Transfers within the Extended Family: Theory and Evidence from South Africa

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Abstract

In this paper, we provide a theoretical framework for examining labor supply in extended families. The labor supply is discrete and the self-selection of families into the nuclear or extended household structures is endogenous to labor force participation. We take into account the size of scale economies in consumption and the monetary transfers within the extended household. The main structural components of the model are shown to be identifiable. The model is then estimated using South African data from the 1997 OHS.

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1 Introduction

It is not uncommon, in many developing countries, to find several adults, couples or families living together and sharing their resources. The extended household structure, often considered as the core source of income insurance, affects the incentives to work of household members.[1] More specifically, if income sharing is prevalent in extended households then economic policies may produce unexpected outcomes. Therefore, in countries where various possible combinations of families exist, a specific analysis of labor force participation allowing for money transfers within family is critical for assessing the incidence of economic and social policies.

The influence of a large-size family on the behavior of household members incorporates special features. Importantly, the extended household structure may improve the alternatives for child care arrangements since persons other than the mother may assume child care responsibilities, freeing the mother for a labor market activity (Berhman and Wolfe, 1984). Given that economies of scale depress the shadow price of consumption, workers in extended families may be encouraged to modify their labor market participation in favor of leisure, taking into consideration the labor market states of the other members of the household.[2] Kochar (2000) finds, for instance, that sons contribute to household public goods such as consumer durables and ceremonial expenditures enabling their father to work less. Foster and Rosenzweig (2002) estimate a collective model of household division and find that gains from coresidence arise from cost-sharing a household-specific public good and lower barriers to information-sharing on farming techniques. The existence of scale economies in production makes desirable the coresidence. Thus the consumption of public goods and the increasing returns in household production make larger the optimal household size - which is typically the case of households in poor rural economies (Lanjouw and Ravallion, 1995; Deaton and Paxson, 1998; Fafchamps and Quisumbing, 2003). Given the monitoring advantages of the household, cash and in-kind transfers within the extended family are expected to be larger when members live under the same roof than when they live in different housing. These transfers may, in turn, have a disincentive effect on workforce partic-

[1] An extended household is “a household unit including any family members outside the core nuclear family unit” (Angel and Tienda, 1982).

[2] Technically, a decrease in the price of consumption will negatively affect the participation rate only if the income effect prevails over the substitution effect.

ipation (Bertrand *et al.*, 2003). Lastly, multi-person households are often thought to affect negatively the participation rate because of a self-selection process of household members. If adult's membership in household results from a rational choice, then the household structure is not exogenously taken. In fact, extended households may group together individuals with low resources - or low taste for effort - who choose to remain with their parents, children or married siblings.

In this paper, we develop an empirical model of labor supply taking into account the sharing of resources among persons living in the household, and the economies of scale in consumption. While the decisions in nuclear families are described by the unitary approach, the decisions in extended families are Pareto-optimal and represented by an income sharing rule. We assume a Barten type technology function so that, due to economies of scale, the price of consumption is lower in the extended family. The constitution of an extended family is endogenous to the discrete labor supply decisions. In the first step, each family composed of a single or a couple decides whether to constitute an extended family or not. This decision is endogenous to labor force participation in that it is likely determined by the size of scale economies and the families' taste for consumption. In the second step, each single or couple living in an extended family decides, taking into account the monetary transfers of the other persons living under the same roof, whether to participate in the labor market on a full-time basis or to stay out of it. We show that this model is completely identified from a sample of singles, couples and extended families. In particular, the rule that determines the distribution of resources between families and a measure of scale economies can be recovered. We then apply this model to South African micro-data.

The identification strategy is inspired from the work of Gronau (1991), Couprie (2007), Browning *et al.* (2008), and Lewbel and Pendakur (2009). The extended family household is composed of nuclear families, the utility functions of which can be recovered from the observation of the participation decisions of nuclear families living alone - supposing that the utility function of a nuclear family is the same whether it lives alone or with another family. The observation of the decision to participate in the labor market of persons living in extended family households allows us to identify the economies of scale and the levels of internal income transfers.

Structural models of family labor supply remain scarce about some important features relative to developing countries among which the presence of multi-person households.[3] In the empirical application of this paper, we use data from South Africa, a country whose labor market is traditionally characterized by a significantly high level of unemployment.[4] The specificities of the South African labor market, together with the availability and the quality of the data, have attracted attention from the profession. In particular, studies by Case and Deaton (1998), Duflo (2000, 2003), and Bertrand *et al.* (2003) using the Old Age Pension program, have discovered the existence of bargaining within the extended family. These authors have also pointed out money transfers from older to younger that affect younger's decisions to participate in the labor market. In the nuclear family, Quisumbing and Maluccio (2003) examine the intrahousehold allocation of resources between husband and wife and show that the share of budget devoted to children's education increases more with wife's assets brought at marriage than with husband's. Like the labor market, the family structure in South Africa displays some important features. In fact, the size and structure of households have undergone dramatic changes over the last decade (Wittenberg and Collinson, 2005; Pirouz, 2005). One of the main drivers of population growth dynamics and household structure changes among South African population is the HIV/AIDS. South Africa has more people with HIV/AIDS than any other country in the world. The virus plays a major role in reshaping households and constitutes a critical source of changes in labor supply in the country (see for instance, Thirumurthy *et al.*, 2008).

The remainder of this paper is structured as follows. The theoretical model is developed in the next section. Section 3 formulates parametric and non-parametric identification. South African micro-data used in the empirical analysis are presented in section 4. In section 5, we expose the empirical estimation and report the results of the structural model. Section 6 concludes.

[3] The studies of Newman and Gertler (1994) on rural landholding households in Peru, and Gong and van Soest (2002) on the labor supply of married women in Mexico City remain to note.

[4] Note that despite the high level of unemployment, the informal sector remains relatively small compared to other countries in Sub Saharan Africa, Latin America, and Asia (even if it shows growth during the recent years).

2 The Theoretical Model

In this section, we consider a very simple model with two types of households: nuclear family households and extended family households. The nuclear household is defined as either a single adult or a married couple - with or without children. The extended household consists of two nuclear families living together. We first examine how the participation in the labor market of nuclear and extended family households is decided, and then discuss the factors that affect the decision of families to cohabitate.

In the remainder of this paper, we shall use the following notational conventions: each couple and single family is indexed by i or $j \in \mathcal{N} \equiv$ a sample of single and couple families; the extended families that include two couple families, two single families or a couple family and a single family are then characterized by two indices i and j. The structure of the nuclear family is described by an index r or s, where $r/s = 1$ for single families and $r/s = 2$ for couple families (i.e., the index can be interpreted as the number of adults in the family). The individuals are constrained on the labor market so that only full-time jobs are offered to workers; hence working time of each person can take only two distinct values. The number of alternatives offered to a nuclear family of structure r is simply equal to 2^r, and that offered to an extended family of structures r and s is equal to 2^{r+s}. The alternatives of a nuclear family are indexed by k or $l \in \{1, \dots, 2^r\}$.

2.1 The Behavior of Nuclear Families

To begin with we consider a nuclear family consisting of a single adult or a married couple (with or without children) who make decisions about leisure and consumption. The quantity of goods consumed in a family i choosing alternative k is denoted by c_{ik}. The utility obtained by family i of structure r from alternative k is then equal to:

$$u_{ik}^r = \gamma_k^r(\mathbf{z}_i) + \beta_k^r(\mathbf{z}_i) \cdot \frac{(c_{ik})^\rho}{\rho} \tag{1}$$

where ρ is a parameter comprised between zero and one,[5] $\beta_k^r(\mathbf{z}_i)$ and $\gamma_k^r(\mathbf{z}_i)$ are functions depending on the selected alternative and the structure of the family and $\mathbf{z}_i$ is a vector

[5] These restrictions on the values of ρ are not necessary. However, they make the interpretation easier.

of socio-demographic variables that includes a constant and dummy variables for sex (for single persons), race, education, number of children, region of residence and so on. The number of working hours does not explicitly enter this specification but, since parameters are alternative-specific, the utility can depend on consumption in a fully flexible way across hours of work.[6] In particular, the behavioral restrictions, namely the global satisfaction of Slutsky conditions by the labor supply function, are not necessarily imposed. To interpret the sign of the parameters of this utility function, let us consider two alternatives k and l such that at least one person in the family works more in alternative k than in l (and, in the case of a couple, the other person works the same time). In that case, the leisure is normal if

$$\beta_k^r(\mathbf{z}_i) < \beta_l^r(\mathbf{z}_i)$$

More precisely, an increase in non-labor income increases the household's utility in alternative l more than its utility in alternative k. Thus hours of work falls and more hours of leisure are consumed. Furthermore, the utility is decreasing in working time if

$$\gamma_k^r(\mathbf{z}_i) < \gamma_l^r(\mathbf{z}_i)$$

Observable and unobservable heterogeneity is linearly introduced in the intercept function and the slope function as follows:

$$\begin{aligned} \gamma_k^r(\mathbf{z}_i) &= \zeta_k^r \mathbf{z}_i + \eta_i^r, \\ \beta_k^r(\mathbf{z}_i) &= \varsigma_k^r \mathbf{z}_i + \nu_i^r \end{aligned}$$

where ζ_k^r and ς_k^r are vectors of parameters, η_i^r is an extreme value distributed stochastic term, and ν_i^r is a normally distributed stochastic term with variance σ^r. In placing unobservable heterogeneity in the slope parameters, we follow the common practice (van Soest, 1995) in the estimation of discrete labor supply models.

