Drug Consumption and Intra-Household Distribution of Resources: The Case of Qat in an African Society

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Abstract: This paper estimates the rule governing the intra-household resource allocation between the husband and the wife representing children's interests using 1996 data for the African society of Djibouti. In the Horn of Africa the consumption of qat (a substance similar to amphetamine) is an expensive habit of the male population. We estimate the sharing rule to understand the relationship between the use of qat and the allocation of household resources. Qat is perceived as a desirable good by the consumers but is also a private bad because harmful to the personal health. Further, its consumption implies a trade-off between the consumption of adult males and the claims over resources of the party formed by the female adults and the children. The study uses a structural estimation of the sharing rule within a collective system of individual demands. The results show that households where qat is consumed share resources more unequally with respect to households where qat is not consumed.

Keywords: Intra-household allocation, sharing rule, qat, drug consumption, education, Djibouti

Acknowledgments: The authors would like to thank the National Statistics Department of Djibouti for permission to use the EDAM 1996 household survey and Luisa Ferreira, Diego Lubian, Mauro Maltagliati, Riccardo Magnani, Martina Menon, Eugenio Peluso, Nathalie Picard and the participants to the Workshop on "Equivalence Scales, Household Behaviour and Welfare" held in Florence 27-28 June 2002 for their helpful suggestions. We extend our thanks also to Ranjan Ray for the illuminating discussions that we shared on the topic. All errors and omissions are sole responsibility of the authors.

1 Introduction

In Djibouti, a small country on the Horn of Africa, chewing qat, a natural substance obtained from the *Catha Edulis Forskal* plant, common in East Africa and the Arabian Peninsula, is a common habit. The leaves contain alkaloids with a chemical structure similar to that of amphetamine and ephedrine. The

consumption of qat is not an isolated or sporadic phenomenon. It is widespread mainly in the male population of all social levels. From the 1996 household budget survey conducted by the Djibouti Statistical Office (DINAS), nearly 50 percent of the households has at least one member who consumes qat (*qat user)*. Although many people consume qat at work, it is unusual to chew qat in private and alone. Most male users chew qat daily in groups of varying size at *chewing parties* held at home in the afternoon and lasting for as long as 5 or 6 hours. These parties, which have been held for centuries and which today enjoy recognised legal status, are an important social occasion and offer the opportunity to consolidate kinship relationships.

On one side, qat consumers believe that qat is a *good* because makes them feel physically powerful and sharpens their mind. On the other side, qat is also a private *bad*. The habitual use of qat has negative effects on the health of users and significant social and economic repercussions both within the household and in the society. Participants in the afternoon chewing parties waste time that could be devoted to work or family care. Qat consumption negatively affects labor productivity. *Qat users* work less than *non qat users*. Women oppose qat consumption because *qat users* males are also likely to be more irritable and less aware of family needs. Therefore, the qat habit has an effect on both the budget and time allocation. Men who chew qat are *less caring* towards the household because they spend a large amount of the household resources to buy qat for themselves leaving little available to satisfy the necessities of the other members of the household. As a consequence, it is often the case that the wife, or other members of the household, must look for a job or work more to provide the necessary financial means and family care. Under this perspective, qat is a social plague. This situation is not special neither to Djibouti nor to our times. Seccombe (1993) reports that during the Industrial Revolution in England working-class families were depending heavily on the primary breadwinner's income. In those times, a deepening reliance on the man's income meant that the family's well-being hinged critically upon the division, often not a smooth division, of his wage between his own personal money and the housekeeping budget. In such families defined by Seccombe as egoistic and despotic, the cash wives obtained was an unpredictable and variable residual – the amount left over after their husbands had visited the pub or betting shop. Working men who "drank their pay" were making the life of their wives and children miserable.

In Djibouti, expenditure on qat represents the second most important item for the Djiboutian households after food consumption, respectively 15 percent and 65 percent of total household expenditure. These percentages become respectively 27 percent and 51 percent if we consider only the households with *qat users*. In poor households, qat consumption affects the food intake of the most vulnerable members of the household. Because of this substitution effect, qat is one of the causes of widespread malnutrition in Djibouti (The World Bank 1997).

The daily satisfaction of consuming qat by the adult male may also seriously affect the future well-being of the whole household. Poor and non poor households, especially if consuming qat, differ both in the quantity and in the quality of schooling offered to their children. EDAM 1996 data show that the

expenditure on education per child is significantly less in households where qat is heavily consumed. The private costs of education are high in spite of the fact that primary and secondary education is mostly public in Djibouti. Expenditures on books, materials, uniforms and transportation are in average 4 percent of the budget.

While qat is consumed exclusively by the adult males of the extended Djiboutian household, education is exclusively consumed by the children. In the paper, we use the exclusive nature of qat and education to assess the degree of equality of resource allocation and the distribution of power within the household. From the observation of consumption of qat and education, our objective is then to investigate whether the *lower degree of caring* of Djiboutian males is related to the quantity of resources allocated to alternative uses. Is the consumption of qat associated with a position of privilege or dominance that male users enjoy with respect to other members? To answer this question we estimate the sharing rule governing the allocation of resources between adult males and females, representing the preferences and interests of children, within a collective consumption approach to model household behaviour (Chiappori 1988, 1992, and Browning, Bourguignon, Chiappori and Lechene 1994). The study uses a structural estimation of the sharing rule within a collective system of individual demands. We also show that the proposed structural approach identifies the sharing rule up to a constant. The approach exploits the analogy between the sharing rule, which is not directly observable, and the unobservable scaling demographic function introduced by Barten (1964) to specify an estimable individual demand system. The system is estimated using a generalized Heckman procedure to account for the fact that not all adult males consume qat and some children do not receive education. The results show that households where qat is consumed share resources more unequally with respect to households where qat is not consumed.

The paper is organized as follows. Section two describes the theoretical background describing how the consumption of qat can be associated with the process of intra-household allocation within a collective consumption framework. Section three explains how identification can be achieved from a structural specification. The subsequent section illustrates the model specification and estimation techniques. Section five presents the main features of the Djiboutian household survey used in the analysis and reports the results. The final section summarizes the relevant findings and discusses related policy implications.

2 Drug Consumption and Intra-household Allocation in the Collective Consumption Framework

Traditional *unitary* approaches to the household economy envisage a single utility function to be maximised, given the assumption that a change in individual welfare cannot be separated from a change in household welfare treated as a *black box*. Within this set up, the question of intra-household resource allocation is

necessarily neglected. The collective approach proposed by Chiappori (1988, 1992) shows that, in a micro-society such as a household composed of two individuals, the Pareto problem where one individual maximizes her/his own utility given that the other individual's utility is greater or at least equal to an assigned level of utility corresponds to a decentralized problem of the household economy where each household member maximizes her/his own utility function subject to total individual expenditure that must equate a sharing rule.

This result is an application of the second welfare theorem to the household economy where at the corners of the Edgeworth box we can represent the members of the household. Every Pareto-efficient point on the contract curve can be realised as the outcome of a household general equilibrium through an appropriate redistribution of resources among the household members. Such intra-household redistribution to form individual incomes is described by the sharing rule. Indirectly, it provides a measure of the collective preferences of the household towards equity. While in unitary models only total household income matters in determining consumption patterns, in the collective approach resource allocation is determined by individual incomes and household welfare is critically influenced by the way the individual distributes the resources between personal expenditure and the shared budget.

The identification of the sharing rule has specific data requirement. A useful information is that at least the individual demand of an exclusive good is observed. What makes the case of Djibouti especially interesting is that we can observe the exclusive consumption of education by the children, and of qat by the adult males. Because qat is considered a good by the consumers, intakes are truthfully revealed. This is not the case in western societies where the consumer of drugs has strong incentives to lie because the consumption of drugs is restricted by law.

Our set of information does not include leisure. Therefore, our collective model is confined to information about consumption. In our context, labour supply is fixed, labour income is exogenously determined and child labour is absent.[1] We observe two exclusive goods, qat and education, for which we identify unequivocally the adult male or the child as the consumer. We formally describe these informational constraints in the following three assumptions.

