Gender Ratio, Divorce Rate and Intra-Household Collective Decision Process: Evidence from Iranian Household Labor Supply with Non-participation

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Abstract

This paper provides an empirical investigation on the individual labor supply of Iranian spouses in the intra-household collective decision framework in which gender ratio and divorce rate play a central role in the resource allocation of household. The data-set is taken from the Households' Expenditures Survey (2008) and the Annual Statistical Yearbook of Iran (2008). I have conducted the parameters estimation and hypothesis testing by the Multivariate Tobit techniques to catch the presence of the widespread non-participation of spouses across Iranian households. Our findings explore that unitary model of resource allocation and the collective model of decision process under Iranian civil procedure rules are strongly rejected, but the Pareto efficiency in the family resources allocation and validity of the specified model are confirmed. On average couple's sharing rule are determined by the non-labor incomes of both spouses. Couples' labor supplies are affected significantly by the gender ratio, (total number of females over males in provinces - urban areas) and divorce rate. In addition, the own log wage of spouse drives her/his individual working hours, and the direction of cross log wage effect is negative and less than the own log wage coefficient in absolute value, which are compatible with theoretical expectations. Spouses' working hours are substitute, education is the main driving force for females' market participation, and non-labor incomes negatively affect both labor participation and work hours of males and females. The results also show that reservation wages of women are positive and far from zero; whereas those of males are close to zero.

Keywords: Intra-Household Decision Process, Gender Ratio, Divorce Rate, Non-participation, Multivariate Tobit, Reservation Wages
JEL Classification: D13, J22

1. Introduction

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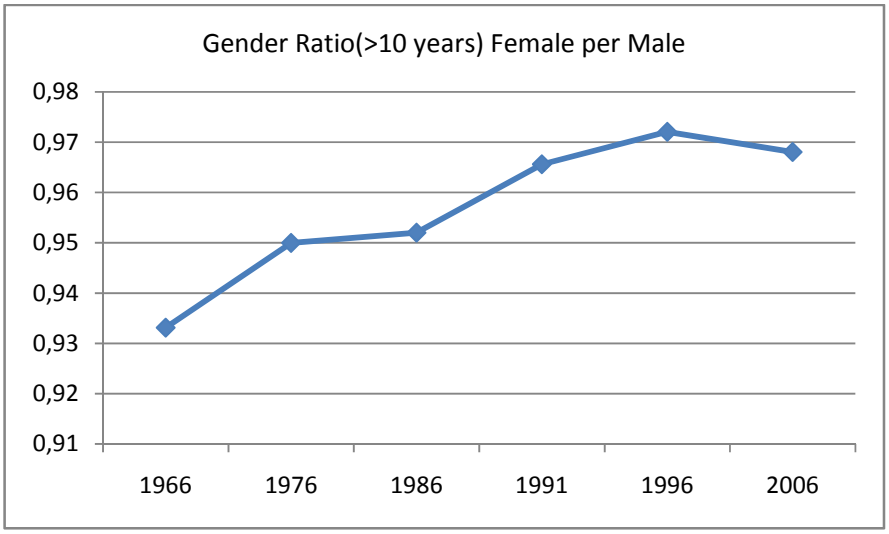
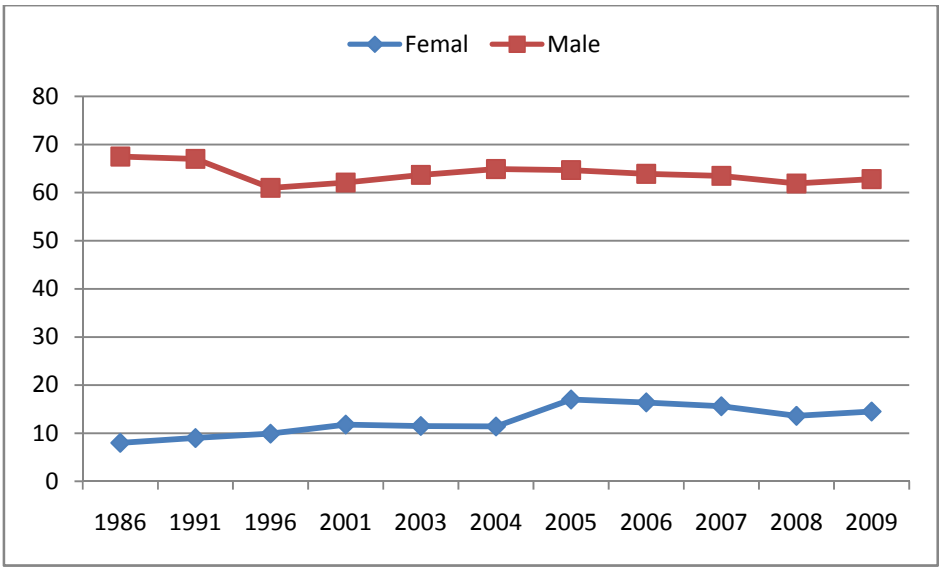
The paper intends to estimate the individual's labor of Iranian couples with a special focus on the gender ratio which is defined as the total number of local divorce ratio and female population over male between 20 and 60 years old, in same provinces and the near age group of urban area. The figure (1-1) plots the trend of the gender ratio over 1696 to 2006 in Iran. It shows that the ratio was rising from 0.933 to 0.968 females per male over the period. Figure (2-1) indicates the female and males participation rate over 1986-2006. The statistics show that female labor participation over the last decade does not exceed from 19 percent and it even was slightly decreasing over the last five years prior 2009. The paired figure reveals that females' labor participation correlated positively with gender ratio. Males' participation however reveals a reverse relationship with the ratio. Along with the gender ratio, non-labor and labor incomes, education, and divorce ratio have attracted extensive interests as driving forces of an individual to supply her labor in the literature. Figure (1-3) shows the divorce ratio in Iran. The figure shows a rather sharp increase in divorce rate (total number of marriages to divorces). Which factors cause the market participation of females and males in Iran? To what extent intra-household bargaining factors determine females' market participation? These are the main questions that I am addressing in the paper.

Figure (1-1): Gender Ratio in Iran



Statistical Center of Iran: Annual yearbooks

Figure (1-2): Female and Male Labor Market Participation Rate

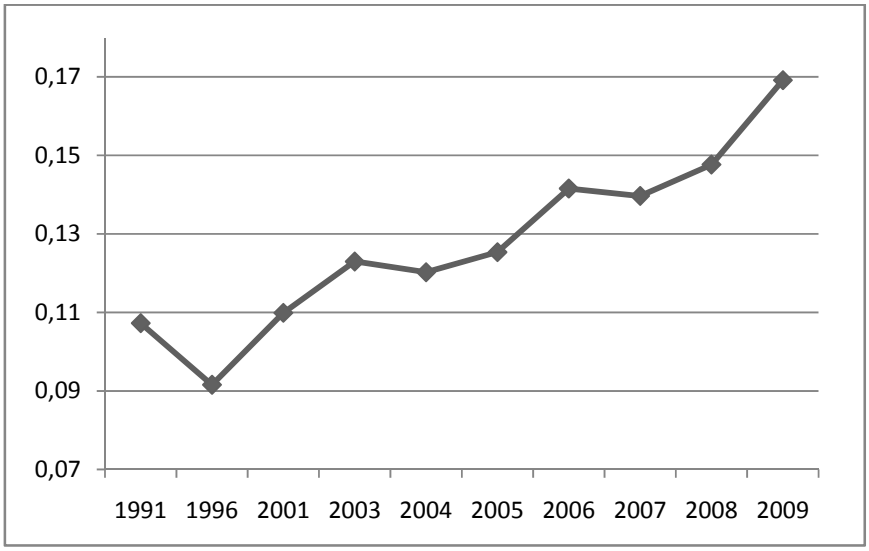


Statistical Center of Iran: Annual yearbooks (1986-2009)

Gender ratio impacts the bargaining strength of spouses in household, such that decreases in the ratio (scarcity of local females to males) in local society, weakens wife's intra-household bargaining position which in turn affects directly the wife's non-labor income share and will decrease her relative utility. Consequently, she has to increase her labor supply and with the similar reasoning that of males will decrease. Therefore it is expected that the ratio to play a significant role in the intra-household resource allocation and also in the labor market participation as well. The results have been verified by Chiappori et al (1998) in the labor market of France. Furthermore, Hourriez (2007) and Fernandez-Val (2003) argue the same reasoning in their influential works.

Research has shown that women increase their labor force participation in the years prior to a divorce and divorced women engage in less housework (Johanson and Skinner(1986) , Lundberg and Rose (1999). These studies do not conclude that females' labor participation causes divorce, but it may bring about a higher likelihood of female labor participation. Because the majority of divorce procedures are initiated by women, easy divorce which is measured by higher divorce rate seems to be favorable to women. Factors like alimonies, dower or a local lower gender ratio that provides higher opportunities for remarriages for divorced wife which make divorce easier, lead to a better female non-labor income allocation and accordingly reduce female labor supply. Symmetrically, the male non-labor income allocation becomes lower so that male work hours increase. A better wife's non labor income allocation discourages her to participate. These data are reported in the annual statistical yearbook by statistical center of Iran which varies from 0.09 to 0.17over 2000-2008, as Figure (1-3) shows.

Figure (1-3): Divorce Rate Over (1991-2009)



Statistical Center of Iran: Annual yearbooks (1986-2009)

The literature on intra-household resource allocation can be categorized into three general theoretical streams. The ***first*** attempts that starts with Becker's seminal works, have taken place during 1950 to 1970's and are known as the traditional or unitary approach that assumes a utility function with only one set of underlying rational preferences for spouses.
The ***second*** approach is known as Nash bargaining theory, and analyzes the household decision making process in a cooperative bargaining framework and the theory endogenizes bargaining power of different members of households. The Nash cooperative bargaining model argues that divorce is too strong to be credible and couples never dissolve the marriage. Mc-Elroy and Horney (1981) put forward an alternative Nash bargaining model according to which threat points come from non-cooperation within the household. That is, spouses stop cooperation, remain together but no longer coordinate their contribution to family public consumption goods. In these models, household members are assumed to maximize their utility, taking the other individuals' behavior as given. In general, this Nash equilibrium setting imposes more restrictions on observable household behavior than the unitary approach. One potential drawback of these non-cooperative models, however, is that it does not necessarily result in Pareto efficient intra-household allocations. That is, in many cases, it is possible to make an individual better off, without making the other household members worse off.

Chiappori(1988) pioneered the ***third*** approach, namely sharing- rule of intra-household decision making that requires an explicit bargaining framework. In the intra-household decision process literature , this approach is known as *"collective household model".* He bases his model solely on the single assumption of Pareto efficiency outcome in the household decisions. It can be shown that this collective model leads to household preferences that are dependent on wages, prices and individual non-labor incomes. The presence of the latter in the household's preferences reflects the fact that the distribution of the bargaining power within a household may depend on the level of each of these variables , as well as gender ratio (Chiappori, P.A., B. Fortin and G. Lacroix 2002).

Intra-household decision making process of resource allocation is carried out by a utility optimization which is assumed for family or its members. Because of its realistic underlying assumptions and possibility of incorporating the effect of sharing factors like divorce rate, gender ratio and difference in the schooling years in the individual labor supply of spouses, the empirical model of interest is based on the Chiappori (1998) and Chiappori (2001).