[6]This flexible specification is suggested by Bargain (2005).

If there is no income transfer between families, the budget constraint for a nuclear family i who chooses alternative k is given by:

$$c_{ik} = y_i + e_{ik}$$

where e_{ik} is the labor income of family i for alternative k and y_i is its non-labor income. Typically, if taxation can be ignored, the labor income is simply defined by $e_{ik} = \sum_a w_{ia}\bar{h}_{ka}$, where the summation is made over adults a in family i, w_{ia} is the wage rate of adult a and $\bar{h}_{ka}$ is her working hours in alternative k. To show how families make decisions, we incorporate the budget constraint in the utility function and obtain:

$$u_{ik}^r = \gamma_k^r(\mathbf{z}_i) + \beta_k^r(\mathbf{z}_i) \cdot \frac{(y_i + e_{ik})^\rho}{\rho} \qquad (2)$$

The family is then facing 2^r alternatives and selects the alternative k^* that yields the highest level of utility, that is,

$$u_{ik^*}^r = \max_{k \in \{1,\dots,2^r\}} u_{ik}^r$$

One remark is in order here. To make the model as simple as possible, and limit the number of parameters to estimate, we suppose that the behavior of couples is consistent with the unitary approach, i.e., the household behaves as a single agent. The unitary approach can be seen as a reduced-form of the true decision process here; of course, it does not mean that there is no economies of scale and income distribution between spouses, but simply that our concern is what happens within the extended family and not the nuclear families. Note that the unitary representation of spouses' behavior is not really restrictive here because neither the Slutsky symmetry nor the negativity are imposed in our model.[7] In principle, it would be possible to model the behavior of couple families by the collective approach, thereby supposing that the distribution of bargaining power within the family depends on spouses' wage rates and some other variables. However, the identification of the "individual" utility functions may be complicated in practice. Indeed, in the empirical application, we opt for a

[7]The only restriction we impose is the exclusion of distribution factors. However, the empirical application does not use distribution factors.

strategy of identification that exploits a comparison of nuclear families and extended families. To do so, we need valid instruments to explain the participation to a specific form of family that we do not have to model the decision of marriage.[8]

2.2 The Behavior of Extended Family

In our definition, the extended family is made up of two "nuclear families" i.e., two couple families, or two single families, or a couple family and a single family, living together.[9] The complicated interactions between two "nuclear families" who live under the same roof can be described by the collective approach which was initially suggested by Chiappori (1988, 1992) in a slightly different context. This approach postulates that the bargaining process within the household leads to Pareto Optimal outcomes; no additional requirement is made upon the choice of the particular outcome on the Pareto frontier as in the bargaining models. Formally:

Pareto Optimality (PO). The outcome of the bargaining process within the extended family is Pareto Optimal, i.e., the utility of one "nuclear family" cannot be increased without decreasing the utility of the other one.

To model the technological differences that may exist between nuclear and extended families and represent the fact that extended families may benefit from a greater fraction of joint consumption, we make use of equivalence scales consistent with the linear household technology proposed by Barten (1964). The economies of scale and scope in consumption associated to the presence of two families in the same household implies that the "private equivalent" consumption differs from what is really purchased by the extended family, that is, the cost of the "private equivalent" consumption in the extended family composed of families i and j is given by $\left(\kappa^{r|s} c_{ik} + \kappa^{s|r} c_{jk}\right)$, and $\kappa^{r|s}$ is the shadow price of consumption for the family i of structure r living with a family j of structure s and $\kappa^{s|r}$ is the shadow price of consumption for the family of structure s. These parameters are constant over all extended families of the same structure r and

[8]Theoretically, identification using Chiappori (1992)'s result is also possible. However, it does not permit identifying the level of shares. Moreover, in the absence of distribution factors, the identification of the intra-household distribution of resources may be fragile.

[9]With a slight misuse of language, we call "nuclear family" the couple family or the single family who live in the extended family. The extended families consisting of more than three "nuclear families" are excluded from the theoretical and empirical analysis.

s. The budget constraint is then given by:

$$\kappa^{r|s} c_{ik} + \kappa^{s|r} c_{jk} = y_i + y_j + e_{ik} + e_{jk}$$

If the shadow price of consumption is below one, then there are economies of scale. Hereinafter, we illustrate how the shadow price are determined.

In the present framework, where all the consumption is equivalently private, the PO hypothesis essentially means, as explained by Chiappori and Ekeland (2006, 2009), that there exists a well-behaved rule that determines the sharing of total non-labor income between the two "nuclear families". In a first step, the total non-labor income is allocated between families according to the so-called sharing rule, so that the family i of structure r cohabitating with family j of structure s receives a share of total non-labor income equal to $\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j)$, with

$$\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + \phi^{s|r}(\mathbf{x}_j, \mathbf{x}_i) = y_i + y_j,$$

where $\mathbf{x}_i$ and $\mathbf{x}_j$ are vectors of variables that influence the distribution of resources within the extended family. In a second step, each family maximizes its utility with respect to its budget constraint. The second-stage budget constraint of family i can thus be written as:

$$\kappa^{r|s} c_{ik} = \phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + e_{ik}.$$

Thus, the extended household budget constraint can be written:

$$\kappa^{r|s} c_{ik} + \kappa^{s|r} c_{jk} = \phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + \phi^{s|r}(\mathbf{x}_j, \mathbf{x}_i) + e_{ik} + e_{jk}$$

In order to interpret scale economies in consumption, let us suppose that the fraction of joint consumption in a family of structure r living with a family of structure s is constant and equal to $\theta^{r|s}$, and the fraction of private consumption is equal to $1 - \theta^{r|s}$. The consumption of the nuclear family who cohabitates is then equal to:

$$c_{ik} = \phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + e_{ik} + \theta^{s|r}[\phi^{s|r}(\mathbf{x}_j, \mathbf{x}_i) + e_{jk}];$$

By assuming that the consumption values are equal for the two nuclear families, that is $\phi^{s|r}(\mathbf{x}_j, \mathbf{x}_i) + e_{jk} = \phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + e_{ik}$,

$$c_{ik} = (1 + \theta^{r|s})[\phi^{r|s}(\mathbf{x}_j, \mathbf{x}_i) + e_{ik}];$$

hence, $\kappa^{r|s} = 1/(1 + \theta^{r|s})$ and, similarly, we have: $\kappa^{s|r} = 1/(1 + \theta^{s|r})$. Note that the fraction devoted to private consumption certainly depends on the number of persons living in the nuclear family i. Therefore, the economies of scale that can be exploited from the extension of the family are likely more limited for a couple family than for a single family.

If we incorporate the corresponding budget constraint in the utility function of family i, we obtain:

$$u^r_{ij} = \gamma^r_k(\mathbf{z}_i) + \frac{\beta^r_k(\mathbf{z}_i)}{\rho} \cdot \left(\frac{\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + e_{ik}}{\kappa^{r|s}}\right)^\rho \tag{3}$$

The extended family then selects the alternative k that maximizes this function.

To make things easier, we suppose here that the sharing rule is everywhere continuous, thereby implying that an extension of the "double indifference" condition, due to Blundell *et al.* (2007), is satisfied. This condition says, more precisely, the following.

Double Indifference (DI). The utility of one "nuclear family" along the participation frontier does not depend on the participation decisions of the other one.

The DI hypothesis intuitively means that the drop in leisure, when one person in the extended family is participating, is compensated exactly by a discontinuous increase in consumption of this person that preserves the smoothness of each family's well-being.[10] Technically, a consequence of DI is that the share received by family i is not indexed by the alternative k chosen by the family j (and conversely) This condition is a real assumption, albeit not extremely restrictive: the fact that both "nuclear families" should be indifferent sounds like a natural requirement, especially in a context where compensations are easy to achieve via transfers of the consumption good.

[10]Note that PO requires that, if one "nuclear family" is indifferent between participating along the frontier, then the other one is indifferent as well.

Even if the theory is not very explicit regarding the variables $\mathbf{x}_i$ and $\mathbf{x}_j$ that enter the sharing rule, empirical researches carried out, in particular, by Bertrand *et al.* (2003), Case and Deaton (1998) and Duflo (2000, 2003), indicates that the various household resources (including the potential wages of the individuals which represent an indicator of the spouses' outside opportunities) should play a role in determining the intra-household allocation of household income. The simple linear form is adopted for the sharing rule:

$$\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) = \bar{\pi}^r \bar{\mathbf{x}}_i + \bar{\pi}^s \bar{\mathbf{x}}_j + \pi_w^r \mathbf{w}_i + \pi_w^s \mathbf{w}_j + \pi_y (y_i + y_j)$$

and

$$\phi^{s|r}(\mathbf{x}_j, \mathbf{x}_i) = y_i + y_j - \phi^{rs}(\mathbf{x}_i, \mathbf{x}_j),$$

where $\bar{\pi}^r$, $\bar{\pi}^s$, π_w^r, π_w^s and π_y are (vector of) parameters, $\mathbf{w}_i$ and $\mathbf{w}_j$ are vector of wages and $\bar{\mathbf{x}}_i$ and $\bar{\mathbf{x}}_j$ are vectors of variables that may affect the distribution of resources within the extended family (besides the variables that directly affect the household budget constraint). Denoting $\mathbf{x}_i = (\bar{\mathbf{x}}_i, \mathbf{w}_i, y_i)$, $\mathbf{x}_j = (\bar{\mathbf{x}}_j, \mathbf{w}_j, y_j)$, $\pi^r = \left(\bar{\pi}^r, \pi_w^r, \pi_y^r\right)$, and $\pi^s = \left(\bar{\pi}^s, \pi_w^s, \pi_y^s\right)$, the sharing can be written more compactly as:

$$\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) = \pi^r \mathbf{x}_i + \pi^s \mathbf{x}_j.$$

Let us note that the vector of variables $\bar{\mathbf{x}}$ may include "preference factors" $\mathbf{z}$ that enter utility functions; it may also include so-called "distribution factors" that affect the decision process but do not affect preferences.