Assumption 1. **A Consumption Based Information Set:** *Partners Labour supply is fixed and there is no child labour.*

The information set I_o can be described as follows:

$$\left(e^m, e^c, o^i; \bar{h}_i; (p_e, p_o) \right) \in \Omega_o; \quad i \in m, f,$$

[1] About 99.3 percent of the children less than 14 years old, who are 31 percent of the 15701 individuals sampled in EDAM, does not work.

where e^m, e^c indicate respectively the exclusive consumption of qat by adult males and education by children, o^i refers to the *unobservable* private proportion of the *ordinary* good consumed by member i (o^f represents both children and wife's consumption) and (p_e, p_o) the associated vector prices which in cross-section data are usually constant across households and exogenous. The amount of hours $\bar{h}_i$ offered by individual $i \in \{m, f\}$ is fixed, $\bar{h}_c \geq 0$.

Assumption 2. **Exclusivity.** *Mothers and children do not consume qat. Qat is an adult good/bad consumed exclusively by the males. Education is a child good consumed exclusively by children.*

Assumption 3. **Absence of Externalities.** *Qat consumption is private and generates no externalities. We choose to neglect the externalities generated by smoking.*

Djibouti is prevalently a Muslim country where households are traditionally male-headed. From a social point of view, women do not enjoy the same opportunities as their husbands in terms of access to the labour market, education and basic human rights. Women care about the household's needs, children and relatives and bargain for them with their husbands. As in most households, children are not decision makers and do not have direct control over resources. For example, mothers purchase the books, education materials, and uniforms that are consumed by the children.[2] It can be plausible, then, to think at a joint utility function for the mother and children as if it were a single household party.

Assumption 4. **The Mother Represents Children's Interests.**

In the Djiboutian society, the family reliance upon the man's pay is high. This is often the expression of the patriarchal structure of marital relationships where the male head of the household exercises greater control over resources. It is frequent that the head of the household withholds part of the common resources to fund his callous wants such as qat or cigarettes. This behaviour jeopardizes the satisfaction of the basic needs of other members, diverts the household budget from other uses such as children's education and, in general, adds uncertainty to the daily life.

In line with these observations, we model the preference structure of adult males as exerting *caring* towards the wife and children. Wives, on the other hand, are *caring* towards the husband and *paternalistic* towards children whose consumption and education directly affects women's utility.

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[2] Interestingly, the good/bad dichotomy that can be found for qat, can be seen for education as well. Education can be considered a *good* by the mother, while children, in some instances, may disagree and the assumption of a joint utility function may no longer be tenable.

Assumption 5. **Preferences:** *Each partner's preferences are strictly increasing, strongly quasi-concave and continuously differentiable. Wife's preferences are caring towards the husband and paternalistic towards children*

$$W^f\left(U^f\left(e^c, o^f\right), U^m\left(e^m, o^m\right)\right),$$

husband's preferences are caring, but not paternalistic

$$W^m\left(U^m\left(e^m, o^m\right), U^f\left(e^c, o^f\right)\right).$$

The man shows non-paternalistic preferences towards the other household members, but cares for the wife and, indirectly, for the children. Wife's utility depends directly on the exclusive consumption of the child good and on the proportion of the ordinary good o^f representing both wife and children consumption. The difference behaviour of husband and wife towards the children, respectively *caring* and *paternalistic*, is represented by children's consumption entering directly U^f and indirectly W^m.

Within a collective model, addictive consumption would represent a natural barrier to trade within the household and an intrinsic cause of failure of the intra-household markets. Experts of the World Health Organization (Kennedy, 1980) report that qat effects are similar to the amphetamine type of drugs which gives psychic not physical dependence. The continued use of qat, which is also related to a peculiar form of cultural and social dependence, would then lead one to expect habituation but not addiction. In general, addiction creates physical abstinence or withdrawal symptoms, when the use of the drug is discontinued, and generates tolerance, which is a physiological phenomenon requiring the individual to use more and more of the substance (Kennedy, 1980, Stein, Bentler and Newcombe 1988).[3]

Assumption 6. **Non Addiction**. *Qat consumption does not generate addiction in the strict sense of physical dependence.*

In the collective framework, Pareto efficiency breaks down the decision process in two stages. In the first stage, the husband and the wife agree or bargain on a sharing rule determining the direction and amount of the transfers between members. In the second stage, each member chooses the personal consumption level conditional on the individual budget constraint given by the level of the sharing rule. Exclusive goods are often highly detailed goods that are not

[3] Tolerance for a drug may be independent of the drug ability to produce physical dependence which manifests itself by the symptoms of abstinence when the drug is withdrawn.

consumed by all individuals in the sample. This characteristic poses the question of modelling corner solutions in consumption.

Given this set of assumptions, we represent the decentralized maximization problem in the collective consumption framework as follows:

$$P_1\begin{cases} Max W^m\left(U^m\left(e^m, o^m\right), U^f\left(e^c, o^f\right)\right) \\ s.t.\ \ p_e e^m + p_o o^m = \mu\left(p_e, p_o, w_m, w_f\right) \end{cases}$$

$$P_2\begin{cases} Max W^f\left(U^f\left(e^c, o^f\right), U^m\left(e^m, o^m\right)\right) \\ s.t.\ \ p_e e^c + p_o o^f = y - \mu\left(p_e, p_o, w_m, w_f\right) \end{cases} \tag{1}$$

$$e^m \geq 0, e^c \geq 0, o^i \geq 0,$$

where y is the total household income and w_m, w_f are the (potential) wages of the partners. The function $\mu(\cdot)^m$ is the sharing rule that is the male head's share of total budget y.

An interesting question is whether there exists exchange between the husband, who is not directly interested in consuming education, and the wife, who perceives qat as a bad. Contracts may not realize. However, in our framework, husbands and wives bargain for the monetary resources associated with the consumption of qat, education and the other ordinary goods. In a sense, the contractors do exchange power where qat and education are the inputs of the power generating technology. As an example, if a male chews less qat, then the wife and children's welfare increases indirectly through an increase in resources otherwise allocated to the man, that is an increase in power and control over resources of the wife.

3 Identification of the Sharing Rule

The identification of the sharing rule depends on the information available in the data and deducible from economic and econometric theory. In general, it may be sufficient to observe one exclusive good to identify the sharing rule up to a transformation, or three ordinary goods or alternatively an exclusive good plus an ordinary good to achieve identification up to a constant (Bourguignon 1999).

The choice of functional form is also critical if the objective is to achieve identification of the sharing rule by estimating the collective model in structural form. In this section, we show how we achieve the economic identification of the sharing rule, where we do not make specific assumptions about functional forms, and the econometric identification which is conditional upon the functional choice. The line of proof simply compares the Jacobian matrix of the parametric structural form and the associated unrestricted non-parametric reduced form. Our

information set is formed by two exclusive goods. Therefore, we achieve identification up to a constant. When a model is not identified, then several structural models are observationally equivalent in the sense that they cannot be distinguished from observed behaviour. The possibility to integrate back from the observed demand to recover a unique structure of preferences is lost because different structures generate the same demand functions.

We indicate with x_m, x_f [4] the individual total expenditure of the household head *m* and of the joint expenditure of the wife and children *f*. In general, the proportion of ordinary goods o^i such as food or water is not directly observable. Therefore, we need to make assumptions about the repartition of ordinary goods. Our preferred choice is the fair allocation. Ordinary goods are accessible to all household members without restrictions. We also assume that each member consumes at least an exclusive good. The difference in consumption between the members is therefore given by what the members consume exclusively. As a consequence, the intra-household allocation process depends on the proportion of resources that each member is able to divert towards personal consumption. Given these assumptions, we construct x_m, x_f as:

$$x_m = x_o^m + x_k$$
$$x_f = X - x_m - x_o^f + x_e$$

where $X = x_m + x_f$ is total household expenditure, $x_o = x_o^m + x_o^f$ is the household expenditure on ordinary goods for $x_o^m = x_o^f = 0.5x_o$, and $x_k = x_k^m, x_e = x_e^f$ are the observable individual expenditures on exclusive goods, respectively qat x_k and education x_e. Note that the gender index $i = m, f$ used as a subscript indicates exogenous variables, as a superscript denotes endogenous variables. In the case of exclusive goods the gender superscript is redundant.

