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A Collective Model of Female Labor Supply: Do Distribution Factors Matter in the Egyptian Case? *

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Abstract

Nous estimons un modèle collectif d'offre de travail. Pour les femmes, l'offre de travail est modélisée dans le cadre d'un modèle de choix discret prenant en compte la possibilité de non-participation (Vermeulen, 2006). Contrairement, l'offre de travail des hommes est considéré comme exogène dans cette étude. Le modèle collectif est estimé sur des données égyptiennes provenant du "Egyptian labor market and panel survey" de 2006. L'originalité de cette étude est de tester la validité de nouvelles sources de pouvoir pour les femmes comme facteurs de distribution. Ces dernières sont des variables liées au marché du mariage, à la violence domestique, à l'accès direct de la femme au revenu du ménage, ainsi que sa participation dans la prise de décision dans la famille. L'identification du modèle repose principalement sur l'hypothèse que seulement certains des paramètres sont identiques pour les femmes mariées et pour les femmes célibataires. Nous trouvons de fortes relations entre ces dernières et l'offre de travail des femmes.

Abstract

This paper examines the intrahousehold ressource allocation in Egyptian married couples and its impact on females labor supply. Using data from the Egyptian Labor market and Panel Survey of 2006, we estimate a discrete-choice model for female labor supply within a collective framework. The economic model incorporates the possibility of non-participation for females which represents the working situation of more than 70 percent of Egyptian married women. The originality of this paper consists on testing new distribution factors, i.e., a set of exogenous variables which influence the intrahousehold allocation of resources without affecting preferences or the budget constraint. The latter are variables related to the marriage market, gender attitudes, domestic violence, direct access to the household income and participation in household decision making. Identification of the model relies on the assumption that only some parameters of the utility function are identical for single and married females. We find significant relations between females bargaining power and labor supply decisions. This study's results has important policy implications.

JEL classification: D11, D12, J22

Mots-clés : Modèle collectif d'offre de travail, Facteurs de distribution, Maximum de Vraisemblance Simulée, Egypte.

Keywords: Collective model, labor supply, Distribution factors, Maximum simulated likelihood, Egypt.

1 Introduction

Recent studies have shown that gender inequalities persist in the household sphere as well as in the labor market. The latter result has been verified in both developed and developing countries. The present paper aims at exploring intrahousehold ressource allocation in married couples in Egypt.

The standard and basic 'Unitary' approach considers the household as a single decision making unit. This unitary framework is also called 'inefficient household modeling' since the income pooling assumption has largely been rejected in previous studies (Thomas, 1990; Clark et al., 2004; Lundberg et al., 1997; Fortin and Lacroix, 1997; Duflo, 2003). And using Egyptian micro data, a recent study by Namoro and Roushdy (2008), has also rejected the unitary approach. Moreover, the latter model does not allow to study intrahousehold allocation issues since it completely overlooks all kinds of multi-sources of power that could exist between members of a same household. For those reasons, a growing literature on the collective modeling of the household that is also called 'the individualistic approach', has been introduced by Chiappori (1988b, 1992) and Apps and Rees (1988). The latter has been progressively applied in microeconomic literature in order to study intrahousehold allocations with regards to the plurality of the decision makers within the household. The key assumption of the collective model is that the behavior of family members can be seen as the outcome of an pareto efficient process (Chiappori, 1988, 1992; Browning and Chiappori, 1998; Dauphin and Fortin, 2001; Vermeulen, 2002a; Chiappori and Ekeland, 2002a; Donni, 2004). In addition to that, testable implications of the collective approach turn out to be less restrictive than those of the unitary one.

Using data from the Egyptian Labor market and Panel Survey of 2006, we estimate an econometrically identifiable collective model of labor supply which incorporates the possibility of non-participation for females. The model is estimated using conditional logit and mixed logit specifications. In the latter case, estimation is done by the Maximum Simulated Likelihood.

The collective framework that we estimate is inspired from Vermeulen (2006). The novelty of the present study lies in the application of the model to within ressource allocation issues in Egypt. Original distribution factors are tested here. Though, our model suffers

from the non incorporation of neither tax schemes nor domestic activities. One more limitation of the Vermeulen's model is that male labor supply is considered to be exogenous. In the empirical work, both married females' preferences and their share of total household consumption are completely identified. Two types of females are considered in this study. On the first hand, we consider married women currently living with their husband conditional on the non presence of young children (aged less than 15). And on the other hand, we consider single women in age of marriage who are still living in the parental household. Egoistic preferences are assumed, i.e., women only care about their own consumption and their own leisure. Single women preferences are directly recovered since both working hours and consumption can be calculated at each alternative. Note that, as a result of cultural and religious habits in Egypt, females in age of marriage continue living in their parental household till they get married. Then, we rely on the Equivalent scales method in order to calculate their non labor income share. For married women, the individual consumption cannot not observed, which means that the coefficient on the female's individual consumption is no longer identified. For this, the assumption that some, and not all, coefficients of the utility function are identical is key for the complete identification of the sharing rule. Only the coefficient on the working hours variable is allowed to differ between the two groups of women.

The present research is then interested in the bargaining power of Egyptian females and its main goal is to determine the share that each partner receives from the household net income.

The outline of the paper is as follows: Section 2 presents the literature review on the subject in both developed and developing countries. Section 3 exhibits the Vermeulen (2006)'s discrete choice model of female labor supply and discusses the identification of the sharing rule. Section 4 is devoted to the presentation of the data used in the empirical work as well as the original sources of females empowerment. Section 5 presents the main results. And, section 6 concludes and discusses the main policy implications of the study.

2 The Discrete Choice Model of Labor Supply

The model we estimate is inspired from Vermeulen (2006). This is a discrete choice model of labor supply that takes into account the possibility of non participation for females. As describes above, two types of household are considered in this analysis: single females still living in parental households and married females currently living with their husband. Only the females labor supply is modeled and males labor supply is assumed to be exogenous.

2.1 Females Preferences

Following Vermeulen (2006), we consider all households that consist of two working age individuals; the female and the male (f and m). Males labor supplies are considered to be exogenous and fixed to full time; which is clearly supported by our data since all males in our sample are working around 48 hours per week. Furthermore, the model assumes egoistic preferences which implies that females have preferences only over their own consumption and their own leisure (see Chiappori; 1998). [1]

Female labor supply is modeled as a disrete choice between J alternatives for weekly working hours (Van Soest, 1995). Regarding the estimation methodology, we opt for both conditional logit and mixed logit specifications in order to compare the different utility levels associated to each of the labor supply alternatives. Then, in a second stage, we choose the choice that yields the highest utility. In other words, the female i chooses the alternative j only if her utility u_{ij}^{f} is the maximum among the J alternatives. Hence, the statistical model is driven by the probability that the choice j is made (Greene, 2003),

$$Prob(u_{ij} > u_{ik}) for j \neq k$$

The utility of alternative j for the individual f is represented as follows,

$$u_{fj} = V(c_{fj}, l_{fj}, d_f) + \varepsilon_{fj} \quad (1)$$

[1] The assumption of egoistic preferences.can be relaxed by assuming "'caring" preferences which would imply that individual preferences will also depend on their partner consumption and leisure.

where c_{fj} is the female's private consumption at alternative j, l_{fj} represents the female's working hours encompassing the time spent on domestic activities. And d_{fj} consists on a vector of individual characteristics as the age, the education level and the region of residence. Then, this vector consists on capturing the preferences observed heterogeneity. Note that individuals' consumptions, for both singles and married women, cannot go beyond the household's gross income. Budget constraints can then be represented as,
for married females:

$$c_{fj} + c_{mj} \leq Y + w_{fj}l_{fj} + w_{mj}l_{mj} \equiv x \tag{2}$$

for single females:

$$c_{fj} \leq Ysingle + w_{fj}l_{fj} \tag{3}$$

Where Y is the household's non labor income, w_{fj} denotes the female's hourly wage rate at alternative j, l_{fj} is the female's labor supply, and c_{fj} represents the individual's private consumption.
For single women, consumption c_{fj} is equal to the net income , which is calculated for each j alternative from knowledge of the wage offer (observed or potential wages) and of non labor income. Note that, as a result of the traditional and religious norms in Egypt, single women continue living in their parents' household till moving to the marital household. Consequently, the singles' non labor income is not observed. One way to calculate it is by relying on the 'Equivalent scales' method. This method is approved by statisticians and it consists on dividing the parental household's non labor income by the number of individuals living in it in order to obtain $Ysingle$, which represents the non labor income of single females. And, since w_{fj}, l_{fj} and $Ysingle$ are observed, the individual's consumption can simply be calculated for single women. And, the estimation of the discrete choice model is straightforward. However, for married females, only the household consumption $(c_{fj} + c_{mj})$ can be obtained. Consequently, the parameters of the female's utility function are no longer identified. With the unitary framework, this model doest not seem to be a problem since the household is assumed to be acting as a single individual. This implies, consequently, the famous income pooling assumption that

consists on the idea that it makes no difference whether the non labor income is addressed to the husband or the wife. However, as presented above in this study, this assumption has largely been rejected using data from both developed and developing countries. And, for the case of Egypt, Namoro and Roushdy (2008) have rejected the unitary approach when they showed that mothers and fathers characteristics have differential effects on children's education. Moreover, The unitary framework does not allow the study of intrahousehold allocation issues, which represents the main objective of the present research. All those reasons motivate us to rather rely on the collective framework.

