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EMPIRICAL APPLICATION OF COLLECTIVE HOUSEHOLD LABOUR SUPPLY MODEL IN IRAQ

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Abstract

In this study we explore the determinants of the women's labour supply and we attempt to identify the sharing rules for married couples. The analysis relies on data derived by the Iraqi Household Socio-Economic Survey (IHSES) in 2012-2013. The study considers the housework contributed by both spouses and we also include the disability status as a distribution factor. Moreover, we estimate the sharing rules accounting for female non-participation in the labour market. The household collective model is preferred over the unitary model as the results support that changes on wages, non-labour income, age, education, number of children and disability as a distribution factor affect the bargaining power and the share of spouses. The findings show that for a one per cent increase on female's daily wage rate, her share on full income is increased by 1,250 Iraqi Dinar (ID) corresponding to \$1.1, while is increased at 1,470 ID (1.25\$) when the domestic labour is considered. Similarly, increases on the male's wage increase her share by 600 ID (0.48\$), while increases of 1 ID in the non-labour income increases female's share by 0.42. The estimates show that the disabled women decrease the share by 1,135 ID (0.96\$) more than the non-disabled ones reaching the 1,300 ID (1.1\$) including the domestic labour supply. Therefore, considering disability as a distribution factor, besides the traditional factors of age, education and sex ratio, it can significantly influence the labour supply choices of the couples, their bargaining power and the intra-household resource allocation. Furthermore, the findings show that when the non-participation of the wife in the labour market is examined, her share and therefore bargaining power is lower than their married and earners counterparts.

JEL Classifications: D13, H31, J22, O15

Keywords: Collective Model; Disability; Household Behaviour; Labour Supply; Sharing Rule; Unitary Model

ملخص

في هذه الدراسة، نبحث محددات عرض العمالة النسائية ونحاول تحديد قواعد مشاركة الأزواج. يعتمد التحليل على البيانات المستمدة من المسح الاجتماعي والاقتصادي للأسر في 2012-2013. كما تنظر الدراسة في العمل المنزلي الذي يساهم فيه كلا الزوجين، بما في ذلك وضــع الإعاقة كعامل في توزيع العمل. وعلاوة على ذلك، فإننا نقوم بتقدير قواعد المشــاركة التي تؤدى إلى عدم مشــاركة المرأة في ســوق العمل. وفى هذا الصــدد نفضــل النموذج الجماعي الأســري على النموذج الذي يعتمد على الوحدة حيث تدعم النتائج التغييرات التي تطرأ على الأجور، والدخل من غير العمل، والعمر، والتعليم، وعدد الأطفال، والإعاقة كعامل توزيع يؤثر على قدرة الزوجين تفاوضية وحصــتهما. وتظهر النتائج أنه بزيادة قدرها واحد في المائة في معدل الأجور اليومي للإناث فإن نصيبها من الدخل الكامل يزيد بمقدار 1250 ديناراً عراقياً (تعادل 1.1 دولار) بينما تبلغ الزيادة 1470 ديناراً (تعادل 1.25 دولار) عندما يتم اخذ العمل المنزلي في الاعتبار. وبالمثل، فإن الزيادات في أجور الذكور تزيد نصيب المرأة بمقدار 600 دينار (تعادل 0.48 دولار)، في حين أن الزيادات التي تبلغ دينارا عراقيا واحدا في الدخل من غير العمل تزيد حصــة الإناث بنسبة 0.42. وتبين التقديرات أن النساء المعاقات يقللن الحصــة بمقدار 1135 دينار (0.96 دولار) أكثر من نظيراتهن من غير المعاقات اللاتي تصــلن إلى 1300 دينار عراقي (1.1 دولار) بما في ذلك ما يقدمن لعرض العمالة المنزلية. لذلك، وبالنظر إلى الإعاقة كعامل توزيع، إلى جانب العوامل التقليدية من عمر، ونسبة التعليم والجنس، يمكن أن يؤثر ذلك كله بشكل كبير على خيارات عرض العمل للأزواج، وعلى قوتهم التفاوضية، وتخصيص الموارد داخل الأسرة. وعلاوة على ذلك، تظهر النتائج أنه عندما يتم فحص عدم مشاركة الزوجة في سوق العمل، فإن نصيبها وبالتالي القدرة التفاوضية تقل عن نظيرتها المتزوجة والتي تتقاضى أجرا.

