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Normative Evaluation of Tax Policies: From Households to Individuals

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ABSTRACT

Normative Evaluation of Tax Policies: From Households to Individuals*

We analyze the impact on French couples of a tax policy change – the introduction of a family tax credit – using jointly a collective model of household labor supply and a tax-benefit microsimulation program. In a first step, we suggest a larger interpretation of labor supply behaviors which represent a general concept of 'effort' rather than the simple working duration. In this case, individual productivities cannot be assimilated with wage rates and must be retrieved. We do so by inverting the optimal household program to express productivities in function of observed labor incomes, under simple assumptions on preferences and the bargaining rule. In a second step, the calibrated model is used to predict distributive and incentives effects of the reform. By use of the collective approach, individual or household welfare indices can be aggregated within a social welfare function. Under previous assumptions, it is shown that the desirability of the reform may depend on the unit under consideration (household or individual). This simple exercise aims to take family modeling toward empirical applications and questions the validity of normative tools (social welfare functions) when both intra- and inter-household redistribution effects are accounted for.

JEL Classification: C71, D13, D31, D63, H21, H31, J22

Keywords: collective model, intrahousehold distribution, social welfare, household labor supply, microsimulation, tax reform

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1 Introduction

While the ultimate object of concern of redistributive systems is the welfare of *individuals*, the literature has mainly focused on measures of equity across *households* and paid little attention to intra-household inequality. Yet, this approximation is not innocuous as equitable distribution within households is far from guaranteed. As a matter of fact, Haddad and Kanbur (1990) show that it leads to understate overall (inter-individual) inequality by an order of 30-40% when using observations on individual levels of nutrition in Philippines. This issue is not only a matter of concerns in developing countries:

> "Many initiatives in fiscal, social security and labour market policies focus on income at the level of the family. However, policies that do this and pay no attention to inequalities within households will have unwanted effects. For example, the conventional assessment of who is living in poverty is based on total household income; policies trying to alleviate such poverty may fail to tackle women's hidden poverty within the household." (ESRC Gender Equality Network, UK).

A major difficulty is the agency problem of the household. Without information on the redistributive process within households, it is difficult to design policies that would target specific individuals in families, and the public decider is usually constrained to assume that an equal sharing is taking place.

Recent models of household behaviors, accounting explicitly for the presence of several decision makers, have been developed to tackle this issue. In particular, the collective model introduced by Chiappori (1988, 1992) has come as a substantial improvement in the modeling of joint labor supply of couples. This semi-structural model relies solely on the assumption of Pareto-efficiency of household decisions, then encompasses both the unitary representation and cooperative models which specify the intrahousehold negotiation process (e.g. Nash-bargaining). In order to ground scientifically this type of models, most of the recent literature has consisted in testing original restrictions derived from the efficiency assumption. Rarely have these restrictions been rejected by the data on couples, whereas those associated with the unitary model often were.[1]

Yet, implementation of these models for policy evaluations has been seldom. The main reason is that no simple econometric technique is yet available when accounting for the distinction between participation and hours of work (see Blundell and al., 2001) as well as for actual tax-benefit systems, responsible for non-linear and possibly non-convex budget sets (see Moreau and Donni, 2002). To take family modeling toward empirical applications for policy evaluations, recent attempts have necessarily relied on calibration techniques (see Laisney et al., 2002, and Bargain and Moreau, 2002). In these studies, calibration goes through introducing heterogeneity across households with respect to preferences and bargaining rules. The methodology has shown difficulties, however, as concentrated distributions of work hours in France convey to the idea that heterogeneity on preferences capture institutional and demand constraints as

[1] The most general result is probably given by Browning and Chiappori (1998). See Vermeulen (2004) for a survey.

much as true preferences.

In this paper, we explore a somewhat dual approach to calibrate a collective model with taxation on French data. We start from the observation made by several authors that the productive effort which generates labor income is not limited to time spent at work but may well be related to other (unobservable) dimensions such as intensity of work, mobility, learning effort, etc. In that case, the choice variable (let us simply call it effort) does not correspond to observed hours and true productivities are unobserved. Our approach then consists in recovering individual productivities by inversion of the household program at its optimum, under simple assumptions on preferences and the bargaining rule.

Once calibrated, the model allows to simulate a tax-benefit reform – the introduction of a Working Family Tax Credit – and to assess its distributive and incentive effect on French couples. A social welfare function can be used together with the behavioral model to evaluate the desirability of the reform over a range of values for the social aversion to inequalities. The analysis is conducted for several regimes of labor supply elasticities.[2] This exercise illustrates the possibility to carry normative analysis of a given policy at both household and individual levels. Interestingly, it is shown that taking the distribution of welfare within households into account may drastically change normative conclusions.

The layout of the paper is as follows. In Section 2, we describe the reinterpretation of the labor supply model and the specification of the collective approach. In Section 3, we present the calibration of the model. In Section 4, we explain the simulation technique, describe the tax reform, then gauge its impact on equity and efficiency and proceed with a normative analysis based on a social welfare function. Section 5 concludes.

2 An Extended Labor Supply Model

2.1 The Collective Approach

In our model, the household is essentially seen as two spouses, the wife f and the husband m, with their own private consumption c_i $(i = f, m)$, their level of productive effort e_i and their own preferences gathered in a well-behaved direct utility function U_i. As in Chiappori (1988, 1992), we assume only the efficiency of household decisions. Under the convexity of the utility possibility set, efficiency can be

[2] The use of a simulation-based approach allows circumventing the main difficulties we may encounter. First, econometric estimates of labor supply elasticities are not very accurate. As detailed in Blundell and MaCurdy (2000), the relative consensus concerns the signs of the various elasticities but not their magnitude; e.g. own wage-elasticities vary between 0 and 1 across studies, while variations in that range can change completely the conclusions of an equity-efficiency analysis of tax policies. In this respect, a sensitivity analysis around different levels of elasticity seems a sensible approach. Second, the present methodology is not mainstream and is adapted to the assumption that productive behaviors are not restricted to work duration (see Bourguignon and Spadaro, 2000). Last, implementation of a multi-utility model toward policy analysis with taxation and participation is not standard practice yet, and a simulation-based approach seems a reasonable first step in this direction.

represented simply by the maximization of a convex combination of individual utilities – the 'household welfare index' $W(c_f, c_m, e_f, e_m)$ hereafter – written as follows:

$$\begin{aligned} & \max_{c_i, c_j, e_i, e_j} \mu(\theta) U_f(c_f, e_f, e_m) + (1-\mu(\theta)) U_m(c_m, e_m, e_f) \qquad (1) \\ \text{s.t. } c_{f_h} + c_{m_h} &= g(\omega_{f_h} e_{f_h}, \omega_{m_h} e_{m_h}, Z_h). \end{aligned}$$

The convexity of the utility set is itself guaranteed if individual utilities are strictly concave and the budget set is strictly convex. The first condition is easily respected with mild restrictions on the functional form while the second requires more caution, as explained below. In the objective function, weight μ on the wife's utility is an index for her bargaining power in the household, which may depend on a certain number of exogenous parameters (vector θ) likely to influence the negotiation process. Individual preferences are not egoistic – an assumption often retained in empirical tests of the collective approach – but depend here on the partner's productive decision. The household budget constraint makes explicit how the total level of consumption $c_f + c_m$, which corresponds to household disposable income in a static setting, results from individual gross earnings $y_i = \omega_i e_i$ (for $i = f, m$), household characteristics Z (including demographic characteristics and non-labor income), and the function g incorporating the tax-benefit rules.

2.2 Reinterpretation of the Labor Supply Model

As in Bourguignon and Spadaro (2000), we assume that working hours do not reflect 'true' labor supply behaviors.[3] In effect, the productive efforts which generate observed earnings are probably not limited to time spent at work but incorporate (unobservable) dimensions such as intensity of work, learning effort, mobility, etc. In these circumstances, effects of tax reforms may exceed the simple variations of working time – those usually captured in the estimations. As a matter of fact, Feldstein (1995) shows that the sharp reduction of marginal tax rates during the 1986 US reform seems to have had a larger effect on taxable incomes than on working hours. The argument is widely spread in the optimal taxation literature, as it justifies the fact that agents' productivities cannot be observed by the government, even though labor income y^* and weekly working time h^* hence hourly wage $w^* = y^*/h^*$ are observable [observables are denoted with a star hereafter]. Then, if the productive effort e differs from work duration h (due to unobservable aspects or, simply, to measurement error), then the true productivity, denoted $\omega = y/e$, is unobservable.

Exogenous productivities are consequently the key element of our approach and must be inferred from observed incomes. To do so, we suggest a somewhat symmetrical approach to the usual econometric method or previous calibration exercises. Let us describe it in a stylized way for a single individual. The usual approach consists of recovering homogenous preferences (i.e. parameters of function h)

[3] The main difference with the present paper is that Bourguignon and Spadaro (2000) treat households of more than one person as entities from which an aggregated labor supply and a household productivity (some kind of interpolation of household members' productivities) are derived.

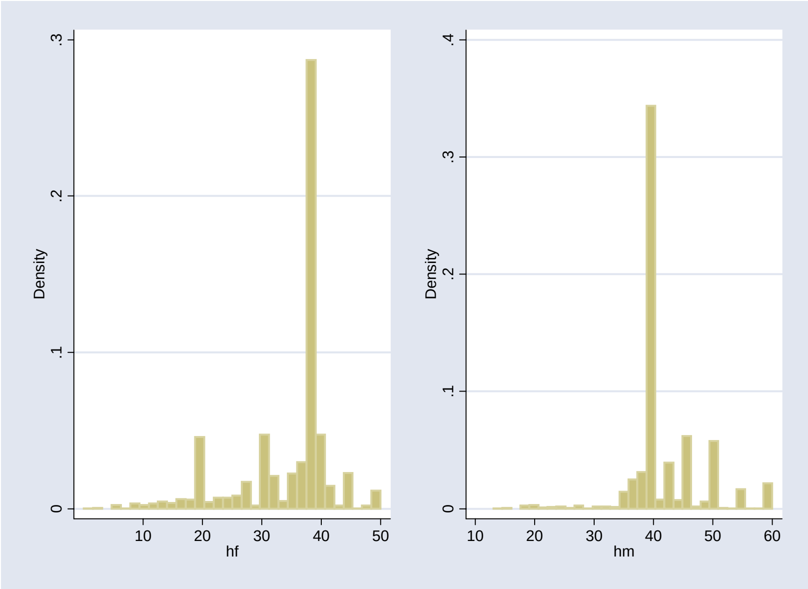


Figure 1: Distribution of Working Hours for Participants (Selected Couples)

from observed earnings $y^* = w^* h(w^*)$, under the hypothesis that each individual is represented by its wage/productivity w^*. Instead, we suggest that true productivity ω can be retrieved from observed earnings $y^* = \omega e(\omega)$ under simple assumptions on preferences (i.e. parameters of function e). The strategy simply consists in inverting expression $y^* = \omega e(\omega)$, or, more generally, the optimal household program.