Considering that in the Djibouti EDAM 96 household survey quantities consumed are not reported, we express observable demands in terms of individual shares for the husband *m* and the wife *f*:

[4] The subscript denotes here that the variables refer to the instrumented male and female's total expenditure while the expenditure on specific goods are endogenous.

$$\begin{pmatrix} s_k = \dfrac{x_k}{x_m} \\ s_o^m = \dfrac{x_o^m}{x_m} \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} s_e = \dfrac{x_e}{x_f} \\ s_o^f = \dfrac{x_o^f}{x_f} \end{pmatrix},$$

where $s_k + s_o^m = 1$ and $s_e + s_o^f = 1$. The individual systems of collective share demand equations are specified as follows:

$$\begin{pmatrix} s_k = G^k(\mu(x_m, z), d_c) \\ s_o^m = G^{o_m}(\mu(x_m, z), d_c) \end{pmatrix} \text{ and } \begin{pmatrix} s_e = G^e(\mu^f(.)) = G^e(X - \mu(x_m, z), d_c) \\ s_o^f = G^{o_f}(\mu^f(.)) = G^{o_f}(X - \mu(x_m, z), d_c) \end{pmatrix} \quad (2)$$

where $\mu^m + \mu^f = X$. The set of variables $z = \{w, d_s\}$, which includes exogenous wages w and other exogenous characteristics d_s, affects the decision process only. The set of exogenous variables d_c affects the consumption of each partner conditional on the sharing rule. Note that the *sharing rule* μ^m is not observed, but can be identified up to a constant from the observable partial effects. The argument used to demonstrate the economic identification is illustrated in the following two propositions. The first proposition follows the line of proof used in Bourguignon (1999).

Proposition 1.1. **Economic Identification (1)** *Assume that there are four goods, and that good 1 is consumed exclusively by member m and good 3 exclusively by member f. There are no consumption externalities. Good 2 and 4 are respectively the private composite ordinary goods complementing the basket of goods consumed by member m and f respectively. Then the sharing rule $\{\mu(x_m, z), \mu^f, X\}$ is identified up to an additive constant.*

Proof. Let us invert the system of demand shares (2) for the male to obtain the unobservable sharing rule as a function of observable variables:

$$\mu = g(s_k, d_c),$$

where $g = G^{k-1}$ is a continuously differentiable function and $\mu = \mu^m = X - \mu^f$. Let us then substitute the share f into the share demand for e to derive the demand of education *conditional* on the demand of k:

$$s_e = G^e(X - g(s_k, d_c), d_c) = \varphi(X, s_k, d_c), \quad (3)$$

where $?(?,?)$ is a continuous and differentiable function. Differentiate $?(?,?)$ with respect to X and s_k and obtain:

$$\frac{??}{?X} ? G^{e'}(X ? g(s_k, d_c), d_c)$$
$$\frac{??}{?s_k} ? G^{e'}(X ? g(s_k, d_c), d_c)(? g').$$

Solving this system of equations for the partial effects g':

$$\frac{??}{?s_k} \Big/ \frac{??}{?X} ? ? g'.?$$

Note that identification is achieved from the first order effects using the information about two exclusive goods and the restrictions $s_k ? s_o^m ? 1$ and $s_e ? s_o^f ? 1$. The indeterminacy about the constant does not affect the identification of individual utilities functions and preferences in general. An arbitrary choice of an anchoring point from which one can evaluate the partial effects of the sharing function, such as the fair allocation of ½, would not alter the welfare rankings.

In the case we had information about one exclusive and one ordinary good, the demand for the ordinary good can be expressed as sum of the individual demands:

$$s_o ? s_o^m ? s_o^f ? G^{o_m}(?^m(x_m, z), d_c) ? G^{o_f}(X ? ?^m(x_{m,} z), d_c).$$

In this case the sharing rule can be identified up to a constant resorting to the second order effects.

In the second proposition, we show that inversion of the share demand equation and the specification of a conditional demand system is not the only possibility to define the sharing rule as a function of observable effects. We use the analogy between the unobservable sharing rule and the unobservable scaling demographic function introduced by Barten (1964) to specify an estimable modified individual demand system permitting identification of the sharing rule.

Proposition 1.2. **Economic Identification (2)** *Assume that there are four goods, and that good 1 is consumed exclusively by member m and good 3 exclusively by member f. There are no consumption externalities. Good 2 and 4 are respectively the private composite ordinary goods complementing the basket of goods consumed by member m and f respectively. Further, model the sharing rule as*

an unobservable independent variable function of a Rx1 vector of observable independent exogenous variables z *indexed by r=1,..,R as* $? \; ? \; ? \; ^{m} \; ? \; x_m ? (z) \; ? \; x_m^*$ *where* x^*_m *is a shadow income. Then, the sharing rule* $\left\{ ? \; ? \; ? \; ^{m}, ? \; ^{f} \; ? \; X \; ? \; ? \right\}$ *is identified up to an additive constant.*

Proof. Let $? \; ? \; ? \; ^{m}$ be specified as a shadow individual income x^*_m where the sharing rule is an unobservable independent variable function of observable independent variables:

$$? \; ? \; ? \; ^{m} \; ? \; x_m ? (z) \; ? \; x_m^*, \tag{4}$$

where $? \; ? \; ?$ is a demographic function continuously differentiable which scales x_m. Note that the sharing rule expressed as a shadow income is an object analogous to $?(X, s_k, d_c)$ in equation (3). Substituting equation (4) in the system of share equations (2) gives:

$$\begin{aligned} s_k \; &? \; G^k (x_m ? (z), d_c) \\ s_e \; &? \; G^e (X \; ? \; x_m ? (z), d_c) \; ? \; F(X, z, d_c). \end{aligned}$$

Taking the derivatives of the continuously differentiable function $F(X, z, d_s)$ with respect to X and z_r, the *r-th* component of z, gives:

$$\begin{aligned} \frac{?F}{?X} \; &? \; G^{e'} (X \; ? \; x_m ? (z), d_c) \\ \frac{?F}{?z_r} \; &? \; G^{e'} (X \; ? \; x_m ? (z), d_c) ? (? \; x_m ? _{z_r}). \end{aligned}$$

Solving for the *r*-th element of the gradient $? _z$, we obtain:

$$\frac{?F}{?z_r} \Big/ \frac{?F}{?X} \; ? \; ? x_m ? _{z_r} \qquad ? \; r.$$

This expressions identifies all the partials of the sharing rule and therefore the sharing rule itself up to a constant.?

Interestingly, the sharing rule $?$ can be interpreted as a post-transfer shadow income where the scaling function $?(z)$ measures the direction and size of the intra-household transfer (Caiumi and Perali 2002):

$$? \; ? \; ?^{m}(x_m, z) \; ? \; ?(z)x_m$$
$$? \; ^{f}(.) \; ? \; X \; ? \; ? \; ? \; x_f \; ? \; (1 \; ? \; ?(.))x_m ,$$

where $? \; ^{f}(.) \; ? \; ?^{m}(.) \; ? \; X$, and the amount offered by the husband $(?(.) \; ? \; 1)x_m$ corresponds to the amount received by the wife $(1 \; ? \; ?(.))x_m$. The more transfers one of the party is capable to attract, the greater the power it exerts.

The scaling specification of the individual income is suggestive of another plausible constant that helps interpreting the behavioural content of the sharing rule. In lieu of using a fair division by ½ which is the same for all households, we can choose the actual observed share x_m / X which is household specific. By the same token, the constant of the sharing function can also be chosen in levels. An appropriate candidate is x_m.