1. Introduction

Household resource allocation and participation in the labour market have always been topics of research in economics. Earlier research has developed various theories in an attempt to identify the patterns that the household members participate in the labour market and share the resources maximising their utilities. The first applications rely on the unitary model that treats the household as an individual who maximises his/her utility. In this case, the household is considered as one entity which interacts only with the outside world economy and society. This model thus violates the concept of methodological individualism, because the household members are not characterised only by their own utility functions or preferences, but their choices and utilities depend also on the characteristics of the other household members. This can be misleading for policy making, especially for the welfare indicators and policies targeting inequality and poverty which may have contradictory results and consequences when they are based on the unitary model analysis. Chiappori (1988) proposed a household collective model, where it is assumed that each household member is characterized by his (her) own utility function and that decisions result in Pareto-efficient outcomes. This specification rules out various forms of altruism in which each individual cares about the other's utility and consumption of private goods, and the advantaged member can have preference that favour redistribution.

Any exogenous variable internal or external to the household that has no direct impact on preferences or the household budget constraint can be defined as a potential distribution factor. Therefore, shifts in distribution factors affect the intra-household decision process on the distribution of the resources and the welfare of individuals within the households, but they do not shift its utility possibility frontier. In other words, these variables influence the family behaviour only through the effect on the intra-household decision process, but do not enter into the household's budget constraint or the individual preferences. In our case, the working supply functions may depend on such distribution factors and therefore a shift on them will have consequences for the intra-household decisions and the individuals within the household (Chiappori et al., 2002; Chiappori and Ekeland, 2009; Menon and Perali, 2012).

This study aims to answer how the household choices of labour supply and resource allocation are made in Iraq, based on the spouses' and household characteristics and disability as a distribution factor. Disability is a topic of major interest, especially in the case of Iraq, where people have been disproportionally affected by violence, terrorism and armed conflicts that were dominating the country over several decades and have prevailed since 2003 after the Iraqi war. These events resulted to injuries, devastation of property and livelihoods and significant number of lives lost. While those disabled persons belong to various kinds of religious communities and ethnic groups, as well as, they belong in all gender and age groups, yet they face common experiences of often multiple and aggravated forms of discrimination that deteriorate their well-being and hinder their right to access and participation in all aspects of society. Furthermore, the prolonged armed conflicts have resulted in the release of various toxic and hazardous substances into the air, water and soil and in combination with environmental neglect have contributed to high levels of toxicity that may have contributed to the development and increase of detrimental health conditions at birth. The Iraqi war in 2003 caused physical displacements and disabilities, long-term psychological repercussions and broken families embodying collective experiences. A study by World Health Organisation and the Government of Iraq in 2009 explored the impact of trauma exposure on mental health conditions. The study shows that the 56.02 per cent of the respondents of the survey present a high lifetime exposure to trauma, while only the 6.12 per cent has access to treatment for mental health conditions (Hassnawi et al., 2009).

The capacity to earn a living and to contribute to household life and work is determined by one's health status, increasing disabled people's dependency and vulnerability (Tibble, 2005;

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Burchardt and Zaidi, 2008). It is very important to recognise that the provision of care for a disabled family member may compete with other activities, such as productive employment and schooling, exacerbating existing differentials in resource allocation (Pitt and Rosenzweig, 1990). The resources required to provide assistance and care for disabled household members compete other household resource needs. Therefore, especially due to poverty conditions, disabled people's health problems are often only met when other household members' needs have been met (Pitt and Rosenzweig, 1990; Tibble, 2005; Burchardt and Zaidi, 2008; Cullinan and Lyons, 2015). The analysis can be useful for future studies to compare the same households before and after the incidence of a permanent disability in one of the members. Furthermore, it is encouraged to estimate the disability costs comparing households with and without disabled members, extending also the analysis for the children.