Estimations and statistical tests are conducted by HES (Households' Expenditures Survey) (2008), and a few individualized aggregate variables like gender ratio, divorce rate, Industrial development Index and average of families' income in the provinces. Nonparticipation of spouses is an obvious feature of the Iranian households, and therefore, this characteristic should be taken into consideration in the econometric analysis of data. There are two interrelated limited dependent regression equations with likely significantly correlated residuals. I use a multivariate Tobit model with the lower limits of zero for daily working hours of spouses. Therefore a maximum likelihood estimation procedure is used to catch all the pointed out features of the data and also the theoretical model of individual labor supplies.

The paper is structured as follows: Theoretical and empirical literature surveys are presented in the sections 2 and 3. Section 4 and its subsections are devoted to the theoretical framework of the paper. Data description and a summary of econometrics consideration for the limited dependent simultaneous labor supply equations in the presence of nonparticipation spouses are given in section 4. Specification tests, empirical econometric analysis and calculation of reservation log wages are undertaken in section 6 , and finally section 7 concludes.

2- Theoretical literature review

This section provides the theoretical literature that has been formed over the recent decades. An excellent starting point into these issues is Becker's seminal works on the family economics. Traditionally, the standard consumer theory, the so called unitary model, has been used to deal with the analysis of household behavior. The model assumes a utility function for the household as a whole and considers the family as a basic decision-making

unit. The unitary model implies incomes pooling, that is, the income from the household members are aggregated and also, that in the labor supply modeling of household members the source of income does not matter. Although this approach seems to be very convenient in theoretical modeling and empirical analysis, its application has been strongly criticized in the last decades by Manser and Brown (1980), Apps and Rees (1988), Chiappori (1992), Bourguignon and Chiappori (1992), Browning and Chiappori (1998). *First*, it is argued that treating the family as the representative agent violates the individualism principle, which states that each individual must be characterized by her own preferences. *Second*, since the unitary model considers the family as a whole, it does not allow raising any intra-household related issues that might have a significant effect on each member's welfare, which it turns out to be very restrictive model for households behavior modeling. It is reasonable to assume that preferences differ across family members, and consequently household behavior can be formulated to take into account the interaction process among family members.

Third, income pooling imposes restrictions on the labor supply function of individual household members and the unitary model, implies Slutsky conditions, which are often rejected by empirical studies for households with more than one member (Hans G. Bloemen 2004). [2]

From the late of 1970, various intra-household bargaining models which pay special attention to the interaction between family members have appeared. In fact, a household can be seen as a micro society that consists of several individuals with their own rational preferences.

Three more fruitful approaches that explicitly take into account individuals in a household make use of game-theoretic approach: the Nash cooperative bargaining, the non-cooperative and the collective settings. Cooperative Nash bargaining household model is the earliest attempt to explicitly describe the decision-making process within a householed; Manser and Brown (1980) and Mc-Elroy and Horny (1981). Household members are the agents that try to come to an agreement on how to divide the gains of cooperation when living together. Under symmetric information, the outcome of these kinds of games is Pareto efficient. They provide a more appropriate framework for intra-household analysis. In this bargaining model, individuals, given their relative bargaining power in the family, have to reach an efficient allocation of the gains obtained from the fact of living together.

An important criticism of the approach of choosing a particular bargaining concept to model household behavior is that if its empirical implications are rejected, then it is impossible to determine whether the particular choice itself is rejected or the bargaining setting in

2 - In a well described empirical evidence survey, Zeyu Xu(2007) categorizes the intra-household models and its empirical evidence.

general causes this rejection. More details on the difficulties with the Nash bargaining household model have been discussed in Zeyn Xu (2007).

Chiappori (1988, 1992) and Apps and Rees (1988) initiate an alternative theory with the only assumption of Pareto efficiency in the intra-household decisions. This approach which is called collective household model or Pareto efficient model was extended by Bourguignon, Browning Chiappori, and Lechene (1994), Browning and Chiappori (1998); Basu (2001), Koolwal and Ray (2002), Maitra and Ray (2003). It can be shown that this collective model leads to household preferences that depend on wages and individual non-labor income. Since the collective model is only based on the assumption of Pareto efficiency and does not impose any additional structure on the interaction process, it provides a very attractive setting for raising questions related to intra-household allocation of resources and the distribution of decision power.

Although some articles categorize the collective model as a special type of cooperative bargaining model that does not impose any structure on the bargaining process, there is an alternative game theoretic approach that considers the interaction as a non-cooperative game and uses the standard concept of Nash equilibrium. In this framework, household members are assumed to maximize their utility taking the other's behavior as given (see. e.g., Leuthold (1968), Ash worth and Ulph (1981), Browning (2000), Chen and Woolley (2001) and Lundberg and Pollak (1993)).

One of the main restrictions of the Nash cooperative bargaining framework is its choice of threat points which can be corresponded to divorce, or to a non-cooperative equilibrium within marriage (Ulph (1988) and Lundberg and Pollak (1993)). In general cooperative bargaining models make the more restrictive assumption that utility is invariant across marital statuses (Mc-Elroy (1990)). This restrictive assumption gives rise to developments in cooperative bargaining framework. Problems with choosing an appropriate threat point and with providing realistic schemes in which Nash bargained agreement leads to non-cooperative bargaining models, do not assume that household members enter into binding and enforceable contracts.

These models are typically characterized by a two-stage decision making process with non-cooperative solutions integrated into a generalized Nash cooperative game as its threat point. Contrary to the cooperative models in which Pareto efficiency can be realized, if information is symmetric and agreement resulting from the game is binding and costlessly enforceable, the non-cooperative models have the advantage of focusing on self-enforcing equilibriums which can be (but not necessarily) Pareto optimal (see Lundberg and Pollak (1996), Basu, (2000) and Ligon (2003)).

Empirical Literature

On the empirical side, using micro-data several contributions have estimated individuals' household decision process toward labor supply and tested unitary versus collective framework. Dependent on the presence of participation and non-participation in the market they have used various estimation procedures, such as GMM, Sample Selection, Censored and Multivariate Tobit with Simulated Maximum Likelihood Estimation procedures.

Bourguignon et al. (1993), making using of a subsample of French households' budget survey 1989-85, which consists of couples whom both members are full-time wage earners, with maximum one child at schooling age or younger (843 family's), find that the income pooling hypothesis is clearly rejected. They perform the test using both the Blundell and Meghir(2007) infrequency estimator, OLS and GLS without finding noticeable differences in the obtained results.

Browning et al. (1994), consider only married couples which both partners work fulltime. They use difference in ages and income of two partners as sharing factor in Canadian data. They use a nonlinear and restricted SURE method and find that the final allocations of expenditures on each partner depend significantly on their relative incomes and ages and on the level of lifetime wealth. Moreover, their empirical support for unitary approach is rather weak.

Fortin B. and Lacroix G. (1997), tests the unitary and the collective household labor supply models within a non-liner unrestricted household labor supply which are estimated as a function of all instrumental variables, then the fitted value are used in the FIML estimation of the structural supply equations. The data are drawn from the public use micro-data file on families (1986) for working couples between age of 25 and 50. Using a series of likelihood values they compute likelihood ratio statistics and find strong evidence against unitary, income pooling and symmetry restrictions.

Using Canadian micro data on household, Browning and Chiappori (1988) select married couples with at least fifty weeks of fulltime employment for both of them in the survey years. They instrumented total expenditure and applied GMM and used minimum chi-squared method to test the symmetry of Slutsky matrix and over-identifying restrictions. Their findings show that symmetry and the over-identifying restrictions are both rejected, and moreover findings are in favor of collective setting. Chiappori et. al. (2001) in a seminal work provides a theoretical framework for analyzing the impact of the marriage market and divorce legislation on household labor supply. This article is an extension of Chiappori (1992) to allow for distribution factors in the sharing rule and in turn in the individual supply equations. Using PSID data for the year (1988), on the couples which both spouses are working, they applied a full information GMM method to consider endogenity in covariates and to take into account heteroskdasticity of unknown form. Their results reject irrelevancy of distribution factors to intra-households decisions process and provide

statistical support for the significance of marriage market in the intra-household decision process.

Fernandez-Val (2003) estimates and test household labor supply models for Spain within a structural approach. He considers endogenity in wages and selection problem, which is raised from sample truncation for strictly positive work hours. Using likelihood ratio tests he shows that the micro-data on Spain households reject income pooling restrictions and unitary model. Laura Crespo (2005), provides an empirical contribution to the suitability of collective and unitary models of intra-household labor supply in Spain. He uses micro-data on couples with both members aged less than 65, and continuously working as employees throughout the sampling year. With making use of the well known GMM, he estimates structural parameters of couples' labor supplies and infers that neither the unitary model nor the collective one fits the Spanish household labor supply data.

Application of intra-household collective model for developing countries is rare and Chau et. al. (2007) is one of the researches that test the collective model versus the unitary one for China. He uses a random sample of 1615 observations from couples with positive work hours for both husband and wife, between the ages of 25, and 60. The estimation method in this research is GMM and the hypothesis testing rejects unitary model, in favor of power sharing between spouses.

Although non-participation and corner solutions are extensively argued theoretically in the household decision literature, empirical assessments of individual labor supply and more specifically the collective models with non-participation are rarely considered by empirical practitioners. However, for empirical work on collective household labor supply the inclusion of non-participation is of key importance, since restricting the sample to couples with working spouses may lead to selectivity bias in the structural parameters estimation. Recently Donni (2003) and Blundell et al. (2001) in their influential works included nonparticipation in the collective labor supply, and the former show that the identification result by Chiappori (1988) for the sharing rule can be extended to the case in which one of the household members does not participate.

Following the theoretical development, various empirical works allowed for the non-participation in the collective household labor supply. Bloemen (2004) is the first application of Donni's model on Dutch socio-economic panel over the period (1990-1997). He specifies an empirical model of collective household labor supply that allows for nonparticipation of husband and wife. Parameters of the labor supply functions and the wage equations of husband and wife are estimated simultaneously to capture the correlations in unobserved components. Symmetry of the Slutsky matrix which is implied by unitary model was rejected by LR test.

Also, the issue of nonparticipation is addressed both theoretically and empirically by Hourriez (2005). He includes distribution factors like gender ratio and divorce rate in the

sharing rule and finds the true model specification and identify structural parameters of sharing rule.

Using individual household panel data on French couples and applying a mixture of Heckit and instrumental estimation procedure, Blundell et al, (2007) extends Donni (2004) to allow the possibility that one or both partners do not work and one of the partners make just a discrete work choice, that is to work or not. Their conclusions for the U.K. families expenditures survey 1978-2001 fails to reject the unitary model.

4- Theoretical Framework

This section briefly presents the unitary and collective models with family members who may not participate at market and choose to stay with zero work hours. We consider a family composed of two members of working age whose preferences are defined over the consumption composite good and leisure. Assume a household with two decision-makers ($i = m, f$; where m refers to husband and f denotes the wife) whose preference relation are defined over the composite consumption good c_i , and leisure time l . Let h_m , and h_f be the labor supply of husband and wife respectively. The labor supply can be measured as working hours in a year, moth, week or day and is a nonnegative decision variable in the constrained utility maximization program. Therefore leisure time of each spouse is defined as $l_i = T - h_i$ and T is the total available time during a period (year, month, week or day) for individual i .