2.3 The decision to cohabitate

The two "nuclear families", when they live together, are generally confronted to a direct loss of utility but, at the same time, they also benefit from economies of scale in consumption. To fix ideas, the utility function of a nuclear family when living with another nuclear family can be extended as follows:

$$u_{ik}^r = \gamma_k^r(\mathbf{z}_i) + \beta_k^r(\mathbf{z}_i) \cdot \frac{(c_{ik})^\rho}{\rho} + \delta_i^r$$

where δ_i^r is a positive constant if cohabitating generates direct advantage in terms of utility (besides economies of scale and transfers) and a negative constant otherwise. The optimal decision will result from the trade-off between these advantages and disadvantages. If the decision to cohabitate is Pareto-Optimal, then the two generations will decide to live together on the condition that cohabitating generates a global positive surplus. The surplus will depend, in particular, on the disagreement associated to cohabitation for each "nuclear family" and on the income available for each "nuclear family", i.e., the "nuclear family" will "buy" the possibility to live alone if the income is sufficiently important. The surplus will also depend on the specific taste for consumption of each "nuclear family" and on the economies of scale in consumption. The idea is that, if both "nuclear families" attach importance to consumption, then they will more easily accept to support the desutility of living together to benefit from economies of scale.

The decision to cohabitate is even more complicated because it depends on the complete environment of the household. For instance, the existence of several children and of several parents makes that the negotiation cannot be seen as simply bilateral. A structural approach then requires to construct a matching model (à la Gale) between a large number of agents, which is largely beyond the scope of this paper (see Brock and Durlauf (2001) for a survey of this literature). In the empirical section, we thus opt for a reduced-form equation for the self-selection into the extended family. From the discussion that precedes, it must be clear that the error term of this equation will generally be correlated with the heterogeneity terms ν_i^s. It is reasonable to suppose that nuclear families that decide to cohabitate have a marked taste for consumption.

3 Identification

We first examine how the parameters can be identified from a sample of nuclear and extended families. The procedure can be then generalized to a non-parametric identification.

If, in a first step, the selection problem is ignored, it is clear that the previous model is (parametrically) identified. As in any mixed logit model, the absolute level of utility is irrelevant; only difference in utilities can be identified (see Train, 2003, for instance). Hence, the intercept function $\gamma_k^r(\mathbf{z}_i)$ must be normalized for one alternative. For instance, without loss of generality, we use the following identifying restriction:

$$\gamma_k^r(\mathbf{z}_i) = 0, \quad \text{hence} \quad \zeta_k^r = \mathbf{0} \quad \text{for} \quad k = 1.$$

In that case, the vector of parameters ζ_k^r for $k = 2, \ldots, 2^r$ and ς_k^r for $k = 1, \ldots, 2^r$ and $r = 1, 2$ can be recovered from a sample of single families and nuclear families.

Let us recall that, in an extended family, the utility function for the family i of structure r can be written as:

$$u_{ik}^r = \gamma_k^r(\mathbf{z}_i) + \frac{\beta_k^r(\mathbf{z}_i)}{\rho} \cdot (\frac{\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + e_{ik}}{\kappa^{r|s}})^{\rho}.$$

The idea of the identification strategy is that, knowing the parameters $\boldsymbol{\zeta}_k^r$ and $\boldsymbol{\varsigma}_k^r$ as well as α, the sample of extended families will allow one to identify the other parameters $\kappa^{r|s}$, $\kappa^{s|r}$, π^r and π^s. Instead of formally demonstrating this result, which is rather intricate, we can give here the intuition. Let us consider two families i and i' with exactly the same characteristics $\mathbf{z}_i^*$ and $\mathbf{w}_i^*$, the former is living in an extended family and the latter in a nuclear family. If the families i and i' have the same probability to choose alternative k, then they must have the same level of consumption and, in particular,

$$\frac{\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + e_{ik}}{\kappa^{r|s}} = y_{i'} + e_{i'k} \tag{4}$$

This gives one equation. In order to identify $(\phi^{r|s}, \phi^{s|r})$ and $(\kappa^{r|s}, \kappa^{s|r})$, the observation of the participation decision of two other persons living in the extended family can be used[11] and generate a second and a third equation. Solving these equations, and noting that $\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j) + \phi^{s|r}(\mathbf{x}_j, \mathbf{x}_i) = y_i + y_j$, then gives $(\phi^{r|s}, \phi^{s|r})$ and $(\kappa^{r|s}, \kappa^{s|r})$. Interestingly, this intuition remains valid in a non-parametric context provided that $\phi^{r|s}$ and $\kappa^{r|s}$ are not stochastic.

The crucial feature in the preceding discussion is the possibility to deal with the selection problem. To do so, the presence of a regressor that traces out the probability of selection is necessary. Intuitively, if there exists a set of instruments, independent of

[11] Alternatively, the probabilities can be computed at a different point $\mathbf{z}_i^{**}$ and $\mathbf{w}_i^{**}$. This gives other equations.

families' participation decisions, with some configuration such that the probability of living in a nuclear family is equal to one, then the parameter α and the functions $\beta_k^r(\mathbf{z}_i)$ and $\gamma_k^r(\mathbf{z}_i)$ can be identified. If the probability of living in a nuclear family is equal to zero for another configuration of the instruments, then the other structural components of the model, the parameter $\kappa^{r|s}$ and the function $\phi^{r|s}(\mathbf{x}_i, \mathbf{x}_j)$ can be identified (see Heckman, 1990, for instance).

4 Data Description

The source of our data is the October Household Survey (OHS). It is an annual household survey conducted in South Africa from 1995 until 1999. The OHS provides information mainly related to employment, unemployment and the size of the informal sector in the country. Moreover, the survey is rich in information on individuals (workers and non-workers), living within a household, and some general characteristics of the household. Among the five different annual surveys, the 1997 OHS has the richest information about household members who are absent temporarily or permanently at the time of the survey. The survey of 1997 best fits the analysis of labor supply in the extended family, thus we adopt it for our empirical framework.[12]

The 1997 OHS includes a population base of 140,015 on a sample of 29,811 households. We examine the household structure and find that the average size of the household is 4.70. The 1997 data reveal a racial difference in terms of the household size, with 3.00 members per household in average in the White community, and 4.94 members per household for the Black population group (see Table A.2). The labor supply can be qualified of discrete since, among people aged 15 and more, 26.56% are full-time workers and 70.13% do not have a job (Table A.3).[13] General basic statistics show that the Whites have the highest average participation rate, while the Blacks have the highest unemployment rate among all the other racial categories (see Table A.4).

Since we are interested in the outcome associated to employment status, an important piece of information required from our data is that concerning remuneration. For

[12]In Table A.1 we present a definition of all the variables used in our empirical analysis.

[13]Note that 88.11% of employees work on a full-time basis, and that part-time workers have on average 38.74 hours of work during the week preceding the survey (with nearly 60% of all part-time workers spending more than 35 hours per week).

those persons in paid employment, the 1997 OHS explicitly asks for the salary amount in their main job during the past week.[14] More precisely, the 1997 survey provides a person's daily, weekly, or monthly income and hours worked in the previous week in their main employment activity. We use these information to calculate hourly wage rates. One should note that for about 30% of employees reported their salary in income categories rather than actual values. For these we use the mid-point between category thresholds, except for the first and last category where we simply use the threshold itself as the salary value.[15] We distinguish between formal and informal employment and net hourly wages are then computed using the income tax rates for the year 1997-1998. We reduce our sample to working age population and we exclude self-employed persons from the study.

To solve for the recurrent problem with labor supply models of unobserved wage rates of many individuals, we predict wage rates for nonworkers. To do this, we estimate wage equations separately for non-self-employed men and women, and we consider a reduced form participation equation to take account of the selection bias (Heckman, 1979).[16] Results are presented in Table 1.
The dependent variable is the (log) net hourly wage rate and the explanatory variables include age, dummies for education levels, dummy for the white race, and dummies for spoken languages. Moreover, we introduced the regional unemployment rate, the urban zone dummy, and the number of children by age category. The estimated slope coefficients of the wage equation are in accordance with standard analysis. The wage rates are increasing with age and education; the increase with age is lower for the highest education levels. The unemployment rate has no impact on men wages; however it reduces wage rates of women. In order to correct for the selection bias, we introduce exclusion variables in the participation equation that do not affect wage rates. The results show that men and women living in a dwelling owned by the household have a lower participation. When the person is the household head, his labor market participation is higher. While being member of a household in which at least one individual earns pension benefits reduces the participation of working age persons. There is a

[14] Declared wages include overtime and bonus.