This approach clearly abandons the possibility to treat observed hours as choice variables from which information about the household decision process can be inferred. It may be especially appropriate for countries like France where hours of work are strongly constrained. In that case, in effect, usual estimates are likely to capture more than pure preferences and may certainly be 'contaminated' by institutional and demand-side rigidities. This is illustrated in Figure 1 for a selected sample of French couples (data selection is described in the next section). It appears that most people are compelled to work at the legal full-time duration (39 hours per week in 1998, our year of interest) while women are also concentrated around part-time and three-quarter of a part-time. Nonetheless, it may well be the case that the spread of observed earnings translates a great diversity of productive behaviors, which express themselves through other channels than work duration.

2.3 Specification

We assume individual preferences of the Stone-Geary type with an extra additive term accounting for the partner's disutility of work:

$$U_i(c_i, e_i, e_j) = \beta_i^c \ln(c_i - \underline{c}_i(Z)) + \beta_i^l \ln(T_i - e_i) + \delta \ln(T_j - e_j) \quad \text{for } i, j = f, m. \tag{2}$$

This functional form is also used by Kooreman and Kapteyn (1990) in the case of purely public consumption. We assume that on average, the model coincides with the usual interpretation in terms of labor supply, that is, that mean effort $\overline{e}$ corresponds to average working time $\overline{h}$ (for active men and active women separately).[4]

The collective model does not impose any specific solution (e.g. Nash bargaining) and avoids the difficult assessment of outside options. The opposite difficulty is that there is absolutely no guidance as to what variables should appear in the set of bargaining factors θ. A whole list of factors could well be suggested but the recent literature has been constrained by the paucity of available data. Usual candidates in labor supply models are individual wage rates and non-earned income (e.g. Chiappori, 1988, 1992, Beninger and Laisney, 2002, Lise and Seitz, 2004, among others).[5] Information on non-labor income, in particular capital income, is often little reliable, and information at the individual level is seldom (some exceptions are Fortin and Lacroix, 1997, Couprie et al., 2003). The exogeneity of wage rates can also seriously be questioned, as discussed above. In the present exercise, the calibration approach limits the number of determinants of the bargaining rule and we must posit a simple form which gives the essence of previous choices in this literature. This way, we focus on individual (exogenous) productivities and suggest the following bargaining rule:

$$\mu = \frac{\omega_f}{\omega_f + \omega_m}. \tag{3}$$

Individual productivities represent spouses' relative (potential) contributions to household income, and can also be related to individual achievements in case of non-cooperation (outside options).[6]

A word must be said about domestic production. We follow the bulk of the literature by interpreting non-market time as leisure. Yet, the introduction of domestic production, usually seldom due to the scarcity of time use surveys with information on incomes and socio-demographics, is a necessary im-

[4]In this specification, T_i $(i = f, m)$ is usually taken as the total time endowment minus a minimum requirement accounting for physiological regeneration and standardized aspects of household production so that T_i reflects the maximum time available per week for market activity. Here, we interpret T_i more broadly as the maximum productive effort which can be accomplished by the worker over a week. This way, the 'effective leisure' $T_i - e_i$ may correspond to the concept of leisure, diminished in case of above-average effort, e.g. additional tiredness prevents from enjoying fully weekly hours of leisure; or prevents from generating the whole of domestic goods usually produced in non-work time (this point is naturally an extrapolation since the model does not explicitly account for domestic production).

[5]Differences in spouses' age levels or education achievement are sometime introduced. Other environmental factors (degree of divorce liberalization, sex ratio) have been incorporated for specific tests of the model (see Chiappori et al., 2002, Moreau and Donni, 2003) and relate specifically to divorced-type of threat points. Couprie et al. (2003) is the only study, to our knowledge, to enrich the specification of the distribution function with subjective data on political opinion or religious orientation.

[6]There is some ambiguity in referring to *potential* rather than actual labor incomes when trying to account for some relative financial power in the household. However, introducing labor incomes instead of wages (productivities) would imply an endogenous bargaining rule (in a labor supply model) and the loss of the efficiency hypothesis (see Basu, 2001). In consumption models, the introduction of labor incomes as distribution factors relies on the assumption of separability between labor supply and consumption behaviors (cf. Browning et al., 1994).

provement.[7] Another important issue is the fact that individual domestic productivities – and not only market productivities – could be relevant variables explaining intra-household distribution of resources, i.e. entering (3). To our knowledge, the very first theoretical and empirical attempt in this direction, within a collective framework, is provided by Bourguignon and Chiuri (2005), who focus primarily on marketable domestic goods (home childcare, among others, is not considered).

A connected issue is the treatment of children. As often in the related literature, children are assumed not to have decision-making power in the household.[8] They are simply treated as an additional source of consumption for spouses through the minimum amounts $\underline{c}_i(Z)$. The household's minimum consumption $\underline{c}(Z)$ is defined for each type of household composition as the lowest potential disposable income in that group, i.e. the level of resources obtained if purely on welfare. Consequently, this amount varies in function of the number of children according to the implicit equivalence scales of the minimum income scheme and housing benefits. On the one hand, these calibrated minimum consumption terms are in line with the usual specification of the LES utility ("...give a natural way of incorporating differences in tastes and household circumstances...", according to Deaton and Muellbauer, 1980, p.98). On the other hand, they can be seen as an additive equivalence scale.[9] Finally, they do not change with the reform at stake.

2.4 Some Restrictions

As argued above, a necessary condition for program (1) to represent Pareto efficiency is the convexity of the budget set. However, some non-convexities may arise from the means-testing of social and family benefits. In turn, this would imply possible non-convexities in the utility sets as represented in Figure 2. In the following, we assume (i) that (cardinal) individual utilities are of the Von Neumann-Morgenstern type and (ii) that all couples play mixed strategies that increase their expected utilities (see Friedman, 1990). This way, the allocations which are achievable by maximization of the household welfare index in (1) are restricted to a subset where the portion between B and C is excluded. As noted by Friedman (1990), any equilibrium A located in this non-concave region of the frontier is *locally* efficient, while we assume couples to be *globally* efficient by considering the convex hull of the utility set.

Non-convexity is mainly due to means-tested social assistance (the *Revenue Minimum d'Insertion*, in France), which generates a flat budget constraint at low levels of earnings in the case of low-wage

[7] Interestingly, recent findings from Donni (2004) show that (i) simple functional forms which are consistent with the traditional collective model of labor supply can sometimes be compatible with more sophisticated models incorporating domestic production, (ii) if the domestic good is marketable, these models can be tested and partially identified using traditional household surveys (i.e. without resort to time allocation surveys). This is a path to follow for future research.

[8] Their preferences are often assumed to be internalized into those of their parents. Bourguignon (1999) and Dauphin and Fortin (2000) are noticeable exceptions.

[9] On this issue, Muellbauer and Van de Ven (2002) recall the difficulties specific to comparisons of welfare across households of different compositions, notably the fact that equivalence scales estimated from expenditure data necessarily depend on exogenously imposed value judgments. Interestingly for our study, they emphasize that the intuitive appeal of equivalence scales based on a country's transfer system is the perception that these relativities embody a social consensus.

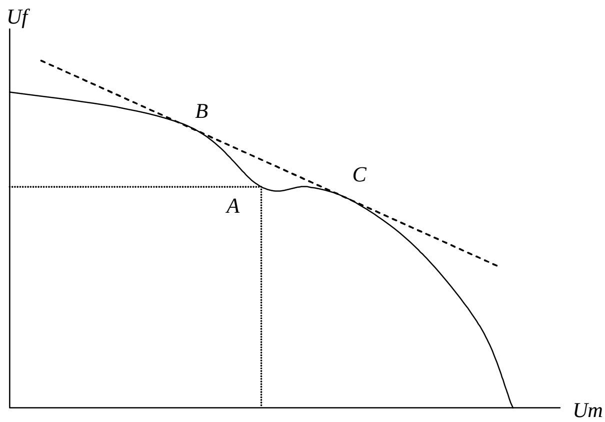


Figure 2: Possibility set with VNM utilities

households (see l.h.s. graph of Figure 3 in the next section). Any household observed to be working and located in this flat portion displays apparently irrational behaviors according to the static model at use, while it may be in a transitory situation or make a more complex rational choice (e.g. there may be stigma attached to living purely on welfare, or long-term gains in keeping a link to the labor market). In practice, it must be ensured that this inconsistency does not show up in our empirical application. This issue requires a bit of attention in the calibration stage, less so in the simulations.

As we shall see, the *calibration* relies on the existence and unicity of analytical solutions, involving local linearization of the budget curve. One way of dealing practically with possible inconsistency is to assume that all labor incomes are observed with measurement error drawn from some arbitrary distribution. The measurement error is such that, without it, households would be 'rational' and make choices which locate them in a convex part of the budget set. This treatment of the data is analogous to the original econometric model of labor supply in case of non-linear and possibly discontinuous budget constraint described by Hausman (1981).

For the *simulation* of behavioral responses, we use the calibrated model to compute the household welfare level for each discrete choice of efforts over a large number of alternatives, hence simulating the continuity of effort choices, and select the welfare-maximizing allocation. This numeric solution allows any type of budget constraint to be dealt with.

3 Calibration of the Model

3.1 Selected Data and Stochastic Corrections

The data at use are selected from the French Household Budget Survey 1994 (INSEE) which contains information on 11,220 households. We select a sample of married and cohabiting couples in the age bracket $25-64$ and available for the labor market, *i.e.* not disabled, retired or in education. Households with self-employed workers or farmers are excluded since their labor supply behavior may be rather different from salary workers. Households with more than two decision-makers, i.e. with other adults than the basic couple, and those with more than 3 children or where children earn substantial incomes are discarded.