4-1 The Unitary Model

The unitary approach considers a household as a decision unit where the household behavior is the results of maximization of a single utility function at the household level. Normalizing the time endowment to unit and denoting individual wage rate and non-labor income by w_i and y_i respectively and considering the structure of data-set in which any aggregate consumption of the household ($c = c_m + c_f$) are reported, the household utility maximization program is formed as follow:

$$\begin{aligned} &\underset{(c,h_m,h_f)}{Max} && u = u(c, 1-h_m, 1-h_f) \\ &\text{s.t.} && c \le w_f h_f + w_m h_m + y \end{aligned} \qquad (4\text{-}1)$$

Where $c \ge 0, 0 \le h_i \le 1, y = y_m + y_f$ and $i = m, f$. Let $h_m(w_m, w_f, y)$ and $h_f(w_m, w_f, y)$ denote the non-negative solutions - the Marshalian labor supplies- of the program(4-1), which both of them could vary continuously in response to changes in wages

and non-labor income. The two sets of restrictions are imposed on $h_m(.)$ and $h_f(.)$ within this unitary model.

1-It is clear that the distribution of aggregate non-labor income across family members plays no role in determining individual labor supply. That is, the model imposes the pooling restrictions:

$$\partial h_m(.)/\partial y_m = \partial h_m(.)/\partial y_f \quad \text{and} \quad \partial h_f(.)/\partial y_f = \partial h_f(.)/\partial y_m$$

2-In an interior solution for both $h_m(.)$ and $h_f(.)$, the usual Slutsky restrictions must be satisfied. These restrictions are stated as follows:

$$s_{mf} = s_{fm}$$

Where, it shows the symmetry of compensated wage effects. $s_{ii} \geq 0; \quad i \in \{m, f\}$ which denotes the non-negativity of compensated own wage effects for both of the spouses. Finally, non-negativity of the determinant of Slutsky matrix is:

$$s_{ii}s_{jj} - s_{ij}^2 \geq 0$$

Where $s_{ij} = \partial h_i / \partial w_j - h_j \, \partial h_i / \partial y$; $(i, j \in \{m, f\})$ is compensated (own or cross) wage effect.

Amongst the restrictions, income pooling hypothesis has been rejected in several studies (Altonji et al. (1989), Bourguignon et al. (1993), Fortin and Lacroix (1997) and Fernandez-Val (2003)).

4-2 Collective Framework

Chiappori (1988, 1992) has proposed an alternative model of labor based on a collective representation of household behavior, in which the individual is the basic decision unit and is represented by her own preferences, and moreover, collective decisions leads to a Pareto efficient outcome. Using the notation defined above and assuming the utility function $u_i = u_i(c_m, c_f, l_m, l_f)$ for $i \in \{m, f\}$, under the collective decision process setting the family's behavior is represented by the following maximization problem.

$$\underset{\{c_m, c_f, l_m, l_f\}}{Max} \quad W = \mu(w_m, w_f, y, \mathbf{s})u_m(c_m, c_f, l_m, l_f, \mathbf{z}) + (1-\mu(w_m, w_f, y, \mathbf{s}))u_f(c_m, c_f, l_m, l_f, \mathbf{z}) \qquad 4\text{-}2$$

$$s.t. \qquad c_m + c_f \leq y + w_f h_f + w_m h_m; \quad h_i = 1 - l_i, \; 0 \leq h_i \leq 1$$

Where the weighting factor $0 \leq \mu(w_m, w_f, y, \mathbf{s}) \leq 1$ is assumed to be a function of exogenous variables w_m, w_f, y and the distribution factors, $\mathbf{s}$. Therefore it varies freely across households, and depends on the respective bargaining position of both spouses within each couple. In the empirical literature several proxies have been used for the distribution factors: Hourriez (2005) uses parameters of the local marriage market (gender-

ratio or divorce rate), and Chan et al. (2007) use difference in non-labor income and difference in years of education. Individual preferences are assumed to be altruistic. Thus, each member's preferences are represented by a utility function, $u_i = u_i(c_m, c_f, l_m, l_f, \mathbf{z})$ for $i \in \{m, f\}$ in which the egotistic preferences are nested. It is assumed that the utility function is well-behaved in all its arguments.

In this program the vector of distribution factors $\mathbf{s}$ only appears in the weighting factor but neither in preference and not in the budget constraint. In a more general framework, in addition to the arguments, Chiappori et al. (2001) represented the individual's utility function by a function of the K-vector $\mathbf{z}$ of preference factors, such as age, age squared, education of the two agents, and number of kids among others.

In order to obtain more testable restrictions and to identify the model, in empirical specification of the collective model, a separablility assumption is generally added. Under the assumptions of separability, Pareto efficiency of decision in the program (4-2), and existence of a single-valued and infinitely differentiable function $\mu(w_m, w_f, y, \mathbf{s})$ Chiappori et. al.(2001) show that the (4-2) is equivalent to the existence of some function $\phi(w_m, w_f, y, \mathbf{s})$, called sharing rule, such that each spouse solves the following program.

$$Max \quad u_i(T - h_i, c_i) \qquad (4\text{-}3)$$
$$s.t. \qquad c_i \le \phi_i + w_i h_i; \quad 0 \le h_i \le T$$

Where $\phi_f = \phi_f(w_f, w_m, y_f, y_f, \mathbf{s})$ and $\phi_m = y - \phi_f(w_f, w_m, y_f, y_f, \mathbf{s})$. So each member separately chooses labor supply subject to the corresponding budget set. Given an interior solution for both h_m and h_f the individual labor supply functions can be written as:

$$h_m = h_m(w_m, w_f, y_m, y_f, \mathbf{s}, \mathbf{z}), \quad h_f = h_f(w_m, w_f, y_m, y_f, \mathbf{s}, \mathbf{z})$$

it can be easily shown that the collective model does not impose income pooling, because the decision process takes place in two stages. First, members divide the non-labor income according to some predetermined rule, which is a function of exogenous and unobservable sharing rule that reflects each individual bargaining power in the household. Specifically, the sharing rule is represented by a function $\phi_i(w_f, w_m, y_f, y_f, \mathbf{s})$ that demonstrates the fraction of non-labor income that goes to the individual i. In the second stage, the members independently choose c_i and h_i subject to their own budget set. For interior solutions (participated husband and wife) Chiappori (1988) shows that Slutsky conditions on compensated individual labor supply in the second stage of the decision making process are satisfied. Donni (2001) proves that Chiappori's conclusions are still valid if either of the husband or the wife (but not both) does not work. Therefore it is possible to recover uniquely the sharing rule even in the cases where one of spouses does not participate.

4-3 Functional Form for Labor Supplies

In order to conduct estimations and statistical inferences about unitary and collective household decision models, I follow closely Chiappori et. al.'s (2001) functional form of individual labor supply functions specification. The following semi log labor supply system is popular in the individual collective labor literature, although following Hausman and Ruud (1984) a quadratic functional form of labor supply is also used. Now consider that the sharing rule $\phi_i(w_f, w_m, y_f, y_f, \mathbf{s})$ is of the following form,

$$\begin{aligned}\phi_m(w_f, w_m, y_f, y_f, \mathbf{s}) &= k_0 + k_1 \log(w_m) + k_2 \log(w_f) + k_3 \log(w_m) \times \log(w_f) \\ &\quad + k_4 y_m + k_5 y_f + \mathbf{k}_6 \mathbf{s}\end{aligned} \tag{4-5}$$

$$\phi_f(w_f, w_m, y_f, y_f, \mathbf{s}) = y - \phi_m(w_f, w_m, y_f, y_f, \mathbf{s})$$

The Marshalian individual labor supplies for each couple take the form of $h_m = Max\{0, h_m^*\}$ and $h_f = Max\{0, h_f^*\}$, with

$$h_m^* = a_0 + a_1 \log(w_m) + a_2 \phi_m + \mathbf{z}_m \mathbf{a}_3 + \varepsilon_m \tag{4-6}$$

$$h_f^* = b_0 + b_1 \log(w_f) + b_2 (y - \phi_m) + \mathbf{z}_f \mathbf{b}_3 + \varepsilon_f \tag{4-7}$$

Where at least one of spouses works and $\boldsymbol{\varepsilon}$ is of normal distribution with mean zero and covariance matrix of;

$$\begin{bmatrix} \sigma_m^2 & \rho\sigma_m\sigma_f \\ \rho\sigma_m\sigma_f & \sigma_f^2 \end{bmatrix} \tag{4-8}$$

A positive ρ implies that a higher working hour husband is living with higher working hour wife. Inserting (4-5) in (4-6) and (4-7) would result in the unrestricted reduces system with distribution factors and preference covariates:

$$\begin{aligned}h_m &= m_0 + m_1 \log(w_m) + m_2 \log(w_f) + m_3 \log(w_m) \times \log(w_f) \\ &\quad + m_4 y_m + m_5 y_f + \mathbf{m}_6 \mathbf{s}_m + \mathbf{m}_7 \mathbf{z}_m + \varepsilon_m\end{aligned} \tag{4-9}$$

$$\begin{aligned}h_f &= f_0 + f_1 \log(w_m) + f_2 \log(w_f) + f_3 \log(w_m) \times \log(w_f) \\ &\quad + f_4 y_m + f_5 y_f + \mathbf{f}_6 \mathbf{s}_f + \mathbf{f}_7 \mathbf{z}_f + \varepsilon_f\end{aligned} \tag{4-10}$$

Where m_j and f_j for $j = 1, \cdots, 5$ are scalar, and $\mathbf{m}_6$, $\mathbf{m}_7$, $\mathbf{f}_6$ and $\mathbf{f}_7$ are vectors whose dimensions are determined by the dimension of $\mathbf{s}_i$ and $\mathbf{z}_i$ respectively.

Note that if leisure is a normal good for both husband and wife, then f_4, f_5, m_4 and m_5 must be negative. The parameters of distribution factors should have the opposite sign across the supply equation. Therefore the terms of distribution factors in the sharing rule can be interpreted as variables that represent the relative power of husband and wife.

4-4 Unitary Model Restrictions

The unitary model imposes several restrictions on the system that can be rather easily tested. Unitary model requires that distribution factors should not affect household decision, since they only appear in the sharing rule rather than utility function argument and the household budget constraint. Consequently unitary model is relevant if:

$$\mathbf{m}_6 = \mathbf{0} \text{ and } \mathbf{f}_6 = \mathbf{0} \qquad (4\text{-}11)$$

The income pooling and Slutsky symmetry restrictions are obtained by imposing:

Income pooling restrictions: $f_4 = f_5, \quad m_4 = m_5$ (4-12)

Symmetry restrictions: $f_2 = f_3 = f_4 = m_1 = m_3 = m_4$ (4-13)

Where, the latter implies that each labor supply equation depends only on own wage rate and preference factors.