Collective models are also called "efficient models" because they rely on the famous Pareto efficiency assumption regarding household outcomes (see Chiappori; 1988, 1992). The latter assumed to be the result of a two stage budgeting process. The first stage consists on distributing the total household expenditure among members of the same household. this income distribution process is mainly the result of spouses bargaining powers. And, in a second stage, each spouse maximizes its utility subject to his budget constraint resulted from the first stage. This process leads to the following maximization problem,

$$max_{c_{fj}l_{fj}} V(c_{fj}, l_{fj}, d_f) \tag{4}$$

subject to:

$$c_{fj} \leq \phi(x, z) \tag{5}$$

where $\phi(.)$ is the sharing rule function which represents the female's share of the total household expenditure. This share directly depends on individual wages, household's non labor income and a vector z of distribution factors. , i.e., exogenous variables which influence the intrahousehold allocation of resources without affecting preferences or the budget constraint.

Following Vermeulen (2006), we assume the following functional form for the observed part:

$$V_{fj} = \beta_l(d_f)l_{fj} + \beta_{ll}(d_f)(l_{fj})^2 + \beta_c c_{fj} + \beta_{cl} l_{fj} c_{fj} \tag{6}$$

Then, the female's utility function depends not only on factors that varies across the alternatives as c_{fj} and l_{fj} but also on individuals specific variables as d_f. Consequently, the model has to allow for individual specific effects. And, one way to do so is to introduce a variable for the choices and multiply it by this individual specific vector d_f in order to allow the coefficient to vary not only across the individuals but also across the alternatives (Greene, 2003).

As mentioned above, individual levels of consumption c_{fj} can only be calculated for single females. However, for married females, we observe their household consumptions. Though, we know that the private consumption of the latter group equals to the share of the total household consumption x that is allocated to them via the sharing rule.[2]

2.2 Introducing Unobserved Heterogeneity

Individual unobserved heterogeneity is introduces into the model via the following terms: $\beta_{ll}(d_f)$ and $\beta_l(d_f)$ as there is random variation in the coefficients on l and l^2 conditional on the observed factors d,

$$\beta_{ll}(d_f) = \beta_{ll0} + \beta_{ll1}^{'} d_f + \nu_{llf} \tag{7}$$

$$\beta_l(d_f) = \beta_{l0} + \beta_{l1}^{'} d_f + \nu_{lf} \tag{8}$$

Those additional parameters $\beta_{ll}(d_f)$ and $\beta_l(d_f)$ are estimated using a random coefficient model (mixed logit model). This model is estimated using Maximum Simulated Likelihood (Train, 2003). And, the errors terms ν_{llf} and ν_{lf} are assumed to be normally distributed as follows,

$$\begin{pmatrix} \nu_{llf} \\ \nu_{lf} \end{pmatrix} \approx N(0, \Sigma)$$

with

$$\Sigma = \begin{pmatrix} \sigma^2_{\nu ll} & \rho \\ \rho & \sigma^2_{\nu l} \end{pmatrix} \approx N(0, \Sigma)$$

For simplicity, and following Vermeulen (2006), we assume that $\rho = 0$.

[2]This share is the result of the bargaining process.

2.3 The Sharing Rule

Estimating the sharing rule is one the main goals of this study. The latter can be defined as the unobserved share κ that the female gets from the household net income through some bargaining process. And, as presented in the equation bellow, this sharing rule ϕ is function of individual characteristics x_{fj} as well as a vector z_f of distribution factors.

$$c_{fj} = \phi(x_{fj}, z_f) \tag{9}$$

One main contribution of this paper is the testing of distribution factors that are new to the literature on collective model and quite original to the Egyptian context such as the contribution to the costs marriage, gender attitudes, domestic violence, direct access to the household income and participation in household decision making.
The sharing rule itself can the be written as follows,

$$\phi(x_{fj}, z_f) = (1 + \kappa_1 + \kappa_2 z_f) x_{fj} \tag{10}$$

where κ_1 and κ_1 represent the sharing rule parameters to be estimated. As κ_2 represents the distribution factor parmarmeter, the idea is that if κ_2 is positive, then, more empowered women get a bigger share of the household net income than less empowered ones. And this is assumed to have important implications on females labor supply decisions.
To take into account the single versus married women distinction, we also add the indicator variable $dCouple_f$. [3]
The private consumption of all women, whether married or singles, can then be re-written as follows,

$$c_{fj} = (1 + \kappa_1 dCouple_f + \kappa_2 dCouple_f z_f) x_{fj} \tag{11}$$

[3]This indicator variable equals to 1 if married and equals to zero if single.

2.4 Identification

The model aims at identifying the sharing rule of married females using preferences of single ones. This identification procedure has already been applied in some of the previous studies. Bamby and Smith (2001) assumed that all preferences of individuals in couples are similar to those of singles. However, in the present study, as in Vermeulen (2006), this assumption will be relaxed as it will presented in details in this section.
The identification procedure consists on the use of the difference in parameters between single and married females in order to infer something about the sharing rule.
By plugging the last private consumption's equation into the utility function to obtain,

$$\begin{aligned} U_{fj} &= \beta_l d_f l_{fj} + \beta_{ll} d_f (l_{fj})^2 + \beta_c (1 + \kappa_1 dCouple_f + \kappa_2 dCouple_f z_f) x_{fj} \\ &\quad + \beta_{cl} l_{fj} (1 + \kappa_1 dCouple_f + \kappa_2 dCouple_f z_f) x_{ij} + \varepsilon_{fj} \end{aligned} \tag{12}$$

This last expression can also be written separately for married and single females.
for married females: where $dCouple_f = 1$

$$\begin{aligned} U_{fj} &= \beta_l d_f l_{fj} + \beta_{ll} d_f (l_{ij})^2 + [\beta_c x_{fj} + \beta^*_{c1} dCouple^*_f x_{fj}] \\ &\quad + [\beta_{cl} l_{fj} x_{fj} + \beta^*_{cl1} dCouple^*_f l_{fj} x_{fj} + \beta^*_{cl2} z_f l_{fj} x_{fj}] \end{aligned} \tag{13}$$

for single females: where $dCouple_f = 0$

$$U_{fj} = \beta_l d_f l_{fj} + \beta_{ll} d_f (l_{fj})^2 + \beta_c x_{fj} + \beta_{cl} l_{fj} x_{fj} \tag{14}$$

The latter equations show that single and married females may react differently to labor supply parameters β_l and β_{ll}. The parameters for single women are β_c; β_{cl} and those for married women are $\beta^*_{c1} = \beta_c \kappa_1$; $\beta^*_{cl1} = \beta_{cl} \kappa_1$. In other words, β^*_{c1} represents the difference between how married and single females value a unit of household expenditure. And, since κ_1 should be the same regardless of whether it is calculated via x_{ij} or $l^f_{ij} x_{ij}$, then we need to impose the following restrictions:

$$\kappa_1 = \frac{\beta^*_{cl1}}{\beta_{cl}} = \frac{\beta^*_{c1}}{\beta_c}, \tag{15}$$

And,

$$\kappa_2 = \frac{\beta^*_{cl2}}{\beta_{c2}} = \frac{\beta^*_{c2}}{\beta_c}, \tag{16}$$

In other words, the sharing rule parameters κ_1 and κ_2 can directly be calculated as, by estimation of the discrete choice model, the following parameters are identified,

$$\beta_{ll}(d_f), \beta_{cl}, \beta^*_{cl1} = \beta_{cl}\kappa_1, \beta^*_{cl2} = \beta_{cl}\kappa_2, \beta_c, \beta^*_{c1} = \beta_c\kappa_1, \beta^*_{c2} = \beta_c\kappa_2 \tag{17}$$

And the standard errors of the sharing rule are calculated using the delta method.
To put into a nutshell, The identification of the sharing rule rely on the assumption that (only) some of married females' preferences are identical to singles'. More precisely, we allow for the coefficients on labor supply β_l and β_{ll},and hence the marginal rates of substitution, to differ from married to single females. And, only the coefficients related to the private consumption terms β_c and $\beta_{cl}$are assumed to be identical for for both types of females.
Note that while we can easily identify different reactions of single and married females to household consumption, the actual twist of the collective model is to make use of that information in order to infer something about the sharing rule. For this, we rely on the idea that married women value less each unit of household consumption since they only get a share of it for their own private consumption. And, "how much they value it less" is used to identify the sharing rule given two additional assumptions. The first consists on assuming that single females only care about private consumption.