Couples receiving unemployment benefits are also taken out as job seekers are supposed to be demand-side constrained (see further justifications in Bargain and Orsini, 2004). As most of male inactivity is due to demand factors, this last step of selection results in hardly any inactive men left. Therefore, we only keep *two-earner* and *male-earner couples*. This way, we do not treat hereafter the case of double corner solutions (i.e. both spouses are inactive) but only those of interior solutions and single corner solutions (i.e. he is working, she is inactive). We simulate the tax-benefit legislation for 1998 and data are grossed up for this purpose, i.e. all monetary variables are inflated for the period 1994-1998 (see Bargain and Terraz, 2003). We end up with $2,044$ households whose descriptive statistics are shown in Table 1.

Table 1: Descriptive Statistics

	women	men
Participation rate	77.7%	100.0%
Working time of participants (hours/week)	34.8	41.8
Gross wage rate (euros/hour) / participants	11.1	13.3
Gross wage rate (euros/hour) / out-of-work	8.7	*n.a.*
Average age	38.7	40.8
Primary education	30.7%	17.9%
Vocational training	37.9%	46.0%
High school diploma	14.8%	17.9%
University studies	16.7%	18.2%
Average number of children	1.47	
No. of selected households	2,044	
% of total population	18.2%	

As aforementioned, we follow the traditional literature on labor supply (Hausman, 1981) and correct observed behaviors for various types of errors (heterogeneity in preferences, measurement errors, optimization errors or transitory aspects) by adding a continuous random disturbance to observed labor incomes.[10]

[10] For household h, corrected income becomes $y_h^* = y_h^{obs} + u_h$, with the natural restriction $y_h^{obs} + u_h \geq 0$. The random term u_h is assumed to be independently and identically distributed for all households and drawn from a normal distribution with zero mean and minimum variance.

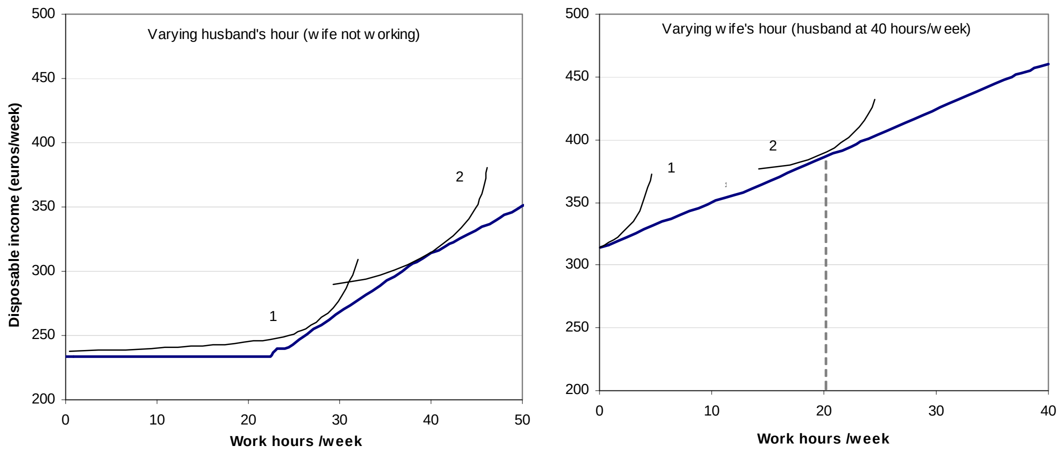


Figure 3: Budget Constraints

We have previously noted that means-tested social assistance can be responsible for a flat segment at the bottom of the budget constraint. Contrary to Spadaro (2004), who account for all types of households, this problem is limited here since we have restricted our sample to two-earner and male-earner couples. The issue may concern primarily low-wage male-earner couples in our case. The l.h.s. graph of Figure 3 depicts precisely this situation, showing how total disposable income c varies with h_m when $h_f = 0$, for a couple of workers paid at the wage floor (6 euros/hour).

In practice, then, we draw several sets of random measurement errors until obtaining one for which all 'irrational' behaviors have disappeared, i.e. households observed in the flat segment are placed on a higher range of the budget constraint which allows a consistent solution, as depicted by sections of indifference plans 1 and 2 on the l.h.s. graph.[11] This is fairly easy since low-wage men receiving some social assistance are mostly concentrated closely to the exhaustion region, i.e. the right end of the flat segment.[12]

Notice that the l.h.s. graph of Figure 3 is a section of the (h_f, h_m, c)-space and solutions depicted by indifference planes 1 and 2 are in fact single corner solutions (since $hf = 0$). The same is true for the solution depicted by the indifference plane 1 in the r.h.s. graph, defining the limit situation where she starts working; indifference plane 2 shows an interior solution where $h_m = 40$ and $h_f = 20$ hours/week.[13]

[11] Other non-convexities might appear due to means-tested transfers to families with children. Those benefits (*Complément Familial*, *Allocation Pour Jeunes Enfants*) are described by Bourguignon and Magnac (1990) and Moreau and Donni (2002). The previous approach based on measurement errors is used to ensure that households are not located in non-convex portions of the budget set.

[12] In fact, it comes from our selection that most men are working full-time and only 2.5% of them are working less than 30 hours per week [all women work in this case, except 4 observations].

[13] The discussion refers here to *hours* to ease the presentation of budget constraints, but the implicit choice variable is *effort*.

3.2 Principle of Calibration

With previous precautions, it is now possible to use the analytical properties of the model to proceed with the calibration. First of all, it is necessary to linearize the budget constraint locally (at the point of observation). In other words, we can compute effective marginal tax rates (EMTRs) as follows:

$$t_i(y_f, y_m, Z) = 1 - \frac{\partial g(y_f, y_m, Z)}{\partial y_i},$$

so that the budget constraint is locally written:

$$c_f + c_m = \widetilde{\omega}_f e_f + \widetilde{\omega}_m e_m + \widetilde{y}_0,$$

with implicit productivity $\widetilde{\omega}_i = (1 - t_i)\omega_i$ for spouse $i = f, m$ and $\widetilde{y}_0$ the virtual non-earned income.

As briefly explained, individual productivities are calibrated on observed earnings by inversion of the optimal program. We describe here the principle for interior solutions; analytical solutions with the specific functional forms at use are detailed in the Appendices for both interior solution and single corner solutions.

First, let us rewrite individual utilities as follows:

$$\begin{aligned} U_i(c_i, e_i, e_j) &= U_i(c_i, \frac{y_i}{\omega_i}, \frac{y_j}{\omega_j}) \quad \text{for } i, j = f, m \\ &= u_i(c_i, y_i, y_j; \omega_i, \omega_j) \quad \text{for } i, j = f, m. \end{aligned}$$

The (local) optimal program becomes:

$$\begin{aligned} &\underset{c_f, c_m, y_f, y_m}{\text{Max}} \quad \mu(\omega_f, \omega_m) u_f(c_f, y_f, y_m; \omega_f, \omega_m) + (1 - \mu(\omega_f, \omega_m))\, u_m(c_m, y_m, y_f; \omega_m, \omega_f) \\ &\text{s.t.} \quad c = c_f + c_m = (1 - t_f)y_f + (1 - t_m)y_m + \widetilde{y}_0. \end{aligned}$$

First-order conditions lead to marshallian demands of the form:

$$\begin{aligned} y_f &= \Upsilon_f(\omega_f, \omega_m, t_f, t_m, \widetilde{y}_0) \\ y_m &= \Upsilon_m(\omega_f, \omega_m, t_f, t_m, \widetilde{y}_0) \\ c &= c_f(\omega_f, \omega_m, t_f, t_m, \widetilde{y}_0) + c_m(\omega_f, \omega_m, t_f, t_m, \widetilde{y}_0). \end{aligned}$$

The last equation is inverted to give an expression of the virtual non-labor income which is substituted into the two first equations, so that:

$$\begin{aligned} y_f &= Y_f(\omega_f, \omega_m, t_f, t_m, c) \\ y_m &= Y_m(\omega_f, \omega_m, t_f, t_m, c). \end{aligned}$$

Finally, this system is inverted to retrieve productivities for $i = f, m$:

$$\begin{aligned} \omega_f &= \Omega_f(y_f^*, y_m^*, c^*, t_f^*, t_m^*) \\ \omega_m &= \Omega_m(y_f^*, y_m^*, c^*, t_f^*, t_m^*), \end{aligned}$$

evaluated at observed values of labor incomes y_f^* and y_m^*, total consumption $c^* = g(y_f^*, y_m^*, Z)$, and effective marginal tax rates $t_i^* = t_i(y_f^*, y_m^*, Z)$.[14] In the Appendices, we show that with the functional forms at use, previous inversions are possible and lead to a unique solution.[15]

3.3 Elasticities

Two sets of preference parameters are chosen in order to obtain two levels of wage-elasticity (or rather productivity-elasticity), in line with lower and upper bounds in the literature (see Blundell and MaCurdy, 2000; see Laroque and Salanié, 2002, and Bargain and Orsini, 2004, for recent estimates for France). This way, we can analyze the sensitivity of our results to different orders of magnitude of the labor effort responsiveness. Note that the scope of choices for those parameters is in fact restricted by certain criteria. Firstly, parameters must not lead to an implausible distribution of the power index. Secondly, we impose that the three coefficients β^c, β^l, and δ sum up to unity for each spouse (usual regularity conditions on individual utilities simply impose that these coefficients are positive). This normalization conforms to the necessity to make individual utilities comparable for the sake of the social welfare evaluation. Lastly, elasticities must reflect stylized facts, i.e. larger wage-elasticities for married women, small cross-wage elasticities, etc.[16] The two sets of parameters are presented in Table 2 together with corresponding mean elasticities.[17] We limit ourselves to two preference regimes only for clarity of exposition; results with more than two regimes are available upon request, as well as other aspects of effort supply responsiveness (e.g. cross-wage elasticity, income elasticity, etc.).

