_i\beta_i D$. The number of type i individuals is represented by n_i .

Under no government intervention each individual chooses C , L , and β to

solve the following problem:

$$\begin{aligned} \text{Max} \quad & p_i U(C_i^l, L_i^l) + (1 - p_i) U(C_i^n, L_i^n) \\ \text{s.t.} \quad & C_i^n = w_i L_i^n - p_i \beta_i D \\ & C_i^l = w_i L_i^l - p_i \beta_i D - D + \beta_i D \\ & \text{for } i \in \{1, 2\}, \end{aligned}$$

where l and n represent the loss and no-loss situations, respectively. Individuals pay $p_i \beta_i D$ for being insured against illness, if they suffer the loss from illness they receive $\beta_i D$ from the insurance company. Individuals maximize the expected value of utility subject to the resource constraints in each state of the world. Since U is increasing and strictly concave each individual chooses full insurance, i. e., $\beta_i^* = 1$. This implies that consumption and labor supply are constant regardless of health state, i.e. $C_i^l = C_i^n$ and $L_i^l = L_i^n$. Let $C_i(w_i, p_i)$ and $L_i(w_i, p_i)$ represent optimal consumption and labor supply and $V(w_i, p_i)$ the indirect utility function. The budget constraint implies

$$C_i(w_i, p_i) = w_i L_i(w_i, p_i) - p_i D.$$

Note that $p_i D$ takes the form of an exogenous income. The probability of risk can be negatively or positively correlated to wage. If wage and risk are negatively correlated, consumption and wage are positively correlated. Otherwise, consumption and wage may be positively correlated if D is large, or negatively correlated if D is small. In this last case risk is the most important factor of inequality.

These relations are important when dealing with poverty. In this setting the poor individual is not necessarily the individual with a low wage; it is possible to find a situation where high-wage individuals are poor if they also face higher risk.

5. The optimal social security system

In this section, I will study the optimal redistributive social security system when individuals behave as hypothesized in section 4 and the government's objective mixes welfarist and poverty concerns as introduced in section 2.

5.1. Universal coverage

There are two instruments government can use for redistribution: taxation and social security. I will assume that government charges a constant marginal tax rate, t , on each individual's labor income, to finance a lump-sum subsidy, T , and the social security system. The social security system is represented by α , which is the coverage rate of the social security system. Since individuals are risk averse and choose to have full insurance they will choose $\beta_i^* = 1 - \alpha$. In

this case optimal choices of the individual are represented by $C_i(w_i, p_i; \alpha, t, T)$ and $L_i(w_i, p_i; \alpha, t, T)$ satisfying

$$C_i(w_i, p_i; \alpha, t, T) = (1 - t)w_i L_i(w_i, p_i; \alpha, t, T) - p_i(1 - \alpha)D + T.$$

The indirect utility function can now be represented by $V(w_i, p_i; \alpha, t, T)$; $\Gamma(w_i, p_i; \alpha, t, T, Z)$ represents the individual indirect poverty measure.¹ Note that Γ is increasing in t and decreasing in T and α .

There are several ways in which the central planner can finance the social security system. Among them, charging a constant prime rate to every member in the society or using the funds collected from labor income taxation. Cremer and Pestieau (1996) work under the first scheme and in this section, I am working under the second one. The reason for this choice is that in the analysis of the model when there is targeting the usefulness of social security under the first scheme is limited. The results in this section do not depend on this election; as it will be seen later, the results in Cremer and Pestieau (1996) are similar to those presented in this section.

Following the discussion in section 2, the government's objective function is given by

$$E[V(w_i, p_i; \alpha_i, t, T)] - \gamma E[\Gamma(w_i, p_i; \alpha, t, T, Z)]$$

where, as before, E is the expectations operator. The first term of the objective function is the traditional utilitarian welfare function; it is exactly equal to the sum of the utility function of individuals with every individual given the same weight. The second part accounts for the government's concern about poverty. It is the sum of the individual poverty measure defined above. γ reflects the weight the planner gives to poverty.