[15] The questionnaire provides 14 income categories. The proportion of observations with income categories that were in the lower and upper group were 0.54% and 0.37%, respectively.

[16] Actual observed wages are used for workers.

significant positive parameter of the Inverse of the Mill's Ratio (IMR) for both men and women.

The empirical application of this paper relies upon the theoretical framework that considers three family types. In terms of defining family types, we divide individuals in four different age groups: "under 18", "18-40", "41-64", and "64 and more". In Table A.5 in the Appendix, we provide age group repartition for the total population and a distinct repartition according to marital status. Then we defined couples. Three types of couples exist: young couple, middle-age couple and old couple, corresponding respectively to the second, third and fourth age group.[17] First, we define nuclear couple household a man and woman who are married or living together as a couple. Observations of households where more than one couple lives are excluded. Second, we define single-nuclear family every single, widow or divorced adult living alone. We dropped all observations of households where an old single person lives and/or where an old couple lives. Thus, the extended household structure is one adult and one couple who cohabitate. This classification does not exclude the case where these families might have children. With respect to the theoretical model developed, we restricted the empirical analysis to these family structures, and hence dropped all households where other possible extended household structures might appear.[18] We exclude from the analysis households where at least one individual aged "18-24" lives, and we define children those who are less than 18.

After controlling for missing values, we are left with a total number of 8,212 observations among which 5,605 observations are for couple families, 2,111 are for single adult families and the rest is for extended families. In 42.5% of extended families, only one member has a paid job and in 31% of the cases two members are employed. For 3,075 couple families, only one of the two partners is employed and in 90% of the observations it is the husband. In 29% of couple families in our sample both wife and husband work. For single families, up to 65% of men are working and nearly 48% of women have a job. In Table 2, we report some statistics of the labor market for the dif-

[17]Note that the couple type is defined relatively to the husband age. However, we kept observations with both partners from working age population.

[18]For instance, we do not consider 1,009 households where a single adult or/and a couple lives with an old person. However, in the South African context, the amount of pensions might have an important impact especially that the South African social pension is so generous (Duflo, 2003).

ferent household structures we composed. We can see that labor market participation is lower in extended families. More specifically, employment dummy falls from 0.650 to 0.375 for single men and from 0.478 to 0.299 for single women. Similarly, it decreases from 0.780 to 0.673 for married men and from 0.340 to 0.274 for married women. In our study sample, weekly working hours are 48.2 for married men, 42.6 for married women, 48.6 for single men and 44.6 for single women. In Figure 1 we plot the distribution of the working hours per week from the sample of employed men and women.

As the labor choice in our study is discrete, every person in nuclear or extended households chooses whether to participate in the labor market on a full time basis or to stay out of it. In the empirical part of our study, we fix the week time endowment at 80 hours, and if the person decides to join the labor market the number of working hours per week is 45.[19] The net hourly wage rates that are used result from the previous two-stage estimation. The non-labor income includes disability grant, state maintenance grant, private maintenance by father/former spouse (not living in the same household at the moment of the survey), care dependency grant, foster care grant, and any financial support.

5 The Empirical Specification and the Estimation

5.1 The likelihood function

In the data, the unit of observation is the household. Thus, every household constituted of a single adult or a couple, either living alone or cohabitating within an extended family, is considered one observation. The observations are indexed by i or j. A household where a single adult and a couple live together (for instance, if the i^{th} family cohabitates with the j^{th} family) constitutes an extended household.

For the reasons which were previously exposed, the self-selection of families between these types of demographic structures is certainly not exogenous to labor supply decisions. To model the latter we have thus to formulate a selection equation. For extended families, we observe a large range of variables characterizing both families that may af-

[19]The regulation of working hours in South Africa states that ordinary hours of work, i.e., excluding overtime, may not be more than 45 hours per week. Any additional hour has to be considered overtime for which a specified amount of additional remuneration is prescribed. Note that overtime is limited to 10 hours per week and may not exceed 3 hours per day. Furthermore, our total data sample shows that, in average, both men and women work 45 hours per week.

fect the decision to cohabitate (including both families' income).[20] For nuclear families, we have limited information about the single(s) or the couple(s) with which this family could match. To exploit the maximum of variables in the specification of the selection, the idea is then to use two selection equations, one for each type of nuclear family. To do so, for each family i of structure r in the data set, we define a dummy variable p_i^r which is equal to one if the family i does not cohabitate with another family and equal to zero otherwise. The selection equation can then be written as:

$$p_i^{r*} = \alpha^r \mathbf{x}_i - \varepsilon_i^{p,r},$$

where p_i^{r*} is a latent variable, such that

$$\begin{aligned} p_i^r &= 1 \quad \text{if} \quad p_i^{r*} > 0, \\ p_i^r &= 0 \quad \text{if} \quad p_i^{r*} \leq 0, \end{aligned}$$

and $\varepsilon_i^{p,r}$ is a stochastic term that is normally distributed with zero mean and unit variance. If the i^{th} family and the j^{th} family live together, then $p_i^{r*} \leq 0$ and $p_j^{s*} \leq 0$. To construct the likelihood function, we then distinguish two regimes depending on the type of the household.

A. The Contribution of Nuclear Families. To compute the contribution to the likelihood function of the observation of a family i of structure r living alone, the random terms that represent taste heterogeneity has to be decomposed as follows:

$$\nu_i^r = \omega_i^r \varepsilon_i^{\nu,r} + \sigma^r \varepsilon_i^{p,r} \tag{5}$$

where $\varepsilon_i^{\nu,r}$ and $\varepsilon_i^{p,r}$ are normally distributed stochastic terms with zero mean and unit variance. The decision to participate in the labor market will be endogenous to the decision to cohabitate if $\sigma^r \neq 0$.

Following the discussion that precedes, let us note that the family i will live alone if and only if $\varepsilon_i^{p,r} < \alpha^r \mathbf{x}_i$. The probability that the family i lives alone and actually chooses

[20] Nevertheless, the characteristics of all the families that were potentially candidates for the constitution of the extended family are not observed.

alternative k^* is then given by

$$\Pr(k = k^*) = \Phi(\alpha^r \mathbf{x}_i) \times \int_{-\infty}^{\alpha^r \mathbf{x}_i} F_{k^*}(\varepsilon_i^{p,r}) \cdot \phi(\varepsilon_i^{p,r}) \cdot \mathrm{d}\varepsilon_i^{p,r} \tag{6}$$

where

$$F_{k^*}(\varepsilon_i^{p,r}) = \int_{-\infty}^{+\infty} \frac{\exp\left(u_{ik^*}^r\right)}{\sum_{k=1}^{2^r} \exp\left(u_{ik}^r\right)} \cdot \phi_{\nu|\varepsilon}\left(\nu_i^r \mid \varepsilon_i^{p,r}\right) \cdot \mathrm{d}\nu_i^r$$

is the conditional probability of choosing alternative k^* when $\varepsilon_i^{p,r}$ is given, ϕ and $\Phi(\cdot)$ designate respectively the density function and the cumulative function of the (univariate or multivariate) standardized normal distribution, and $\phi_{\nu|\varepsilon}$ the density function of the conditional distribution of ν_i^r given $\varepsilon_i^{p,r}$. The first term on the left-hand-side of expression (6) is the marginal probability of not cohabitating; the second term is the conditional probability of selecting alternative k^* provided that the family does not cohabitate with another family.

B. The Contribution of Extended Families. The introduction of taste heterogeneity is much easier if the random terms of the two families are not correlated. Hence we shall adopt this assumption here. The family i of structure r and the family j of structure s will live together if and only if $\varepsilon_i^{p,r} > \alpha^r \mathbf{x}_i$ and $\varepsilon_j^{p,s} > \alpha^s \mathbf{x}_j$. In the extended family, the joint probability that the family i selects alternative k^* and that the family j selects alternative l^* is given by

$$\begin{aligned} \Pr(k = k^*, l = l^*) \quad &= \quad [1 - \Phi(\alpha^r \mathbf{x}_i)] \times [1 - \Phi(\alpha^s \mathbf{x}_j)] \\ &\quad \times \int_{\alpha^r \mathbf{x}_i}^{+\infty} F_{k^*}(\varepsilon_i^{p,r}) \cdot \phi(\varepsilon_i^{p,r}) \cdot \mathrm{d}\varepsilon_i^{p,r} \\ &\quad \times \int_{\alpha^s \mathbf{x}_j}^{+\infty} F_{l^*}(\varepsilon_j^{p,s}) \cdot \phi(\varepsilon_j^{p,s}) \, \mathrm{d}\varepsilon_j^{p,s} \end{aligned}$$

where $F_{k^*}(\varepsilon_i^{p,r})$ and $F_{l^*}(\varepsilon_j^{p,s})$ are defined as above. The contribution to the likelihood is thus simply the product of the conditional probability of choosing alternative k^* and that of choosing alternative l^*, given that both families cohabitate.

5.2 The Simulation-Based Method

The present model is analogous to a mixed logit model except that this model can be estimated using simulation techniques. One simple simulation process to estimate this model can be described as follows.