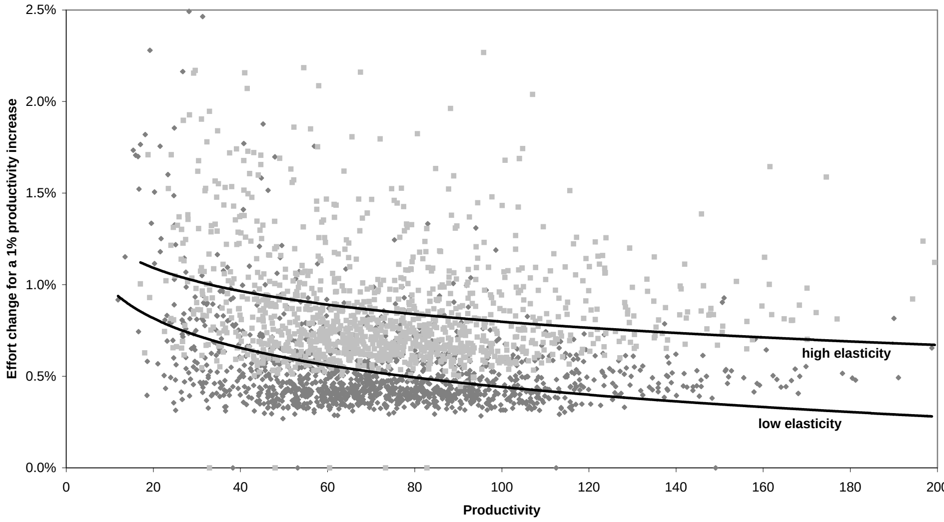
The present model avoids the restrictive assumption of isoelasticity often retained in the normative literature (c.f. Spadaro, 2004). The distribution of individual female elasticity is shown in Figure 4 for

[14] The French tax-benefit microsimulation program SYSIFF98 allows computing total consumption (disposable income) as well as effective marginal tax rates, by numerical differentiation of the budget constraint at observed locations (see Bargain and Terraz, 2003).

[15] Let us discuss, however, the general underlying condition. To do this, consider the case of single individuals with identical preferences and differing only with respect to their productivity. The previous procedure then simply consists of inverting the expression $y = Y(\omega)$, which is possible and unique if and only if income is a monotonic function of productivity. In other words, a more productive agent must accomplish a productive effort leading to a higher income, i.e. in the (y, c) plane, the indifference curve of a more productive agent is flatter. Interestingly, this is the agent monotonicity condition often met in the optimal taxation literature. This is not entirely surprising since individual income must act as a self-selection device to reveal the level of exogenous productivity of each agent.

[16] Labor supply of married women is well-known to be more elastic than for men. This can be due to the presence of children but also to anticipated fertility decisions. These aspects are accounted for very simply here by positing larger propensity to consume non-market time for women.

[17] Elasticities are computed using postulated parameters, specifications and calibrated productivities obtained as previously described. The complexity of the tax-benefit system deters us from searching analytical expressions and we resort to numerical calculations which simply consist in increasing uniformly female (resp. male) productivities by 1% to simulate corresponding variations in productive effort. The method is the same as that used to simulate tax reforms, as explained in Section 4.



Note: this graph depicts the distribution of women's elasticites according to their level of productivity. The upper (resp. lower) observations corresponds to the assumption of high (resp. low) elasticity and the black curves give the trend in each case.

Figure 4: Productive Effort Elasticities in Function of the Level of Productivity (Wives)

each regime of preference (the male distribution is available upon request). Trend curves indicate that elasticities tend to diminish with the level of productivity, a characteristic in line with the literature (see Immervoll et al., 2004).

Table 2: Preference Parameters

Preference regime	male		female		joint	own-wage elasticity	
	β_c	β_l	β_c	β_l	δ	female	male
I	0.8	0.1	0.65	0.25	0.1	0.58	0.26
II	0.65	0.2	0.5	0.35	0.15	0.25	0.15

3.4 Results of the Calibration

Figure 5 presents the distribution of calibrated productivities for active men and women and for the two different levels of elasticity. Expressed in proportion of the sample mean, these distributions are very close to those of labor incomes, and all the closer as elasticities are lower. Women work more often part-time for small labor incomes so that the female distribution shows more symmetry than for men. Average male productivity is 13.3, average productivity for active female is 11.1 and average productivity for inactive

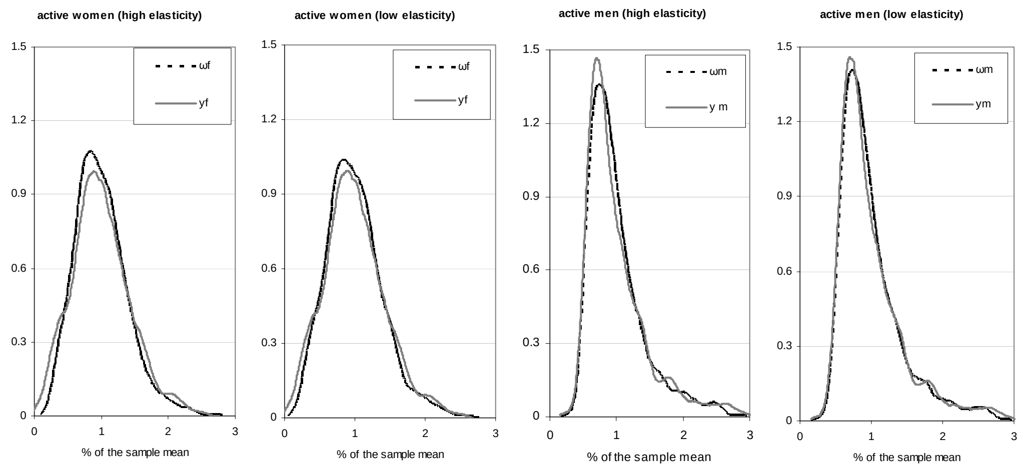


Figure 5: Distributions of Incomes (y) and Exogenous Productivities (ω)

female is 8.7 (in euros per *unit of effective labor*). The two former figures correspond roughly to the average wage rates (in euros per hour) since we have assumed that working time and productive effort among active individuals must coincide on average. Also note that the correlation between calibrated productivities and wage rates is 60% (resp. 57%) for women and 84% (resp. 87%) for men in the case of high (resp. low) elasticities.

The distribution of Pareto weights on female utilities (i.e. power indices) is computed using expression (3) and calibrated productivities. The mode is close to 0.5 but the distribution is skewed on the left hand side, due to inactive women whose productivities are relatively smaller. In a scenario of high (resp. low) elasticities, the index μ is 37% on average (resp. 33.7%) for one-earner couples and 45.5% (46%) for two-earner couples. Graphs of the distribution are available upon request.

Figure 6 presents the distribution of productive efforts resulting from the calibration, for men and women respectively and for both high and low regimes of elasticities. It is worth comparing it to the distribution of working hours in Figure 1,[18] highly concentrated around spikes which translate the institutional and demand-side rigidities typical to the French labor market. It turns out that with our reinterpretation of the labor supply model, productive efforts compatible with observed earnings appear much more spread than work durations, both for men and women. Figure 7 completes the picture by plotting hours against efforts (here for women). While correlation is obvious, it also appears clearly that for each of the main hour spikes for women (39, 30 and 20 hours/week), a large variety of productive efforts are possible, all consistent with observed earnings and the postulated rationality.

[18] Both distributions are represented with the same scale, efforts being normalized so that mean effort coincides with mean hour; for the same reason, the modes of the two distributions are also very close.

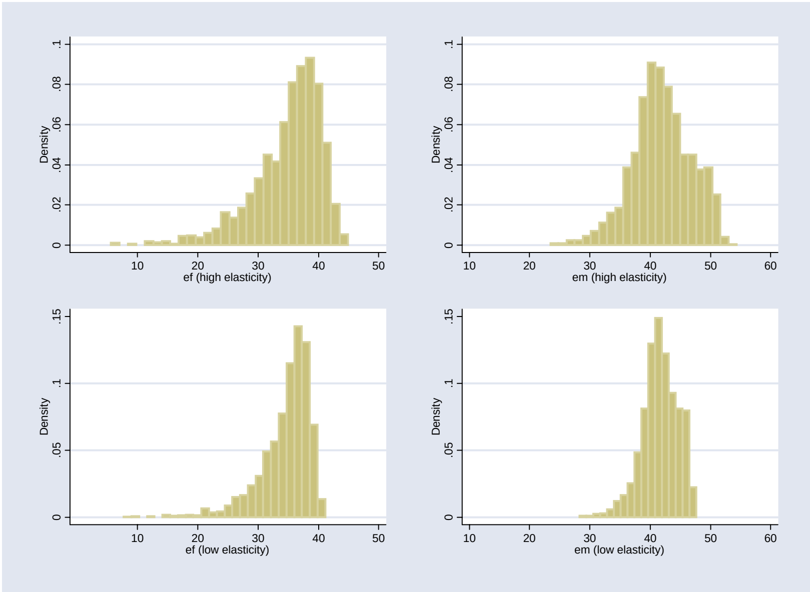


Figure 6: Distribution of Productive Efforts

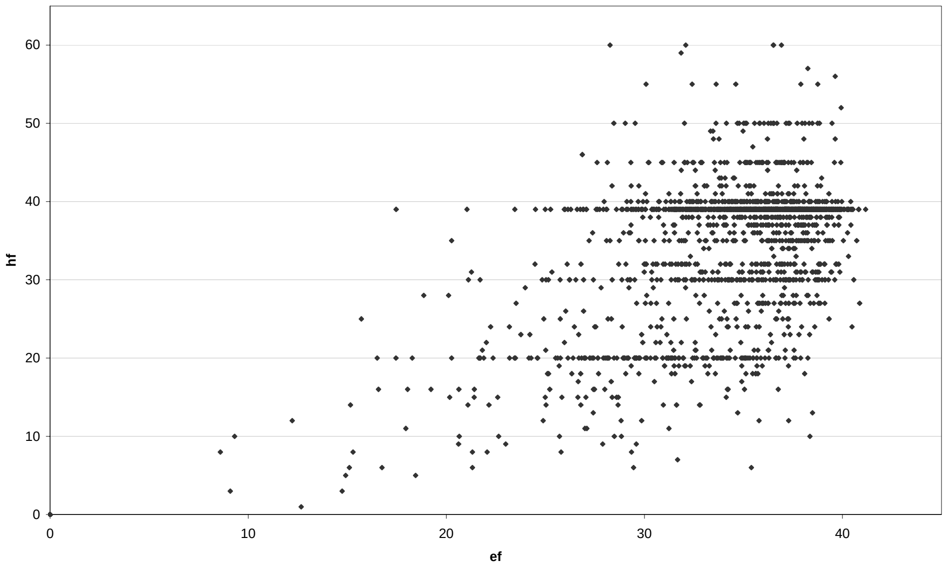


Figure 7: Hours versus Efforts (Women)