The female labour force participation (FLFP) rate in Iraq, but also to other countries of the Middle East and North Africa (MENA) region is still lower than any other region in the world. This trend has been consistent, besides the periods of high economic growth, faster urbanisation and also lower illiteracy and fertility rates. However, in recent years this trend has begun to changes, where females enter the labour market in greater numbers than ever before. Even though the women's labour supply-participation has significantly increased the last 50 years, and especially in the developed countries, there are still time allocations to both household work and market that are highly differentiated by gender (Sayer et al., 2004; Cooke and Janeen, 2010; Bianchi et al., 2014). Iraq is one special case, where the men still dominate in the labour market in terms of wage and professional class (United Nations, 2010). The analysis about the ways that the domestic and household labour is shared within the household is essential for social and economic policy evaluation, especially in the Iraqi context, where we consider also the disability status. Additionally, we will explore the non-participation of wife in the labour market and this can be crucial about the effect of changes in the potential wage of non-participating members, providing key insights into the bargaining process. This is important as the way that women's experience in the labour market around the globe, especially in developing and underdeveloped countries, but also in developed and industrialised economies, remains structured by unpaid care responsibilities and still is characterised by discriminative practises and inequalities. There are no studies so far in Iraq and other developing countries about the investigation of the relationship between gender, disability and access to labour market, as the majority of the literature review examines US, British and other European cases. However, their results may shed some insights about the disadvantageous position of women in the labour market considering also their disability status. Berthoud (2006) using the Health and Disability Survey in England over the period 1996-1997 and he found that disabled males were 42 per cent less likely to have a job than the non-disabled ones, and disabled mothers 69 per cent less likely than their respective counterparts. Smith and Twomey (2002) used the Labour Force Survey (LFS) of 2001 and they explored the relationship between disability and employment. They considered both men and women of working age- 16-64 for men and 16-59 for women. Their results show great disparities on labour market access, where the 50.3 of the disabled men declared that are economic active and work, while the respective percentage for non-disabled men is 86.6. For the women the percentages are even lower at 45.2 and 75.3 respectively for disabled and non-disabled. Other studies form US and European cases found similar results (Randolph and Andreson, 2004; Randolph, 2004; Berthoud and Blekesaune, 2006; Parker et al., 2007; Lodovici et al., 2017).

Overall, people with physical, but also with psycho-social disabilities are at risk of being victimized and exploited, and especially women in Iraq, with psycho-social disabilities are at particular risk of exploitation, abuse and sexual harassment, and abuse (USAID, 2014). According to a report of United Nations (UN), a double discrimination against women with disabilities is reported which is linked to their special living condition (UN, 2016). In particular,

the double discrimination refers to the women's imprisonment by both disability and society norms, beliefs and traditions. These reports reveal that disabled men are still generally more likely to have more educational opportunities and obtain a job compared to women with disabilities. Disabled women, are further burdened by lack of freedom resulting from gender, societal and traditional beliefs-values and expectations, and thus face more difficulties accessing basic services, completing education and finding employment. Additionally, disabled women are far less aware about their rights and how to claim them. Indeed earlier studies found that women with disabilities have a particular disadvantage in relation to their access to education, which is derived by the society's perception that women's education is not valued and is not considered to be a priority (UNICEF, 2010; UN Children's Fund).