(a) For each observation i of family of structure r, we draw a set of T truncated standardized normal variables $\varepsilon_{i,t}^{p,r}$ (for $t = 1, \ldots, T$) such that $\varepsilon_{i,t}^{p,r} < \alpha^r \mathbf{x}_i$ if the observation corresponds to a nuclear family, and such that $\varepsilon_{i,t}^{p,r} > \alpha^r \mathbf{x}_i$ if the observation corresponds to an extended family. We also draw a set of T untruncated standardized normal variables $\varepsilon_{i,t}^{\nu,r}$;

(b) For each observation i of family of structure r, using the values obtained in step (a) and decomposition $\omega_i^r \varepsilon_i^{\nu,r} + \sigma^r \varepsilon_i^{p,r}$, we construct a set of T stochastic terms $\nu_{i,t}^r$;

(c) For each observation i of family of structure r and each drawing t, using the values obtained in step (b) and expressions (2) and (3), we compute the levels of utilities $u_{i,k,t}^r$ obtained from 2^r alternatives offered to the family;

(d) The utility levels obtained in (c) are incorporated in the logit function and, for the family i of structure r, the simulator is given by

$$f_{i,k,t}^r = \frac{\exp(u_{i,k,t}^r)}{\sum_{k=1}^{2^r} \exp(u_{i,k,t}^r)}$$

The simulated probability of not living together and choosing alternative k^* is then given by

$$\widetilde{\Pr(k = k^*)} = \Phi(\alpha^r \mathbf{x}_i) \times \frac{1}{T} \sum_{t=1}^{T} f_{i,k,t}^r \quad (7)$$

The simulated probability for extended families is given by:[21]

$$\begin{aligned} \widetilde{\Pr(k = k^*, l = l^*)} &= [1 - \Phi(\alpha^r \mathbf{x}_i)] \times [1 - \Phi(\alpha^s \mathbf{x}_j)] \\ &\quad \times \frac{1}{T} \sum_{t=1}^{T} f_{i,k,t}^r \times \frac{1}{T} \sum_{t=1}^{T} f_{j,k,t}^s \end{aligned}$$

[21] In the empirical part of our study, we use $T = 20$ for the unrestricted sample and $T = 100$ for the restricted sample.

5.3 Empirical Results

Our theoretical model is estimated separately on the 8,212-observation sample as well as on the reduced sample of no-children households - as the model might be not well adapted to treat of children presence within the household. The remaining 2,571 observations that do not enter Table A.6 constitute the restricted sample of households without children.[22]

5.3.1 A. Participation to Nuclear *vs.* Extended Families

Table 3 shows the estimation results of the participation to nuclear families for singles and couples, respectively. The parameter estimates of the unrestricted sample are qualitatively similar to those of the restricted sample. The coefficients xs_{01} and xc_{01} of the dummy variables of the age category "18-40" are significant for single adults and for couples, and show that younger single adults are more likely to be members of extended families while couples with men aged "18-40" are more likely to be in nuclear families compared to those where men are aged "41-64". Moreover, it seems that single White adults are more likely to be in nuclear families than their Black, Asian and Colored counterparts. This might be due to privacy desire and/or to worker migration. Similarly, a big proportion of extended couple families are from the non-White population.

Importantly, we observe in both the restricted and unrestricted samples that higher wages affect negatively the single adult's participation decision to extended family, while wages of married men and women seem not to affect the couple's cohabitation decision. In our sample, single adult females are more likely to be in nuclear families than single adult males. The estimated parameters of the urban dummy - significant in the unrestricted sample only - are negative meaning that living in urban areas increases the probability of cohabitation of an adult and a couple. This result contrasts with the common thought according to which nuclear family structures are predominant in urban areas whereas extended family structures are more prevalent in rural areas (Burch, 1967). This negative urban parameter estimate might be due to the fact that we consider a specific structure of extended family in our empirical study. In contrast to the

[22] Among these observations, 1,196 are for single-nuclear families, 1,267 for couple-nuclear families, and 108 for extended families.

traditional view, one might think that there exists a difference in family arrangements among Whites and Blacks. More precisely, for some reasons of cultural preferences and affordability, White South Africans succeed to maintain the nuclear family system, while non-White South Africans remain in extended families independently from the living area.

The empirical research of the consequences of living in an extended family on individual's labor supply is crucial given the endogeneity of belonging to extended family in labor supply decision (interdependency of choices). Thus our empirical study relies on the availability of instruments that explain the decision of a single adult or a couple to cohabitate but do not explain labor supply. The 1997 OHS data provide information on parents and family members of questioned persons like whether mother, father or sister aged more than 15 are still alive and whether there exists an adult family member who does not live in the household. By introducing these variables in the participation equation to nuclear family, we find that having his/her own mother still alive affects negatively the single adult's participation to extended family. However, this effect differs among people belonging to the "18-40" age group and those belonging to the "41-64" age group. In particular, if we look at the estimated parameters xs_{09} and xs_{13} we conclude that single adults aged more than 40 are more likely to be in nuclear families when the mother is still alive. Similarly, the negative sign of xs_{14} shows that older adults are more likely to live alone even if their fathers are still alive. These effects are significant solely in the unrestricted sample. Furthermore, we notice that single adults - with or without children - who live in extended families are more likely to have a family member who does not live in the same household. The reason for that could be the necessity in extended families for at least one member to leave in order to work and help supporting the family or to get more privacy. However, extended family members are less likely to have a sister aged more than 15 still alive. This result is consistent with the unrestricted sample as well as the restricted sample. Concerning couples, we observe that living in an extended family is negatively affected when the wife is aged less than or equal to 40 and her mother is alive. The presence of a family member who is not living in the household at the moment of the survey affects positively the couple's decision to cohabitate.

5.3.2 B. Labor Supply Estimation Results

We start by reporting, from Table 4, the estimates of the parameters of single adults' labor supply, separately for men and women. For these estimations we take "not working" as the base category, and therefore all the parameters are interpreted as changes in probability of working relative to not working. The slope parameters of the utility functions relative to the decisions of not working - β_{0sm} and β_{0sf} - and working - β_{1sm} and β_{1sf} - are positive and significant for single men and women. Given that β_{1sm} and β_{1sf} are positive, an increase in the wage rate implies a substitution of leisure to work for men and women, as the price of leisure increases, and the individual probability to work increases. Non-participation probability is increasing with non-labor income, since β_{0sm} and β_{0sf} are greater than β_{1sm} and β_{1sf}, respectively. Thus, leisure is a normal good. A similar analysis is valid for couples concerning their decisions not to work or not. In fact, the estimations give the labor supply of couples when the base category corresponds to the case where both husband and wife do not work. Three other alternative categories remain. Table 4 shows the estimated slope parameters of all possible alternatives: β_{00c}, β_{01c}, β_{10c} and β_{11c}. The results confirm the fact that leisure is a normal good as $\beta_{..}$ is smaller when the number of working hours is higher. Essentially, this is verified for the $\beta_{..}s$' estimations except for the β_{11c} that is slightly larger than β_{10c}; yet this difference is not significant.

The decision to participate in the labor market is endogenous to the decision to cohabitate. There is a non-observed heterogeneity that affects the decision to participate to nuclear family $\epsilon_i^{p,r}$ that also affects labor decision. Although not significant, the positive sign of the parameters of the truncated standard normal, σ_s and σ_c, that enter the taste heterogeneity expression shows that being member of an extended family decreases the labor market participation of the single adults and/or the couples. Furthermore, there is a non-observed heterogeneity captured by the individual random effects. The estimated parameters ω_s and ω_c represent the marginal utility on consumption for singles and couples. These results are similar for the unrestricted and restricted samples.

In Table 5 and Table 6, we present the estimates of the parameters of the intercept of the utility function for single adults - men and women separately - and for couples, respectively. In both the restricted and unrestricted samples, the White single's probability to participate in the labor market is lower with respect to the other race groups for both men and women. Young single men and women are more likely to work than those aged more than 40. Moreover, living in an urban area affects negatively the participation decision of single men and positively that of single women. The parameter estimates of the unrestricted sample show that while single men labor supply is not affected by the presence of young children, single women reduce their labor supply in the presence of children; this reduction is higher when children are younger. The corresponding results for couples are as follows. The labor supply of Whites decreases when at least one of the two partners is working relative to the other race categories. Here again, the participation of women in the labor market is negatively affected by the presence of young children (see Alternatives 2 and 4). However, the participation decision of married men when their wives are not working is positively affected by the existence within the household of children aged "0-3". Furthermore, the couples where the husband is aged "18-40" are more likely to have at least one of both partners working compared to couples where the husband is older than 40. Finally, the probability of observing a couple where the wife is employed while the husband is not increases when the couple lives in urban areas.

5.3.3 C. Sharing Rule Parameters

The estimation results show that, at the mean sample, the single's share of non-labor income constitutes 25.15% of total non labor income in the unrestricted sample and 11.26% in the restricted sample. The distributions of single's share are represented in Figure 2 for both the restricted and unrestricted samples.