The graphs of Figure 8 represent the share of total consumption received by women on average per decile (upper graph) and centile (lower graph). Comparing these graphs indicates a large intra-decile variance. Nevertheless, it appears that the poorest and the richest households tend to be less egalitarian in terms of intra-household distribution of resources.[19] On the one hand, wives' productivity, hence their bargaining power, is relatively lower than husbands' in poorer households as these women are often inactive. This is illustrated by the average female participation rate per decile in the upper graph of Figure 8 (black curve and r.h.s. axis). On the other hand, female share decreases from the 8th decile onward, which is usually explained by the fact that the gender pay gap increases with earnings (the 'glass ceiling' effect).[20] The specific pattern found here has implications on the final results.[21]

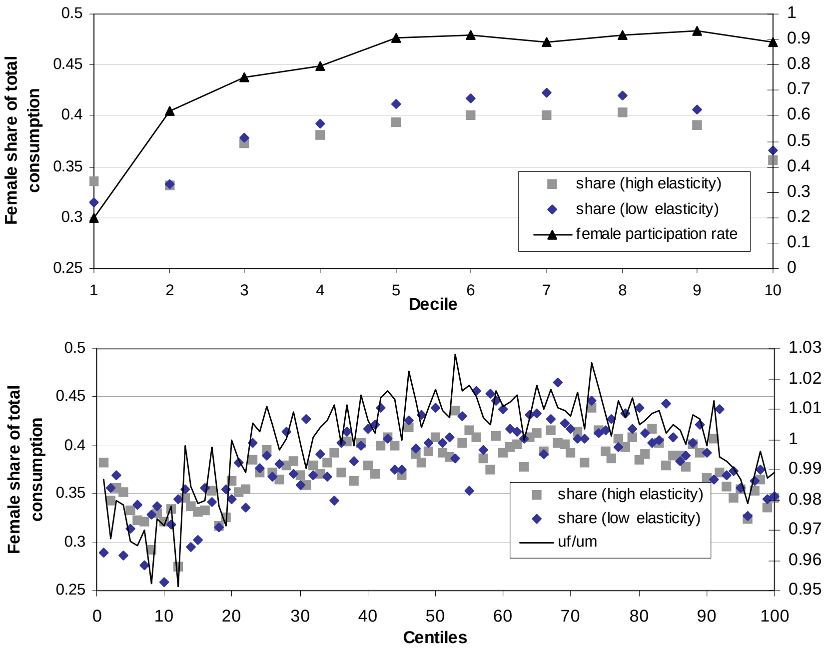
It is possible to decompose inequality across individuals into two components: inequality across households and intra-household inequality (see Haddad and Kanbur, 1990). Using the variance as a simple measure of inequality, we find that under high (resp. low) elasticities, intra-household inequality explains 37.3% (resp. 37.8%) of the total variance in individual consumptions. Even if it is difficult to compare quantified results to other studies, it is worth mentioning that Haddad and Kanbur obtain similar orders of magnitude when using observed individual consumptions. In a recent study, Lise and Seitz (2004) estimate a collective model on British data and find that the level of intra-household inequality represents between a third and a fifth of the total inequality across individuals.

The black curve in the lower graph of Figure 8 (r.h.s. axis) represents the average ratio U_f/U_m per centile, utilities being rescaled by the average value for women and men respectively in order to neutralize the recurrent differences of cardinalization between female and male welfare measures. It turns out that this average welfare ratio varies closely around 1, while following the same trend as the consumption

[19] This result is naturally driven by the fact that intra-household distribution is assumed to depend essentially on the productivities ratio through (3), reflecting the essence of previous collective models of labor supply; the distribution of intra-household inequalities then coincide to some extent with that of the gender wage gap.

[20] Arulampalam et al. (2004) find that in some European countries including France, gender pay gaps are typically bigger at the top and the bottom of the wage distribution, which is consistent with the glass ceiling interpretation at the top; at the bottom, authors argue that women stay longer at initial wages ('sticky floors').

[21] Some researchers have attempted to characterize theoretically the relation between the level of household resources and the level of intra-household inequality. Haddad and Kanbur (1992) apply the efficiency wage model of Stiglitz (1976) to agricultural households. They find an analogue to the Kuznets curve transposed at the intra-household level: as the household resources increase, inequality increases then decreases. The consequences of such regularities would be important, in particular the possibility of a trickle-down effect on individuals as transfers take place toward the poorest ones. In a related approach, Peluso and Trannoy (2003) show that with an increasing concave sharing rule, i.e. when inequality increases with the level of resources, a transfer from rich to poor households provides a double dividend (redistribution across households and redistribution from an unequal couple to a more equal couple). If these specific regularities of the sharing rule were empirically verified, conclusions on the ranking of two distributions of household incomes (e.g. before and after reform) would be conserved at the individual level. For any other sort of sharing rules, like in the present exercise, normative conclusions necessarily depend on the shape of social preferences. Two remarks: (i) the pattern found here is in fact the inverse to Haddad and Kanbur's, (ii) while previous studies focus only on inequalities, we additionally account for possible behavioral responses to redistributive policies.



Note: the upper graph depicts the wife's average share (in %) of household consumption per decile (left scale) and the female average participation rate (right scale). The lower graph depicts the wife's average share per centile (left scale) and the average welfare ratio between spouses (right scale), individual utilities being deflated by the population mean.

Figure 8: Consumption Share of Women in the Distribution of Income in the Population

sharing. It is noticeable, however, that even if the sharing is fairly unequal for low income households (only between 30 and 35% of the total consumption goes to the wife in the first two deciles), the repartition of welfare is not as uneven. In effect, the ratio U_f/U_m always remains close to 1 and even exceed 1 from the 3^{rd} to the 9^{th} decile.[22]

4 Simulation of a Tax-Benefit Reform

4.1 Simulation of Behavioral Responses

With the model and the functional forms used in the paper, it is possible to express individual consumptions as simple functions of total disposable income c:

$$\begin{aligned} c_f &= p(c - \underline{c}) + \underline{c}_f \\ c_m &= (1-p)(c - \underline{c}) + \underline{c}_m, \end{aligned} \tag{4}$$

[22] Naturally, this comes from the fact that women are compensated by a higher level of leisure. Yet, non market time can also correspond to domestic production, which generates additional goods but possibly some disutility for the wife. This means that we somehow understate welfare inequalities between men and women. This point can only accentuate the conclusions of the next section, related to the possible bias committed in the normative analysis when individual rather than household welfare is accounted for.

where p and $(1-p)$, the individual shares of 'net consumption', are simply determined by individual preferences and the Pareto weight (see expression (11) in the Appendices). Recalling from the budget constraint that $c = g(\omega_f e_f, \omega_m e_m, Z)$, we can rewrite total household welfare simply as a function of both productive efforts:

$$W(e_f, e_m) = \mu U_f(c_f(e_f, e_m), e_f, e_m) + (1-\mu)U_m(c_m(e_f, e_m), e_m, e_f).$$

This way, the collective program simplifies into the maximization of the index $W(e_f, e_m)$. To search for an optimum, it is then possible to *loop numerically over the set of possible values for* (e_f, e_m) to find the pair of values which maximizes this index. The fundamental difference with the previous calibration step is that maximization is conducted by *discretizing effort supplies* (with a step small enough to simulate continuity). Analytical solutions are not required and, in this case, any type of budget set hence any type of reform can be handled. Own-wage elasticities are computed by searching for the optimal pair (e_f, e_m) once individual productivities are increased marginally. Tax-benefit reform are simulated by searching for the optimal pair (e_f, e_m) once the tax-benefit program (i.e. function g) is modified along the lines of the reform.

4.2 The Reform: a Working Tax Credit in France

In-work transfers have been suggested to 'make work pay' in France – see Laroque and Salanié (2002) – and an earned income tax credit (*Prime Pour l'Emploi*) has been implemented in 2001. Yet, its effects are argued to be close to null due to the modesty of the distributed amounts. Instead, we suggest the simulation of the generous tax credit in force in the UK and often taken as a benchmark in international comparisons (see Bargain and Orsini, 2004). The British WFTC (*Working Family Tax Credit*) is applied here to the selected population of French couples. This reform, introduced in 1999 in the UK, consists of a tax credit targeted to households with children in which at least one member works for a minimum of 16 hours per week.[23] The maximum amount of 75 EUR per week is increased by 49% per dependent child and by 20% if work duration exceeds 30 hours per week. When earnings are above a threshold of 128 EUR per week, the maximum amount is diminished by 55% of the net income (i.e. net of tax and social contributions). We extend this reform to all types of households, with and without children. A more precise definition of the reform is given in Bargain and Orsini (2004), as well as the specific modalities retained to adapt the reform to the French tax-benefit system.

4.3 Incentive and Distributive Effects

While the reform encourages participation of single individuals, it is suspected to have a strong disincentive impact on secondary earners in couples, usually the wives, since their net gain to work may decrease

[23] To respect this condition in the simulation, working time is computed using wage rates - observed or predicted for non-participants - and simulated earnings, that is, labor income corresponding to optimal effort supply choices.

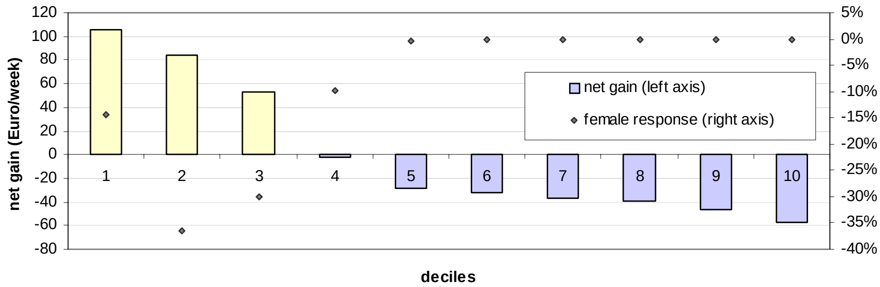
with the introduction of the tax credit. In effect, total disposable income increases when she does not work (as the household is eligibility to the transfer through the husband's salary) while the household may be too rich to be eligible when she works. Consequently, the wife is induced to diminish her effort. This disincentive effect is common to in-work policies which are conditional on the spouses' joint income (cf. Blundell et al., 2000, among others). In addition, the reform pushes effective marginal tax rates upward which may results into lower working hours/efforts.