The analysis relies on the model proposed by Rapoport et al. (2011) who have included also the household domestic production by examining the sharing rule on household decision making, regarding time allocation and sharing on market and household time. The study aims also to identify the housework functions for both husbands and wives in Iraq and to estimate the sharing rules accounting for female non-participation in the labour market. Earlier studies have shown the significance of the spouses' wages and household characteristics, especially the number of children on the individual's hours of labour choice (Chiappori, 1988, 1992; Lundberg et al., 1997; Browning and Chiappori, 1998; Chiappori et al., 2002; Attanasio and Lechene, 2002; Blundell at al., 2005, 2007). This evidence requires further research of the collective model applications taking into consideration the intra-household links among the family members with direct interest to policy design. For instance, exploring the relationship between the additional income, coming in the form of tax credits or subsidies, and the impact of labour market conditions on the labour supply can be a useful guide to policy makers to design and implement policies related to employment and economic stability. Considering the changes of females' labour hours and the indirect impact on females caused by the relative bargaining power in the household can be useful for the implementation of incentive programs that increase the working hours for females resulting to unemployment reduction and increase of their bargaining power within the household (Apps and Rees, 1988; Donni, 2003; Blundell et al., 2007; Bloemen, 2017).

The evidence provided by earlier studies shows that the intra-household collective framework is proper as it predicts that disabled wives will spend less time on labour market than the non-disabled wives (Gallipoli and Turner, 2009). Moreover, studies show that the intra-household model on allocation time and labour supply choices is relevant for policy makers, because the household labour supply and demand depend on who in the household is subsidied or taxed. However, there is no study so far exploring the disability as a distribution factor and the female labour participation accounting also for the spouses' time use to household domestic production.

Nevertheless, the scope of this study is to extend the model proposed by Rapoport et al. (2011) considering also the female labour market non-participation and disability status. The analysis relies on data derived from the Iraq Household Socio-Economic Survey (IHSES) over the period 2012-2013. The findings support the household collective model, while the unitary model is rejected. In particular, we reject the assumption that changes on the non-labour income or distribution factors do not influence the labour supply choices. Increases in the female's daily wage by one per cent increase her share of full income by 1,470 ID (1.25$) considering also for the labour domestic production. Respective increases in male's wage increase her share at 600 ID (0.48$). Increases on non-labour income correspond to increase of female's share by 0.42. About the impact of disability status on intra-household distribution, we find that disabled women decrease their share by 1,135 ID (0.96$) and the negative share becomes larger, at 1,300 ID (1.1$), when the household domestic production is included. The overall concluding remark is that disability is an important factor, determining the participation in the labour

market and the household-domestic production. Nevertheless, the main limitation of our analysis is that the disability severity status is unknown and we include also the respondents who are disabled and participate in the labour market. Therefore, in the case we know the disability severity status we are able to identify the impact of disability on the intensity of labour and household production participation varying with the degree of disability. However, due to data unavailability, which is common in the household surveys of Iraq and other Middle East countries, we consider only the case where the respondent is disabled or not.

The study is organized as follows. Section 2 presents the overview of the previous literature and approaches to labour supply modelling. Section 3 describes in details the theoretical framework and the setup of the empirical model. In section 4 the dataset employed in the study is described, while in the section 5 the empirical results are reported. In the last section we discuss the concluding remarks.

2. Literature Review

This section discusses previous researches exploring the unitary model and studies related to the collective model of the household labour supply and resource allocation. Becker (1981) was probably the first that formalized the household behaviour within the extension of the neoclassical consumer demand models to families. Nevertheless, Samuelson (1956) before Becker has already developed the household welfare function to express social indifference curves. Therefore, considering and combining the frameworks by Samuelson and Becker, it is assumed that the household attempts to maximise a joint welfare function where the marginal rate of substitution is equal across all the pairs of goods. The unitary model treats the household to behave in the same way as individual does implying that the neoclassical consumer theory axioms and assumptions can be applied (Vermeulen, 2002). However, neoclassical consumer theory applies only to individuals and not to groups. Moreover, according to the Arrow's Impossibility Theorem, group preference relations do not necessarily behave in the same way as those for the individuals and therefore they cannot be modelled in the same fashion (Browning and Chiappori, 1998). Besides the criticism of the individualism violation that characterises the unitary model, there are case studies that can offer some insights on the intra-household distribution of welfare (Alderman et al, 1995; Haddad et al., 1997). While unitary model captures some outcomes of the household decisions at the household level, the process of how individual resources are actually shared and the outcomes derived at individual level remain largely unknown. Thus, employing the unitary model, the process of determining the household preferences that interact with efficiency gains is ignored and the household is put in this way into a black box.