In Table 7 we present the results of the estimated parameters of the sharing rule in families where a single adult and a couple cohabitate. These parameters represent the impact of a marginal change in one of the variables on the non-labor income accruing to the single adult when he/she is part of an extended family. According to our estimates, a R 1 increase in the non-labor income induces an increase in adult's share of 0.065. Moreover, an increase in the single adult's hourly wage rate reduces his/her share from non-labor income. At the mean of hours worked by singles, an increase of R 2,480 reduces single's share of non-labor income of R 273. The husband's labor income has no effect on the adult's share. However, an increase in wife's labor income induces a significant increase in adult's share of total non-labor income. More precisely, a R 1 increase of labor income (that is equivalent to an annual increase of R 2,178 in her labor income at the mean of hours worked by women in the extended family) translates into an increase in the amount of non-labor income accruing to the single adult of R 2,802. The estimated parameter of male dummy is 0.027 and 0.052 in the unrestricted and restricted samples, respectively. It supports the idea that single men who cohabitate with couples get a higher share of non-labor income than do single women. Although not significant, the presence of children in the household reduces single's share of non-labor income. Living in urban areas relative to rural areas has no effect on the intrahousehold allocation of non-labor income. However, we notice a difference among race categories so that single White adults have a smaller share than singles of other races. We also find that belonging to the age category "18-40" has a small positive effect on non-labor income accruing to singles in extended families.

Concerning the economies scale in consumption resulting from cohabitation, the estimates are given in Table 8. As presented in the theoretical model, we introduced different parameters for the singles and the couples. For the singles, we also distinguish between men and women. Thus, we estimate κ_c, κ_m and κ_f in the unrestricted and restricted samples for couples, single males and single females, respectively. We find that κ_m and κ_f are lower than unity, a proof that there exists a significant gain for adults from cohabitating. These economies of scale are about 75% for single men and 67% for single women in the unrestricted sample. Concerning couples who decided to cohabitate and to share their resources, we find that there are no economies of scale; yet the result remains valid as the gains from cohabitation are already exploited when living in couple. Unexpectedly, in the restricted sample, the parameters of scale economies are 0.345 and 0.244, respectively for single men and single women. One might explain this result by supposing that, in extended families without children, a single accepts a low share from the intrahousehold allocation provided that he/she benefits from high economies of scale in consumption.[23]

[23]Nevertheless, we note that κ_m and κ_f in the restricted sample remains low though.

6 Conclusion

We develop a model of labor supply taking into account the decision of a nuclear family - a single adult or a couple - to cohabitate with another nuclear family, and the resources sharing among persons in the resulting extended family. The decisions in extended families are Pareto-optimal and described with an income sharing rule, whereas the decisions in nuclear families are described with the unitary approach. First, the decision to participate to the extended family is determined by the size of scale economies and families' taste for consumption. Second, each member within the extended household decides between not working and working on a full-time basis. The model is completely identified from a sample of single-nuclear families, couple-nuclear families and extended families. We present the rule that determines the distribution of resources within the extended family and a measure of the scale of economies that result from cohabitation.

The model is estimated using the 1997 OHS. In the data, the unit of observation is the household. The household is nuclear when a single or a couple lives alone, and extended when a single and a couple cohabitate. The estimations are given separately for a sample of 8,212 observations of all households, nuclear and extended, who may have children or not (unrestricted sample), and for a sample of 2,571 observations of no-children households (restricted sample). The results show that people belonging to age group "18-40" or those who are from the non-White population are more likely to be in extended households. In both the restricted and unrestricted samples, higher wages of singles affect negatively their cohabitation decision, while wages of spouses do not affect their self-selection into the extended family. The analysis of the estimates of the slope of the utility function indicates that an increase in the wage rate implies a substitution of leisure to work for single adults, both men and women. Moreover, labor participation probability is decreasing with non-labor income, a proof that leisure is normal good. There is a non-observed heterogeneity that affects both the labor supply and the decision to participate to nuclear family. The estimates, although not significant, show that being member of an extended family decreases the labor market participation of single adults and couples.

In the unrestricted sample (restricted sample), the scale economies are about 75% (34%) for single men and 67% (24%) for single women. No economies of scale are observed for couples. The parameters of the sharing rule show that the share devoted to the single adult is positively related to the household non-labor income. Furthermore, the adult's share in non-labor income decreases in his/her wage rate but increases in both husband and wife wages. The estimated parameter of male dummy shows that single males have a higher share than single female adults.

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Table 1: Estimation Results
Participation Model and Wage Regression

	Participation Equation		Wage Equation	
	Males	**Females**	**Males**	**Females**
Age	0.249***	0.219***	0.107***	0.071***
Age^2	-0.003***	-0.003***	-0.001***	-0.001***
White	0.039	-0.106***	0.499***	0.358***
Black	0.080	-0.012	0.067	-0.052
English	0.341***	0.294***	0.385***	0.305***
Afrikaans	0.156**	0.270***	0.109**	0.052
Married	0.349***	-0.213***	0.246***	0.056***
Educ1	0.384**	0.494***	-0.079	0.116
Educ2	0.460***	0.140	0.391***	0.100
Educ3	0.078	-0.265**	0.644***	0.501***
Educ4	0.345***	-0.111	1.196***	1.134***
Educ1*Age	-0.012***	-0.010**	0.005	-0.002
Educ2*Age	-0.011***	-0.003	-0.002	0.005
Educ3*Age	-0.002	0.009***	-0.003	0.002
Educ4*Age	-0.003	0.016***	-0.006***	0.007**
Urban zone	0.037*	0.217***	0.469***	0.419***
Unemployment Rate	-0.040***	-0.019***	0.002	-0.005**
Household Head	0.717***	0.224***		
Own House	-0.545***	-0.337***		
Child0_3n	0.054***	-0.034***		
Child4_6n	-0.009	-0.035***		
Child7_12n	-0.055***	-0.051***		
Pension dummy	-0.203***	-0.152***		
Inverse Mills Ratio			0.168***	0.153***
Constant	-3.869***	-4.070***	-1.796***	-1.202***
Obs.	**34,013**	**41,337**	**13,061**	**9,320**

(1) Significance levels of 10%, 5% and 1% are noted *, ** and ***, respectively;
(2) *English* and *Afrikaans* are dummies for spoken languages;
(3) The *unemployment rate* is represented by region (for the 9 provinces in South Africa), separately for men and women;
(4) *Pension dummy*=1 if there is at least one individual in the household who has a pension;
(5) *Child0_3n*, *Child4_6n*, and *Child7_12n* are the number of children aged 0-3, 4-6, and 7-12 years, respectively;
(6) *Household head* is a dummy for whether the person is the head of the household and *Own house* is the dummy for whether household's members are owner of their house;
(7) There are 4 dummies for the education levels that go from the junior primary (*Educ1*) to the university (*Educ4*). *No education* is the reference category.

Table 2: Summary Statistics by Family Type

	Single Male Adult			***Single Female Adult***			***Married Man***			***Married Woman***		
Variable	***Mean***	***S.E.***	***Obs.***	***Mean***	***S.E.***	***Obs.***	***Mean***	***S.E.***	***Obs.***	***Mean***	***S.E.***	***Obs.***
NUCLEAR SINGLE FAMILY												
Age	37.422	10.733	832	39.798	9.682	1279			—			—
Employment dummy	0.651	0.477	832	0.477	0.499	1279			—			—
Working hours (per week)	48.467	15.832	542	44.549	13.849	610			—			—
Gross hourly wage rate	12.610	15.870	542	11.193	14.246	610			—			—
Net hourly predicted wage rate (workers and nonworkers)	7.848	9.191	832	5.980	7.633	1279			—			—
Non-Labor income (per week)	71.071	194.643	175	73.798	120.918	486			—			—
Formal employment dummy	0.828	0.377	542	0.669	0.471	610			—			—
NUCLEAR COUPLE FAMILY												
Age			—			—	39.121	9.295	5605	34.727	8.788	5605
Employment dummy			—			—	0.781	0.413	5605	0.341	0.474	5605
Working hours (per week)			—			—	48.267	12.753	4379	42.662	13.018	1911
Gross hourly wage rate			—			—	15.961	19.750	4379	13.678	17.778	1911
Net hourly predicted wage rate (workers and nonworkers)			—			—	10.052	11.073	5605	7.121	9.346	5605
Non-Labor income (per week)			—			—	115.177	507.178	489	111.295	366.702	184
Formal employment dummy			—			—	0.903	0.295	4379	0.824	0.381	1911
EXTENDED FAMILY												
Age	33.164	9.510	232	35.458	11.150	264	44.839	11.227	496	40.327	11.041	496
Employment dummy	0.371	0.484	232	0.284	0.452	264	0.669	0.471	496	0.270	0.444	496
Working hours (per week)	49.686	16.814	86	45.400	14.946	75	47.461	12.815	332	41.895	11.930	134
Gross hourly wage rate	9.666	9.131	86	9.970	9.470	75	13.073	14.695	332	12.598	14.807	134
Net hourly predicted wage rate (workers and nonworkers)	6.222	5.592	232	5.651	5.814	264	8.565	8.147	496	6.262	8.366	496
Non-Labor income (per week)	111.389	94.780	18	91.382	47.600	29	74.167	85.354	57	92.991	105.021	18
Formal employment dummy	0.860	0.348	86	0.813	0.392	75	0.925	0.264	332	0.821	0.385	134