As shown in Goldberger (1972) and Pagan (1984) the unobservable sharing rule specified as a shadow income is also estimable. The approach described in Proposition 1.2, with respect to the method outlined in Proposition 1.1 based on the derivation of a conditional demand, has the advantage of estimating directly the partial effects of the sharing rule. We now take on the issue of the econometric parametric identification by adopting the functional form that we will estimate in the empirical section of the paper.

Proposition 2. **Econometric Identification.** *Specify a functional form for a structural collective demand system in individual shares and the associated unrestricted reduced form. Let both the structure and reduced form be continuously differentiable. If the reduced form is sufficient to establish a one-to-one correspondence with the structural form, then the pair of demand shares* (s_k, s_e) *are solutions of problem P1 and P2 for the sharing rule* $? \; ^{m} \; ? \; ?$ *which is identified up to an additive constant.*

Proof. Let the structural form of the collective demand system specified in individual shares and the associated reduced form be:

Structural form	*Reduced form*
$s_k \; ? \; ?_1 \ln(? \; ^{m}(x_m, w_m, w_f, d_{s_1}))$	$s_k \; ? \; k_1 \ln x_m \; ? \; k_2 \ln w_m \; ? \; k_3 \ln w_f$
$? \; ?_{d_2} \ln d_{c_1}$	$? \; k_4 \ln d_{s_1} \; ? \; k_5 \ln d_{c_1}$
$s_e \; ? \; ?_1 \ln(X \; ? \; ?^{m}(x_m, w_m, w_f, d_{s_1}))$	$s_e \; ? \; ?_1 \ln x_f \; ? \; ?_2 \ln w_m \; ? \; ?_3 \ln w_f$
$? \; ?_{d_2} \ln d_{c_1}$	$? \; ?_4 \ln d_{s_1} \; ? \; ?_5 \ln d_{c_1}$

(5)

where the set of exogenous variables $z \; ? \; (w_m, w_f, d_s)$ is composed by the (potential) wage of the husband w_m, the (potential) wage of the wife w_f and d_s

which is a subset of exogenous characteristics affecting the decision process directly. The notation d_c denotes a set of preference factors such as the age or education of the household member. For convenience, we let both subsets d_s ? z and d_c include only one element d_{s_1} and d_{c_1} respectively.

For the sharing rule, we adopt the specification described in Proposition 1.2:

$$? \; ^{m} \; ? \; ? \; ^{m}(x_m, w_m, w_f, d_{s_1}) \; ? \; ?(w_m, w_f, d_{s_1}) \; x_m$$

$$? \; ^{f}(.) \; ? \; X \; ? \; ? \; ^{m} \; ? \; x_f \; ?(1? \; ?)x_m$$

where the scaling function

$$?(w_m, w_f, d_{s_1}) \; ? \; (w_m \; ^{?_1} w_f \; ^{?_2} d_{s_1} \; ^{?_3})$$

interacting with individual expenditure x_m is assumed to have a Cobb-Douglas form.

Consider for convenience the demand for qat. The unique correspondence between the structural and reduced form coefficients can be found by deriving the elements of the Jacobian matrix of the unrestricted reduced form and the corresponding elements of the Jacobian matrix of the structure which describes the theoretical restrictions relating the reduced form to the structure:

Structural form	*Reduced form*
$\frac{?s_k}{?x_m} \; ? \; \frac{? \; _1}{x_m}$	$\frac{?s_k}{?x_m} \; ? \; \frac{k_1}{x_m}$
$\frac{?s_k}{?w_m} \; ? \; \frac{? \; _1 ? \; _1}{w_m}$	$\frac{?s_k}{?w_m} \; ? \; \frac{k_2}{w_m}$
$\frac{?s_k}{?w_f} \; ? \; \frac{? \; _1 ? \; _2}{w_f}$	$\frac{?s_k}{?w_f} \; ? \; \frac{k_3}{w_f}$
$\frac{?s_k}{?d_{s_1}} \; ? \; \frac{? \; _1 ? \; _3}{d_{s_1}}$	$\frac{?s_k}{?d_{s_1}} \; ? \; \frac{k_4}{d_{s_1}}$
$\frac{?s_k}{?d_{c_1}} \; ? \; \frac{? \; _{d_2}}{d_{c_1}}$	$\frac{?s_k}{?d_{c_1}} \; ? \; \frac{k_5}{d_{c_1}}$

By equating the corresponding elements of the Jacobian of the structural and reduced form and solving we obtain:

$$
\begin{aligned}
?_1 &? k_1 \\
?_1 &? k_2 / k_1 \\
?_2 &? k_3 / k_1 \\
?_3 &? k_4 / k_1 \\
?_{d_2} &? k_5
\end{aligned}
$$

the partials $(?? / ??)(?? / ?z_r)$ of the sharing rule which is identified up to a constant. ?

Note that in the parametric context just described, identification is conditional upon the functional form. Proposition 2 shows that the partial effects of the sharing rule can be estimated directly from the structure. This feature greatly simplifies the estimation. Otherwise, we would need to estimate the parameters of the sharing rule as functions of the parameters of the conditional demand system or it would be necessary to estimate the reduced form in the first stage and then recover the partials of the sharing rule by imposing the above theoretical restrictions using a Minimum $?^2$ estimation procedure as performed by Chiappori, Fortin, and Lacroix (2002).

4 Model Specification and Estimation

The empirical application uses the collective demand system specified in terms of individual shares as described in the structural system of equations (5) in Proposition 2. The functional form of the Engel curves is of the Working-Leser type. Let the sharing function be specified as in Proposition 1.2:

$$
?^m ? ?^m(x_m, w_m, w_f, d_s) ? x_m ?(z) ? x_m ?(w_m, w_f, d_s)
$$

and the scaling function $?(z)$ as a Cobb-Douglas double-logarithmic form:

$$
?(w_m, w_f, d_s) ? \left(\prod_i w_i^{?_i} \prod_l d_{s_l}^{?_l} \right) \quad for \quad i ? m, f, \; l ? 1,.., L
$$

where $d_s ? z$ is now a Lx1 vector of demographic variables indexed by l=1,..,L. Then, the stochastic specification of the joint system is:

$$\begin{cases} s_k = \alpha_0 + \beta_1 \ln(x_m / \pi(w_m, w_f, d_s)) + \sum_{n=1}^{N} \delta_{d_n} \ln d_{c_n} + u_m \\ s_e = \alpha_0 + \beta_1 \ln(X - x_m / \pi(w_m, w_f, d_s)) + \sum_{n=1}^{N} \delta_{d_n} \ln d_{c_n} + u_f , \end{cases} \tag{6}$$

where d_c is an Nx1 vector of demographic variables indexed by n=1,..,N and u_m and u_f are spherical error terms. The variables included in the vector d_c are the age of the husband and the wife, the sector of employment[5], house ownership and area of residence. The set of variables $z \subset \{w_m, w_f, d_s\}$ argument of the scaling function π are the potential wages of wife and household head. The subset $d_s \subset z$ is composed of the age difference, the total household income, the difference in education of the partners, and the number of children between 6 and 18 years old. Adding up of the shares $s_o^m = s_k - 1$ and $s_o^f = s_e - 1$ requires that the complement shares are excluded from the system. For convenience, we excluded the shares of the ordinary goods s_o^m and s_o^f. The error terms of the system of equations are seemingly unrelated because the decisions of the husband and wife clearly interact. The set of parameters μ of the sharing rule are in fact the same in both individual systems of shares. The estimation is then performed jointly. The parameters of the excluded equations can be derived from the adding up conditions.