The testable restrictions of the unitary model include income pooling and the Slutsky symmetry (Browning et al, 1994). The Slutsky symmetry requires that there is symmetry in the compensated cross wage effects of the different household members in terms of labour supply (Fortin and Lacroix, 1997). The *income pooling hypothesis*, is a condition where the household resources, including the non-labour income, labour, capital and land are pooled together. In particular, this condition states that the source of the non-labour income has not absolutely influence in the household allocation maximization problem. The Income Pooling Hypothesis has been rejected in several studies (Bourguignon et al., 1993; Fortin and Lacroix, 1997). Many studies used collective models to examine the consumption allocation and to test the income pooling (Chiappori, 1988, 1992; Lundberg et al., 1997; Chiappori et al., 2002; Attanasio and Lechene, 2002; Arias et al., 2004; Blundell at al., 2005, 2007; Menon and Perali, 2012). Lundberg et al. (1997) exploited a policy change in United Kingdom in late of 1970's that transferred child benefits from husbands to wives. According to the income pooling hypotheses, the change of the recipient's transfer should have no effect on the household demand. However, the authors found a greater expenditure on women's and children's clothing

after the change, rejecting the income pooling hypothesis. Another study is by Blundell et al. (2007) who estimated a collective labour supply model of married couples without children using data from UK Family Expenditure Survey during the period 1978-2001. The study rejects the unitary model and the main findings suggest that the labour supply of female depends on the male wage, when the husband is working which is consistent with the bargaining interpretation. The increase of man's wage is associated with reductions in the female's labour supply, which is consistent with the income effect, because increases in the male's wage increase also the total household income and the wife's non-labour income.

Fortin and Lacroix (1997) tested the unitary and collective household labour supply models and they show that the income pooling hypothesis is rejected providing support in favour of the collective labour supply model. The study by Hendy and Sofer (2010) explored the intra-household resource allocation in the married couples in Egypt and the plausible impact on the female labour supply. The authors employed data from the Egyptian Labor Market and Panel Survey of 2006 and they tested new innovative distribution factors, such as the female's contribution to the total cost of the marriage (Roushdy, 2004) and the "moakhar" which represents the amount of the money that the husband must pay to his wife in the case of divorce. The results show that females' contribution to marriage costs influence significantly their labour supply choices. Moreover, the authors suggest that females tend to spend their own money on the household as the estimated share is found to be negative. However, the sharing rule parameters are statistically insignificant.

Overall, as we discussed in this section, previous empirical studies found evidence supporting the validity of the collective model. Nevertheless, the choice of the household behaviour modelling framework is still an open question, and especially in emerging and developing economies as is the Iraqi case. In addition, the consumption or the labour supply settings can be extended to other areas of the household behaviours, including off-farm activities, fertility, savings and disability.

Following the methodology by Chiappori (1992) and Rapoport et al. (2011) we consider spouses' disability as a distribution factor, instead of the sex ratio. In a study by Butikofer et al. (2011) the findings show that the older wives consume between 30% and 42% of total household expenditures; however, these shares increase dramatically when the husband's health is poorer. The main aim of this study is threefold. First, we aim to identify conditions of a more general class of household production functions, without pooling together leisure and household domestic production. Second, the aim is to extend the model by Rapoport et al. (2011) considering and identifying also men's housework function. Third, we include the female non-participation in the labour market and disability as a distribution factor.