Table 3: Estimation Results of Participation to Nuclear Families

Parameter	Variable	Unrestricted Sample Estimates		Restricted Sample Estimates	
SINGLE ADULTS					
xs_{00}	*constant*	2.385	(0.362)	2.980	(0.642)
xs_{01}	*age_ad*	-0.250	(0.107)	-0.599	(0.246)
xs_{02}	*adult's (log) hourly wage*	0.190	(0.042)	0.167	(0.078)
xs_{03}	*white_ad*	0.525	(0.144)	0.242	(0.230)
xs_{04}	*black_ad*	0.211	(0.212)	0.425	(0.359)
xs_{05}	*english_ad*	-0.704	(0.230)	-0.731	(0.376)
xs_{06}	*afrikaans_ad*	-0.481	(0.211)	-0.291	(0.368)
xs_{07}	*urban dummy*	-0.244	(0.071)	-0.175	(0.140)
xs_{08}	*male_ad dummy*	-0.355	(0.066)	-0.250	(0.139)
xs_{09}	*mother_ad*	0.307	(0.134)	0.096	(0.283)
xs_{10}	*father_ad*	-0.090	(0.175)	-0.277	(0.354)
xs_{11}	*sister15_ad*	0.359	(0.071)	0.547	(0.125)
xs_{12}	*adult_nohh_ad*	-0.676	(0.078)	-1.098	(0.155)
xs_{13}	*mother_ad * age_ad*	-0.342	(0.162)	-0.231	(0.343)
xs_{14}	*father_ad * age_ad*	-0.341	(0.192)	-0.240	(0.386)
COUPLES					
xc_{00}	*constant*	0.847	(0.313)	0.255	(0.692)
xc_{01}	*age_m*	0.259	(0.087)	0.499	(0.231)
xc_{02}	*husband's (log) hourly wage*	-0.058	(0.037)	0.008	(0.081)
xc_{03}	*wife's (log) hourly wage*	0.039	(0.041)	-0.059	(0.090)
xc_{04}	*white_m*	0.612	(0.102)	0.565	(0.187)
xc_{05}	*black_m*	0.139	(0.166)	0.450	(0.351)
xc_{06}	*english_m*	-0.035	(0.181)	0.111	(0.371)
xc_{07}	*afrikaans_m*	0.050	(0.164)	0.258	(0.354)
xc_{08}	*urban dummy*	-0.109	(0.062)	-0.006	(0.139)
xc_{09}	*mother_m*	0.138	(0.073)	-0.081	(0.134)
xc_{10}	*father_m*	0.300	(0.106)	0.470	(0.233)
xc_{11}	*mother_f*	-0.027	(0.081)	-0.042	(0.147)
xc_{12}	*father_f*	0.078	(0.108)	0.073	(0.194)
xc_{13}	*sister15_m*	0.070	(0.064)	0.145	(0.127)
xc_{14}	*sister15_f*	-0.008	(0.064)	0.061	(0.124)
xc_{15}	*adult_nohh*	-0.264	(0.063)	0.019	(0.121)
xc_{16}	*mother_m * age_m*	-0.068	(0.106)	0.078	(0.259)
xc_{17}	*father_m * age_m*	-0.164	(0.128)	-0.343	(0.298)
xc_{18}	*mother_f * age_f*	0.171	(0.093)	0.068	(0.203)
xc_{19}	*father_f * age_f*	0.090	(0.123)	-0.089	(0.249)

(1) Extensions "*_m*", "*_f*" and "*_ad*" denote characteristics relative to married man, married woman and single adult, respectively;
(2) Standard errors are in parentheses.

Table 4: Estimates of the Slope of the Utility Function

	Parameter	Unrestricted Sample		Restricted Sample	
	Parameter	***Estimates***		***Estimates***	
SINGLE MEN	β_{0sm}	97.102	(11.015)	120.363	(14.698)
	β_{1sm}	5.903	(0.841)	5.746	(0.894)
SINGLE WOMEN	β_{0sf}	21.196	(2.085)	19.155	(3.800)
	β_{1sf}	4.766	(0.489)	3.542	(0.731)
	ω_s	-0.068	(0.386)	0.165	(0.453)
	σ_s	0.186	(0.388)	-0.234	(0.357)
	β_{00c}	28.910	(1.641)	29.399	(3.438)
COUPLES	β_{01c}	6.410	(0.376)	6.063	(0.785)
	β_{10c}	5.609	(0.275)	4.628	(0.507)
	β_{11c}	5.701	(0.241)	4.544	(0.456)
	ω_c	-0.636	(0.297)	-0.006	(0.540)
	σ_c	0.343	(0.234)	0.464	(0.389)

(1) β_{0sm} and β_{1sm} represent the slopes of the utility functions of single men when not working and when working, respectively - similarly for single women with β_{0sf} and β_{1sf};
(2) β_{00c}, β_{01c}, β_{10c} and β_{11c} represent the slopes of the utility functions of couples when none of them works, only woman works, only man works, both man and woman work, respectively;
(3) Standard errors are in parentheses.

Table 5: Parameter Estimates of the Intercept of the Utility Function
(Sample of Single Men and Women)

			Unrestricted Sample		Restricted Sample	
	Parameter	***Variable***	***Estimates***		***Estimates***	
	a10_sm	*constant*	182.530	(21.835)	229.824	(29.213)
	a11_sm	*black_ad*	-0.275	(0.747)	-0.655	(0.923)
	a12_sm	*white_ad*	-2.317	(0.627)	-2.437	(0.702)
	a13_sm	*urban dummy*	-0.985	(0.217)	-1.214	(0.240)
Men	a14_sm	*child0_3*	-0.914	(0.883)	—	
	a15_sm	*child4_6*	-0.223	(0.608)	—	
	a16_sm	*child7_12*	-0.483	(0.409)	—	
	a17_sm	*age_ad dummy*	0.937	(0.203)	1.139	(0.225)
	a18_sm	*english_ad dummy*	-1.133	(0.747)	-1.031	(0.843)
	a19_sm	*afrikaans_ad dummy*	0.713	(0.743)	0.436	(0.898)
	a10_sf	*constant*	32.084	(4.138)	30.058	(7.505)
	a11_sf	*black_ad*	-0.048	(0.485)	0.695	(0.801)
	a12_sf	*white_ad*	-1.479	(0.315)	-0.829	(0.475)
	a13_sf	*urban dummy*	0.266	(0.136)	0.138	(0.240)
Women	a14_sf	*child0_3*	-0.620	(0.158)	—	
	a15_sf	*child4_6*	-0.450	(0.157)	—	
	a16_sf	*child7_12*	-0.293	(0.129)	—	
	a17_sf	*age_ad dummy*	0.576	(0.132)	0.746	(0.217)
	a18_sf	*english_ad dummy*	-0.198	(0.558)	0.262	(0.927)
	a19_sf	*afrikaans_ad dummy*	0.527	(0.481)	0.976	(0.811)

(1) Extension "*_ad*" denotes characteristics relative to single adult;
(2) The alternative of reference is where the adult does not work;
(3) Standard errors are in parentheses.

Table 6: Parameter Estimates of the Intercept of the Utility Function
(Sample of Couples)

		Unrestricted Sample		**Restricted Sample**	
Parameter	***Variable***	***Estimates***		***Estimates***	
Alternative 2					
a01_c0	*constant*	61.455	(4.665)	63.302	(9.829)
a01_c1	*black_m*	-0.031	(0.491)	0.757	(0.863)
a01_c2	*white_m*	-2.022	(0.265)	-2.460	(0.478)
a01_c3	*urban dummy*	0.510	(0.157)	0.190	(0.318)
a01_c4	*child0_3*	-0.354	(0.153)	—	
a01_c5	*child4_6*	-0.008	(0.151)	—	
a01_c6	*child7_12*	0.155	(0.136)	—	
a01_c7	*age_m dummy*	0.194	(0.137)	0.289	(0.287)
a00_c8	*english_m dummy*	-0.250	(0.546)	0.911	(0.917)
a00_c9	*afrikaans_m dummy*	0.742	(0.482)	1.141	(0.846)
Alternative 3					
a10_c0	*constant*	65.312	(4.582)	69.514	(9.685)
a10_c1	*black_m*	0.177	(0.320)	0.292	(0.615)
a10_c2	*white_m*	-1.527	(0.175)	-1.781	(0.312)
a10_c3	*urban dummy*	0.051	(0.087)	-0.196	(0.184)
a10_c4	*child0_3*	0.240	(0.086)	—	
a10_c5	*child4_6*	0.083	(0.089)	—	
a10_c6	*child7_12*	-0.092	(0.082)	—	
a10_c7	*age_m dummy*	0.949	(0.082)	1.392	(0.172)
a10_c8	*english_m dummy*	0.102	(0.356)	0.427	(0.663)
a10_c9	*afrikaans_m dummy*	0.788	(0.313)	0.548	(0.606)
Alternative 4					
a11_c0	*constant*	63.554	(4.591)	67.996	(9.704)
a11_c1	*black_m*	0.406	(0.340)	0.806	(0.670)
a11_c2	*white_m*	-2.210	(0.189)	-2.229	(0.355)
a11_c3	*urban dummy*	-0.676	(0.105)	-1.120	(0.220)
a11_c4	*child0_3*	-0.169	(0.099)	—	
a11_c5	*child4_6*	-0.077	(0.101)	—	
a11_c6	*child7_12*	-0.015	(0.092)	—	
a11_c7	*age_m dummy*	1.214	(0.095)	2.005	(0.196)
a11_c8	*english_m dummy*	0.872	(0.376)	1.740	(0.712)
a11_c9	*afrikaans_m dummy*	1.748	(0.333)	1.872	(0.658)

(1) Alternative 1: both husband and wife do not work; Alternative 2: wife works and husband does not; Alternative 3: husband works and wife does not, Alternative 4: both husband and wife work;
(2) Extensions "*_m*" and "*_f*" denote characteristics relative to married men and women, respectively;
(3) Standard errors are in parentheses.