3 The Data

3.1 Data Description

Data used in this study are obtained from the Egyptian Labor Market and panel Survey (ELMPS) of 2006. This is the second wave of a nationally-representative household survey conducted in 1998. And it consists of a total of 8,349 households. The 2006

ELMPS data is composed of three main questionnaires (see Barssoum, 2007). First, the household questionnaire that contains information on basic demographic characteristics of household members, movement of household members in and out of the household since 1998, ownership of durable goods and assets, and housing conditions. Then we find the individual questionnaire that is administered to the individual him/herself. The latter contains information on parental background, detailed education histories, activity status, job search and unemployment, detailed employment characteristics, a module on women's work, migration histories, job histories, time use, earnings and fertility. In addition to this, a new critical module has been added to the questionnaire in order to allow a profound examination of marriage dynamics in Egypt. The latter contains detailed information on costs of marriage as well as costs of divorce. And finally, the questionnaire contains a household enterprise and income module that elicits information on all agricultural and non-agricultural enterprises operated by the household as well as all income sources, including remittances and transfers.

The ELMPS is the first panel data available in the Arab region and is known for its richness that allow economists to profoundly study various issues related to the Egyptian labor market.

3.2 Sample Selection

Turning to labor supplies of single and married females, we aim at observing the difference in bargaining power between males and females. Two samples are selected for the empirical exercise. The first one consists on married women, husbands being present in the household, aged from 16 to 55 years old. And, all males are assumed to be working full time (48 hours or more). We exclude all households with children aged less than 15 since we assume that household net income is split into private consumptions of the husband and the wife. We are aware that the latter is a quite strong assumption especially for the Egyptian context. Students, self employed, unvoluntarily unemployed, and (pre) retired are excluded from the dataset. Females' breadwinners are also excluded here because those women don't work to achieve self dependence but they are rather enforced due to economic reasons and led to role conflicting (Nassar, 2002). And, the second sample study consists on single females that are selected subject to the same sample selection of mar-

ried females. The sample sizes are 1,492 and 1,257 for married and singles respectively. Note that all females can be employed due to the extended definition of employment or voluntarily unemployed [4]and that employed females can be paid in monetary (for wage employees) or in kind (for unpaid family workers). The latter represents the case of 28.7 percent of the whole working sample.

In the empirical exercise, we estimate a discrete choice model where the female chooses between J labor supply alternatives; see e.g. Train (2003). Four alternatives are considered here: Non participants with $l_f = 0$; Employed "part time" with $l_f \in]0, 25]$; Employed "full time" with $l_f \in]25, 35]$ and over employed with $l_f > 35$.

Clearly, the sample study is characterized by a high proportion of females non-participation that reach 71.30 percent. And, 93.24 percent of the latter declare not desiring and not ready to work during the reference period. Those non-participant females' real hourly wages are estimated by means of Heckman's two-step estimation procedure to correct for the selectivity bias.

As represented in figure 1, 62 percent of females in our sample are married. Contrarily to single females, married females are majoritarly concentrated in the inactivity and the full-time status; 70 percent of the non-participant population and 57 percent of the full-time working population are married. On the other hand, 55 percent of females working more than 35 hours per week are singles. In figure 2 we observe that 60 percent of singles and 80 percent of married women are inactive. And, very small proportions are concerned by the part-time and Full-time alternatives. One explanation is that Single females work mainly to save money for marriage and once they get married they usually stop working (see e.g. Amin & Al-Bassisi, 2003).

To put into a nutshell, as observed in these figures, a significantly large proportion of females do not participate in the labor market. And, married females seem to be more concerned by this inactivity situation.

[Figures 1 and 2 about here]

Figures 3 and 4 display the females distribution by levels of education and labour supply alternatives. Clearly, the majority of Egyptian females tend to not participate in

[4]This market labor force includes those engaged in the production of economic goods and services whether for the market or for barter (ILO, 1982).

market work whether they are educated or not. We can then predict that a similar reality could have negative effects on females' incentives to education. Six levels education are Considered and we properly separate between females enrolled in vocational (technical) and general education. As showed in these figures, we can observe that regardless the marital status, high proportions of technically educated women choose alternatives 1 and 4. For singles, 32 percent are inactive and 38 percent are working more than 35 hours a week. In contrast, having a university degree increase the probability of one woman to be active; 23 percent, 35 percent and 31 percent of single women having a university level of schooling are working part-time, full time and more than 35 hours a week respectively.

[Figures 3 and 4 about here]

Finally, for married females, about 50 percent of the full-time working and 45 percent of the part-time working populations never went to school before. Married women having high levels of education as a university degree tend to spend more than 35 hours per week in the labor market. And, this is also the case of females having technical education. Interestingly, females having general education completely disappear from the part-time and full-time situations. The latter observation could reflects the greater need of the Egyptian labor market for vocational education rather than general education.

3.3 Sources of Bargaining Power

Concerning distribution factors, our data allows us to test new direct measures of married females bargaining power. Contrary to Chiappori et al. (2002), the sex ratio does not seem to be a convenient distribution factor for a developing country as Egypt. And, for that specific reason, we try to find out the main sources of females' power in Arab countries in general and specifically in Egypt. Various factors are tested here. First are factors related the marriage market as the female's contribution to total costs of marriage (see Roushdy, 2004) and the "moakhar" which represents the amount of money that the male will have to pay to his wife in case of divorce. Amin and Al-Bassusi (2003) showed that the average marriage costs in Egypt are substantially higher relatively to the rest of the Arab world. In addition to that, the girl's "gehaz" or trousseau is ritualized to make its content public knowledge to benefit the bride by displaying her family's wealth,

presumably to enhance her status within her new marital family. The assumption is then that the more assets she brings to her new household, the better will be her bargaining position. Concerning the moakhar, this value is determined before the marriage takes place which assure its exogeneity. Furthermore, we test variables that could mostly be considered as measures of the female's capacity within her own family. Examples of such variables are: the female's participation in the decision making process, her access to the household financial resources, her mobility and domestic violence against her.

4 Empirical Results

4.1 Empowerment and Labor Supply Decisions

Tables 2, 3, 4 and 5 display the results of the generalized method of moments estimations. The latter aims at testing the effect of different sources of females empowerment on labour supply decisions. The dependent variable being a continuous variable of labor supply. And, in these estimations, females and males' labor incomes are instruments by a vector of demographic variables that characterize both the individual and the household.

Table 2 shows the existence of a significantly positive relationship between different sources females' empowerment and labour supply decisions. We control for different household characteristics as the household size, the household wealth, the household non labour income and the region. We also control for individual and spouses' characteristics as age, educational level and labour income. The "empowerment indicators" are constructed using factor analysis. In the first column we observe the significant positive effect of participation in household's decision making on females' labour supply. For instance, participating in household decisions increase one female's labour supply by 12 hours a week relative to those who do not participate at all in the decision making process. This "decision making indicator" consists on weighting different decision making variables as: Buying clothes for herself, Getting medical treatment or advice for herself and her visits to family, friends or relatives etc...

As to empowerment indicators, gender role attitudes positively and significantly influence female's labour supply. The "gender role attitude indicator" reflects females agreements with equal gender roles as: a woman's place is not only in the household but she should be

allowed to work, If the wife has a job outside the house then the husband should help her with the children, If the wife has a job outside the house then the husband should help her in household chores, For a woman's financial autonomy, she must work and have earnings and Women should continue to occupy leadership positions in society. See the appendix for more details on gender role attitudes variables. This result shows that women supporting a better gender equality situation tend, in a sense, to be more empowered and to spend more time outside home activities.

Clearly, having direct access to household money increase a females' labour supply at a 5 percent level of significance.

Finally, these factors directly affect a female's bargaining power within her family and, consequently influence her participation in outside home activities; which could be the result of females preference heterogeneity or state dependence.

[Table 2 about here]

Tables 3 and 4 display the effect of other sources of females' empowerment on labour supply. In table 4 we observe a positive and significant relationship between the female's contribution to costs of marriage. This verifies our assumption presented above that consists on the idea that the more females and their families contribute to costs of marriage and the more her bargaining power increase in her own household after marriage. In addition to this, female's labour supply seem to increase with the level of education but the husband's education does not have any significant effect on his spouse's labour supply. Moreover, women living in urban and rural regions spend less hours in the labor market than women living in Cairo the capital and Alexandria.

[Tables 3 and 4 about here]

The results presented above, contrarily to the common literature, show that more empowered married women work more in the market. Now the question is, do they on the other side spend less time on domestic activities that we call here "home based activities". To answer this question, we estimate a system of structural equations, where the market labour equation contains an endogenous variable among the explanatory variables. This endogenous variable is the "domestic labour supply". Typically, this endogenous regressor is a dependent variable from another equation in the system. Estimation is done via

three-stage least squares.