Collective Model Restrictions

In the semi log specifications, the restrictions which are imposed by the collective model mainly rely on the distribution factors. The generalized labor supply functions are derived by:

$$\frac{\partial h_m(.)/\partial s_k}{\partial h_m(.)/\partial s_l} = \frac{\partial h_f(.)/\partial s_k}{\partial h_f(.)/\partial s_l} \qquad (4\text{-}14)$$

For any element *k* and *l* of the vector of distribution factors $\mathbf{s}$, and implies that the ratio of the impacts of all distribution factors on the two labor supplies are equal under the egotistic preferences[3]. If these restrictions are held in an empirical hypothesis testing, then it implies the satisfaction of Pareto efficiency in a collective model of labor supply. Chiappori and Ekeland(2001) show that these condition are also sufficient for the Pareto efficiency.

The Slutsky conditions on individual labor supplies are derived by $\partial h_m(.)/\partial w_i - h_m \, \partial h_m(.)/\partial \phi_i \geq 0$ where in the special case of semi log functions they take the forms of $a_1/w_m - a_2 h_m \geq 0$ and $b_1/w_f - b_2 h_f \geq 0$ for husband and wife respectively.

These conditions are verified for each observation in the empirical analysis. However theoretically restrictions $a_1 \geq 0, a_2 \leq 0, b_1 \geq 0$ and $b_2 \geq 0$ must be satisfied globally, although in some cases it is only satisfied locally.

4-6 Participation frontiers and reservation wages

3 - See Chiappori et al.(2002), proposition 2.

One can solve (2-6) and (2-7) for $\log(w_i)$ when individual *i* does not participate. From the work hours supply functions; we obtain the equation of the participation frontier for husband as wife respectively:

$$\log(w_m) = (m_0 + m_2 \log(w_f) + m_4 y_m + m_5 y_f + \mathbf{m}_6 \mathbf{s}_m + \mathbf{m}_7 \mathbf{z}_m)/(m_1 + m_3 \log(w_f)) \quad (4\text{-}15)$$

In a similar way it is easy to find that

$$\log(w_f) = (f_0 + f_2 \log(w_m) + f_4 y_m + f_5 y_f + \mathbf{f}_6 \mathbf{s}_f + \mathbf{f}_7 \mathbf{z}_f)/(f_1 + f_3 \log(w_m)) \quad (4\text{-}16)$$

Provided that $m_1 + m_3 \log(w_f) \neq 0$, $f_1 + f_3 \log(w_m) \neq 0$, $w_m > 0$ and $w_f > 0$, the reservation wages are uniquely solved.

4-7 Iranian civil procedure and bargaining power of spouses

Institutional environment forms the social relationships among the people who live in the society. According to the Iranian civil procedure (Act 1105) husband is the head of family and according to the Act (1111) he is absolutely in charge to provide all of financial needs of his wife, children and finally his parents. In addition, the Law of Islamic Punishment (Act 642) requires that abstention of paying alimony would result in sentencing to prison for 91 days up to 5 months. However, wife does not have any commitment against husband, except the condescension. Furthermore, she is the owner of her personal earning and assets (Act 1118) and can arbitrarily use it in any way that she likes. Therefore based on the rules they would bargain on the y_m, the non-labor income of husband and while they decide to dissolve the marriage, depending on the amount of wife's dower, she can posses her husband's non-labor, 0.25 of his monthly wage and all of his properties except his car, house and professional instruments an work place, (Execution of Civil Judgments, Act 524). An appropriate modeling methodology should consider and statistically test the effectiveness of these rule and regulations in the modeling. In what follows the collective decision theory are modified to take into account the rules in the non-labor income sharing, and budget constraint.

The bargaining between spouses is taken place over the husband's non-labor income and the amount of share depends on the individual's bargaining power and cultural customs. Then, applying the rule, which would give rise to the sharing rule for husband and wife, are defined respectively as:

$$\phi_m = \phi_m(w_m, y_m, \mathbf{s})$$

$$\phi_f = y_m - \phi_m(w_m, y_m, \mathbf{s}) + y_f$$

The budget constraints of husband and wife are derived as $c_m \leq w_m h_m + \phi_m(w_m, y_m, \mathbf{s})$ and $c_f \leq w_f h_f + \mathrm{y_m} - \phi_m(w_m, y_m, \mathbf{s}) + y_f$ respectively. In the framework of Chiappori (2002) only

the husband's labor supply functional form will change, particularly y_f is excluded from the right hand side of $h_m(.)$. Thus the restricted model is nested in the (2-8). Validity of the constraint can easily be examined empirically by usual statistical test statistics as well as LR or Wald test.

5- Data Description and Econometric Consideration

I use data from two sources of HES (2008) and annual statistical report (2008), which both are reported by Statistical Center of Iran. The sample consists of couples in which wives and husbands are aged between 20 and 60. Students, housewives, all the men who are spending mandatory military services, and those who are unable to work for health reason or are prohibited by law are excluded from the sample. But, those who are involuntarily unemployed but have non-labor income are included in the selected sample. Applying all these restriction, we are left with 13410 observations.

An advantage of household's expenditure survey which is annually conducted in urban and rural areas of Iran is that includes a rather detailed information on the daily work hours of family members, their monthly wage and yearly non-labor income. Furthermore individuals' schooling, their age, the detailed composition of non-labor income, marital status, job status, individual's relation with the head of family, gender, family size, and the economic sector in which he/she is working, are reported separately. Moreover I use local gender ratio for several ages and divorce rate (total number of recorded divorces over the recorded marriages in each province) in the urban areas of Iran to capture the effect of distribution factors on the market participation and sharing rule between spouses as well.

Table(5-1)(a): Sample Descriptive Statistics for husbands and wive

	Husband		**Wife**	
Variables	Mean	std. err	Mean	std. err
Participation rate	0.87	0.33	0.11	0.31
Daily work hours(whole sample)	7.95	3.73	0.69	2.11
Daily work hours if emp=1	9.07	2.39	6.38	2.27
Daily work hours if emp=1 and college edu	8.27	2.43	6.30	1.76
Log of hourly wage (whole sample)	5.42	4.81	0.76	2.65
Log of hourly wage if emp=1	6.19	4.65	7.07	4.51
Log of hourly wage if emp=1 and college edu.	8.90	3.37	9.85	1.80
Non-labor earnings (million Rial)	8.17	22.76	0.76	7.07
Age	41.80	9.37	36.9	9.19
College educated 1 or 0	0.17	0.38	0.107	0.31
College educated 1 or 0 if emp=1	0.175	0.38	0.52	0.49
Average years of schooling if emp=1	8.435	5.07	11.45	5.40

Table(5-1)(b): Sample Descriptive Statistics in household and aggregate level

	Household	
	Mean	Std.er
Variables		
Years of age difference(Male-Female)	4.90	4.32
Number of pre-school kids	.48	.65
Number of children equal or over6	1.72	1.48
Years of schooling difference (Male-Female)	1.16	3.96
Divorce Rate (divorce/marriage)	.104	.042
Gender Ratio(women/men)	1.216	.216
Average of households' income in the provinces	.0158	.005
Industrial development index	.233	.237
# of observations	13410	

The HES does not provide annual hours of work, instead individuals are asked to report the daily hours of work and the number of days they worked during the last week. They are also asked to report monthly wage during the month prior to the sampling and yearly non-labor income in the last year. The dependent variables are each member's daily hours of work in all his/her jobs. About 19.2% of employed people are dual job holder in Iran, but the rate varies with economic growth and capital formation (Keshavarz-Haddad and Mohit(2010). The measure of the wage rate is the average hourly earnings, which is defined by dividing total net yearly labor income including: permanent and nonpermanent incomes (over time working) for wage earner, and net labor income for employees with private and self employed jobs, over annual working hours. The annual non-labor income includes financial transferred aids, rental income, earnings from bank deposit, bound yield and share dividend and education relate aids.

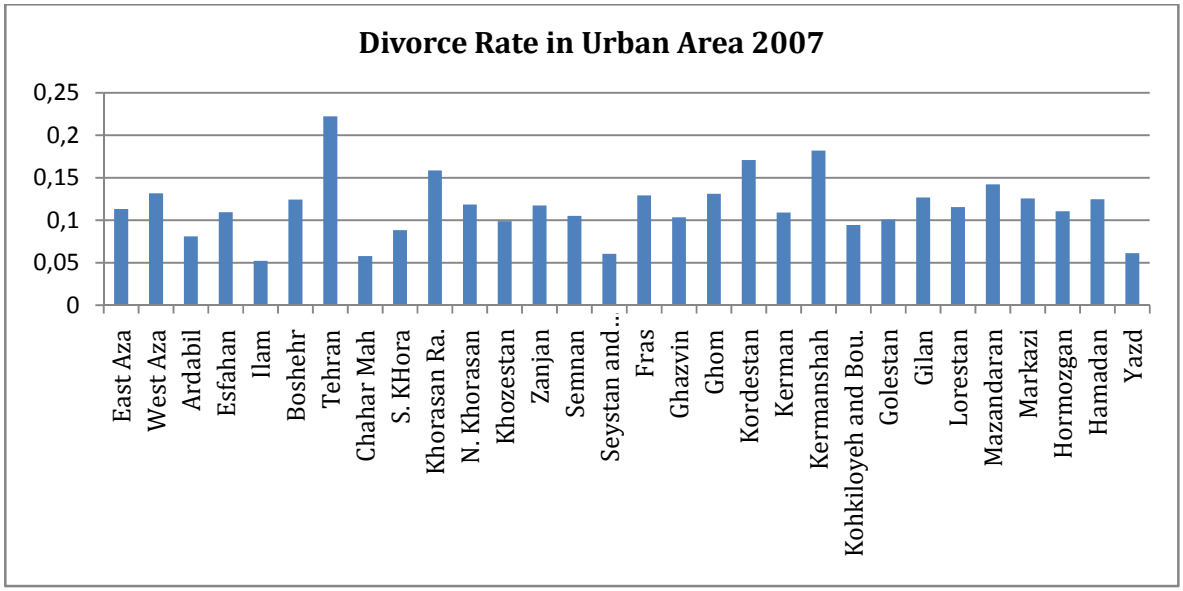
Table (5-1)(a) shows that 87% of males and 11% of females participate in the Iranian labor market, while only 17.5% of participated males and 52% of participated females are college educated. However in the entire sample 17% of males and 0.1% of females are college educated. Therefore it seems that education is a driving force of females' participation. Men's daily work hours and wage rate are greater than those of women in the entire sample. The same pattern exists for non-labor income and years of schooling. That is, on average men receive more non-labor income. Large standard errors for wage income stem from the fact that more than 85% of females do not participate. When we restrict the calculation to the employed men and women, average of labor income for men and women significantly change. The average of females' working hours increases to 5.38 and their log wage rises to 7.07, while it was 0.76 for the whole sample. When the average is restricted to the employed

with college and non-college degree, the mean working hours and log wage of males would increase to 9.07 and 6.19 respectively, and those of females would increase to 6.38 and 7.07. A similar pattern exists for employed males and females with college degrees.

These statistics confirm that higher educated females are highly motivated to participate in the labor market, but the same conclusion cannot be true for the males. Once the working hours are restricted to the college educated people they reduce to 8.27 and 6.30 for males and females respectively. In contrast to many studies (Bloemen (2010); and Fortin and Lacroix (1997), Chua (2007) among other) on average, hourly wage rate of females is higher than males in Iran. The average of *log* W_m for employed males and females are 6.19 and 7.07 and those with collage degree are 8.90 and 9.85 respectively. It seems that females' reservation wages are higher than males'. Also, average years of schooling for employed females is 11.4 and that of males is 8.43.