Both personal and total expenditures as well as wages may be endogenous (Mroz 1987) due to the presence of measurement errors and simultaneity and possible self-selection. The Wu-Hausman test reported in the Appendix rejects the exogeneity hypothesis. Therefore, personal and total expenditures have been instrumented following the procedure described in the Appendix. Exogenous potential wages have been estimated using full-information maximum likelihood applied to Heckman type earning functions. Given the high level of detail of the selected exclusive goods, the estimation strategy needs to account for zero expenditures both in qat and education. We implement the strategy by extending the method proposed by Heckman (1974, 1979) to the estimation of selection models within a system of equations. We describe what we term the Generalized Heckman (GH) procedure using the following representation of each censored equation in the system (6) :

[5] The dummy for employment takes the value of 1 if the head or the wife is employed in the public administration which is the largest employment sector in Djibouti.

$$s_? ? f_?(?_?, ?_?) ? u_? \text{ if } f_?(w_?, ?_?) ? ?_? ? 0$$

$$s_? ? 0 \text{ if } f_?(w_?, ?_?) ? ?_? ? 0, \tag{7}$$

where $s_?$ is the share corresponding to the ?-th equation in the system for ?=*k*,*e*, $?_?$, $w_?$ are vectors of explanatory variables, $?_?, ?_?$ are vectors of parameters with ß$_k$={?} and ß$_e$={?} and $u_?, ?_?$, $u_? \sim N(0, ?_{u?}^2)$ and $?_? \sim N(0, ?_?^2)$ are the ?-th components of the multivariate normal random vectors. The procedure transforms the system of censored equations in (7) into an unconditional system of uncensored equations by using the appropriate correction:

$$s_? ? ? E(s_? | s_? ? 0) ? ?_? ?_?(?_?, ?_?) ? ? \frac{f_t(w_?, ?_?)}{?_??} ? ? ?_? ? \frac{f_t(w_?, ?_?)}{?_??} ? ?_? \tag{8}$$

where the terms ? and ? denote the cumulative density function and the probability density function of the standard normal distribution. Note that the random errors $?_? ? s_? ? E(s_? | ?_?)$ with $? \sim MVN(0, ?)$ are different from the random variables of the censored system $u_?$. This expression corrects for the possible selection bias arising from the presence of zero realizations in the system of share equations. As shown in Arias and Perali (2002), the GH procedure gives comparable estimates in terms of both bias and efficiency with respect to other competing methods used to estimate a system of Tobit equations such as Minimum Distance and Simulated Maximum Likelihood. The GH procedure is here implemented using a Limited Information Maximum Likelihood estimation. In the first stage, probit estimates of ? and ? are obtained and are then used to estimate jointly the system of equations s_k, s_e corrected as shown in (8) by maximum likelihood. This guarantees that the results are invariant with respect to the deleted equations which, in this case, are the ordinary goods of both partners. Standard errors have been corrected for heteroskedasticity by computing the White consistent error variance-covariance matrix.

5 Data and Empirical Results

The cross-section data set is the national household survey (*EDAM, Enquête auprès des ménages*) conducted in 1996 by the Statistics Department of Djibouti (DINAS) among the sedentary population. The population is formed by four main groups: nomads, homeless, refugees and sedentary tribes that is the group targeted

by EDAM. The survey was articulated in a separate questionnaire for households and for individuals. The survey sampled 15,701 individuals belonging to 2,380 families. About 67 percent of the households lives in the city capital Djibouti, 16 percent in other towns and the remaining 17 percent in rural areas. Data on qat use reports weekly expenditures and the number of male and female users in the household. Because qat is perceived as a good rather than a bad, the consumption is revealed truthfully. For the purpose of estimating the sharing rule, we selected a subgroup of 1,271 male-headed households where both parents are present and have at least one child of school age. The average household size in the selected sample is 7.7 members where males and females are evenly represented. The 48 percent of the household heads and the 15 per cent of the wives has a primary education level corresponding to the ability to write and read and make simple computations. The 65 percent of the households in the subgroup lives in the capital Djibouti. As it is reasonable to expect, the households living in the city capital are more educated. Almost 80 percent of the household heads and 82 percent of the wives who have primary education live in Djibouti, the capital city. The education gap between urban and rural also partly explains the income differential between the city capital and the rest of Djibouti where incomes are in average half of the city income. The selected subgroup is composed by both *qat user* and *non qat user*[6] households, respectively the 56 and 44 percent of the sub-sample. The descriptive statistics of the variables included in the econometric analysis are reported in table 1.

Inspection of table 2 reveals that in average the largest expenditure item is food, taking 65 percent of the budget. Qat represents 15 percent of total household expenditure, energy is 11 percent, education 4 percent, clothing 4 percent and health 2 percent. The comparison of the average budget of the poor and non-poor Djiboutian household reveals that the qat share reaches a level of 23 percent in non poor households, while the education share shifts from 3 percent to 5 percent. This evidence reveals that when more resources become available to the family they are preferentially devoted to the consumption of qat rather than, for example, to the consumption of education or health care.

Table 3 shows how qat and education may trade within the household in relation to the household expenditure quintile and to the presence of a member who chews qat in the household. The *heavy qat user* households (that is households with a consumption of qat greater than the average) invest less in education with respect to *non qat user* ones. With the exception of the first quintile, where the number of *qat user* households is low, the annual expenditure on education per child is lower when in the family there is a heavy *qat chewer* (Table 3). This pattern suggests that the consumption of qat has a significant and negative impact on the allocation of resources to education.

[6] The term *qat user* refers to households with at least one member who chews qat.

Table 1: Descriptive Statistics.

Variables	Mean	Std.Dev.	Min.	Max.
Household Head				
Age	45.805	11.138	22	94
Education/years	3.089	4.529	0	16
Primary education *(1=Attained)*	0.487	0.501	0	1
(Log) daily wage	4.866	1.625	0.235	7.928
Wife				
Age	37.795	9.552	15	76
Education/years	1.018	2.732	0	16
Primary education *(1=Attained)*	0.159	0.366	0	1
(Log) daily wage	0.872	0.705	0.041	6.389
Family Characteristics				
Poor *(1= I-III Quintiles)*	0.684	0.4652	0	1
Living in the capital *(1=Djibouti)*	0.652	0.476	0	1
Qat user *(1=Qat User Household)*	0.563	0.496	0	1
House ownership *(1=Owner)*	0.704	0.456	0	1
No. students	1.095	1.370	0	8
Chlidren 6 -18	3.301	1.966	1	15
Children< 6	1.103	1.178	0	7
Children's 6-18 average age	11.396	3.058	6	18
Average household size	7.683	2.859	2	27
No. Males	3.843	1.945	1	15
No. Females	3.841	1.841	1	15
Husband's age-Wife's age	2.071	3.817	-12	16
Husband's education-Wife's education	8.011	7.391	-12	51
Expenditures (Djiboutian Francs)*				
Male total expenditure	542458	488341	9460	4475820
Qat share	0.24	0.24	0	0.86
Male's ordinary goods share	0.76	0.23	0.14	1
Female total expenditure	392717	300412	18960	2845460
Education share	0.08	0.11	0	0.84
Female's ordinary goods share	0.92	0.11	0.16	1
Total expenditure	935176	726741	28420	5776680
Total household income	940856	939861	1328	9519561

Observations: 1271. (*) Exchange Rate in 1996 1US$=Fdj 177.21

Table 2: Composition of the Djiboutian Budget by Income Class

Expenditure shares	*Poor Hous. I-III Quintiles Observations 869*			*Non Poor Hous. IV-V Quintiles Observations 402*			*Total sample Observations 1271*		
	Mean	% of Trunc.	Std.Dev.	Mean	% of Trunc.	Std.Dev.	Mean	% of Trunc.	Std.Dev.
Qat and cigarettes	0.12	0.49	0.15	0.23	0.16	0.18	0.15	0.44	0.17
Education	0.03	0.32	0.06	0.05	0.21	0.09	0.04	0.28	0.07
Food	0.71	0	0.16	0.53	0	0.15	0.65	0	0.18
Clothing	0.04	0.25	0.04	0.04	0.07	0.03	0.04	0.19	0.04
Health	0.01	0.53	0.03	0.02	0.24	0.03	0.02	0.44	0.08
Energy	0.09	0.12	0.07	0.13	0.01	0.08	0.11	0.08	0.03

Table3: Annual Expenditure on Education per Child by Income Quintile and Presence of a Heavy (*) *Qat User* Member in the Household

	Annual Expenditure on Education per Child Non Qat User Household				
Quintile	Mean	Std. Dev.	Min	Max	Obs.
I	2669	5217	0	34250	271
II	7232	12024	0	83200	124
III	17111	24908	0	119501	77
IV	18810	24884	0	94800	46
V	49833	105423	0	590000	37
	Heavy (*) Qat User Household				
I	3002	5074	0	33520	65
II	6001	9945	0	69800	105
III	7777	10817	0	79600	132
IV	17840	30000	0	205000	133
V	32586	46968	0	255000	115

(*) Heavy = Qat Consumption Greater than the Average in Qat User Households

Table 4 reports the estimates of the collective system of individual share demands for qat and education (equation 2). The estimates are corrected for the presence of both *qat user* and *non qat user* households in the sample and of

children who do not receive education using the Generalized Heckman procedure. All the parameters of the sharing rule are significantly different from zero at the 5 percent significance level. The level of significance is high also for the coefficients associated with the other demographic variables included n the estimated individual demands. The signs are coherent with expectations.