Tables 6, 7, 8 and 9 presented bellow display the results of the structural equations system. Turning to 6, it is quite clear that the more the female participates in the household decision making process and the more she works not only in the market but also at home. Interestingly, those females have more bargaining power but that seems to not decrease their family burden. However, The latter significantly decreases with the spouse's labor income. For instance, having a richer husband decrease one female's number of hours spent in labour market activities.
Similarly for the gender attitude indicator. It is worth mentioning that females encouraging less gender inequalities spend weekly 13 hours more in the labour market than other women. However, the latter does not affect female's domestic labour supply.

[Tables 6 about here]

Interestingly, in table 8, the presence of domestic violence increases significantly one female's family burden and time spent on work at home. One explanation for this could be the weak position of these females within their households.

[Tables 8 about here]

Finally, table 9 shows the effect of other sources of females empowerment on both market labour supply and domestic labour supply. Wa can observe that being afraid of men in the household decreases the domestic labour supply with a level of significance of 10 percent. This could be due to the will of these women to shirk domestic violence by staying outside home.

[Tables 9 about here]

In conclusion, more empowered Egyptian married females take advantage of their power by spending longer hours in the labour market. The problem is that, on the other hand, they do not spend fewer hours in domestic activities which leads to the double burden problem they suffer from.

4.2 Results of the discrete choice model of labor supply

Table 10 displays the parameter estimates for the utility function. The parameters are estimated via Maximum Simulated Likelihood under the i.i.d. assumption for the error terms. Note that we only show the results of some of the distribution factors tested[5]. As explanatory variables, we introduce different interaction variables. When looking to the interaction x*Couple, we observe a positive coefficient which means that females in couple attach a higher value to one unit of household net income than single females do. However, the latter is not significant.

[Table 10 about here]

Results of the sharing rule parameters $\kappa 1$ and $\kappa 2$ are presented in table 11. As defined earlier, those parameters represent the share of household net income that the female gets for her consumption. Interestingly, contrarily to all other studies estimated using European data, this share tend to be negative. The first line of table 11 shows that, for all women- regardless the age difference, her contribution to marriage costs or her Moakhar- this share is of about -25.30. However, this estimated share is not statistically significant. "Unfortunately, in the case of sub-groups for which the collective model is not rejected, the sharing rule and individual preferences are not precisely estimated. A possible explanation for this result is that these parameters are highly nonlinear functions of statistically significant and insignificant parameter estimates" [Fortin and Lacroix (1997); 953].

[Table 11 about here]

In table 10, l represents the female's labour supply choice. Clearly, coefficients of this variable is always positive and statistically significant. Similarly, all interaction between distribution factors and x or xl are not statistically significant; which imply that whether- for example- the age difference between the female and her husband is low or high, that doest not influence the share of income she gets from the household income. The latter result explains the insignificance of the sharing rule parameters presented in table 11.

[5]Results of the other distribution facts are available upon request.

5 Conclusion and Policy implication

In the present chapter, we estimate a discrete choice model of females labor supply that is cast in the collective setting (Vermeulen, 2006). The latter takes into full consideration the non participation possibility for females. For instance, the novelty of the present research is that the collective framework is applied to Egyptian micro data in order to analyze resource allocation patterns within Egyptian households. Both Married females' preferences and the sharing rule parameters are fully identified by assuming that some preference coefficients of married females are the same as those of their singles counterparts but leisure coefficients are allowed to differ between the two groups. And, we use this difference in parameters between single and married females to infer something about the sharing rule.

We also test new sources of females empowerment that are original to the Egyptian context. We are fortunate to have the ELMPS 2006 that includes a whole section on women status as well as on females contribution to marriage costs.
Empirical results show that the latter influence significantly the females labour supply choices. An important conclusion of the present research is that Egyptian married females do not really get any of the household income for their own consumption. They even tend to spend their own money on the household since the estimated share is negative. But, all this is not very precise since the sharing rule parameters are not statistically significant as presented above.
Results presented here reflect the weak females position within their own family. Another explanation could be that Egyptian females tend to have caring preferences towards their families. In other words, instead of getting a share of the household income to spend on their own consumption, they rather give a share of their own money to their families.
As noted, this study does not consider the domestic production nor taxation. We call for future studies to model these latter in order to significantly improve the model's reliability.

Tables and Figures

Tables

Summary statistics

Table 1: Descriptive statistics (working sample)

	Married couples		Single Females	
Variables	Mean	Std. der.	Mean	Std. der.
female participation	0.21	0.41	0.37	0.48
male participation	1	0		
female education 1	0.22	0.41	0.27	0.44
female education 2	0.25	0.43	0.26	0.44
female education 3	0.02	0.14	0.01	0.11
female education 4	0.31	0.46	0.28	0.45
female education 5	0.20	0.40	0.18	0.39
male education 1	0.14	0.35		
male education 2	0.34	0.47		
male education 3	0.02	0.14		
male education 4	0.26	0.44		
male education 5	0.22	0.42		
Dummy 1 for region	0.23	0.42	0.16	0 .37
Dummy 2 for region	0.18	0.39	0.14	0.34
Dummy 3 for region	0.24	0.43	0.29	0.45
Dummy 4 for region	0.34	0.47	0.41	0.49
Age (female)	34.85	10.037	30.74	12.48
Age (male)	39.94	10.50		
years of experience (female)	12.79	9.89	7.93	8.39
years of experience (male)	13.59	9.59		
Hourly gross wage rate (female)	5.18	35.07	2.41	7.02
Hourly gross wage rate (male)	2.14	6.04		
working hours per week (female)	40.86	12.24	45.29	15.07
working hours per week (male)	60.07	12.22		
Weekly consumption- non labor income	13.78	68.25	60.03	98.36

Source: Constructed by the author using the ELMPS 2006, Notes: Dummy for labor market participation: 1= working, Dummy 1 for schooling: 1= Never gone to school, Dummy 2 for schooling: 1= Primary/ Preparatory, Dummy 3 for schooling: 1= General Secondary, Dummy 4 for schooling: 1= 3-5 years of Technical secondary, Dummy 5 for schooling: 1=Above intermediate/ University stages, Dummy 1 for region: 1= Cairo, Dummy 2 for region: 1= Alexandria & Suez Canal, Dummy 3 for region: 1=Urban areas in lower & upper Egypt, Dummy 4 for region: 1= Rural areas in lower & upper Egypt.

Empirical Results

Table 2: Determinants of married females labour supply

	Coefficient	t stat	Coefficient	t stat	Coefficient	t stat	Coefficient	t stat
Women Status Variables								
Decision making Indicator	**1.221*** **	2.69						
Gender role attitudes indicator			**1.189*** **	2.68				
Access to financial resources *					**1.884** **	2.23		
Access to financial resources *							1.17	1.24
household size	-0.64***	2.93	-0.66***	2.96	-0.68***	3.16	-0.71***	3.18
female's hourly wage	-0.14	0.38	-0.14	0.39	-0.13	0.34	-0.15	0.40
Male's hourly wage	0.22	0.65	0.24	0.71	0.22	0.65	0.22	0.63
female's age	2.08***	3.96	2.07***	3.83	2.09***	3.95	2.14***	4.00
female's age squared	-0.02***	2.86	-0.02***	2.73	-0.02***	2.87	-0.02***	2.88
Male's age	-1.15***	2.04	-1.11***	1.98	-1.10**	1.99	-1.10**	1.98
Male's age squared	0.01**	1.69	0.01*	1.60	0.01*	1.61	0.01	1.59
female's education 1*	-1.56	1.27	-1.47	1.19	-1.42	1.16	-1.45	1.19
female's education 2*	1.59	0.41	1.08	0.27	0.99	0.25	1.37	0.35
female's education 3*	11.60***	4.04	11.49***	3.91	11.63***	4.1	11.81***	4.07
female's education 4*	19.75***	6.18	19.71***	6.03	19.83***	6.26	19.98***	6.14
Male's education 1*	-0.49	0.43	-0.65	0.57	-0.64	0.56	-0.47	0.41
Male's education 2*	0.65	0.18	0.57	0.16	0.65	0.18	0.74	0.21
Male's education 3*	-0.14	0.07	-0.30	0.16	-0.28	0.14	-0.12	0.06
Male's education 4*	-0.42	-0.18	-0.79	0.34	-0.47	0.20	-0.51	0.22
Urban regions*	-9.85***	6.47	-10.03***	6.57	-10.05***	6.61	-10.22***	6.62
Rural regions*	-16.33***	7.59	-16.49***	7.65	-16.67***	7.78	-16.70***	7.73
Wealth index	-0.16	0.36	-0.15	0.35	-0.17	0.41	-0.16	0.36
HH non labor income	0.00	0.83	0.00	0.83	0.00	0.90	-0.01	0.97
Constant	9.45	1.05	9.06	1.01	7.66	0.86	7.61	0.84
Observations	1938.00		1938.00		1938.00		1938.00	
Centered R squared	0.40		0.39		0.40		0.39	
Uncentered R squared	0.66		0.65		0.66		0.66	
Hansen J statistic	21.11		21.18		21.89		21.35	
Chi-sq(14) P-val	0.10		0.10		0.08		0.09	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Those are the results of a generalized method of moments estimation. iii. females and males labor earnings are instrumented. iv. * represents dummy variables.