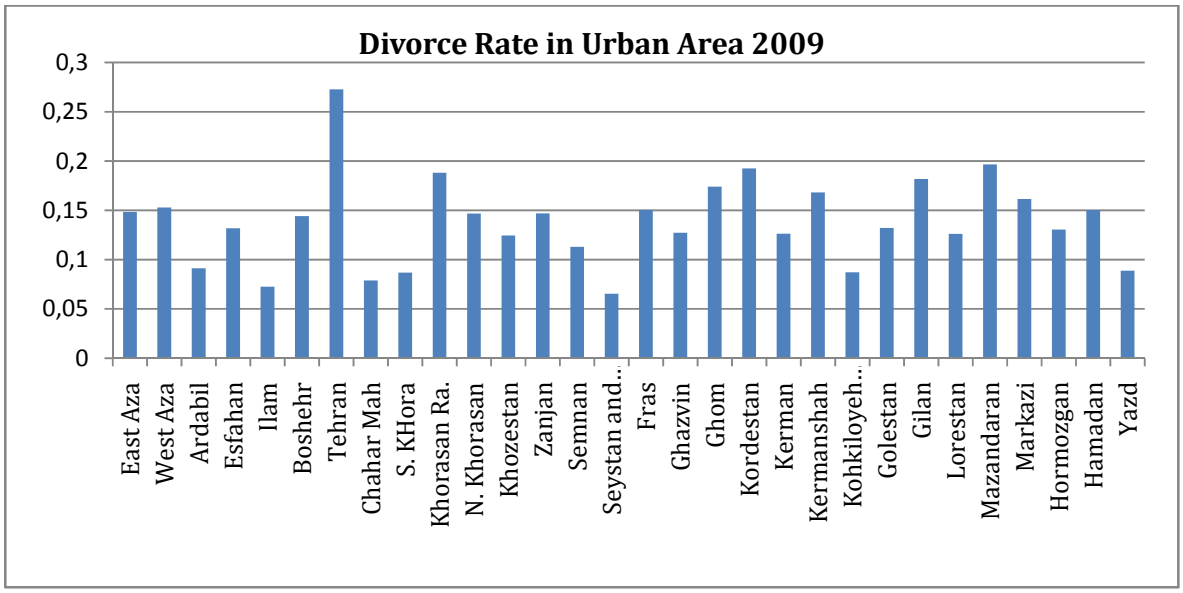
Following Chiappori et al. (2001) and Hourriez (2005), two distribution factors of divorce rate and gender ratio are included in the empirical model specification. The divorce rate and gender ratio are calculated at provinces level, for urban areas. Mean of divorce rate in Iran is 10.4 out of 100 marriage and it maximum is above 27 which is comparable with 25 divorces out of 100 marriages in the Paris (Hourriez (2005)). Figures (5-1) and (5-2) shows the divorce rates across provinces for 2007 and 2009. Tehran was of the highest rate in both years with 0.22 and 0.27 respectively, and all of other provinces experienced a positive growth over the period as well.

Table (5-1): Divorce rate by Geographical Areas (2007)



Statistical Annual Yearbooks (2007)

Table (5-2): Divorce rate by Geographical Areas (2009)



Statistical Annual Yearbooks (2009)

Iranian society has not experienced any changes in Civil Procedures deal with family law during the past years, but the attitudes of people toward divorce, social norms have tangibly changed and it is significantly different across the provinces. During the last decades social attitudes toward the higher amounts of dower (the financial commitment that in the beginning of a common marriage husband accepts in favor of females and it is due upon claim by her) were intensified. These social norms provide a dominant bargaining advantage for married females to have strong bargaining power in the intra-household decision process.

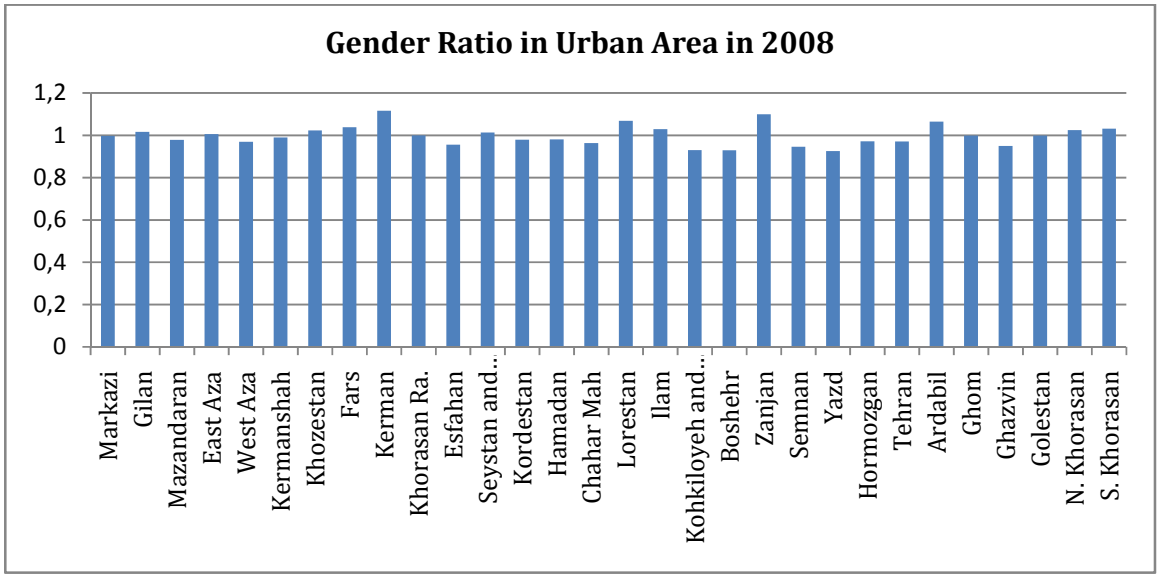
As graphs (5-1) and (5-2) show, there are striking differences in the divorce rate among the provinces, therefore it is expected that marriage market and household labor supply to be different in the provinces, additionally the rate is increasing over the period in all provinces.

Bargaining position of each spouse depends on the consequences of a possible divorce, which is used as a threat point in the bargaining process. Therefore the gender ratio is a distribution factor which seems significantly derives the intra-household decision process. The variable along the other distribution factors determines the intra-household balance of power and enter as an argument in the sharing rule. Chiappori et al (2002) have proposed and tested the factor. It was a relevant determinant to the marriage market. I computed gender ratio for all provinces in urban area with the following definition, which have been applied frequently in empirical works:

$$Gr1 = N_f / N_m$$
$$Gr2 = \sum_{i=0}^{5} N_f(age_m - i) \Big/ \sum_{i=0}^{5} N_m(age_f + i) \qquad (5\text{-}1)$$
$$Gr3 = \sum_{i=0}^{7} N_f(age_m - i) \Big/ \sum_{i=0}^{7} N_m(age_f + i)$$

Where $N_s(a)$ *i*s the local population with the gender of (s) and age of (a). All the definitions show ratio of male to female in same local area with relatively near ages. Gr1 assumes that a divorced man/ woman usually seeks to find a match with the same age. Gr2 assumes that by tradition a man intends to find a 5 years younger woman to form his family. In the sample at hand the average of age difference between husbands and wives is positive and equals to 4.9 years. Gr2 is defined to take into account this fact. Gr3 makes the range wider and suppose that a man searches for woman who is at most five years younger than him and vice versa for woman. Figure (5-4) provides gender ratios by geographical areas in all the 30 provinces. The figure shows the relative scarcity of women in the local population of urban areas. Kerman and Zanjan have the highest gender ratio. But in the provinces with higher immigrant labor forces, which are usually more industrially developed, scarcity of women is observed.

Figure (5-4): Gender Ratio (Gr1) by geographical areas



Browning et al. (1994) argue that the difference in education can be taken as a distribution factor in the sharing rule. However, the education level is considered as an element of preference factors vector as well as own age, and its square (or square root) years of

education, pre-school and school age children. The same argument can be provided for some of other elements of preference factors as well as age to play the dual role in the labor supply.

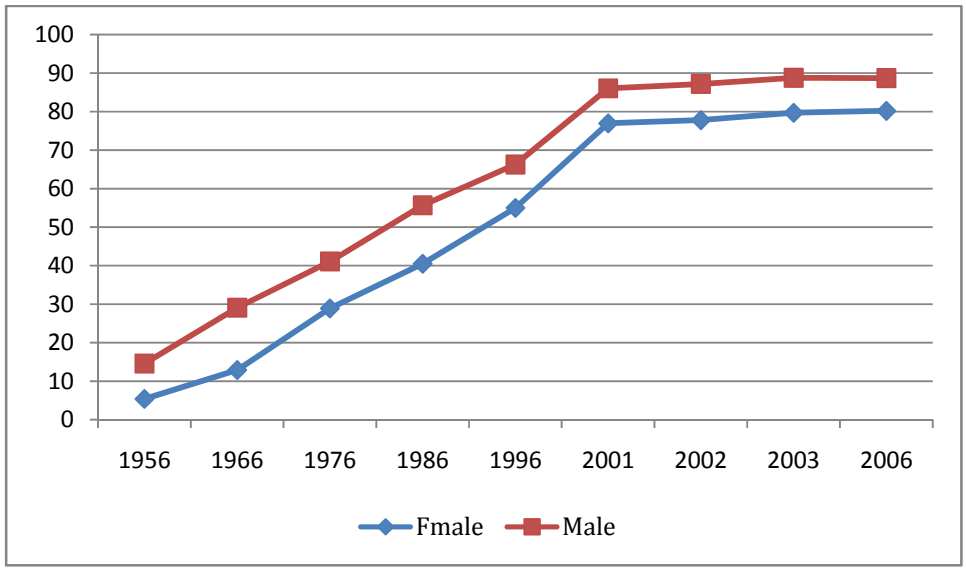
Education improves women's position in the society and boosts females' participation in the labor market. Table (5-2) indicates that literacy rate of females was of increasing trend over 1956-2006 and has reached its steady state in 0.8%. It is increasing but always less than that of males.