Table 4: Joint Estimates of the Collective Demand System

		Estimate	Standard Error
Sharing rule variables	Age difference	-0.0042	0.0006*
	Household Head's wage	-0.0249	0.0027*
	Wife's wage	-0.0831	0.0269*
	Total Household Income	0.0514	0.0024*
	Children 6-18 years	-0.0833	0.0286*
	Education difference	-0.0265	0.0110*
(I) *Household Head's demand variables*	Constant	-2.0347	0.4511*
	Age	-0.0008	0.0010
	Living in the capital *(1=Djibouti)*	-0.1012	0.0309*
	House ownership	0.0058	0.0230
	Husband's profession	-0.0261	0.0240
	Log(?X_m)	0.1866	0.0324*
	s	0.1917	0.0663*
(II) *Wife's demand variables*	Constant	-0.1807	0,1083
	Age	0.0010	0.0005*
	Living in the capital *(1=Djibouti)*	0.0365	0.0099*
	House ownership	0.0168	0,0099
	Wife's profession	-0.0076	0.0140
	Log(X-?X_m)	0.0203	0.0083*
	s	-0.0947	0.0211*

Observations: 1271. (*) Denotes Statistically Significant Coefficients at the 5 %
(I) Dependent Variable: Qat Share
(II) Dependent Variable: Education Share

Table 5 presents the *predicted* values of *?* and the share of male expenditure, the *actual* value of the share of male expenditure computed at the mean. For convenience of interpretation, the sharing rule is predicted anchoring the partial effects to the household-specific constant given by x_m^h / X for the *h*-household. The value of *?* gives the total effect of the exogenous variables included in the sharing rule as an index describing the percentage of income transferred from the man to the woman. In average, the man transfers 5 percent of his income to the wife.

We present a graphical analysis in order to visualise the impact of the partial effects of the sharing rule on the decision process and to verify how the distribution of power varies within the household.

Table 5: Predicted and Actual Values of the Sharing Rule

	Mean	Std Deviation	Min	Max	Obs.
Total household expenditure	935176	726141	28420	5776680	1271
Predicted values					
?	1.15	0.22	0.44	1.89	1271
f/X	0.64	0.13	0.28	0.99	1271
Actual values					
X_m/X	0.56	0.09	0.14	0.87	1271

The size of the intra-household transfers is positively and significantly affected by the (potential) wage of the wife, the age difference, the number of children and the level of education of the wife and the household head.

When the wife's wage increases she has more control over the household resources and can divert them from the consumption of qat toward the satisfaction of other household needs (Fig. 1). Further, an increase in the number of children and in the partner's age and education difference, the latter due to an increase in wife's or household head's years of education reduces *?* and then positively affects the expenditure share of the wife (Fig. 2-3).

An increase in the household head's age and education makes him more aware of the household needs and reduces the qat expenditure share increasing the amount of resources transferred to the spouse.

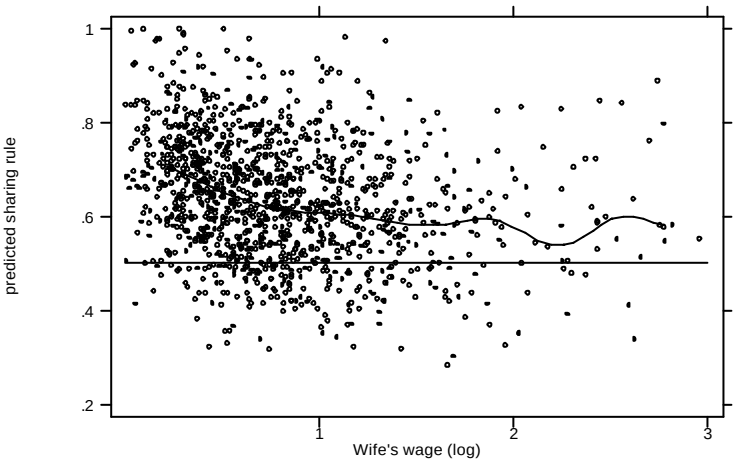

Fig. 1: Sharing Rule and Wife's Wage

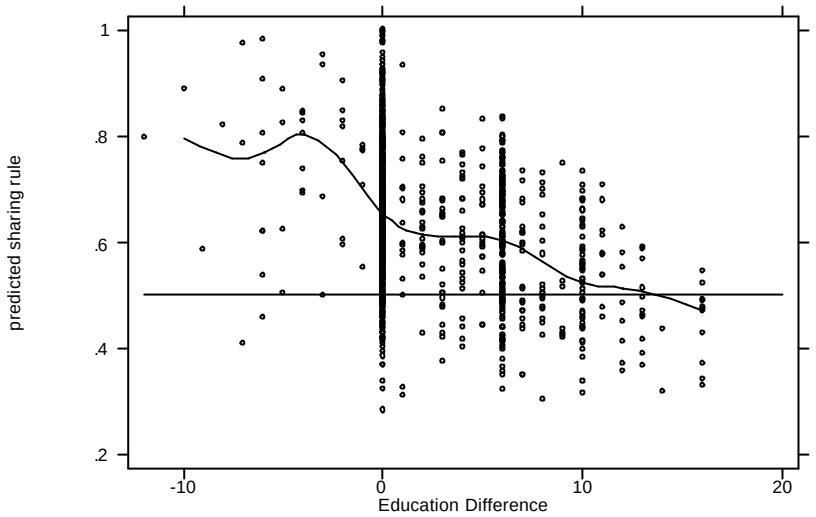

Fig. 2: Sharing Rule and Difference in Education

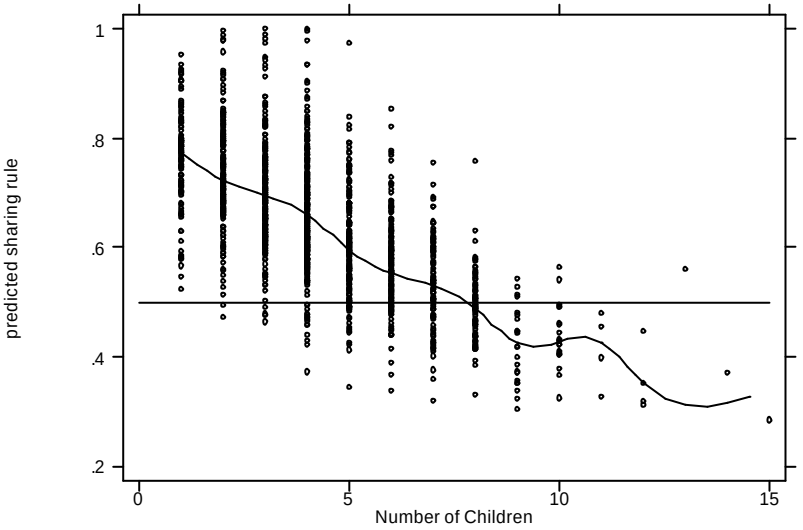

Fig. 3: Sharing Rule and Number of Children

The effect of household income is significantly different from zero at the 5 percent significance level. The positive sign compensates the negative effect associated with the wage of the household head. Inspection of table 6, describing the predicted values of the sharing rule in poor and non poor households, and in poor and non poor households differentiated by the consumption of qat, shows that in both poor and non poor households the household head keeps for himself a high proportion of the household resources but when more resources become available to the family the man share increases.