Table 3: Determinants of married females labour supply

	Coefficient	t stat.	Coefficient	t stat.	Coefficient	t stat.
Women Status Variables						
Mobility Indicator	0.241	0.290				
Domestic Violence Indicator			0.241	0.290		
Fear of men in hh *					-0.528	0.530
household size	-0.722***	3.280	-0.722***	3.280	-0.723***	3.260
female's hourly wage	-0.174	0.440	-0.174	-0.440	-0.197	0.520
Male's hourly wage	0.244	0.710	0.244	0.710	0.259	0.760
female's age	2.088***	3.740	2.088***	3.740	2.060***	3.760
female's age squared	-0.022***	2.660	-0.022***	2.660	-0.021***	2.670
Male's age	-1.095***	1.960	-1.095***	1.960	-1.084*	1.920
Male's age squared	0.011	1.570	0.011	1.570	0.010	1.550
female's education 1*	-1.407	1.140	-1.407	-1.140	-1.362	1.110
female's education 2*	1.640	0.410	1.640	0.410	1.728	0.430
female's education 3*	12.139***	4.230	12.139***	4.230	12.322***	4.350
female's education 4*	20.425***	6.420	20.425***	6.420	20.519***	6.590
Male's education 1*	-0.577	0.510	-0.577	-0.510	-0.626	0.550
Male's education 2*	0.566	0.160	0.566	0.160	0.511	0.140
Male's education 3*	-0.200	0.100	-0.200	-0.100	-0.317	0.160
Male's education 4*	-0.628	0.270	-0.628	-0.270	-0.776	0.330
Urban regions*	-10.037***	6.480	-10.037***	6.480	-9.962***	6.420
Rural regions*	-16.477***	7.360	-16.477***	7.360	-16.372***	7.530
Wealth index	-0.093	0.210	-0.093	-0.210	-0.096	0.220
HH non labor income	-0.005	-0.930	-0.005	-0.930	-0.005	0.960
Constant	8.152	0.890	8.152	0.890	8.599	0.930
Observations	1938.00		1938.00		1938.00	
Centered R squared	0.385		0.385		0.378	
Uncentered R squared	0.651		0.651		0.647	
Hansen J statistic	21.178		21.178		21.087	
Chi-sq(14) P-val	0.097		0.097		0.099	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Those are the results of a generalized method of moments estimation. iii. females and males labor earnings are instrumented. iv. * represents dummy variables.

Table 4: Determinants of married females labour supply

	Coefficient	t stat.	Coefficient	t stat.	Coefficient	t stat.	Coefficient	t stat.
Marriage costs Ind.	0.379	0.740						
Marriage costs 1			**0.001*** **	3.930				
Marriage costs 2					**0.003*** **	2.430		
Marriage costs 3							**0.073***	1.630
household size	-0.720***	2.930	(-0.905)***	4.120	(-0.755)***	3.060	(-0.853)***	-3.590
female's hourly wage	-0.278	-0.660	-0.201	-0.470	-0.306	-0.730	-0.167	-0.350
Male's hourly wage	0.188	0.520	0.221	0.760	0.176	0.480	0.178	0.580
female's age	1.925***	2.980	1.869***	3.290	2.013***	3.110	1.839***	3.410
female's age squared	-0.020***	2.210	(-0.018)***	2.280	-0.021***	2.300	-0.018***	-2.380
Male's age	-0.618	-0.980	-0.789	-1.350	-0.607	-0.960	-0.849	-1.470
Male's age squared	0.005	0.640	0.007	1.020	0.005	0.610	0.008	1.110
female's education 1*	-2.430**	2.090	-1.992	1.67*	-2.173**	1.840	-1.426	-1.220
female's education 2*	-6.022	-1.500	0.315	0.080	-5.612	1.400	0.828	0.210
female's education 3*	10.540***	4.980	10.918***	5.320	10.892***	5.160	10.961***	4.280
female's education 4*	18.655***	6.440	19.093***	7.380	19.099***	6.640	19.825***	6.620
Male's education 1*	0.042	0.030	0.034	0.030	-0.053	-0.040	-0.414	-0.360
Male's education 2*	2.569	0.580	2.461	0.650	2.434	0.550	0.808	0.230
Male's education 3*	1.522	0.940	0.932	0.480	1.563	0.950	0.224	0.120
Male's education 4*	1.394	0.650	0.288	0.130	0.995	0.470	-0.027	-0.010
Urban regions*	-8.946***	5.220	-9.570***	6.420	-9.530***	5.530	-9.504***	-6.190
Rural regions*	-17.420***	8.820	-16.759***	9.61***	-17.969***	9.070	-16.122***	-8.390
Wealth index	-0.192	-0.420	-0.240	-0.580	-0.267	-0.580	-0.182	-0.470
HH non labor income	-0.009	-1.350	-0.005	-1.030	-0.009	-1.360	-0.004	-0.800
Constant	3.924	0.370	6.392	0.650	2.490	0.230	7.623	0.720
Observations	1358.000		1717.000		1361.000		1840.000	
Centered R squared	0.421		0.413		0.419		0.404	
Uncentered R squared	0.668		0.674		0.667		0.663	
Hansen J statistic	25.494		18.883		23.986		21.559	
Chi-sq(14) P-val	0.030		0.169		0.046		0.088	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Those are the results of a generalized method of moments estimation. iii. females and males labor earnings are instrumented. iv. * represents dummy variables.

Table 5: Determinants of married females labour supply

	Coefficient	t stat.	Coefficient	t stat.	Coefficient	t stat.	Coefficient	t stat.
Marriage costs 4	-0.042	-0.690						
Marriage costs 5			0.031	1.420				
Marriage costs 6					-0.057	-1.260		
Marriage costs 7							0.061	1.210
household size	-0.875***	-3.660	-0.865***	-3.620	-0.889***	-3.720	-0.857	-3.600
female's hourly wage	-0.183	-0.390	-0.199	-0.420	-0.198	-0.420	-0.157	-0.330
Male's hourly wage	0.174	0.570	0.178	0.580	0.180	0.590	0.179	0.580
female's age	1.876***	3.480	1.835***	3.400	1.885***	3.500	1.818***	3.370
female's age squared	-0.018***	-2.410	-0.018***	-2.350	-0.018***	-2.410	-0.017***	-2.320
Male's age	-0.852	-1.470	-0.816	-1.410	-0.833	-1.440	-0.825	-1.430
Male's age squared	0.008	1.090	0.007	1.040	0.007	1.050	0.007	1.060
female's education 1*	-1.430	-1.220	-1.463	-1.260	-1.430	-1.220	-1.450	-1.240
female's education 2*	0.726	0.190	0.484	0.130	0.723	0.190	0.649	0.170
female's education 3*	11.165***	4.360	11.067***	4.310	11.163***	4.340	10.952***	4.280
female's education 4*	19.932***	6.650	19.824 ***	6.620	20.003***	6.670	19.734***	6.610
Male's education 1*	-0.392	-0.340	-0.406	-0.350	-0.421	-0.370	-0.401	-0.350
Male's education 2*	0.810	0.240	0.843	0.240	0.734	0.210	0.794	0.230
Male's education 3*	0.329	0.170	0.325	0.170	0.323	0.170	0.205	0.110
Male's education 4*	0.012***	0.000	-0.045	-0.020	-0.119	-0.060	-0.077	-0.040
Urban regions*	-10.156***	-6.870	-9.701***	-6.410	-10.164***	-6.880	-9.651***	-6.330
Rural regions*	-16.793***	-9.080	-16.296***	-8.600	-16.792***	-9.090	-16.302***	-8.550
Wealth index	-0.193	-0.490	-0.184	-0.470	-0.185	-0.470	-0.184	-0.470
HH non labor income	-0.004	-0.850	-0.004	-0.860	-0.004	-0.850	-0.004	-0.810
Constant	7.883	0.740	7.295	0.690	7.462	0.700	7.775	0.730
Observations	1840.000		1840		1840		1840	
Centered R squared	0.402		0.401		0.400		0.4036	
Uncentered R squared	0.662		0.662		0.661		0.6633	
Hansen J statistic	20.841		21.675		20.899		21.634	
Chi-sq(14) P-val	0.106		0.085		0.104		0.08644	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Those are the results of a generalized method of moments estimation. iii. females and males labor earnings are instrumented. iv. * represents dummy variables.