Table (5-2): Population of Educated Females and Males 1956-2006(Percentage)

	1956	1966	1976	1986	1996	2001	2002	2003	2006
Femal	5.4	12.9	28.9	40.5	55.0	76.97	77.8	79.7	80.2
Males	14.6	29.1	41.1	55.7	66.3	86.07	87.2	88.8	88.7

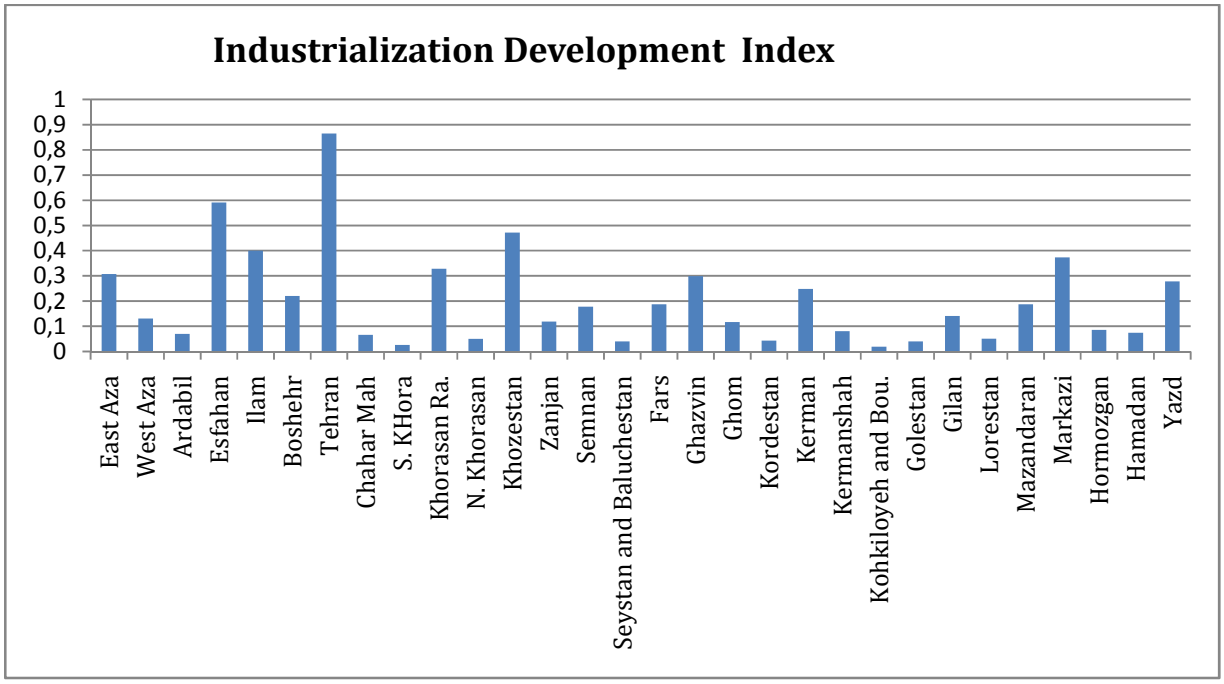
Source: Statistical Centre of Iran, Annual Reports

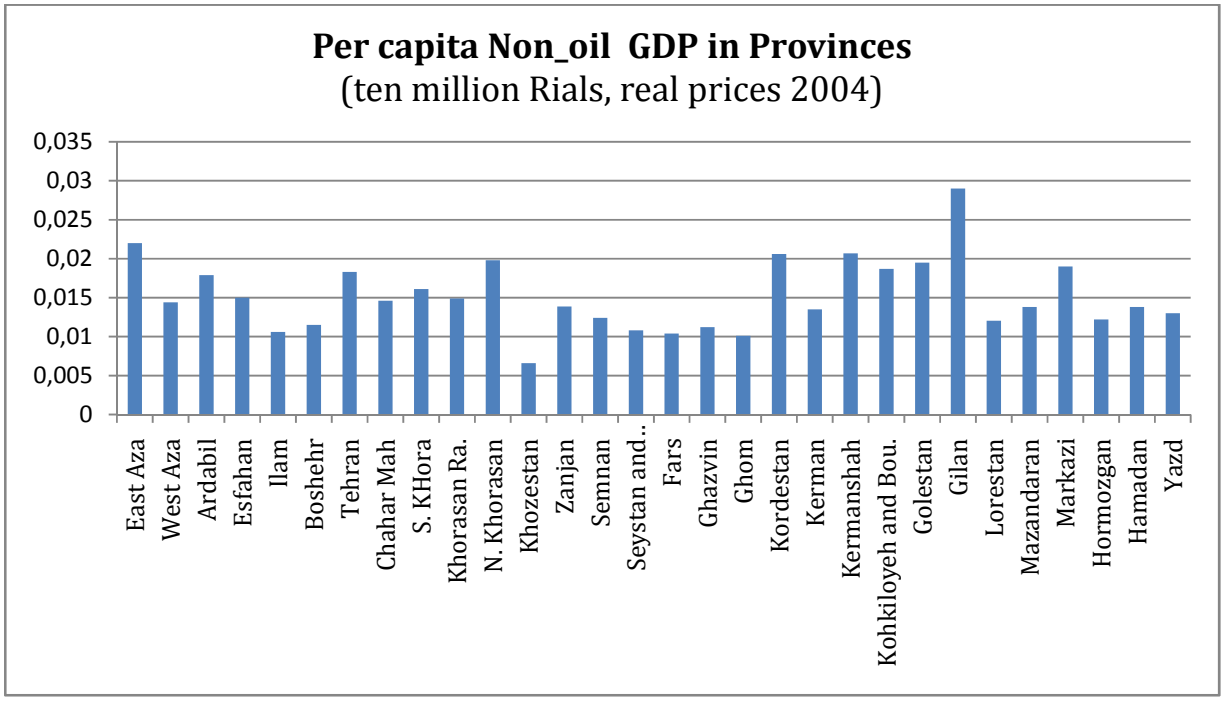
Figure(5-3): Literacy Rate of Females and Males in Iran 1956-2006



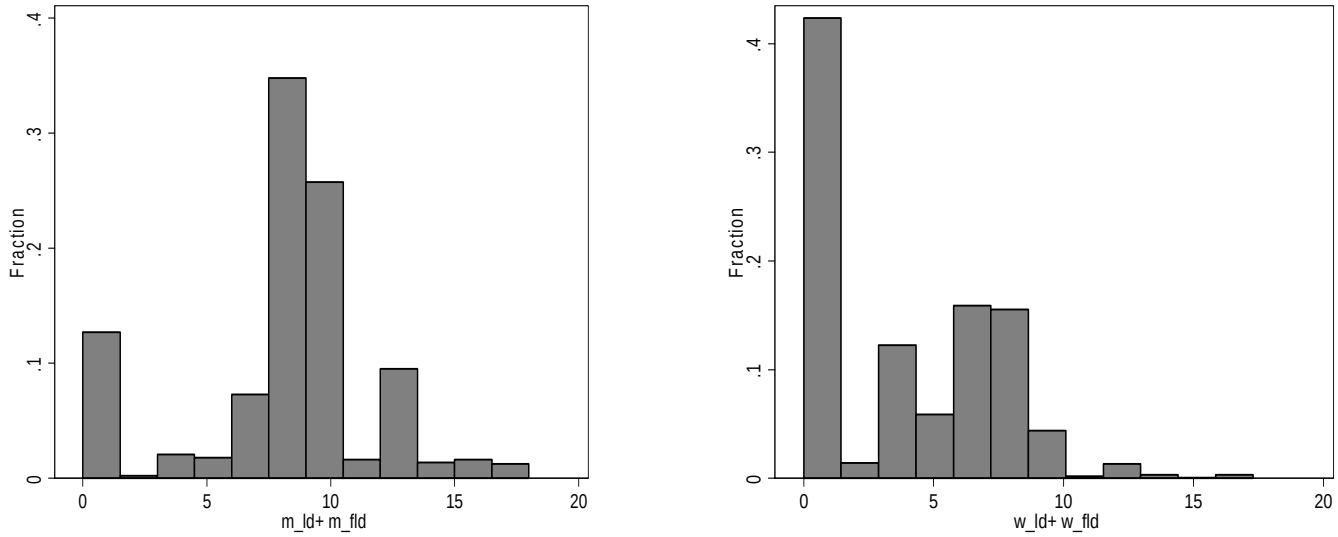
Higher daily work hours can be assigned not only to the bargain position of each spouse in the household, but also it can be due to the higher demand for labor, which in turn stems from the degree of economic and industrial development and economic activity in any provinces. The industrial development index and per capita non-oil GDP in the provinces that spouses are living in are also entered in the supply equations specification to capture the differences in individuals' working hours, which may stem from the norms and potentials that each province is faced with. Figurs (5-5) and (5-6) show that the provinces

development level is heterogeneous, and the level of per capita non-oil GDP varies across the provinces. These two factors are used to control the heterogeneity demand side of local labor market in geographical areas.





A widespread unemployment both, for females and males is the apparent feature of Iranian economy. Figures (5-6)(a) and (5-7)(b) represent the histograms of total daily work hours of males and females respectively.



This figure clearly depicts that a major fraction of married but non-housewife females are unemployed[4]. The rate of unemployment for males is about 0.12. However overtime working is a widespread issue among them, and more than 0.45 of employed males work more than standard 8 hours a day.

Although the subject of corner solution exits in theory of consumer choice and is observed in individual's time allocation, most of the empirical papers so far restricted their working sample to the working couples. Donni (2003), Blundell (2004), Bloemen (2010), Lacroix and Radtchenko (2009) purpose innovative techniques to taking corner solutions into account in the estimation of household labor supply functions. Given the reduced form supply function (2-9) and (2-10) I specify the estimable model as two seemingly unrelated regression equations (SURE) where each equation is of a Tobit type specification. But the disturbances terms, in the SURE regression, may have nonzero correlation. Again recall the (2-9) and (2-10) together with the structure of disturbance vector $\boldsymbol{\varepsilon}$ covariance matrix (4-8). It is convenient to form a SURE system of equations and conduct its parameters estimation by maximizing the following likelihood function for $S = \{1, 2, 3, 4\}$:

4 - Note that housewives and students are excluded from the sample, and all individuals with nonzero working hour are considered as employed.

$$L=\prod_{1} f(h_{mi}-\boldsymbol{\beta}'_m\mathbf{X}_{mi},\, h_{fi}-\boldsymbol{\beta}'_f\mathbf{X}_{fi})\times\prod_{2}\int_{-\infty}^{-\boldsymbol{\beta}'_f\mathbf{X}_{fi}} f(h_{mi}-\boldsymbol{\beta}'_m\mathbf{X}_{mi},\, \varepsilon_{fi})d\varepsilon_{fi}$$
$$\times\prod_{3}\int_{-\infty}^{-\boldsymbol{\beta}'_m\mathbf{X}_{mi}} f(h_{fi}-\boldsymbol{\beta}'_f\mathbf{X}_{fi},\, \varepsilon_{mi})d\varepsilon_{mi}\times\prod_{4}\int_{-\infty}^{-\boldsymbol{\beta}'_f\mathbf{X}_{fi}}\int_{-\infty}^{-\boldsymbol{\beta}'_m\mathbf{X}_{mi}} f(\varepsilon_{fi},\, \varepsilon_{mi})d\varepsilon_{mi}$$

Where $\prod_j$ denotes product over all observations in $j\in\{1,2,3,4\}$. 1 stands for the cases in which both of spouses are working, 2 shows family in which husband works but wife does not. Subscribe 3 refers to the cases that husband is unemployed but wife works, and the last term is the products of densities for couples which neither of them is working. Vectors $\mathbf{X}_{mi}$ and $\mathbf{X}_{fi}$ stand for the covariates in (2-9) and (2-10), and finally $f(.)$ is the joint density function of $\boldsymbol{\varepsilon}$. The last term will be vanished if at least one spouse participates in the market. The ML estimation involves numerical evaluation of the integrals at each stage of iterations. In the application, the simulated maximum likelihood method are used, to evaluate the multidimensional integrals, which the calculation method relies on the Geweke(####)-Hajivassiliou(####)-Keane (19##) so called (GHK) simulator.