Table 6: Predicted Sharing Rule by Income level and Consumption of Qat at Household Level

	Poor	*Non Poor*	*Qat user Poor*	*Non Qat User Poor*	*Qat User Non Poor*	*Non Qat User Non Poor*
Total hous. expenditure	566299	1538018	679597	471003	1541107	1526147
Predicted values						
?	1.16	1.14	1.13	1.18	1.15	1.11
f/X	0.62	0.67	0.62	0.62	0.68	0.62
Actual values						
X_m/X	0.54	0.59	0.61	0.48	0.62	0.47
Observations	869	402	397	472	319	83

Qat user poor households are relatively more rich with respect to the *non-qat user poor* ones (the level of total household expenditures are respectively 679597 DjF and 471003 DjF). However, the greater availability of resources does not imply a more egalitarian distribution between husband and wife since the share of the household head remains relatively high. Qat consumption and income effects are related. Among the poor, the households with a relatively higher availability of resources devote relatively more resources to the consumption of qat.

Among the *non-poor* households (Table 6) there are no significant differences in the level of total expenditure. For *non-poor* households the share of the household head increases from 0.62 for *non-qat users* to 0.68 for *qat user*s and the amount of resources transferred to the wife is relatively lower.

Both in *poor* and *non-poor* households, when the male share is large, males have enough money to consume qat: qat is associated with higher inequality in the distribution of resources that could have otherwise been shared by the family as shown in figure 4 depicting the evolution of the sharing rule between *qat user* and *non qat user* households. The figure shows that the differences in sharing behaviour between *qat user* and *non qat user* households increases with the level of income. The sharing rule in *qat user* households lies always above the sharing rule of households not consuming qat (in figure 4 the highest and lowest curves represent respectively the predicted sharing for qat user and non qat user households).

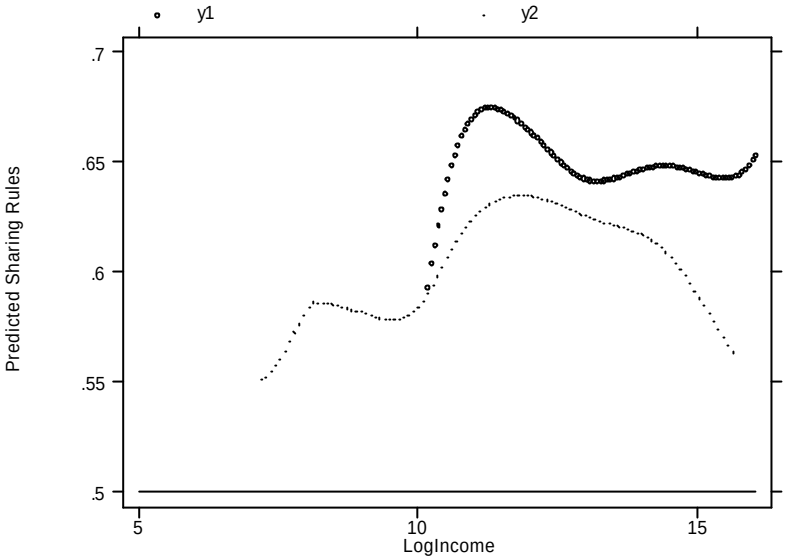

Fig. 4: Sharing Rule in *Qat User* and *Non Qat User* Households

6 Conclusion and Policy Implications

In this paper we analysed how *qat* consumption is associated with the household resource allocation mechanism. The fact that this drug is an exclusive good, along with a novel specification of a collective system of individual demands, enabled us to identify the sharing rule between members of the household with different and often contrasting needs. On one side, there is the head of the household who uses qat. On the other side, there are school age children who are represented by the mother asking for greater support for their education.

Our findings show that qat consumption is associated with higher inequality in the distribution of resources within the family. The observation of a similar sharing rule in both *qat user* and *non qat user* poor households indicates that qat is an adult good hindering a more egalitarian allocation of resources which could be distributed among other members of the household and invested in education. In non poor households consuming qat we observe a sharp shift of the bargaining power towards the husband. This indicates that the adult male enjoys in this type of households a position of privilege.

The estimates of the sharing rule show that the size of the intra-household transfers is positively related to an increase in the level of education of the partners. Higher levels of education contribute to augment the human capital necessary to increase awareness of the negative effects of a century long habit which has become a means of social legitimisation, reducing the amount of

resources kept by the male and positively influencing the degree of equality in the household distribution process.

An important role in the intra-household distribution process is played by the wife. When she works and obtains a higher wage she can divert more resources from the consumption of qat towards the satisfaction of other family needs. For policy purposes, welfare payments should be then given directly to the wives who perform the household chores and care for the children and who generally do not use qat. For example, it would be possible to offer preferential access to certain public services so that the decision-making power of the head of the household could not interfere with resource allocation, and in general it would be advisable to establish direct contacts with those directly penalised by distorted resource allocation within the household.

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Appendix A. Endogeneity

Following Mroz (1987), to test for the endogeneity of individual and total expenditures and wages X, we use the Wu-Hausmann test. This is performed including the residuals of each endogenous variable, obtained from the regression of all the exogenous variables, in the regression of the demand function for the qat and education. If the residuals are significantly different from zero, then endogeneity cannot be rejected. The model can be expressed in a general form as:

$$y_i = X_i'\beta_o + x_i'\beta_o + u_i = Z_i'\beta_o + u_i$$

$$Z_i' = \begin{bmatrix} X_i \\ x_{1i} \end{bmatrix} \quad f(x_i) = \begin{bmatrix} E(X_i \mid x_i) \\ x_{1i} \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} \varepsilon_i \\ 0 \end{bmatrix}$$

where $E(u_i \mid x_i) = 0$, X_i is the possible endogenous variable, x_i is a vector of exogenous variables and x_{1i} is a subset of x_i. The second equation is a reduced form expression for the possible endogenous variable as function of all exogenous variables in x_i.

The results of the instrumentation procedure are reported in tables A.1, A.2, A.3, A.4 and A.5.

Table A.1: Instrumental Regression for Household Head Total Expenditure

Dependent Variable *Household Head's Total Expenditure*	Coefficients	Std Error
Household Head's age	-0.0272	0.0135*
Household Head's primary education *(1= Attained)*	0.1921	0.0467*
Living in the capital *(1=Djibouti)*	0.1649	0.0445*
House ownership	-0.0542	0.0342
No children 6-18	-0.0147	0.0077*
Partners education difference	-0.0198	0.0121
Partners age difference	-0.0036	0.0145
Household Head's wage /log	0.4301	0.0186*
Wife's wage /log	0.3266	0.0579*
Transfers	0.0001	0.0001*
Potable water *(1=if House has Potable Water)*	0.3123	0.0362*
Wife's primary education *(1= Attained)*	-0.0685	-0.0641
Household Head's age square	0.0006	0.0001*
Wife's age square	0.0000	0.0001
Household Head's education square	-0.0006	0.0008
Wife's education square	-0.0080	0.0016*
Car ownership	0.0609	0.0613
House surface	0.0017	0.0004*
Livestock ownership	0.0721	0.0389*
Access to health service	0.0304	0.0359
Presence of bathroom	0.0793	0.0453*
children0-5*wife's age	-0.0025	0.0046
children0-5*household head's age	0.0026	0.0037
constant	10.0001	0.2792*