Table 6: Structural equations: market work versus domestic production

	Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply		Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply	
	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat
Domestic L.supply	-0.081	-0.160			-0.102	-0.180		
Decision making Indicator	1.371***	1.950	1.148*	1.470				
Gender role attitudes indicator					1.308***	2.330	-0.575	-0.700
household size	-0.477	-1.110	0.725***	1.920	-0.478	-1.150	0.628**	1.660
female's age	2.003***	4.710	0.082	0.100	1.973***	4.580	0.135	0.170
female's age squared	-0.023***	-3.030	-0.010	-0.910	-0.022***	-2.780	-0.010	-0.940
Male's age	-0.951**	-1.680	0.452	0.470	-0.864*	-1.450	0.522	0.540
Male's age squared	0.009*	1.400	-0.005	-0.450	0.008	1.160	-0.006	-0.540
female's education 1	-1.615	-1.180	-1.393	-0.680	-1.567	-1.130	-1.287	-0.620
female's education 2	0.563	0.130	4.138	0.560	-0.085	-0.020	4.274	0.580
female's education 3	10.195***	8.010	0.614	0.250	9.951***	7.510	1.145	0.460
female's education 4	17.832***	7.980	-2.099	-0.670	17.620***	8.520	-1.408	-0.450
Male's education 1	-0.676	-0.320	-3.358**	-1.610	-0.890	-0.390	-3.392**	-1.630
Male's education 2	0.116	0.030	-2.040	-0.310	0.072	0.020	-2.055	-0.310
Male's education 3	0.410	0.300	-0.091	-0.040	0.345	0.250	-0.082	-0.030
Male's education 4	0.229	0.080	-4.303*	-1.460	-0.068	-0.020	-4.317*	-1.460
Urban regions	-10.034***	-3.540	-5.088***	-2.240	-10.380***	-3.220	-5.372***	-2.370
Rural regions	-16.757***	-9.470	-2.834	-1.190	-17.091***	-8.430	-3.190*	-1.350
Wealth index			-0.680	-1.060			-0.618	-0.960
female's hourly wage	-0.044	-0.860	-0.093***	-2.610	-0.046	-0.830	-0.093***	-2.600
Male's hourly wage	0.026	0.310	0.158***	2.950	0.025	0.270	0.159***	2.960
HH non labor income	-0.004	-0.670	-0.004	-0.450	-0.004	-0.620	-0.005	-0.570
Constant	12.087	0.420	55.279***	3.670	12.555	0.410	53.044***	3.530
N	1934		1934		1934		1934	
R- squared	0.414		0.050		0.408		0.049	
Chi2	1382.420		101.250		1368.530		1368.530	
P value	0.000		0.000		0.000		0.000	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Estimation is made via 3SLS.

Table 7: Structural equations: market work versus domestic production

	Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply		Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply	
	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat
Domestic L.supply	-0.075	-0.130			-0.052*	0.396		
Access to financial resources (dummy)	1.814*	1.450	-1.516	-1.000				
Access to financial resources (dummy)					1.457	2.000	4.861***	3.300
household size	-0.536	-1.230	0.635**	1.690	-0.568*	0.349	0.690**	1.840
female's age	2.001***	4.660	0.134	0.170	2.059	0.428	0.205	0.260
female's age squared	-0.022***	-2.770	-0.010	-0.930	-0.023	0.007	-0.011	-1.020
Male's age	-0.886*	-1.460	0.531	0.550	-0.903	0.548	0.460	0.480
Male's age squared	0.009	1.190	-0.006	-0.550	0.009	0.007	-0.006	-0.500
female's education 1	-1.495	-1.060	-1.305	-0.630	-1.464	1.262	-1.289	-0.630
female's education 2	-0.071	-0.020	4.407	0.600	0.182***	4.081	3.621	0.490
female's education 3	10.279***	7.860	1.086	0.440	10.312	1.293	0.272	0.110
female's education 4	17.990***	8.650	-1.420	-0.450	18.037	2.252	-2.782	-0.890
Male's education 1	-0.786	-0.330	-3.377*	-1.620	-0.542	1.723	-3.055*	-1.470
Male's education 2	0.109	0.030	-2.046	-0.310	0.288**	3.608	-1.633	-0.250
Male's education 3	0.413	0.300	-0.117	-0.050	0.441	1.372	0.040	0.020
Male's education 4	0.249	0.070	-4.436*	-1.500	0.257*	2.592	-4.430*	-1.500
Urban regions	-10.228***	-3.030	-5.409***	-2.390	-10.312	2.556	-5.775***	-2.550
Rural regions	-17.029***	-8.090	-3.214*	-1.360	-17.113	1.694	-3.398*	-1.440
Wealth index			-0.589	-0.920			-0.874*	-1.360
female's hourly wage	-0.045	-0.770	-0.092***	-2.580	-0.040	0.041	-0.089***	-2.510
Male's hourly wage	0.024	0.250	0.158***	2.950	0.021	0.069	0.1609***	3.010
HH non labor income	-0.004	-0.750	-0.005	-0.540	-0.005	0.005	-0.005	-0.590
Constant	9.560	0.290	53.842***	3.590	8.303	22.205	52.814***	3.530
N	1934.000		1934.000		1934		1934	
R- squared	0.414		0.049		0.417		0.054	
Chi2	1377.420		100.020		1381.410		110.430	
P value	0.000		0.000		0.000		0.000	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Estimation is made via 3SLS.

Table 8: Structural equations: market work versus domestic production

	Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply		Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply	
	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat
Domestic L.supply	-0.160	-0.290			-0.160	-0.290		
Mobility Indicator	0.678	0.300	4.064***	4.500				
Domestic Violence Indicator					0.678	0.300	4.064***	4.500
household size	-0.494	-1.070	0.732***	1.960	-0.494	-1.070	0.732***	1.960
female's age	2.006***	4.530	-0.109	-0.140	2.006***	4.530	-0.109	-0.140
female's age squared	-0.023***	-3.250	-0.008	-0.710	-0.023***	-3.250	-0.008	-0.710
Male's age	-0.823*	-1.350	0.554	0.580	-0.823*	-1.350	0.554	0.580
Male's age squared	0.008	1.070	-0.007	-0.560	0.008	1.070	-0.007	-0.560
female's education 1	-1.629	-1.130	-1.421	-0.690	-1.629	-1.130	-1.421	-0.690
female's education 2	0.777	0.170	4.259	0.580	0.777	0.170	4.259	0.580
female's education 3	10.462***	7.800	0.107	0.040	10.462***	7.800	0.107	0.040
female's education 4	18.023***	7.090	-2.627	-0.840	18.023***	7.090	-2.627	-0.840
Male's education 1	-0.995	-0.450	-3.253*	-1.570	-0.995	-0.450	-3.253*	-1.570
Male's education 2	-0.066	-0.020	-2.090	-0.320	-0.066	-0.020	-2.090	-0.320
Male's education 3	0.493	0.350	0.534	0.210	0.493	0.350	0.534	0.210
Male's education 4	-0.051	-0.020	-3.482	-1.180	-0.051	-0.020	-3.482	-1.180
Urban regions	-10.746***	-3.470	-5.253***	-2.330	-10.746***	-3.470	-5.253***	-2.330
Rural regions	-17.335***	-9.240	-2.883	-1.220	-17.335***	-9.240	-2.883	-1.220
Wealth index			-0.651	-1.020			-0.651	-1.020
female's hourly wage	-0.053	-0.880	-0.104***	-2.930	-0.053	-0.880	-0.104***	-2.930
Male's hourly wage	0.038	0.420	0.159***	2.980	0.038	0.420	0.159***	2.980
HH non labor income	-0.005	-0.850	-0.004	-0.410	-0.005	-0.850	-0.004	-0.410
Constant	14.901	0.470	56.852***	3.800	14.901	0.470	56.852***	3.800
N	1934		1934		1934		1934	
R- squared	0.382		0.059		0.382		0.059	
Chi2	1300.170		120.220		1300.170		120.220	
P value	0.000		0.000		0.000		0.000	

Notes: i. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Estimation is made via 3SLS.