6- Econometrics Analysis and Empirical Modeling

This paragraph provides the empirical analysis in 3 subsections. In subsection (6-1) the result of model restriction tests and the effect of the Iranian Civil Procedure on the intra-household resources allocation are presented. Subsection (6-2) gives the parameters estimation results which includes the market participation analysis and working hours equations. The last part of the paragraph calculates the reservation log wages for males and females.

6-1 Specification tests

To test the validity of Iranian Civil Procedure as a households' collective bargaining setting, the model within which the coefficient of y_f in the male's sharing equation is subjected to zero is estimated. Table (A1) in the appendix shows that, the sign and significance of explanatory variables is in the same direction which were expected, but absences of y_f in the sharing rule is strongly rejected by LR test. Therefore from now on all the statistical analysis will be continue by the conventional models of intra-household collective decision process.

Relevance of unitary model versus intra-household collective decision model is tested in two stages. At first income pooling is tested, and then the income pooling hypothesis is combined with zero exclusion constraints of distribution factors. More technically, $m_4=m_5$ and $f_4=f_5$, $m_4=m_5$, $\mathbf{m}_7=0,\ \mathbf{f}_7=0$. Table (6-1) shows that both of procedures reject the

null hypothesis of income pooling and no distribution effects with income pooling at one percent significance level with calculated Wald tests of 42.56 and 146.41, respectively. Therefore the sources of non-labor income have dissimilar effects on the spouses' time allocation and the distribution factors have significant effects on the intra-household decision making toward their hours of work and leisure. These finding reject the unitary model and imply that Iranian families are not managed by one of parents, and the head of family (by tradition the father) does not have absolute authority over all its members, instead intra-household power is distributed among all the family members.

Bourguignon, Browning and Chiappori (1995) prove that the restrictions $\frac{\partial h_m / \partial s_k}{\partial h_m / \partial s_1} = \frac{\partial h_f / \partial s_k}{\partial h_f / \partial s_1}$, $k = 2,\ldots,L$ must be satisfied in a collective intra-household setting. These equalities require that distribution factors affect the labor supply through bargain power of spouses, and imply that the impacts of all distribution factors on the labor supply equation are equal and these equalities provide a test for Pareto efficiency, which is an underlying assumption for the collective model of the labor supply. Table (6-1) reports that Wald statistic of Pareto efficiency hypothesis is 0.55. Consequently, the hypothesis cannot be rejected at any conventional significance level. For the sharing rule (4-5) to be valid in the collective setting, the necessary and sufficient conditions are (Chiappori, et. al. (2001)):

$$\frac{m_3}{m_{61}} = \frac{f_3}{f_{61}},\ \frac{m_3}{m_{62}} = \frac{f_3}{f_{62}},\ \frac{m_3}{m_{63}} = \frac{f_3}{f_{63}}$$

Where f_{6l} and m_{6l} (l=1,2,3) are the coefficient of the three distribution factors which are included in the sharing rule (2-3) for each couples. The constraints are hypothesized and tested by Wald statistic. The calculated statistic is 2.81 and shows that at even 0.10 critical rejoin one cannot reject this joint hypothesis, this confirms validity of the functional from (4-5) of under consideration as a true sharing rule which fits with the data in Iran.

Table (6-1): Model specification test

Tests on unrestricted model	Test statistics	Degree of freedom	*p*-value
LR test for fulfillment of Iranian civil procedure in sharing rule	67.6	1	0.00

Wald test of income pooling	42.56	2	0.00
Wald test for exclusion of distribution factors and income pooling	146.41	8	0.00
Wald of Pareto efficiency	0.55	2	0.76
Wald test for Validity of sharing rule parameters' identification	2.81	3	0.42
LR test of roh12=0 in the multivariate Tobit	42.76	1	0.00

6-2 Estimation Results

Econometric findings are present in two stages. First the factors which affect market participation probability of spouses as an auxiliary apparatus in the interpretations and explanation of labor supply functions is examined. Because some covariates might affect on the participation likelihood and working hours in different direction, therefore at first one should explore the direction that the covariates determine the likelihood and then the response of working hours can be describe by a limited dependent response model. For example individuals with college degrees are highly motivated to participate but they may supply less working hours to the market. The similar reasoning may exist for other determinants, then the supply parameters are estimated by a Multivariate Tobit.

Table (6-2): Probit Estimation of the Male and Female Market Participation

	Husband		**Wife**	
Variable	Estimate	std. err	Estimate	std. err
Intercept	.61657	.33074	-4.928	.32126
Log of hourly wage of husband(w_m)	-	-	-.00289	.00356
Log of hourly wage of wife(w_f)	.32982	.05132	-	-
Log(w_m)× Log(w_f)	-	-	-	-
Non-labor earning of husband(y_m)	-.02451	.00055	-.0024	.00073
Non-labor earning of wife(y_f)	-.01014	.00218	-.03730	.00532
Number of pre-school kids	.03364	.03111	-.07068	.0294
Number of children equal or over6	.020177	.012637	-.07062	.0146
Age	.08274	.01549	.19538	.01694
Age squared	-.00134	.00017	-.00231	.00021
College educated 1 or 0	.329828	.05132	1.6637	.04241
Years of schooling difference (man-woman)	-.01312	.00428	-.01694	.00419
Divorce Rate	.80691	.55782	-1.1586	.5732

Gender Ratio	-.14212	.117296	.1667	.11987
Average of households' income in the province	-5.5253	5.783	-30.031	6.0879
Industrial development index	.100855	.12423	.49603	.12621
LR chi2(13) = 3457.04				

The estimated parameters of labor participation of husband and wife is presented in the table(6-2). The sign of all distribution factors are in the direction which were expected, and non-labor incomes irrespective of the source of the income, affect conversely the spouses market participation. Number of pre-school kids is a preventive factor for wives' participation, but being college educated boosts the market involvement. Any increases in the husbands wage would results in less market participation of wife and differences in the years of schooling is of the same effects on the spouses market involvement. In the higher developed province individuals have more work opportunities and the participation probability is high, but this is not true for provinces with higher per capita non-oil GDP.

6-2 Work Hours Estimation

The parameters of labor supplies are estimated by maximizing the Multivariate Tobit likelihood function (5-2). First of all, it is important to notice that correlation between supply equations is positive and significantly different from zero, which confirms the application of multivariate Tobit is valid and the ($\rho_{12} \neq 0$) is statistically a true stochastic specification. In addition, it indicates that spouses working hours have positive correlation. Any increases in the non-labor incomes with any exception, would give rise to decrease in h_f and h_m. It verifies that leisure is a normal good in the household consumption set. Age is a significantly determinant factor of work hours and it determines the dependent variables in quadratic form. In all of cases the sign of relative distribution factors are negative and significant. Divorce ratio negatively impacts females labor supply, whereas it impacts male's labor supply positively, the converse is true for gender ratio. This finding is dissimilar to those of Johanson and Skinner (1986), Lundeberg and Rose (1999) and Betsey Stevenson(2008) which suggest that divorce provides incentives for women to enter and remain in the labor force. Dummy variable of being college educated has negatively and significantly influence on the number of daily working hours. It shows that spouses with higher degree of education enters to the market but

allocate less hours at work than those of do not have college degree, but participated in the market. Taking all other covariates fixed, higher educated females spend less time in the work in comparison with their male with similar level of education. Estimated coefficient for males is -0.91 but that of females is -1.61. A positive change in the gender ratio (female over male) would increase female work hours but decreases male working hours. Gender ratio is of positive effect on the female labor supply, however the direction for males are negative. According to the theoretical framework the relative scarcity of women which is considered to be in the favor of women, increases the market participation of men significantly and that of woman is affected negatively.

In the provinces with higher divorce ratio, on average, females' working hours is less than that of males. Fertility variables have statistically significant impacts on the labor supplies, although the number of children older than 6 years old is statistically insignificant in both of the equations. In summary, the coefficient estimates for distribution factors, non-labor income and kids less than 6 years old confirm the implications distribution factors theory and are consistent with what were expected. Hence, these findings support the hypothesis that intra-household bargaining power is distributed between spouses.

These result are close to the findings in Hourriez (2005) in which divorce rate and non-labor income have negative coefficient and gender ratio is of positive one for wives, but are totally different from those for males. Chau et. al. (2007) finds that presence of pre-school children and school age children have negative impacts on the males and females labor supply, but only this is the presence of pre-school kids that significantly affects females supply equation, and other cases is not statistically significant. Bloemen (2004) suggests that a higher non-labor income reduces

Table (6-3): Simulated Estimation of the Unconstraint Labor Supply Equations (Multivariate Tobit)

	Husband		**Wife**	
Variable	Estimate	std. err	Estimate	std. err
Intercept	3.3911	.63307	-9.7801	2.0295
Log of hourly wage of husband(w_m)	.18557	.01191	-.18577	.02423
Log of hourly wage of wife(w_f)	-.120745	.03345	1.6382	.04682
Log(w_m)× Log(w_f)	.00609	.00343	.013455	.00458
Non-labor earning of husband(y_m)	-.073102	.01028	-.01598	.00423
Non-labor earning of wife(y_f)	-.03356	.01081	-.09859	.00402
Number of pre-school kids	-.11477	.05481	-.58908	.16849

Number of children equal or over6	-.003416	.03048	-.05294	.08803
Age	.245614	.03072	.215893	.98425
Age squared	-.00352	.00037	-.00333	.00126
College educated 1 or 0	-.91163	.09798	-1.4772	.33720
Years of schooling difference (man-woman)	-.04207	.00884	-.06872	.02888
Divorce Rate	8.9933	1.024	-5.0235	3.3921
Gender Ratio	-.2152	.15039	0.05933	.45953
Real per-capita non-oil GDP in the province	-46.472	11.442	-95.3482	35.669
Industrial development index	.58261	.24471	2.69585	.73580
Roh12	0.106			
LR test of roh12=0	chi2(1) = 42.769 Prob > chi2 = 0.00			

labor supply of spouses, and $w_m/(w_m + w_f)$ as a distribution factor has a positive effects on the working hours. In Chiappori et. al. (2001) gender ratio and divorce laws index have negative effect on the wives labor supply and their effects on the husbands and positive, thus the relevant estimated coefficients across equations are always negative. Except the difference in the years of education, the findings of the present paper are not different from those in the literature. Using British data, Clark, Couprie and Sofer (2004) finds significant relationship between gender ration and females labor participation and Moreau (2000) find neither significant nor negative effect on French data;

6-3 Reservation log wages for males and females

This section provides calculated reservation wages for both participated and non-participated spouses with and without college degree. Bloemen and Stancanellil(2001) argues that financial wealth is an important determinant of reservation wage, and in turn it reduces the employment probability. Using Korea data-set Donghun Cho and Joonmo Cho (2010) concludes that women's burden caring for young kids and higher level of education emerge as important determinants of

Table(6-4): Reservation log Wage of Participated and Non-participated Males and Females

	Participated				Non-participated			
	Male		Female		Male		Female	
	Mean	St-err	Mean	St-err	Mean	St-err	Mean	St-err
Entire sample	-38.3	8.610	5.92	.744	-21.7	15.7	5.70	.757

College educated	-30.8	10.92	6.23	.738	-9.05	19.8	6.79	1.60
Non-college educated	-39.8	7.05	5.57	.549	-24.2	13.3	5.81	1.07

women's reservation wages and consequently they control entering into the labor market. Therefore low female participation can be attributed to the higher reservation wages, in the present research it is assumed that reservation wage is determined by individual's taste, distribution factors, non-labor incomes and the wage of the individual's counterpart. Table (6-4) reports that there are of much variations in the log of reservation wages of the groups presented in the table. Those of males' in all categories are negative, that is the wages are near zero, whereas those of females' are positive and almost for all of participated and people with and without college degree is greater than male's. Comparison of women's realized average wages in table (5-1a) with the contents of table (6-4) reveals that average log hourly wage of employed women with college degree is 9.85 and that of reservation wages is 6.23. It confirms that on average working females are those who are offered their reservation wages. The quantities of these variables for females without college degree are 7.07 and 5.57, respectively. Furthermore, reservation wages for non-working women's are higher for both of corresponding groups to college educated and non-college educated to 6.79 and 5.81 respectively. It confirms the proposition that people with higher reservation wage are less likely to enter into the market unless the offered market wage is higher than the reservation wage, since the high level of reservation wage might discourage individuals to enter in the labor market. In effect, the male's unemployment does not seem to be due to the absence of work inclinations, but this is the weakness of demand side of economy that is not able to absorb the labor suppliers. On the other side, it is found that the low females' participation can be attributed to the higher reservation wages.