3. Conceptual Framework and Research Methodology

There are various disadvantages in the unitary model for policy making. First, the unitary model assumes that the recipient of the targeting policy is not important, since one of the main assumptions is that the resources within household are shared, which is not usually the case. This is one strong statement that ignores altruism and does not cover issues like status and intellectual development (Bergmann, 1995). Second, the targeting transfer to the household may be effective when men and women have different preferences, a flexibility which is absent in the unitary model. Third, an important drawback of relying on the unitary model policy guidance is the fact that intra-household resource allocation is primarily affected through changes in prices. Thus, potentially powerful policy handles are ignored, such as changes in public works schemes, strengthening of legal and institutional rights for disabled people, credit, and disability benefits-reforms. In addition, the collective model takes into consideration other policies that affect allocation outcomes, such as changes in institutional rights, credit, and gender discrimination reduction among others. Finally, considering the household as a unique

entity, the intra-household resource allocation and the labour supply choices among the members cannot be distinguished, even when the disabled people are observed in the household and the findings can be misleading. However, the most arguments about policy relevance of a model choice are based on the failings of the unitary model rather than on the strengths of the household collective models. In other words, while the collective models may solve a number of problems derived from the unitary model, still further work improving their predictive power is needed.

The main policy instrument in Iraq is the provision of benefits that depend on the disability severity status and whether is permanent or temporary. For temporary disability the benefits cover the 100 per cent of the last wage before the disability starts and are paid after an eight-day waiting period until recovery or a certification of permanent disability is granted. In the case of partial disability and if the severity is at least 32 per cent, a percentage of the full pension is paid, which is determined according to the assessed degree of disability. For a disability severity status less than 32 per cent a lump sum of four years' of the insured's partial disability pension is paid. Regarding the permanent disability pension, the 80 per cent of the insured's average wage is paid if the assessment shows a total disability, while in no case the pension can be lower than the minimum wage in the insured's sector-profession.

The model applied in this study relies on the assumption that the household decisions are Pareto-efficient (Apps and Rees, 1988; Chiappori, 1988, 1992; Browning et al, 1994; Bourguignon et al., 2009). In addition, we include age and education level as individual characteristics and the disability as a distribution factor. We assume that the spouses have individual preferences over the consumption of an aggregate market good c, leisure time l and a domestic-produced good q, which is the household related chore, such as cooking, cleaning, childcare, and others. The production function for the domestic good-chore q is:

$$q = f\left(t_f, t_m\right) \tag{1}$$

Following Chiappori (1988, 1992) and Rapoport et al. (2011) and the household maximises the following weighted utilitarian household welfare function:

$$\max_{l_f, l_m, C_f, C_m, q_f, q_m} \mu\left[U_f\left(l_f, C_f, q_f; \mathbf{z}\right)\right] + \left(1 - \mu\right)\left[U_m\left(l_m, C_m, q_m; \mathbf{z}\right)\right] \tag{2}$$

$\mathbf{z}$ is a vector of individual and household characteristics, including age, education, disability, the number of children and whether the area-location is urban or rural. In the collective model the individual preferences are assumed to be altruistic, implying that each member does not only care about herself and own decision variables, but also for those of her partner, which is a natural process in the family context. The Pareto weight component μ represents the importance of the couple in the intra-household collective decision process. Under the collective setting μ is a function that captures the bargaining power of individuals contained in [0,1] and it is assumed to be continuously differentiable in all its arguments and variables that affect each member's bargaining power expressed as $\mu = \mu(w_f, w_m, y, s_1, \ldots, s_R)$. Therefore, is a function of wages, non-labour income and the vector $\mathbf{s}$ that include the so-called distribution factors. The maximisation function (2) is subject to the following constraints:

$$\sum_{i=f,m} C_i = \sum_{i=f,m} L_i w_i + y + p_q q - \sum_{i=f,m} w_i t_i \tag{3}$$

$$T_i = h_i + L_i \tag{4}$$

Relation (3) is the budget constraint, w is the wage for $i=m,f$ indicating male and female respectively, y is the non-labour income, C is the consumption. The term $p_q q - \sum_{i=f,m} w_i t_i$ is the profit function, t_f and t_m are the hours devoted to the household production for female and