Table 7: Parameter Estimates of the Sharing Rule

	Parameter	Unrestricted Sample *Estimates*		Restricted Sample *Estimates*	
r_0	constant	0.543	(0.141)	0.307	(0.194)
r_1	$(y+1000)/1000$	0.065	(0.033)	-0.004	(0.042)
r_2	male_ad	0.027	(0.016)	0.052	(0.037)
r_3	what_ad/1000	-0.110	(0.774)	0.692	(0.533)
r_4	what_m /1000	0.440	(0.300)	0.508	(0.314)
r_5	what_f /1000	1.286	(0.552)	0.395	(0.329)
r_6	urban dummy	-0.001	(0.004)	-0.002	(0.002)
r_7	child0_3	-0.007	(0.007)	—	
r_8	child4_6	-0.005	(0.006)	—	
r_9	child7_12	-0.006	(0.004)	—	
r_{10}	age_ad	0.003	(0.004)	0.009	(0.004)
r_{11}	white_ad	-0.032	(0.010)	-0.006	(0.005)
r_{12}	black_ad	0.006	(0.011)	-0.003	(0.048)
r_{13}	english_ad	-0.005	(0.012)	-0.013	(0.048)
r_{14}	afrikaans_ad	-0.001	(0.011)	-0.007	(0.048)

(1) y represents household non-labor income;
(2) *what_ad*, *what_m*, *what_f* are the real/imputed hourly wage rate of adult, husband and wife, respectively;
(3) Standard errors are in parentheses.

Table 8: Economies of Scale Parameters

Parameter	Unrestricted Sample *Estimates*		Restricted Sample *Estimates*	
κ_c	1.110	(0.072)	1.333	(0.068)
κ_m	0.758	(0.143)	0.346	(0.133)
κ_f	0.673	(0.138)	0.245	(0.119)

(1) κ_c, κ_m and κ_f represent the joint consumption for couples, single men and single women, respectively;
(2) Standard errors are in parentheses.

Table A.1: List of the Variables of Interest

Variable name	Definition of the variable
MALE_AD	Dummy variable for male adults in single nuclear household.
BLACK_*i* WHITE_*i*	Two dummies related to a person's race.
AGE_*i*	Dummy variable for whether individual i belongs to age category "18-40".
AFRIKAANS_*i* ENGLISH_*i*	Two dummies defining the most often spoken languages.
EDUC*1_i* ; EDUC*2_i* EDUC*3_i* ; EDUC*4_i*	Dummy variables of i's education level.
CHILD*0_3* CHILD*4_6* CHILD*7_12*	Dummy variables for children aged 0-3, 4-6 and 7-12, respectively.
CHILD*0_3n* CHILD*4_6n* CHILD*7_12n*	Number of children by category age: 0-3, 4-6 and 7-12, respectively.
MOTHER_*i*	Dummy for whether person i's mother is alive.
FATHER_*i*	Dummy for whether person i's father is alive.
SISTER15_*i*	Dummy for whether person i's sister (aged 15 and more) is alive.
ADULT_NOHH_*i*	Dummy for whether person i has at least one child alive and not living in household.

Note: $i \in (ad, m, f)$ represents the characteristics relative to single adults, married men and married women.

Table A.2: Average Household Size, Workers, Migrants, and Births by Population Group

Sample	*All persons*	*Persons above 15*	*Workers*	*Migrants*	*Births*
Total	4.70	3.01	1.48	1.36	4.46
Black	4.94	3.07	1,38	1.36	4.76
White	3.00	2.35	1.63	1.10	2.75
Asian	4.43	3.37	1.79	1.09	3.62
Colored	4.65	3.12	1.73	1.29	4.15

Table A.3: Job Type for People Aged 15 and More

Sample	*Full-time*	*Part-time*	*Casual*	*No job*
Total	26.56%	2.06%	1.25%	70.13%
Males	36.17%	1.99%	1.44%	60.40%
Females	19.03%	2.11%	1.10%	77.76%
Black	21.92%	1.95%	1.10%	75.04%
White	46.98%	2.85%	0.63%	49.55%
Asian	40.49%	2.57%	1.26%	55.60%
Colored	38.85%	2.11%	2.54%	56.50%

Note: People were asked if, during the last 7 days, they had a full-time, part-time or casual job. If the answer is NO, they are asked if they have actually a job from which they were absent the previous week.

Table A.4: Employment Status of Working Age Population
(Persons Aged Between 15 and 65)

	Unemployment rate		**Participation rate**	
Sample	*Definition 1*	*Definition 2*	*Definition 1*	*Definition 2*
Total	21.94%	38.04%	43.62%	54.94%
Males	17.48%	29.82%	53.86%	63.33%
Females	27.36%	46.65%	35.43%	48.25%
Black	27.31%	46.18%	39.10%	52.80%
White	4.01%	6.05%	61.64%	62.98%
Asian	9.75%	12.95%	54.91%	56.93%
Colored	14.28%	21.43%	57.19%	62.40%

(1) Definition 1 is the narrow definition of unemployment;

(2) Definition 2 is the broader definition of unemployment that accepts as unemployed those who did not search for work in a 4-week reference period but who report being available for work and say they would accept if a suitable job were offered.

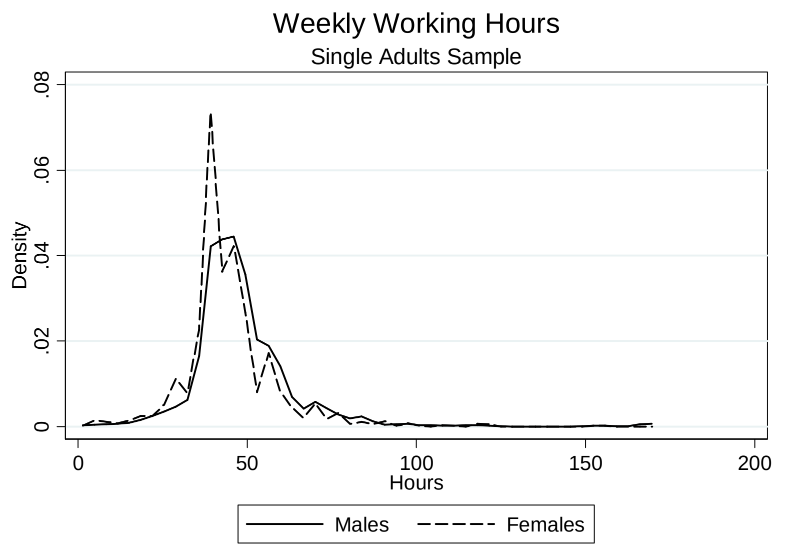
Table A.5: Marital Status by Age Group

Marital Status	*Under 18*	*18-40*	*41-64*	*64+*
Total	43.19%	34.85%	16.37%	5.58%
Single	99.86%	63.08%	12.91%	6.82%
Married/Couple	0.13%	34.33%	69.25%	48.51%
Widow	0.01%	0.86%	12.23%	42.28%
Divorced	0.00%	1.74%	5.61%	2.38%

Table A.6: Number of Children by Age Category and Family Type

	Household Type						**Total Household**	
Variable	**Single-Nuclear**		**Couple-Nuclear**		**Extended**			
	Mean	*S.E.*	*Mean*	*S.E.*	*Mean*	*S.E.*	*Mean*	*S.E.*
Children aged 0-3	0.352	0.564	0.547	0.625	0.559	0.685	0.516	0.624
Children aged 4-6	0.358	0.562	0.452	0.583	0.443	0.601	0.436	0.581
Children aged 7-12	0.951	0.895	0.843	0.847	0.835	0.844	0.860	0.855
Children aged 13-17	0.824	0.817	0.521	0.728	0.657	0.756	0.579	0.753
Obs.	**915**		**4338**		**388**		**5641**	

Figure 1: Weekly working hours of singles and couple - men and women



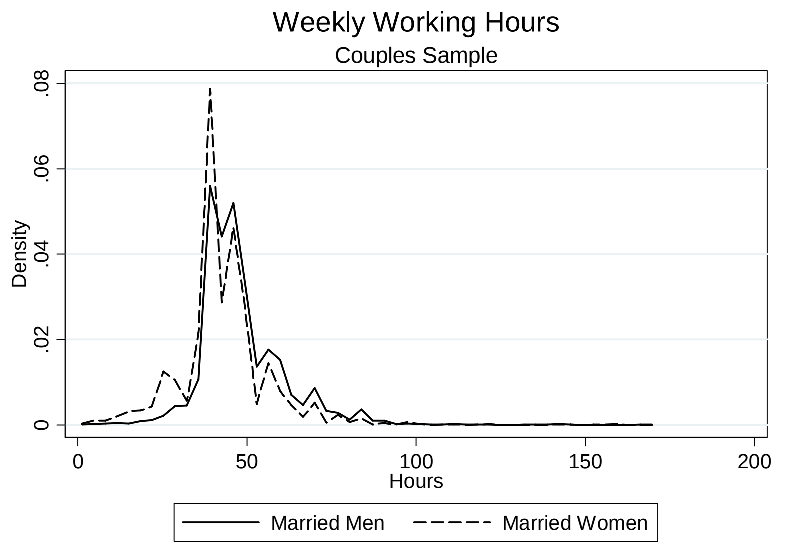


Figure 2: Sharing Rule Distribution