It is important to remark that in this setting in which individuals differ in wage and risk not necessarily the low-wage individuals are the poor. If high-wage individuals face high risk; and is large, they can be the poor.

The planner's problem is to choose t , T and α , such that:

$$\text{Max } E[V(w_i, p_i; \alpha_i, t, T)] - \gamma E[\Gamma(w_i, p_i; \alpha, t, T, Z)]$$

$$\begin{aligned} \text{s.t. } & E[tw_i L_i - T - p_i \alpha D] \geq 0 \\ & \alpha \in [0, 1], t \in [0, 1] \end{aligned}$$

$$\text{for } i \in \{1, 2\}.$$

The first restriction that appears in the problem is the traditional resource constraint; the second simply says that the social security coverage and the tax rate must be positive and less than 100%. Let Ω represent the Lagrangean of

¹This means that $\Gamma(w_i, p_i; \alpha, t, T, Z) = G(C_i(w_i, p_i), Z)$.

the government's problem. The first order conditions are

$$\frac{\partial \Omega}{\partial T} = E \left[\frac{\partial V_i}{\partial T} - \gamma \frac{\partial G_i}{\partial T} + \lambda \left(tw_i \frac{\partial L_i}{\partial T} - 1 \right) \right],$$

$$\frac{\partial \Omega}{\partial t} = E \left[\frac{\partial V_i}{\partial t} - \gamma \frac{\partial G_i}{\partial t} + \lambda \left(tw_i \frac{\partial L_i}{\partial t} + w_i L_i \right) \right]$$

and

$$\frac{\partial \Omega}{\partial \alpha} = E \left[\frac{\partial V_i}{\partial \alpha} - \gamma \frac{\partial G_i}{\partial \alpha} + \lambda \left(tw_i \frac{\partial L_i}{\partial \alpha} - p_i D \right) \right].$$

To simplify the conditions, first define

$$\Theta_i = \frac{\partial V_i}{\partial T} \frac{1}{\lambda} - \gamma \frac{\partial G_i}{\partial T} \frac{1}{\lambda} + tw_i \frac{\partial L_i}{\partial T}$$

as the social gain from a unit increase in an individual exogenous income in terms of public funds. The first part of the right hand side in this equation is the social gain generated by the increase in consumption (or post-tax income) due to an increase in exogenous income of individual i . The second part corresponds to the gain due to an increase in consumption of the poor. The third part corresponds to the loss generated by the reduction in labor income of individual i due to her change in labor supply. Intuitively, Θ_i is larger for poorer individuals. If the poor are the ones with high wage and D is large, Θ_i will be larger for individuals with high wage than for those with low wage.

Using the definition of Θ_i

$$\frac{\partial \Omega}{\partial T} = 0 \implies E[\Theta_i] = 1.$$

As it is standard in the optimal taxation literature, the basic income must be set such that the average social cost of an additional unit of transfer, which is one, must be equal to the social average gain of that additional unit.

The first order condition for t can be simplified using

$$\frac{\partial V_i}{\partial t} = \frac{\partial V_i}{\partial T} p_i L_i,$$

$$\frac{\partial G_i}{\partial t} = \frac{\partial G_i}{\partial C_i} \left((1-t)w_i \frac{\partial L_i}{\partial t} - w_i L_i \right),$$

$$\frac{\partial G_i}{\partial T} = \frac{\partial G_i}{\partial C_i} \left((1-t)w_i \frac{\partial L_i}{\partial T} + 1 \right)$$

and the Slutsky decomposition

$$\frac{\partial L_i}{\partial t} = -w_i S_i - w_i L_i \frac{\partial L_i}{\partial T}$$

where S_i is the derivative of the compensated labor supply with respect to the wage rate. The resulting condition is

$$\frac{\partial \Omega}{\partial t} = -\text{Cov}(w_i L_i, \Theta_i) + \gamma E \left[\frac{w_i L_i \eta_{li}}{\lambda} \frac{\partial G_i}{\partial C_i} \right] - \frac{t}{1-t} E[w_i L_i \eta_{li}]$$

where η_{li} is the compensated elasticity of labor supply.