This is confirmed by the simulations since between 218,500 (5.7%) and 324,500 (8.5%) of the selected women would withdraw from the labor market. These figures are the lower and upper predictions obtained using low and high elasticities of productive efforts respectively. Male participation does not change but overall, male productive effort decreases by a net proportion of 6% (resp. 3.2%) while female effort decreases by 10.6% (resp. 7.8%) in the high (resp. low) elasticity scenario. The disincentive effect implies a drop in tax revenue and a rise of the cost of the reform since tax credit transfers increase via the husbands' salaries.

To make the reform revenue neutral, we have calibrated a consumption tax, which can be seen as a rise of the VAT, assumed to take effect simultaneously to the introduction of the reform. This specific tax amounts to 4.6 (resp. 3.1) percentage points in the high (resp. low) elasticity scenario. These figures may seem fairly high but it must be kept in mind that the cost is only borne by the population of couples in this exercise.

The distributive effect of the reform is unambiguous, as illustrated in Figure 9 (l.h.s. axis). The set of reforms (WFTC and indirect taxation) benefits to the first three deciles of the selected population while the rest of the distribution suffers from an increase in net taxes. Note that the increase in non market time for married women after the reform benefits more to the second than to the first decile (see variation of female working time in Figure 9, r.h.s. axis), since the original participation level was substantially higher there (cf. Figure 8). In terms of welfare, the average ratio U_f/U_m remains higher in the second and third deciles than in the first

Is the reform desirable according to the inequality criterion? There is a clear transfer from the top half to the bottom of the distribution so that inter-household inequality (measured as the variance of household consumption levels) decreases by 5%. The impact on intra-household inequalities is yet ambiguous. In effect, the richer households – the main payers of the complete reform – and the poorer household – the main beneficiaries – are the two groups in which intra-household inequities are the highest (cf. Figure 8). We find that intra-household inequality decreases by 6.8% so that its contribution to total inequality decreases by 0.5 percentage points. Overall, inter-individual inequality benefits from the reduction of inequality both across and within households and decreases by 5.7%.



Note: the graph shows the average net gain of the combined reforms per decile (left scale) and the average change in female labor supply (in %) due to the reform.

Figure 9: Distribution of Net Gains from the Reforms

4.4 Social Welfare Evaluation

Previous results show that the efficiency loss of the reform is offset to some extent by its redistributive performances within the selected population.[24] A comprehensive statement of the equity-efficiency trade-off must necessarily rely on a social welfare evaluation. To do so, we suggest two measures of social welfare:

$$\begin{aligned} SW_1 &= \frac{1}{1-\gamma}\sum_h [W_h(U_{f_h}, U_{m_h})]^{1-\gamma} \qquad (5) \\ SW_2 &= \frac{1}{1-\gamma}\sum_h [(U_{f_h})^{1-\gamma} + (U_{m_h})^{1-\gamma}]. \end{aligned}$$

The first index SW_1 corresponds to the usual practice according to which household welfare is the object of concern. In this case, the public planner ignores intra-household distribution rules and must assume equitable sharing in the household. This means that the planner implicitly attributes the same Pareto weights as the household to individual utilities, or, in other words, that the household rule is optimal for the planner. In contrast, criterion SW_2 assumes that the planner can infer intra-household mechanisms and ultimately target individual welfare. This expression is original and its implementation only possible thanks to the use of a multi-utility model of household decision making.

The social welfare function of the form $\Psi(V) = \frac{V^{1-\gamma}}{1-\gamma}$ is a non-decreasing and concave transformation of cardinal utilities into social welfare; the degree of concavity γ represents the social aversion to inequality. The sensitivity of the results to different levels of aversion are analyzed below, with $\gamma = 0$ corresponding to utilitarian preferences and $\gamma \to +\infty$ to rawlsian preferences.

Notice that household welfare in index 1 or individual levels of utility in index 2 are themselves functions (indirect utility functions) of members' productivities, household characteristics and the tax-benefit system g. In other words, these social welfare indices account for agents' responses to any given change in the environment (e.g. the tax system). In addition, each index is computed before and after

[24] It is conceivable to apply the approach separately to different uniform groups (e.g. singles vs. couples). However, this assumes that redistribution across groups occurs exogenously whereas tax systems in force deal simultaneously with both vertical and horizontal equities. See comments in Bourguignon and Spadaro (2000).

reform while keeping total tax revenue constant, as mentioned above. Overall, then, the approach respects both the incentive compatibility constraint and the budget constraint of the social planner.

Figure 10 presents the result of the normative analysis. For each index, the curve depicts the change in social welfare due to the reform (vertical axis) for different levels of social aversion to inequality (horizontal axis). The general trend of the curves shows that for low values of the social inequality aversion, the pre-reform situation is socially preferred. This is clearly due to the efficiency losses generated by the reform. Yet, as the equity criterion gains importance against efficiency concerns, i.e. as γ increases, the reform becomes socially desirable since it targets the poorest group of the sample. As expected, the range of γ values over which the reform is rejected is shorter with low elasticities. In effect, in this case, the efficiency constraint is slightly relaxed so that the planner needs to be 'a little less rawlsian' to prefer a system in favor of the poorest.

The second important result is related to the fact that the SW_1 and SW_2 curves diverge as γ increases. The reform is more desirable, for a given level of inequality aversion, if individual (rather than household) welfare is what matters. In this case, in effect, the reform has an additional impact on equity: it does not only redistribute from rich to poor households but also reduce intra-household inequality. When concerned with individual welfare, the planner faces larger inequalities (i.e. a combination of inequalities across households and within households) while the reform targets precisely the worst-off individuals, i.e. the wives in the poorest households.

The results illustrate the fact that normative conclusions on the desirability of a reform may not be insensitive to the unit of interest. Divergences may still increase if estimated elasticities are biased. Assume that actual responsiveness is small (cf. lower graph.) while the planner can infer individual welfare (i.e. consider the SW_2 curve). The reform is then accepted on equity grounds as soon as $\gamma \geq 2.33$. In contrast, assume that econometric estimates overstate elasticities (cf. upper graph), as was the case in early econometric estimations of the labor supply in France (see the discussion in Bourguignon and Magnac, 1990). If the government cannot infer intra-household distributions (i.e. consider the SW_1 curve), the reform is then rejected for a range up to $\gamma = 10$.

Two final remarks are required to put results in perspective. First, normative conclusions differ whether we use indices 1 or 2, even though we have departed only slightly from equal sharing of *welfare* within households (recall that in Figure 8, the ratio U_f/U_m goes only slightly below 1 in poor households). Second, possible divergences in policy recommendation depend on the type of redistributive policy we consider, in relation to a given pattern of intra-household inequality across income deciles. Different results may emerge from other types of reforms and other assumptions on the intra-household distribution mechanism.

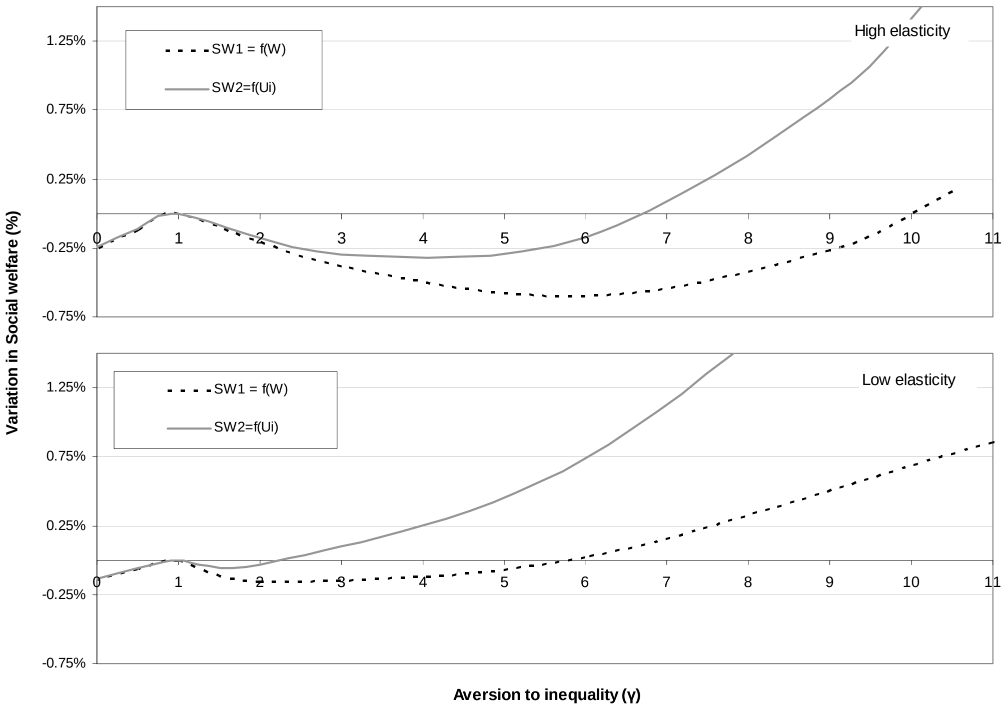


Figure 10: Impact of the Reform on Social Welfare

Final Discussion

It seems reasonable to think that the ultimate object of concern of redistributive policies is the welfare of individuals. Previous studies have shown that the level of inequality between individuals could be dramatically understated when inequality within households is neglected. In this paper, we assess the desirability of a tax reform on a French selection of couples to push the logic of normative analyses to cases where the social planner considers individual (rather than household) welfare. It is shown that conclusions may change depending on the unit of interest. To do so, we suggested the use of a structural collective model calibrated on observed choices. Our approach relies on the assumption that individual productivities are ignored insofar as observed working hours do not reflect the true productive effort generating labor income. Using simple assumptions on household preferences, we invert the optimal household program to retrieve individual productivities consistent with observed individual earnings.