male respectively. The term $w_i t_i$ is the cost of the household chore-production, which is expressed as the opportunity cost or time loss that could have been used in the labour market. In the time constraint (4) we define $h_i = t_i + l_i$, where t_i is the time use on household domestic production, l_i indicates the leisure, and the labour supply is represented by L_i and consequently the total time is denoted by T. The vector **s** only appears in Pareto weight, affecting the bargaining power or position of the adult members, but not their preferences or the household budget constraint (Bourguignon et al., 2009). The maximisation problem becomes:

$$\max_{t_f, t_m} \Pi = p_q q - w_f t_f - w_m t_m \tag{5}$$

And the solutions are:

$$t_f = t_f(w_f, w_m) \tag{5a}$$

$$t_m = t_m(w_f, w_m) \tag{5b}$$

$$\Pi^* = \Pi(w_f, w_m) \tag{5c}$$

Under the separability assumption on individuals' preferences, the Pareto efficiency implies that the intra-household collective process can be interpreted as a two-stage process (Chiappori, 1992). In the first stage the spouses share the non-labour income according to an unobservable and exogenous sharing rule that reflects the bargaining power of each member in the household. In the second stage once the household non-labour income has been allocated between the members, then for the individual i, for $i = f,m$ the maximization problem is

$$\max_{C_i, l_i, q_i} u_i(C_i, l_i, q_i) \tag{6}$$

Subject to:

$$C_i = h_i w_i + \phi_i \tag{7}$$

In constraint (8) φ_i denotes i's non-labour market income and

$$\phi_f + \phi_m = y + \Pi^* \tag{8}$$

As we described earlier φ_f is a function of w_f, w_m, y, s. Therefore, the shares will be a function of wages, non-labour income, preferences and distribution factor and as a result, for interior solutions, the total labour supplies will have the form:

$$h^f = h^f\left(w_f, \phi(w_f, w_m, y, s)\right) \tag{9}$$

$$h^m = h^m\left(w_m, \Pi(w_f, w_m) + y - \phi(w_f, w_m, y, s)\right) \tag{10}$$

The intuition in the set up (9)-(10) differs in the following ways. In the case where the household domestic production is considered as a component of the leisure then h_i will be equal to the market labour supply L_i. Thus, since the household production will not be marketable, the profit Π will be just zero, and the model becomes as in the model by Chiappori et al. (2002). However, in the study by (Rapoport et al., 2011) the model allows Π to enter the model which is endogenously determined, but not observed, because the output of household production is not observed. Following Chiappori et al. (2002) and using a semi-logarithmic specification, the female and male labour supply equations have the following form:

$$h^f = a_0 + a_1 \ln w_f + a_2 \ln w_m + a_3 \ln w_f \ln w_m + a_4 y + a_5 s + a'\mathbf{z} \tag{11}$$

$$h^m = b_0 + b_1 \ln w_f + b_2 \ln w_m + b_3 \ln w_f \ln w_m + b_4 y + b_5 s + b'\mathbf{z} \tag{12}$$

In the structural system (11)-(12) the h denotes the working hours per day for male and female represented by m and f respectively, w, y and s denote respectively the wage, non-labour income and the distributional factors, while $\mathbf{z}$ is defined as in (2). From (11)-(12) we can compute the derivatives of the sharing rule given the relations (13)-(14) which are derived by the manipulations described in details and provided in appendix A (Chiappori, 1992; Chiappori et al., 2002).

$$\phi_f = \frac{BC}{D-C} - t_f = \frac{a_5(b_1 + b_3 \ln w_m)}{\Delta w_f} - t_f \tag{13}$$

$$\phi_m = \frac{AD}{D-C} - t_m = \frac{b_5(a_2 + a_3 \ln w_f)}{\Delta w_m} - t_m \tag{14}$$

Thus, the new component that enters (13) is the t_f which is the time used by the wife to household chores and it is fully observed in our case. In a similar fashion we obtain also (14) for the husband. Therefore, we extend the model by Rapoport et al. (2011), including also the husband's contribution to housework. Since we have a simultaneous system (11)-(12), the seemingly unrelated, three stage least squares (3SLS) and Generalised Methods of Moments (GMM) can be applied. GMM is preferred to 3SLS as it provides efficient estimates of the parameters, because it accounts for the possible correlation between the error terms in the male and female labour supply equations. Also, GMM computes efficient estimators even when the errors are heteroskedastic of an unknown form (Davidson and MacKinnon, 1993).