Note that it is possible to have a zero marginal tax rate on income. This happens if $\text{Cov}(w_i L_i, \Theta_i) > 0$, which is the case when wage and risk are positively correlated and D is large. In this case high-wage individuals have lower consumption than low-wage individuals and thus the high-wage individuals are the poor ones. The first message of this paper is this one: when $\text{Cov}(x_i L_i, \Theta_i) > 0$ and D is large all redistribution is done using the social security system; income taxes should not be used to redistribute if the poor are the high-wage but high-risk individuals.

In the case where $\text{Cov}(x_i L_i, \Theta_i) < 0$ an interior solution for t is likely. The optimal marginal income tax will be implicitly defined by:

$$\frac{\partial \Omega}{\partial t} = 0 \implies \frac{t}{i-t} = \frac{-\text{Cov}(w_i L_i, \Theta_i) + \gamma E \left[\frac{w_i L_i \eta_{li}}{\lambda} \frac{\partial G_i}{\partial C_i} \right]}{E[w_i L_i \eta_{li}]}$$

The condition is very similar to that shown by Wayne (2001), and has the standard interpretation in terms of the equity-efficiency trade off related to changes in t . If labor is normal, an increase in the marginal tax rate decreases labor supply but it allows a higher basic income which increases utility and reduces poverty. The denominator of the expression gives the dead weight loss of an increase in the marginal tax rate, it is the efficiency effect, the higher the own price elasticity of labor supply the lower is t . The numerator is composed of two elements. The first term is the covariance which gives the gain in terms of redistribution; the higher the covariance (in absolute terms) the higher the benefits of redistribution. The second term introduces the concern for poverty. Notice that $\partial G_i / \partial C_i = 0$ if individual i is non-poor and $\partial G_i / \partial C_i < 0$ if i is poor; since the whole expected value is negative it implies that the higher the elasticity of labor supply of the poor the lower the marginal tax rate. If the poor have a low labor supply elasticity, a high marginal tax rate won't affect too much their labor supply calling for a high t that increases redistribution. The difference with the condition found by Wayne (2001) is that now it is possible to have a zero marginal tax rate when age and risk are positively related.

The first order condition for α can be simplified using

$$\frac{\partial L_i}{\partial \alpha} = \frac{\partial L_i}{\partial T} p_i D,$$

$$\frac{\partial V_i}{\partial \alpha} = \frac{\partial V_i}{\partial T} p_i D$$

and

$$\frac{\partial G_i}{\partial \alpha} = \frac{\partial G_i}{\partial C_i} \left((1-t)w_i \frac{\partial L_i}{\partial \alpha} + p_i D \right).$$

Then

$$\frac{\partial \Omega}{\partial \alpha} = E[Dp_i \lambda (\Theta_i - 1)] = \lambda D \text{Cov}(p_i, \Theta_i).$$

We should now consider three cases:

- a) $\text{Cov}(p_i, \Theta_i) < 0$ always,
- b) $\text{Cov}(p_i, \Theta_i) > 0$ always and
- c) $\text{Cov}(p_i, \Theta_i) = 0$ for some $\alpha = 0$.

In the first two cases there are corner solutions: either no social security ($\alpha = 0$) which happens when the covariance is negative, or social security crowds out completely the private market for insurance $\alpha = 1$ which happens when the covariance is positive. When the covariance can take a zero value a social security with partial coverage is possible.

Corner solutions: recall that Θ_i is higher for individuals with low consumption. A positive covariance between risk and Θ_i is found when low-wage individuals have high risk or when high-wage individuals have high risk and D is large. In the first case low-wage individuals will be the poor, and the marginal tax rate will be strictly positive. Consequently redistribution is done with cash transfers and social security. In the second case high-wage individuals are the poor, the marginal tax rate will be zero and the lump-sum transfer will be negative, as it is the only source to finance social security. In this case all redistribution is done through the social security system; it is particularly important to note that monetary transfers are not used to redistribute. The interpretation of this condition is very similar to the one given by Cremer and Pestieau (1996) and by Rochet (1991) in welfarist frameworks.