Our results naturally rely on very specific assumptions relative to the form of the intra-household negotiation and individual preferences. The initial objective, however, is to show that the social welfare evaluation is not insensitive to departures from the hypothesis of equal welfare in the household. Empirical work would ideally rely on estimation techniques and on a more realistic framework, including domestic production, fixed costs of working and public goods.[25] Considerable research effort is still required. In

[25] The question of public goods is a serious issue. One may argue that if all the consumption is public in a household, there is

the meantime, our analysis aims to take family economics toward policy evaluation by using the essence of current multi-utility models of household labor supply, in a framework with taxation and participation decisions.

Should the normative framework be extended to individual welfare when it comes to evaluating tax reforms or to derive optimal tax schedules? From this essential question arise several delicate issues.

First, we may wonder to which extent a given instrument – taxation – is expected to correct simultaneously intra- and inter-household inequities.[26] An extreme example illustrates this point: should the government decrease taxes paid by a rich but very inegalitarian household in order to improve the living conditions of the poor member within this household? In the normative approach using social welfare index SW_2, intra- and inter-household distributions certainly interfere in a hazardous way.

Second, in the abstraction of a social planner, one may conceive that all available instruments are simultaneously set in order to achieve both types of redistribution. For instance, indirect taxation may achieve some intra-household redistribution by subsidizing commodities consumed exclusively by certain individuals in the household, e.g. children goods (see Bargain and Donni, 2005). Legislative measures on alimony or divorce rules might also influence spouses' outside options in a specific way (see Chiappori et al., 2002). Overall, redistribution among households and individuals should be conceived as the result of a broad set of policy and legal instruments.

References

[1] Arulampalam, W., A. L. Booth and M. L. Bryan (2004): "Is there a glass ceiling over Europe ? Exploring the gender pay gap across the wages distribution", *IZA discussion paper*, 1373.

[2] Bargain, O. and N. Moreau (2002): "Is the collective model of labor supply useful for tax policy analysis? A simulation exercise", *Working Paper DELTA*.

no room for inequalities. Yet, the private or public nature of goods is a difficult issue (see Browning et al., 1994). Introducing public goods may also change the pattern of within-household inequalities since the share of public consumption is likely to decrease with the household income level. Interestingly, Lise and Seitz (2004) characterize intra-household inequalities for different definitions of public goods in the household.

[26] The nature of the tax system (i.e. joint or individual) is only partly related to these questions. A switch to individualized taxation would achieve intra-household redistribution – since secondary-earners' net wage would decrease due to lower marginal taxation – only if the decision rule depends on after tax income. More generally, any direct transfer toward a specific individual in the household may well be neutralized fully or partly by the household's distribution mechanism if the latter does not depend on who receive exogenous income within the family. Lundberg et al. (1997) have shown on British data that a *wallet to purse* transfer (i.e. a switch in the identity of the recipient of child benefits from the father to the mother) had significantly effect on the household consumption patterns. The same natural experiment conducted on Australian data by Bradbury (2002) was not so conclusive. See also Bargain and Moreau (2002).

[3] Bargain, O. and K. Orsini (2004): "In-work policies in Europe: killing two birds with one stone?", forthcoming in *Labour Economics.*

[4] Bargain, O. and I. Terraz (2003): "Evaluation et mise en perspective des effets incitatifs et redistributifs de la Prime pour l'Emploi.", *Economie et Prévision*, 160/161, 121-148.

[5] Bargain, O. and O. Donni (2005): "Targettin Rotten Kids", *IZA working paper.*

[6] Basu, K. (2001): "Gender and Say: A Model of Household Behavior with Endogenously-Determined Balance of Power", *mimeo Cornell University.*

[7] Beninger, D. and F. Laisney (2002): "Comparison between unitary and collective models of household labor supply with taxation", *ZEW Discussion Paper 02-65*, ZEW, Mannheim.

[8] Blundell, R.W. and T. MaCurdy (2000): "Labor Supply: A Review of Alternative Approaches", in Ashenfelter and Card (eds), *Handbook of Labor Economics* , Elsevier North-Holland.

[9] Blundell, R.W. , P.-A. Chiappori, T. Magnac and C. Meghir (2001): "Collective Labour Supply: Heterogeneity and Nonparticipation", *mimeo*, University College London.

[10] Blundell, R.W., A. Duncan, J. McCrae and C. Meghir (2000): "The Labour Market Impact of the Working Families' Tax Credit", *Fiscal Studies*, 21, 1, 75-103.

[11] Bourguignon, F. (1999): "The cost of children : may the collective approach to household behavior help ?", *Journal of Population Economics.*

[12] Bourguignon, F. and T. Magnac (1990): "Labor supply and taxation in France", *Journal of Human Resources*, 25, 358-389.

[13] Bourguignon, F. and A. Spadaro (2000): "Social preferences revealed through effective marginal rates", *working paper DELTA* 2000-29.

[14] Bourguignon, F. and M.C. Chiuri (2005): "Labor market time and home production: a new test for collective models of intra-household allocation", *CSEF working paper.*

[15] Bradbury, B. (2003): "Consumption and the within-household income distribution: outcomes from an Australian experiment", presented at the *CESifo Venice Summer Institute'03.*

[16] Browning, M. and P.-A. Chiappori (1998): "Efficient Intra-Household Allocations: A General Characterization and Empirical Tests", *Econometrica*, 66, 1241-1278.

[17] Browning, M., F. Bourguignon, P.-A Chiappori and V. Lechene (1994): "Incomes and Outcomes: a Structural Model of Intra-Household Allocation", *Journal of Political Economy*, 1994, 1067-97.

[18] Chiappori, P.-A. (1988): "Rational Household labor Supply ", *Econometrica*, 56, 63-89.

[19] Chiappori, P.-A. (1992): "Collective labor Supply and Welfare", *Journal of Political Economy*, 100, 437-467.

[20] Chiappori, P.-A. , R.W. Blundell and C. Meghir (2002): "Collective Labor Supply with Children", *IFS working paper*, W02/08.

[21] Chiappori, P.-A., B. Fortin and G. Lacroix (2002): "Marriage Market, Divorce Legislation and Household Labor Supply", *Journal of Political Economy*, 110, 37-72.

[22] Couprie, H., A. Clark and C. Sofer (2003): "Household Negotiation and Labor Supply: Evidence from the BHPS", *IDEP working paper.*

[23] Dauphin, A. and B. Fortin (2000): "A Test of Collective Rationality for Multi-Person Households", *working paper Université Laval.*

[24] Deaton, D.A. and J. Muellbauer (1980), *Economics and Consumer Behavior*, Cambridge University Press.

[25] Donni, O. (2003): "Collective household labour supply: nonparticipation and income taxation", *Journal of Public Economics*, 87, 5-6, 1179-1198.

[26] Donni, O. (2004): "A note on the collective model of labor supply with domestic production", mimeo.

[27] Feldstein, M. (1995): "The effect of marginal tax rates on taxable income: a panel study of the 1986 Tax Reform At", *Journal of Political Economy*, 103, 3, 551-572.

[28] Fortin, B. and G. Lacroix (1997): "A Test of the Neo-Classical and Collective Models of Household labor Supply", *Economic Journal*, 107, 933-955.

[29] Friedman, J.W. (1990): "Game Theory with Applications to Economics", *Oxford University Press.*

[30] Haddad, L. and R. Kanbur (1990): "How serious is the neglect of intra-household inequality?", *Economic Journal*, 100, 866-881.

[31] Haddad, L. and R. Kanbur (1992): "Is There an Intrahousehold Kuznets Curve? Some Evidence from the Philippines", *Public Finance*, 47 (supplement), 77–93.

[32] Hausman, J.A. (1981): "Labor Supply", in *How Taxes Affect Economic Behavior*, ed.H. Aaron and J.Pechman, The Brookings Institution, Washington D.C., 27-72.

[33] Immervoll, H., H. J. Kleven, C. T. Kreiner and E. Saez (2003): "Welfare reform in European countries: a microsimulation analysis", *EUROMOD working paper.*

[34] Kooreman, P. and A. Kapteyn (1990): “On the Implementation of Some Game Theoretic Models of Labor Supply”, *The Journal of Human Resources*, 25, 584-598

[35] Laisney F. (2002) (editor): “Welfare Analysis of Fiscal and Social Security Reforms in Europe: Does the Representation of the Family Decision Process Matter?” *Final Report on EU-project* VS/2000/0778, Mannheim, ZEW.

[36] Laroque, G. and B. Salanié (2002): “Labor Market Institutions and Employment in France”, *Journal of Applied Econometrics*, 17(1), 25-48.

[37] Lise, J. and S. Seitz (2004): “Consumption inequality and intra-household allocations”, *Queens University working paper.*

[38] Lundberg S.J., R.A. Pollak and T.J. Wales (1997): “ Do Husbands and Wives Pool Their Resources? Evidence from the U.K. Child Benefit”, *Journal of Human Resources*, 32, 3, 463-480.

[39] Moreau, N. and O. Donni (2002): “Une estimation d’un modèle collectif d’offre de travail avec taxation”, *Annales d’Economie et de Statistiques*, 62, 55-83.

[40] Muellbauer, J. and J. Van de Ven (2002): “Estimating equivalence scales for tax and benefits system”, *working paper*, Nuffield College, Oxford..

[41] Peluso, E. and A. Trannoy (2003): “Welfare comparisons among individuals under Samuelson’s model of households”, in *Household Behaviour, Equivalence Scale and Poverty*, ed. C. Dagum and G. Ferrari, Heidelberg: Physica-Verlag., 11-28.

[42] Spadaro, A. (2004): “Microsimulation and normative policy evaluation: an application to some EU Tax-Benefits system”, *Journal of Public Economic Theory*, forthcoming.

[43] Vermeulen, F. (2002): “Collective household models: principles and main results”, *Journal of Economic Surveys*, 16 (4), 533-564.