7- Summary and Concluding Remarks

The unemployment and more specifically low females' participation rate are of great concern in Iran. It has been shown that which factors determine the males and females market participation. Several covariates may create the present situations of the low female participation rate in Iran. The present research tried to highlight the role of gender ratio, divorce rate and years of schooling difference (man-woman) as distribution factors and age, education and household's fertility as preferences covariates, log wage and non-labor income as market signals, in the labor supply equation. The well known intra-household collective

decision process is used as the analytical framework and parameters were estimated by Multivariate Tobit procedure. Hypothesis testing show that, the traditional unitary model is not the appropriate model in ran and household decision are made collectively. Furthermore males' working hours are negatively affected by females' non-labor income, which implies that both of spouses cooperate to manage household's members financially. The collective decision process is base on the assumption of Pareto optimality of household's resource allocation, the validity of this assumption is confirmed strongly. Education, gender ratio and economic development are the main driving force for females' participation and husband's wage, non-labor income, divorce rate, number of kids less than 6 years and per-capita non-oil GDP are the main disincentives which discourages job searching actively. It implies that, holding other factors fixed, a woman whose husband earns more, allocates less hours in labor market, also on the other side both of couples cooperate to provide more income to manage the family. In wealthy families, wife has more access to financial resources of household; consequently she decreases her labor supply. And finally presence of the specific legal environment creates a unique situation in Iran which increases females' reservation wages and decreases their market participation.

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Table A1: Simulated Estimation of the Unconstraint Labor Supply Equations (Multivariate Tobit) with the restriction of coefficient y_f=0 in male labor supply

	Husband		**Wife**	
Variable	Estimate	std. err	Estimate	std. err
Intercept	3.857	.725	-9.787	2.030
Log of hourly wage of husband(w_m)	.186	.0072	-.1858	.0242
Log of hourly wage of wife(w_f)	-.116	.0233	1.639	.046
Log(w_m)× Log(w_f)	.0061	.002	.0134	.0045
Non-labor earning of husband(y_m)	-.074	.0016	-.0161	.0042
Non-labor earning of wife(y_f)	-	-	-.093	.0402
Number of pre-school kids	-.106	.0548	-.586	.168
Number of children equal or over6	.0031	.0278	-.0518	.088
Age	.245	.031	.216	.098
Age squared	-.0035	.0003	-.0033	.0012
College educated 1 or 0	-.983	.0971	-1.485	.337
Years of schooling difference (man-woman)	-0.0384	0.008	-0.068	0.024
Divorce Rate	9.076	1.100	-5.008	3.39
Gender Ratio	-0.225	0.150	0.054	0.459
Average of households' income in the province	-46.21	11.44	-95.25	35.68
Industrial development index	0.5920	0 .24	2.69	0.736
Estimated roh	0.106(0.00)			
LR test of roh12=0	chi2(1) = 42.59 Prob > chi2 = 0.00			
Log Likelihood	-40469.87			

Table A2: Heckman Tobit Estimation of the Unconstraint Labor Supply Equations with Endogenous own Log wage

	Husband		**Wife**	
Variable	Estimate	std. err	Estimate	std. err
intercept	1.45537	1.5704§	-16.756	2.719‡

Log of hourly wage of husband(w_m)	.601635	.32534	-.44701	.0691‡
Log of hourly wage of wife(w_f)	.090372	.16698	-3.7806	1.326‡
Log(w_m)× Log(w_f)	-.02788	.02668	.48796	.1162‡
Non-labor earning of husband(y_m)	-.05543	.01511‡	-.01642	.0050‡
Non-labor earning of wife(y_f)	-.02999	.00673‡	-.15216	.0413‡
Number of pre-school kids	-.17322	.07864‡	-.62377	.2017‡
Number of children equal or over6	-.02993	.04128	-.22406	.1091¶
Age	.1993	.05338‡	.70104	.1623‡
Age squared	-.002566	.00094‡	-.00915	.0019‡
College educated 1 or 0	-1.82447	.76010‡	6.7786	2.062‡
Years of schooling difference (man-woman)	-.067947	.01818‡	-.17297	.0390‡
Divorce Rate	12.686	3.1185‡	-8.331	4.033¶
Gender Ratio	.18096	.24734	.83193	.8312
Average of households' income in the province	-77.103	27.869‡	-121.21	42.38‡
Industrial development index	.73365	.31190‡	2.7973	.8706‡
Wald test of own log-wage exogeneity	1.59(0.2078†)		16.77(0.00†)	

†: p-value under asymptotic chi square distribution, ‡: significant at 2 percent critical region, §: significant at 10 percent critical region, ¶: significant at 5 percent critical region

Table A3: Heckman Tobit Estimation of the Unconstraint Labor Supply

Equations with Exogenous own Log wage

	Husband		**Wife**	
Variable	Estimate	std. err	Estimate	std. err
intercept	3.2348	.618457	-9.7392	1.7690
Log of hourly wage of husband(w_m)	.192030	.007167	-.19078	.02421
Log of hourly wage of wife(w_f)	-.11737	.02348	1.6512	.04584
Log(w_m)× Log(w_f)	.005515	.002680	.013263	.013263
Non-labor earning of husband(y_m)	-.07434	.00168	-.0138	.004168
Non-labor earning of wife(y_f)	-.032495	.00608	-.10052	.03751
Number of pre-school kids	-.10840	.05363	-.5973	.16871
Number of children equal or over6	.00548	.027328	-.04148	.08517
Age	.25217	.02979	.214755	.09316
Age squared	-.003656	.000349	-.00338	.00118
College educated 1 or 0	-.87644	.095893	-1.4640	.33644
Years of schooling difference (man-woman)	-.048318	.008461	-.06793	.33644
Divorce Rate	9.0627	1.08528	-6.0652	3.3608
Gender Ratio	.18340	.22326	.11612	.68647
Average of households' income in the province	-45.720	11.2599	-93.681	35.317

Industrial development index	.530472	.240977	2.8687	.727094

‡: significant at 2 percent critical region, §: significant at 10 percent critical region, ¶: significant at 5 percent critical region

Figure A1: Histogram of College Educate Males' Daily Working Hours

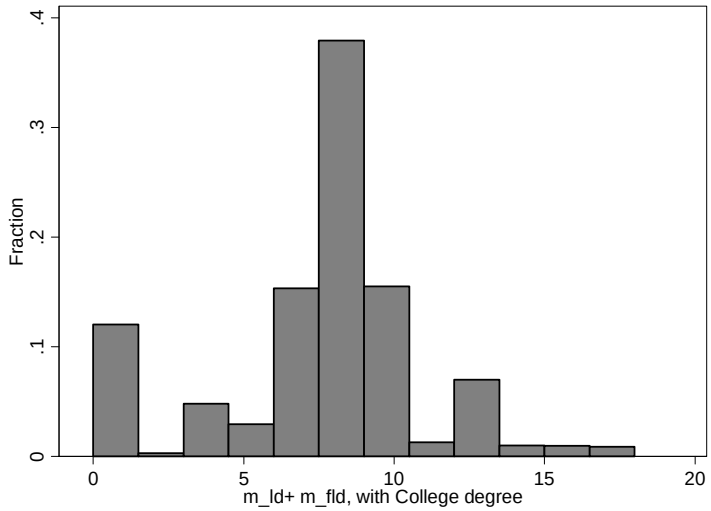

Figure A2: Histogram of College Educate Females' Daily Working Hours

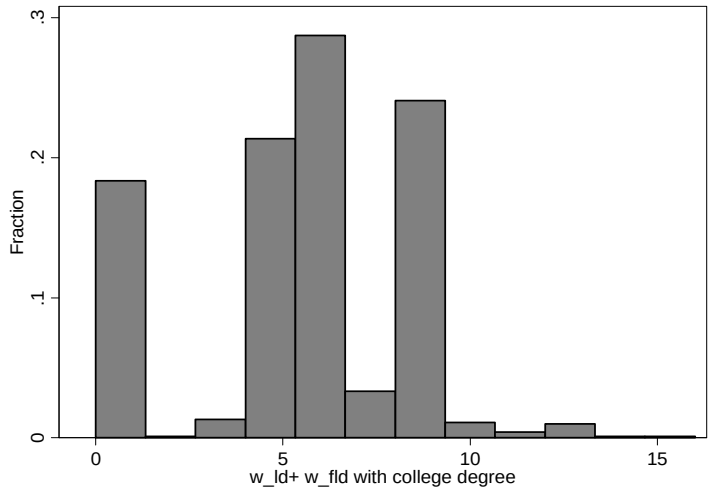

Figure A3: Histogram of Non-college Educated Females' Daily Working Hours

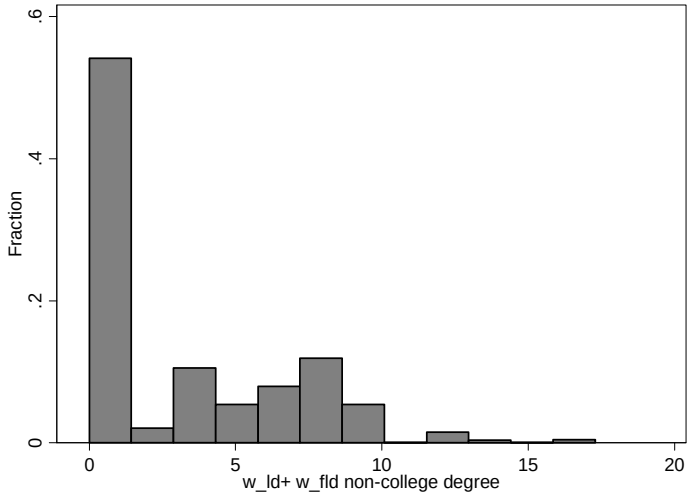

Figure A3: Histogram of Non-college Educated Males' Daily Working Hours