Obs.: 1271. (*) Denotes Statistically Significant at the 10 % Level

Table A.2: Qat Share Function

Dependent Variable *Share of Qat*	Coefficients	Std Error
Household Head's age	0.0034	0.0014*
Household Head's primary education *(1= Attained)*	-0.0110	0.0149
Living in the capital *(1=Djibouti)*	-0.0241	0.0144*
House ownership	-0.0114	0.0115
No children 6-18	-0.0071	0.0022*
Partners education difference	-0.0052	0.0017*
Partners age difference	-0.0002	0.0009
Household Head's wage /log	0.0463	0.0114*
Wife's wage /log	-0.0233	0.0086*
Household Head's total expenditure	0.1129	0.0250*
Residuals	0.1400	0.0267*
constant	1.5001	0.2192*

Obs.: 1271. (*) Denotes Statistically Significant at the 10 % Level

Table A.3: Instrumental Regression for Wife Total Expenditure

Dependent Variable *Wife's Total Expenditure*	Coefficients	Std Error
Wife's age	-0.0004	0.0112
Wife's primary education *(1=Attained)*	0.0118	0.0529
Living in the capital *(1=Djibouti)*	0.2613	0.0367*
House ownership	-0.0097	0.0282
No children 6-18	0.0151	0.0064*
Partners education difference	-0.0242	0.0100*
Partners age difference	-0.0169	0.0095*
Household Head's wage /log	0.2517	0.0154*
Wife's wage /log	0.1609	0.0479*
Transfers	0.0000	0.0000*
Potable water *(1=if House has Potable Water)*	0.3120	0.0299*
Household Head's primary education *(1=Attained)*	0.1937	0.0386*
Household Head's age square	0.0004	0.0001*
Wife's age square	-0.0001	0.0001
Household Head's education square	0.0010	0.0007
Wife's education square	-0.0056	0.0014*
Car ownership	0.0839	0.0507
House surface	0.0021	0.0004*
Livestock ownership	0.0629	0.0321*
Access to health service	-0.0435	0.0297
Presence of bathroom	0.1464	0.0374*
children0-5*wife's age	-0.0051	0.0038
children0-5*household head's age	0.0040	0.0031
constant	10.1771	0.2307*

Obs.: 1271. (*) Denotes Statistically Significant at the10 % Level

Table A.4: Education Share Function

Dependent Variable *Share of Education*	Coefficients	Std Error
Wife's age	0.0022	0.0007*
Wife's primary education *(1= Attained)*	-0.0016	0.0111
Living in the capital *(1=Djibouti)*	0.0305	0.0088*
House ownership	0.0151	0.0066*
No children 6-18	0.0074	0.0013*
Partners education difference	0.0008	0.0009
Partners age difference	0.0011	0.0006*
Household Head's wage /log	0.0055	0.0050
Wife's wage /log	0.0083	0.0059
Wife's total expenditure	0.0261	0.0141*
Residuals	0.0507	0.0157*
constant	-0.4381	0.1319

Obs.: 1271. (*) Denotes Statistically Significant at the 10 % Level

Because individual expenditures are endogenous, we also instrument total household expenditure as shown in table A.5.

Table A.5: Instrumental Regression for Total Household Expenditure

Dependent Variable *Total Expenditure*		Coefficients	Std Error
Household Head's age		-0.0157	0.0117
Wife's primary education	*(1= Attained)*	-0.0326	0.0554
Household Head's primary education	*(1= Attained)*	0.1958	0.0403*
Living in the capital	*(1=Djibouti)*	0.2106	0.0385*
House ownership		-0.0342	0.0296
No children 6-18		-0.0025	0.0067
Partners education difference		-0.02303	0.0105*
Partners age difference		-0.0103	0.0126
Household Head's wage /log		0.3599	0.0161*
Wife's wage /log		0.2574	0.0501*
Transfers		0.0001	0.0000*
Potable water	*(1=if House has Potable Water)*	0.3097	0.0314*
Household Head's age square		0.0005	0.0001*
Wife's age square		-0.0001	0.0001
Household Head's education square		0.0002	0.0007
Wife's education square		-0.0072	0.0014*
Car ownership		0.0718	0.0530
House surface		0.0019	0.0004*
Livestock ownership		0.0722	0.0336*
Access to health service		0.0015	0.0311
Presence of bathroom		0.1016	0.0392*
children0-5*wife's age		-0.0038	0.0040
children0-5*household head's age		0.0033	0.0033
constant		10.7371	0.2413

Observations: 1271. (*) Denotes Statistically Significant at the 10 % Level

Appendix B. Estimation of Potential Wages

Potential male and female wage rates in the model are predicted from a wage equation estimated by applying the Full Information Maximum Likelihood Procedure (Amemiya, 1985) both for the household head and the wife.

The results are reported in table B.1 and B.2.

Table B.1: Potential Wages Estimation for the Household Head

Regression Equation *Dependent Variable* *Household Head's Daily Wage/log*		Coefficient	Std Error
Education-years		0.0423	0.0071*
Age		0.0402	0.0209*
Age square		-0.0001	0.0002
Living in the capital	*(1=Djbouti)*	0.3760	0.0651*
Profession	*(1=Public Administration)*	0.1077	0.0525*
constant		6.1273	0.4833*
Selection equation			
Age		0.0150	0.0267
Age square		-0.0005	0.0003
Education-years		0.0229	0.0118*
Education*children0-5		-0.0097	0.0066
Age*children0-5		-0.0026	0.0025
No children 0-5		0.1822	0.1245
No children 6-18		0.0429	0.0163*
Living in the capital	*(1=Djbouti)*	-0.0819	0.0811
Qat User	*(1=Qat User Household)*	0.1676	0.0668*
No of household components searching job		-0.0669	0.0195*
Transfers		-0.0000	0.0000
Non Poor	*(1=IV-V quintiles)*	0.6520	0.0834*
constant		0.3112	0.6572
rho		-0.9101	0.0154

Observations: 1271; Censored 431, Uncensored 840. (*) Denotes Statistically Significant at the 10 % Level

Table B.2: Potential Wages Estimation for the Wife

Regression Equation *Dependent Variable* *Wife's Daily Wage/log*	Coefficient	Std Error
Education-years	0.1856	0.0272*
Age	0.1048	0.0612*
Age square	-0.0008	0.0007
Living in the capital *(1=Djbouti)*	0.5010	0.1882*
Profession *(1=Public Administration)*	-0.0639	0.1356
constant	2.1911	1.4696
Selection equation		
Age	0.1277	0.0424*
Age square	-0.0012	0.0005*
Education-years	0.1200	0.0222*
Education*children0-5	-0.0073	0.0105
Age*children0-5	-0.0091	0.0054*
No children 0-5	0.3044	0.2024
No children 6-18	0.0215	0.0220
Living in the capital *(1=Djbouti)*	0.3113	0.1129*
Qat User *(1=Qat User Household)*	0.0602	0.0861
No of household components searching job	0.0442	0.0283
Transfers	0.0001	0.0000*
Non Poor *(1=IV-V quintiles)*	0.1795	0.1058*
constant	-4.1695	0.8856*
rho	0.8772	0.0605

Observations: 1271; Censored 1119, Uncensored 152. (*) Denotes Statistically Significant at the 10 % Level

Table B.1 shows that the presence of children 6-18 significantly affects the participation decision of the household head. The likelihood of a male being employed is positively affected by the level of education, the presence of a qat user in the household and the level of wealth of the family, and is negatively

affected by the presence of other household members searching job. The probability of a man being employed is not significantly affected by the region of residence, while this is an important factor influencing the wife's decisions (Table B.2). The likelihood of the wife being employed is positively affected by the age and level of education, the region of residence and the level of household wealth.

The specification of the wage equation includes variables so as to represent human capital and regional dummies to take into account the effect of the labour market situation on wages. Rates of return from schooling (years of education) are positive and age positively influences the wage of both household head and wife. Wages are significantly higher for both men and women living in the capital Djibouti rather than in the other urban and rural areas.

It is interesting to note that the potential wage for the non working wife is very low (4.48 DjiF at the mean compared to 361 DjiF for the man) as we expect it to be considering that the job market offers rare formal employment opportunities to low skill women. Women are often employed in the informal sector at a very low and irregular daily pay.