When the covariance between risk and Θ_i is negative, social insurance should not be used for redistribution. All redistribution should be done with the taxation system.

Interior solutions: now consider the case in which there can be an interior solution for the rate of coverage of the social security system. This happens

when, for $\alpha = 0$, $\text{Cov}(p_i, \Theta_i) > 0$ and the benefits of increasing α are exhausted for some $\alpha < 1$. This is the case when wage and risk are positively related; low-wage individuals are those facing lower risk. If D is big enough, high-wage individuals will be those with a lower consumption. Now suppose that we start increasing α from $\alpha = 0$; this will reduce inequality. This reduction may be such that at some point the high-risk high-wage individuals stop being those with lower consumption. There will be an interior solution for α if at some point $\text{Cov}(p_i, \Theta_i) = 0$.

The most important question that must be answered here is whether the introduction of poverty concerns changes the social security coverage rate. A further decomposition of the first order condition for α is instructive for this purpose. Notice that

$$\text{Cov}(p_i, \Theta_i) = \text{Cov}\left(p_i, \tilde{\Theta}_i\right) - \gamma \text{Cov}\left(p_i, \frac{\partial G_i}{\partial T}\right)$$

where

$$\tilde{\Theta}_i = \frac{\partial V_i}{\partial T} \frac{1}{\lambda} - t w_i \frac{\partial L_i}{\partial T}$$

corresponds to the traditional welfarist value of income in terms of public funds. The first order condition of the pure welfarist planner with respect to α is only related to $\text{Cov}\left(p_i, \tilde{\Theta}_i\right)$.

In the cases where there are corner solutions for the social security coverage rate, it turns out that there is no difference between the solution of the welfarist planner and the poverty concerned planner. It is easy to check that in the cases in which $\text{Cov}(p_i, \Theta_i)$ is always strictly positive or negative the sign of $\text{Cov}(p_i, \Theta_i)$ is equal to the sign of $\text{Cov}\left(p_i, \tilde{\Theta}_i\right)$.

When interior solutions for α are possible, things are different. Recall that interior solutions are possible when risk is the most important factor of heterogeneity (p_i and w_i positively related and D large). In such a case necessarily for the α that solves the problem of the welfarist planner ($\text{Cov}\left(p_i, \tilde{\Theta}_i\right) = 0$) $\text{Cov}(p_i, \Theta_i) > 0$,² meaning that the introduction of poverty concerns induces a larger social security coverage rate.

5.2. Targeting

An important problem in income sustenance programs is targeting. The planner can design two types of security systems: universal or means-tested. Means-tested transfers have the advantage of reducing the planner's budget and thus reducing the burden of taxation. Universal systems (as those discussed in section 5.1) have the advantage of not requiring too much information and

²This follows from noticing that in this case $\text{Cov}\left(p_i, \frac{\partial G_i}{\partial T}\right) < 0$.

thus it implies low costs of administration. Pareto optimality of a means-tested system is now investigated.

To analyze this case I will turn to a simpler setting where there are only two types of individuals.³ Now $i \in \{1, 2\}$ and $w_1 < w_2$. To have an interesting case I suppose that at least one type is considered poor by the government (that with the lowest consumption). Now incentive constraints may be important. Since the coverage level may be different, individuals may be tempted to mimic the other type of individual to receive the benefits of a higher social security coverage rate. The social security system must now satisfy the additional constraint

$$V(w_i, p_i; T, t, \alpha_i) \geq V(w_i, p_i; T, t, \alpha_j)$$

which simply says that any individual must find in her best interest to reveal her true type. An individual may be tempted not to do so if the coverage rate of the social security system offered to the other type is high enough.