Table 9: Structural equations: market work versus domestic production

	Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply		Dep. Var. 1 Market L. supply		Dep. Var. 2 Domestic L.supply	
	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat	Coefficient	t. stat
Domestic L.supply	-0.130	-0.260			0.084	0.060		
Fear of men in the hh (dummy)	-0.666	-0.540	-2.018*	-1.430				
Marriage costs share Indicator					0.457	0.890	-0.119	-0.140
household size	-0.519	-1.280	0.679**	1.810	-0.621	-1.060	0.415	1.010
female's age	2.014***	4.670	0.034	0.040	1.549***	2.210	0.283	0.280
female's age squared	-0.023***	-3.150	-0.009	-0.840	-0.016	-0.840	-0.012	-0.860
Male's age	-0.825*	-1.380	0.577	0.600	-0.459	-0.330	0.923	0.890
Male's age squared	0.008	1.090	-0.007	-0.590	0.004	0.240	-0.010	-0.770
female's education 1	-1.589	-1.160	-1.362	-0.660	-1.951	-0.670	-2.037	-0.930
female's education 2	0.610	0.140	4.007	0.550	-6.908*	-1.450	-0.312	-0.040
female's education 3	10.485***	8.110	0.644	0.260	9.988*	1.450	-5.337***	-1.970
female's education 4	18.048***	7.850	-2.250	-0.720	16.926***	3.250	-4.063	-1.170
Male's education 1	-0.938	-0.430	-3.482**	-1.670	0.302	0.060	-3.783**	-1.680
Male's education 2	0.024	0.010	-1.988	-0.300	2.224	0.400	2.526	0.340
Male's education 3	0.367	0.260	-0.173	-0.070	1.460	0.580	1.285	0.470
Male's education 4	-0.052	-0.020	-4.334*	-1.470	1.867	0.470	-2.864	-0.890
Urban regions	-10.568***	-3.670	-5.252***	-2.320	-8.460***	-1.880	-3.106	-1.140
Rural regions	-17.268***	-9.310	-3.100*	-1.310	-17.283***	-4.800	-2.207	-0.760
Wealth index			-0.702	-1.090			0.309	0.440
female's hourly wage	-0.049	-0.960	-0.095***	-2.650	-0.027	-0.130	-0.158**	-1.730
Male's hourly wage	0.032	0.390	0.157***	2.930	0.026	0.320	0.048	0.600
HH non labor income	-0.005	-0.840	-0.005	-0.560	-0.006	-0.930	0.000	0.020
Constant	13.321	0.470	55.449***	3.680	1.130	0.020	37.982***	2.230
N	1934		1934		1356		1356	
R- squared	0.396		0.050		0.416		0.033	
Chi2	1331.330		101.110		1001.200		46.540	
P value	0.000		0.000		0.000		0.001	

Notes: *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level. ii. Estimation is made via 3SLS.

Table 10: Maximum Simulated Likelihood Estimates

	Conditional logit model							
Variables	Coefficient	t. stat.	Coefficient	t. stat.	Coefficient	t. stat.	Coefficient	t. stat.
lSq	0,817***	1330,000	0,817***	1330,000	0,812***	1296,000	0,806***	1306,000
lSq * education dummy1	-0,334***	-467,000	-0,334***	-467,000	-0,323***	-430,000	-0,316***	-426,000
lSq * education dummy2	-0,123	-149,000	-0,123	-149,000	-0,128	-152,000	-0,112	-135,000
lSq * education dummy3	0,062	81,000	0,062	81,000	0,063	80,000	0,066	86,000
lSq * Couple	-0,044	-83,000	-0,044	-84,000	-0,037	-67,000	-0,045	-82,000
x * l	0,000	-11,000	0,000	-10,000	0,000	-15,000	0,000	-17,000
x * l * Couple	0,005	141,000	0,010**	196,000	0,005	107,000	0,004	57,000
x	0,000	31,000	0,000	31,000	0,000	28,000	0,000	28,000
x * Couple	35,008	16,000	844130,100	2,000	141556,200	1,000	-5867546,000	-2,000
l	-29,462***	-1270,000	-29,462***	-1270,000	-29,263***	-1237,000	-28,971***	-1244,000
l * education dummy1	7,128***	270,000	7,134***	270,000	6,563	237,000	6,256**	229,000
l * education dummy2	-1,501	-49,000	-1,509	-50,000	-1,189	-38,000	-1,804	-59,000
l * education dummy3	-5,328**	-185,000	-5,335*	-185,000	-5,385*	-182,000	-5,560**	-192,000
l * Couple	-1,191	-61,000	-1,147	-59,000	-1,638	-79,000	-1,358	-67,000
x * l * Couple * Age difference			-0,001	-132,000				
x * Couple * Age difference			-422008,500	-2,000				
x * l * Couple * Moakhar					0,000	-14,000		
x * Couple * Moakhar					-2828,620	-1,000		
x * l * Couple * Marriage costs							0,000	11,000
x * Couple * Marriage costs							115052,200	2,000
Log likelihood	-200975,160		-200770,680		-187293,990		-190659,750	
Pseudo R squared	47,260		47,320		47,310		47,390	
Prob > chi2	0,000		0,000		0,000		0,000	

Notes: i. Estimation is done using simulated maximum likelihood. ii. Coefficients and t. stat. are multiplied by 100. iii. Reference for education is"illiterate". iv. Moakhar is the amount of money the husband will have to pay to the woman in case of divorce. The latter is determined before marriage takes place. v. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level.

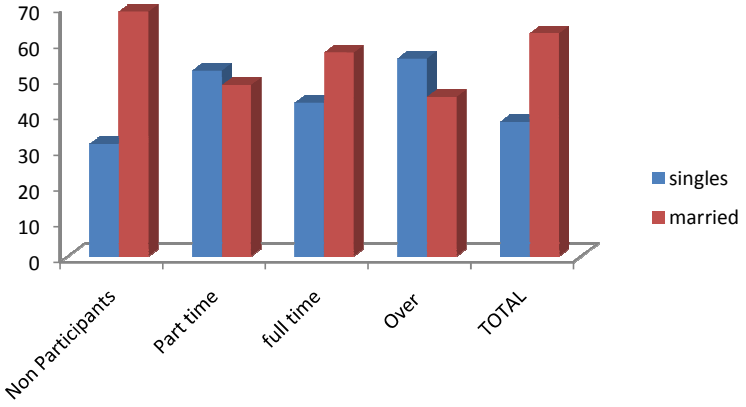
Table 11: Estimates of the Sharing Rule Parameters

	Coefficient	Std. Errors	Lower CI	Upper CI
No Distribution factor				
k1	-25,303	231,544	-479,120	428,514
k2	-	-	-	-
Age Difference				
k1	-56,100	525,628	-1086,312	974,112
k2	5,600	53,510	-99,278	110,479
Moakhar				
k1	-19,316	126,544	-267,338	228,706
k2	0,001	0,009	-0,016	0,018
Female's contribution to marriage				
k1	-13,103	72,625	-155,446	129,240
k2	-0,077	0,809	-1,663	1,510

Notes: i. $\kappa 1$ and $\kappa 2$ are calculated using the delta method. ii. The command in Stata is "nlcom".

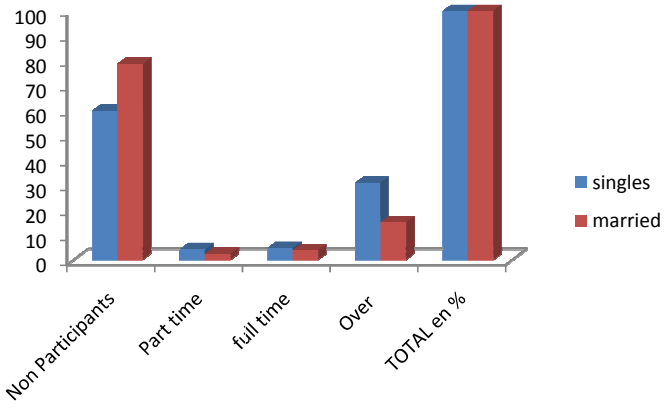
Figures

Figure 1: Percentages of females in each labor supply alternative by marital status



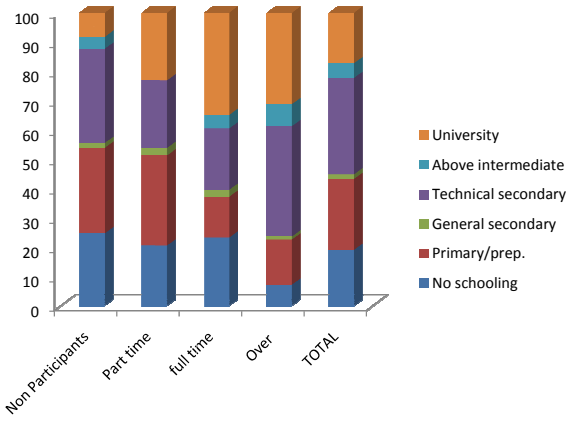
Source: Constructed by the author using the ELMPS 2006.

Figure 2: Percentages of married and single females by labor supply alternative



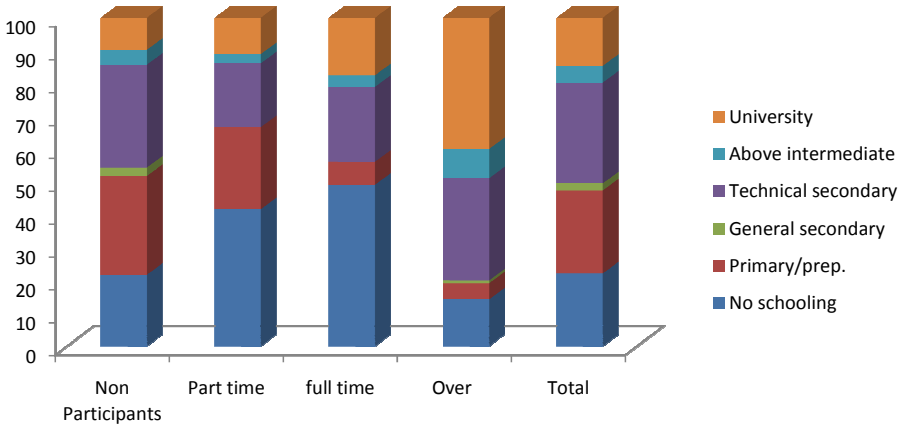
Source: Constructed by the author using the ELMPS 2006.