5 Appendices

5.1 Calibration for Interior Solutions

We present here the calibration procedure when using the specific functional forms introduced in the text. We first **characterize the interior solution** using specifications (1) and (2) and assuming local linearization of the budget constraint. Denoting λ the Lagrange multiplier, first-order conditions (FOC) of the optimal program are written:

$$\begin{array}{ll} c_f = \underline{c}_f + \frac{\mu\beta_f^c}{\lambda} & e_f = T_f - \frac{\mu\beta_f^l + (1-\mu)\delta}{\lambda\widetilde{\omega}_f} \\ c_m = \underline{c}_m + \frac{(1-\mu)\beta_m^c}{\lambda} & e_m = T_m - \frac{(1-\mu)\beta_m^l + \mu\delta}{\lambda\widetilde{\omega}_m}. \end{array}$$

FOC in consumption sum up to give:

$$\lambda = \frac{\mu\beta_f^c + (1-\mu)\beta_m^c}{c - \underline{c}}$$

which is replaced in all four FOC to yield the following conditional functions:

$$c_f = \underline{c}_f + \frac{\mu\beta_f^c}{\mu\beta_f^c + (1-\mu)\beta_m^c}(c - \underline{c}) \tag{6}$$

$$c_m = \underline{c}_m + \frac{(1-\mu)\beta_m^c}{\mu\beta_f^c + (1-\mu)\beta_m^c}(c - \underline{c}) \tag{7}$$

$$e_f = T_f - \frac{\mu\beta_f^l + (1-\mu)\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c}\frac{c - \underline{c}}{\widetilde{\omega}_f} \tag{8}$$

$$e_m = T_m - \frac{(1-\mu)\beta_m^l + \mu\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c}\frac{c - \underline{c}}{\widetilde{\omega}_m}. \tag{9}$$

These conditions are sufficient if the convex combination of individual utilities in expression (1) is strictly concave, i.e. if the Hessian of $W(c_f, c_m, e_f, e_m)$ is negative definite. It is simple to show that, in our setting, the Hessian is diagonal and all the terms are negative. Conditional effort supplies are written:

$$\begin{aligned} e_f &= T_f - B_f\frac{c - \underline{c}}{\widetilde{\omega}_f} \\ e_m &= T_m - B_m\frac{c - \underline{c}}{\widetilde{\omega}_m} \\ \text{with } B_f &= \frac{\mu\beta_f^l + (1-\mu)\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c} \text{ and } B_m = \frac{(1-\mu)\beta_m^l + \mu\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c}, \end{aligned}$$

or:

$$\begin{aligned} e_f &= T_f - B_f\frac{\widetilde{\omega}_f e_f + \widetilde{\omega}_m e_m + \widetilde{y}_0 - \underline{c}}{\widetilde{\omega}_f} \\ e_m &= T_m - B_m\frac{\widetilde{\omega}_f e_f + \widetilde{\omega}_m e_m + \widetilde{y}_0 - \underline{c}}{\widetilde{\omega}_m}. \end{aligned}$$

This system yields (unconditional) marshallian supplies:

$$\begin{aligned} e_f &= \frac{1}{1 + B_m + B_f}[(1 + B_m)T_f - \frac{B_f}{\widetilde{\omega}_f}(\widetilde{y}_0 - \underline{c} + \widetilde{\omega}_m T_m)] \\ e_m &= \frac{1}{1 + B_m + B_f}[(1 + B_f)T_m - \frac{B_m}{\widetilde{\omega}_m}(\widetilde{y}_0 - \underline{c} + \widetilde{\omega}_f T_f)]. \end{aligned}$$

Naturally, this solution is only locally valid since implicit productivities $\widetilde{\omega}$ are globally endogenous to the effort supply. Finally, notice that equations (6) and (7) can be rewritten as:

$$\begin{aligned} c_f - \underline{c}_f &= p(c - \underline{c}) \\ c_m - \underline{c}_m &= (1-p)(c - \underline{c}), \end{aligned} \tag{10}$$

with

$$p = \frac{\mu\beta_f^c}{\mu\beta_f^c + (1-\mu)\beta_m^c}, \tag{11}$$

i.e. the share of 'net consumption' obtained by each spouse is entirely determined by individual preference terms related to consumption and by the power index.

We now proceed with the **calibration**. As total consumption c is known, it is easier to use conditional functions (8) and (9), rather than unconditional functions with $\widetilde{y}_0$ terms, to recover individual productivities. These functions together with the expression (3) of the power index give the following system of three unknowns (μ, ω_f and ω_m):

$$\begin{aligned} y_f &= T_f \omega_f - \frac{\mu \beta_f^l + (1-\mu)\delta}{\mu \beta_f^c + (1-\mu)\beta_m^c} \frac{c - \underline{c}}{1 - t_f} \\ y_m &= T_m \omega_m - \frac{(1-\mu)\beta_m^l + \mu\delta}{\mu \beta_f^c + (1-\mu)\beta_m^c} \frac{c - \underline{c}}{1 - t_m} \\ \mu &= \frac{\omega_f}{\omega_f + \omega_m}. \end{aligned}$$

Equations can be inverted to give:

$$\begin{aligned} \omega_f &= \left[y_f + \frac{\mu \beta_f^l + (1-\mu)\delta}{\mu \beta_f^c + (1-\mu)\beta_m^c} \frac{c - \underline{c}}{1 - t_f} \right] / T_f \\ \omega_m &= \left[y_m + \frac{(1-\mu)\beta_m^l + \mu\delta}{\mu \beta_f^c + (1-\mu)\beta_m^c} \frac{c - \underline{c}}{1 - t_m} \right] / T_m \\ \omega_f &= \omega_m \frac{\mu}{1-\mu}. \end{aligned}$$

To simplify expressions, note the 'before linearized tax' income:

$$\begin{aligned} s_i &= \frac{c - \underline{c}}{1 - t_i} \\ &= \frac{g(y_f, y_m, Z) - \underline{c}}{\partial g(y_f, y_m, Z)/\partial y_i} \\ &= s_i(y_f, y_m), \end{aligned}$$

so that the system simply leads to the equation:

$$\begin{aligned} & (1-\mu) T_m \left[y_f + \frac{\mu(\beta_f^l - \delta) + \delta}{\mu(\beta_f^c - \beta_m^c) + \beta_m^c} s_f \right] \\ = \; & \mu T_f \left[y_m + \frac{\mu(\delta - \beta_m^l) + \beta_m^l}{\mu(\beta_f^c - \beta_m^c) + \beta_m^c} s_m \right], \end{aligned}$$

which is developed as follows:

$$\begin{aligned} & (1-\mu) \left[y_f T_m (\mu(\beta_f^c - \beta_m^c) + \beta_m^c) + (\mu(\beta_f^l - \delta) + \delta) s_f T_m \right] \\ = \; & \mu \left[y_m T_f (\mu(\beta_f^c - \beta_m^c) + \beta_m^c) + (\mu(\delta - \beta_m^l) + \beta_m^l) s_m T_f \right]. \end{aligned}$$

It is rearranged to give the quadratic expression in μ:

$$\begin{aligned} & \mu^2 [(y_m^* T_f + y_f^* T_m)(\beta_f^c - \beta_m^c) + (\beta_f^l - \delta) s_f^* T_m + (\delta - \beta_m^l) s_m^* T_f] \\ & + \mu [(y_m^* T_f + y_f^* T_m)\beta_m^c - y_f^* T_m (\beta_f^c - \beta_m^c) - (\beta_f^l - 2\delta) s_f^* T_m + \beta_m^l s_m^* T_f] \\ & - [y_f^* T_m \beta_m^c + \delta s_f^* T_m] = 0, \end{aligned}$$

expressed for observed values of gross incomes $y_i^*{}_{(i=f,m)}$, total consumption c^*, and effective marginal tax rates $t_i^*{}_{(i=f,m)}$ (or equivalently $s_i^*{}_{(i=f,m)}$). This equation is solved numerically, one of the two roots being systematically rejected as it does not stand in $[0,1]$.

5.2 Calibration for Single Corner Solutions

The question of participation in a collective framework has been analyzed theoretically by Donni (2002) who proves the existence of a reservation productivity, below which a spouse does not work. In the present exercise, we only treat the case of single corner solutions, i.e. the wife does not work. It is intuitive that in this case, we cannot retrieve the wife's productivity. Therefore, we aim to draw a value which is upper bounded by her reservation productivity.

As for interior solutions, we prefer to use expressions conditional to the total consumption level. FOC lead to:

$$\begin{aligned} 0 &\geq T_f - \frac{\mu\beta_f^l + (1-\mu)\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c}\frac{s_f}{\omega_f} && (12) \\ e_m &= T_m - \frac{(1-\mu)\beta_m^l + \mu\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c}\frac{s_m}{\omega_m}, && (13) \end{aligned}$$

which give, together with the expression of the power index:

$$\begin{aligned} \omega_f &\leq \frac{\mu\beta_f^l + (1-\mu)\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c}\frac{s_f}{T_f} && (14) \\ \omega_m &= \left[y_m + \frac{(1-\mu)\beta_m^l + \mu\delta}{\mu\beta_f^c + (1-\mu)\beta_m^c} s_m \right] / T_m && (15) \\ \mu &= \frac{\omega_f}{\omega_f + \omega_m}. && (16) \end{aligned}$$

Inequality (14) defines implicitly her reservation productivity, even though it is not possible to derive its explicit analytical expression, due to the complex tax-benefit function in s_f. Nevertheless, a numerical approach is easy to conduct. Instead of drawing a random value for the productivity, we draw index μ from a normal distribution with mean 0.5 (and ensuring that draws are in the $[0,1]$ interval). Then, we use (15) to compute ω_m and (16) to compute ω_f. The procedure is repeated until condition (14) – which implicitly defines the reservation threshold of the wife – is verified.

Recalling Figure 3, we must also check that the draw is compatible with the fact that it is optimal for the husband to work. As the wife is inactive, this condition is simply written:

$$\mu U_f(c_f, 0, e_m) + (1-\mu)\, U_m(c_m, e_m, 0) > \mu U_f(c_f, 0, 0) + (1-\mu)\, U_m(c_m, 0, 0),$$

and becomes, with the functional forms at use:

$$[\mu\beta_f^c + (1-\mu)\,\beta_m^c] \ln \frac{g(0, y_m, Z) - \underline{c}}{g(0,0,Z) - \underline{c}} + [\mu\delta + (1-\mu)\,\beta_m^l] \ln(1 - \frac{y_m}{\omega_m T_m})] > 0.$$