The problem of the planner is to choose t , T , α_1 and α_2 to solve

$$\begin{aligned} \text{Max} \quad & E \left[V(C_i(w_i, p_i), L_i(w_i, p_i); T, t, \alpha_i) - \gamma G(C_i(w_i, p_i), Z) \right] \\ \text{s.t.} \quad & \alpha_i \in [0, 1] \\ & t \in [0, 1] \\ & E[tw_i L_i - T - p_i \alpha_i D] \geq 0 \\ & V(C_i(w_i, p_i), L_i(w_i, p_i); T, t, \alpha_i) \geq V(C_j(w_i, p_i), L_j(w_i, p_i); T, t, \alpha_j) \\ & \text{for } i, j \in \{1, 2\}, i \neq j. \end{aligned}$$

The problem of the planner in this section is very similar to that in section 4.2. Besides the possibility of having differential coverage rates in social security the planner faces the incentive compatibility constraint. As before let Ω be the Lagrangean of this problem. The first order conditions for t and T are the same as before, the conditions for α_1 and α_2 are

$$\frac{\partial \Omega}{\partial \alpha_1} = n_1 \left[\frac{\partial V_1}{\partial \alpha_1} - \gamma \frac{\partial G}{\partial \alpha_1} + \lambda \left(tw_1 \frac{\partial L_1}{\partial \alpha_1} - p_1 D \right) \right] + \mu_{12} \frac{\partial V_1}{\partial \alpha_1} - \mu_{21} \frac{\partial V_{21}}{\partial \alpha_1}$$

and

$$\frac{\partial \Omega}{\partial \alpha_2} = n_2 \left[\frac{\partial V_2}{\partial \alpha_2} - \gamma \frac{\partial G}{\partial \alpha_2} + \lambda \left(tw_2 \frac{\partial L_2}{\partial \alpha_2} - p_2 D \right) \right] + \mu_{21} \frac{\partial V_2}{\partial \alpha_2} - \mu_{12} \frac{\partial V_{12}}{\partial \alpha_2}$$

where μ_{ij} and V_{ij} are the Lagrange multipliers of the incentive constraints and the indirect utility functions of individual i mimicking individual j . Both incentive constraints will not be binding at the same time. Recalling the four cases

³This is not a very restrictive assumption. In a case with more than two types as that considered in section 4.1 the results would be the same as long as the assumption of only two social security coverage rates is kept, one for the poor and one for the non-poor.

highlighted by Cremer and Pestieau (1996), it can be said that the incentive constraint avoiding type 1 individuals to mimic type 2 individuals will be binding ($\mu_{12} > 0$) when type 1 is the poor, and the other constraint will be binding ($\mu_{21} > 0$) when type 2 individual is the poor. It can be the case that both constraints are not binding ($\mu_{12} = 0$ and $\mu_{21} = 0$).

Using the same relations as for the universal provision case, the conditions may be simplified as follows

$$\frac{\partial \Omega}{\partial \alpha_1} = n_1 D\lambda(\Theta_1 - 1) + \mu_{12} \frac{\partial V_1}{\partial \alpha_1} - \mu_{21} \frac{\partial V_{21}}{\partial \alpha_1}$$

and

$$\frac{\partial \Omega}{\partial \alpha_2} = n_2 D\lambda(\Theta_2 - 1) + \mu_{21} \frac{\partial V_2}{\partial \alpha_2} - \mu_{12} \frac{\partial V_{12}}{\partial \alpha_2}.$$

Again, interior and corner solutions are possible. First suppose none of the incentive constraints is binding. If increasing α from zero does not equalize Θ_1 and Θ_2 full social insurance for the poor and no social insurance for the non-poor is optimal. This is because, $E[\Theta_i] = 1$ then if individual 1 is the poor $\Theta_1 > 1$ and $\Theta_2 < 0$, $\mu_{12} = 0$ and $\mu_{21} = 0$, then:

$$\frac{\partial \Omega}{\partial \alpha_1} = n_1 D\lambda(\Theta_1 - 1) > 0$$

and

$$\frac{\partial \Omega}{\partial \alpha_2} = n_2 D\lambda(\Theta_2 - 1) < 0.$$

If individual 2 is poor the inverse situation is found since $\Theta_1 < 1$ and $\Theta_2 > 1$. If increasing α does make Θ_1 and Θ_2 equalize we would find a zero coverage rate for the non-poor and a coverage rate for the poor which is less than 100%.