Figure 3: Single females by education level and labour supply alternative (1)



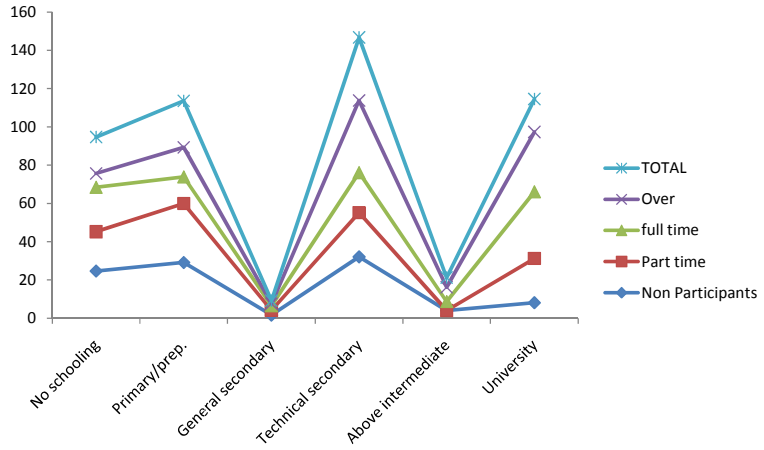
Source: Constructed by the author using the ELMPS 2006.

Figure 4: Married females by education level and labour supply alternative (1)



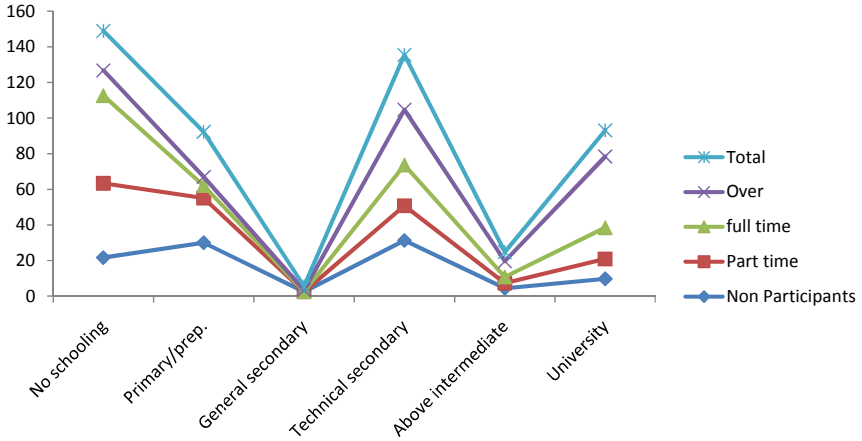
Source: Constructed by the author using the ELMPS 2006.

Figure 5: Single females by education level and labour supply alternative (2)



Source: Constructed by the author using the ELMPS 2006.

Figure 6: Married females by education level and labour supply alternative (2)



Source: Constructed by the author using the ELMPS 2006.

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Appendix

Calculation methods

Calculation of the household non-labor income

The household non-labor income are recovered from different sources. The first type of non-labor incomes we consider are the transfers, denoted by Y_1, whether from non-household members or from household members who are away from home. Note that a significantly high proportion of Egyptians, namely males, migrate to other Arab countries and especially Gulf countries and transfer money to their families in Egypt. Data on other miscellaneous sources of non labor income are also available in the ELMPS as incomes from household pensions and assistances that we denote Y_2. the latter includes retirement pensions, social security benefits and Sadat/Mubarak pensions. And finally, we take into account different types of compensations as disability benefits, ill/injury compensations. And this kind of non-labor incomes is represented by the Y_3 term. However, our analysis completely ignores the taxation and redistribution system for data limitation. But future studies taking into consideration this latter are highly recommended.

Estimation of potential wages: hourly wages for non-participating females

In order to obtain wages for the whole population, including non participant females, different methods have been tested: The ordinary least squares (OLS)estimation or the two-steps Heckman specification. However, when applying the second method, a difficulty arises due to selectivity: a participation model would need to be based on the collective framework, which is difficult. To resolve this problem, we followed Lewbel (2000) who proposes an estimation method for the selection model which does not require the specification of the selection mechanism. We also applied OLS and found no significant differences between the two methods.

Variables definition: Women status indicators

Participation in household decision making: In the data, we have different variables that indicates the whether the female participates in household decision making. The main question is as follows: Who in your family usually has the final say on the following decisions?

And this question is applied for the following types of household decisions,

Variable 1: Making large household purchases.

Variable 2: Making household purchases for daily needs.

Variable 3: Visits to family, friends or relatives.

Variable 4: What food should be cooked each day.

Variable 5: getting medical treatment or advice for herself.

Variable 6: buying clothes for herself.

We create dummy variables for each decision that takes the value zero if the female does not participate in the decision making at all and that equals to one whether she takes the decision alone, jointly with her husband or jointly with husband and family. Similarly, for single females, this variable is equal to one only if the female takes the decision alone or jointly with her parents.

Women direct access to financial resources: Two main questions are available in the data to infer something about the access of women to cash household resources. Two dummy variables are created. the first is equal to one if the woman has direct access to household money in her hand to use and equals to zero if not. And, the second variable consists on knowing whether the female personally has saving, own land, house, jewelry, or other valuables which she can sell or use.

Women mobility: This section on women mobility is quite important since it allows us to better understand the ability of women to move outside the household. Three variables are taking into account,

Variable 1: Mobility to the local market.

Variable 2: Mobility to the local health center or doctor.

Variable 3: Mobility to the home of relatives or friends in the neighborhood.

And, the latter variables take the value of one if the female can go out without permission or just need to inform other members in the household. And they take the value of zero otherwise: If she needs permission or cannot go alone.

Women opinions towards domestic violence: Questions related to domestic violence are only applied to ever married women. Domestic violence can be the result of different reasons as burning the food, arguing with the husband, talking to other me, wasting husband's money, and refusing sex to her husband. The latter are considered as

good proxies for women bargaining power. As for the other empowerment measures, we create dummy variables that take the value one when the married female answers yes to these questions and zero otherwise. Moreover, we are fortunate to have one variable that indicates whether the female is generally afraid to disagree with her husband (father or brother) or other males in the household. Note that the latter variable is available for all women and not only for married ones.

Questions on gender role attitudes: In the Egyptian labor market and panel survey of 2006, we also have detailed variables on gender role attitudes. The latter are the most convenient to be used as distribution factors as they are exogenous to the household bargaining process. Moreover, these variables significantly affect females preferences (as showed in the results).

As represented bellow, very detailed question related to gender role attitudes are addressed in the data,

Variable 1: females place is not only in the household but also in the labor market.

Variable 2: If working woman then the husband should help with the children.

Variable 3: If working woman then the husband should help in household chores.

Variable 4: A thirty year old woman who has a good job but is not yet married is pitied.

Variable 5: Girls should go to school to prepare for jobs not just to make them good mothers and wives.

Variable 6: A woman who has a full-time job cannot be a good mother.

Variable 7: For a woman's financial autonomy, she must work and have earnings.

Variable 8: Having a full-time job always interferes with the ability to keep a good life with her husband.

Variable 9: Women should continue to occupy leadership positions in society.

Variable 10: Boys and girls should get the same amount of schooling.

Variable 11: Boys and girls should be treated equally.

The answers to these questions are ordered from one to five. And, from the five categories we create dummy variables that take the value one if the female strongly agrees or at lease agrees with these facts and take the value zero otherwise. In other words, a positive and significant effect of these variables on females labor supply imply that females agreeing with equal gender roles (more empowered in a sense) tend to spend more time in the labor

market.

Women contribution to marriage costs: In the context of Egypt, about three quarters of the costs of marriage arrangement are usually supported by the groom and his family, while the bride and her family's contribution is in small home furnishing, the *gihaz* (trousseau) (Rashad et al., 2005). Spouses physical capital bought to marriage is proxied by two variables, one for the husband and the other for the wife. The latter are obtained by adding up the monetary shares of the wife and her family in the marriage costs. And the same for the husband's contribution share. These costs include the preparation of the marriage apartment, the purchase of furniture, electronic appliances, and other parts of the *gihaz* (see Namoro and Roushdy, 2008).