When one of the constraints is binding it is possible to have an interior solution in which there is partial coverage for at least one of the groups. For example in the case when individual 2 is the poor, the binding constraint will be that avoiding individual 1 to mimic individual 2, then $\mu_{12} > 0$ and $\mu_{21} = 0$. In this case the first order conditions are

$$\frac{\partial \Omega}{\partial \alpha_1} = n_1 D\lambda(\Theta_1 - 1) + \mu_{12} \frac{\partial V_1}{\partial \alpha_1}$$

and

$$\frac{\partial \Omega}{\partial \alpha_2} = n_2 D\lambda(\Theta_2 - 1) - \mu_{12} \frac{\partial V_{12}}{\partial \alpha_2}.$$

Both conditions can be positive, negative or zero implying that possibly the optimal coverage rate will be different from zero and from one. Since a non-zero coverage insurance rate increases the burden of taxation, when one of the

constraints is binding, the coverage rate for the non-poor will be zero and the coverage rate of the poor will be strictly positive but not necessarily equal to 100%.

The result thus says that independent of the relation between the probability of falling sick and wage, targeting is optimal when the incentive constraints are not binding. If one of the incentives constraints is binding, an interior solution can be found in which there is possibly a partial insurance for at least one of the groups. To interpret the results note that having a binding constraint means that the government faces costs when it tries to elicit information from workers. These costs will cause the social security coverage rate of the targeted group to be smaller than 100%.

The introduction of poverty concerns generates an interesting case with respect to the situation where the planner is pure welfarist. Suppose that for the optimal t and T , $\tilde{\Theta}_1 = \tilde{\Theta}_2$ for $\alpha_1 = \alpha_2 = 0$. In this case the first order conditions for α_1 and α_2 are satisfied and it is not optimal to have social security if the planner is pure welfarist. The introduction of poverty concerns in this case will make social security useful since for the poor $\tilde{\Theta}_i < \Theta_i$ while for the non-poor $\tilde{\Theta}_i = \Theta_i$. Concerns about poverty make the presence of social security a useful instrument for redistribution.

6. Conclusion

This paper has discussed the ideas related to the possibility of justifying a social insurance system as a redistributive tool. The introduction of social security depends on the existence of some risk; in this case it was assumed the existence of an idiosyncratic risk, best understood as the possibility of falling ill, and on the contribution of this risk to inequality. This paper was concerned with the possibility of using social security simultaneously with an optimal redistributive income tax system.

When the social security system must be provided universally the positive correlation between the probability of illness and the social marginal valuation of income justifies the existence of a compulsory social security system. This happens when wage and risk are negatively correlated and when wage and risk are positively correlated and the possible loss is big. When the government can target social security to the poor the existence of social security is always justified. The main contribution of this paper is to show that concerns about poverty may affect the optimal social security coverage rate. If risk is the most important factor of inequality social security will be more generous when the planner is concerned with poverty and utility than when it is only concerned with utility.

These results have a lack of realism, several widely recognized problems of private insurance markets and social security systems are not taken into account. The most important of them is the moral hazard problem; in general moral hazard calls for the inappropriateness of full insurance since with full insurance agent's probability of loss can be greater. The existence of moral

hazard can weaken these results.

On the other hand it has been assumed that the private insurance market is complete, the most important assumption is that poor and non-poor have access to insurance markets. This is not true in general, but the existence of this type of problems reaffirms the conclusions obtained since, even in this idealized framework, full social insurance is justified.

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