In summary, we first estimate the labour supply functions and taking their estimated coefficients we estimate the sharing rule of the model proposed by Chiappori et al. (2002) with non-market time treated as "pure" leisure. Then we re-estimate both sets of parameters, but we take into account the time contributed in the housework.

So far the analysis relies on the fact that both spouses participate in the labour market. Next we will extend the econometric analysis to account also for spouses' labour market non-participation. The index for labour market participation will be:

$$p_i^j = a_0 + a_1 w_i^f + a_2 y_i + a'\mathbf{z} + u_i^j \tag{15}$$

Variables w and y are defined as previously, for male m and female f in household i, while p denotes the labour market participation decision for $j=m, f$. However, in our case we consider always the male participating in the labour market, while we consider for female non-participation. We also allow for a flexible function form inserting quadratic terms on age. We assume that wages do not depend on the characteristics of the spouse and the wage equations taking a standard approach of human capital will be:

$$w_i^f = b_0 + b_1 age_i^f + b_2 (age_i^f)^2 + b_3 educ_i^f + b_4 D_i^f + b'\mathbf{z} + u_i^f \tag{16}$$

$$w_i^m = b_0 + b_1 age_i^m + b_2 (age_i^m)^2 + b_3 educ_i^m + b_4 D_i^m + b'\mathbf{z} + u_i^m \tag{17}$$

D denotes whether the respondent is disabled, as it may determine the wage depending on the disability and severity status, and vector $\mathbf{z}$ is defined as before. We will implement the two-

step Heckman selection model (Heckman, 1979) to predict the wages, corrected for sample selection and considering also wives that do not participate in the market. The selection-participation equation will consider only for individual's age and education level, self-disability status and the household characteristics described later.

4. Data

The analysis in this study relies on data derived from the Iraq Household Socio-Economic Survey (IHSES) over the period 2012-2013. IHSES is a household survey programme which aims to produce high quality data and improved survey methods. It was developed by the need to improve the statistical data at the household level which are required for design, analysis, implementation and evaluation of the social policies in developing countries. Additionally, the aim of the IHSES programme is to offer a measurement and understanding of the living conditions, the interaction of government spending and programmes along with the household behaviour and the assessment of these policies. The first survey was conducted in 2007; however we do not use it because the time use on labour supply and household production is unavailable. The IHSES sample has been explicitly stratified by Gadah (district) and a sample size of 216 households per Gadah was proposed, equivalent to a total sample of 25,488 households for the country. The final sample size is 24,944 households and 176,042 individuals.

The analysis for the first part is limited to the married couples, and specifically 906 couples, in which both spouses are employed due to the requirements of the collective model setup (Chiappori, 1992). Next we extend the model and the empirical estimates to include also whether wife participates in the labour market or not. The dataset contains information on wages, non-labour income, time use on household production, such as chores, care of children and elder family members, shopping, and time use on labour supply. The time use is expressed in hours per day. The wage is expressed either on daily, weekly, fortnight or monthly frequency. In order to make the estimates comparable, we have converted the wage rates into daily basis.

In table 1 we present the summary statistics of the main variables used in the empirical work and include the spouses' characteristics, such as time use on labour market and household production, wage rates, education and age, while the household characteristics refer to non-labour income, number of children belonging in age groups 0-5 and 6-15, and whether the household resides in an urban or rural area. It becomes obvious that there is a strong degree of inequality regarding the time use. While the average daily wage rate between male and female is rather close at 28.2 and 25.4 thousands of Iraqi Dinar (ID) respectively, the inequality gap is significantly increased when the time use on household chores and caring for children and elderly is considered. More specifically, the average daily time of women spent on household chores and caring of other family members, is respectively 4.1 and 2.5 hours per day, while the respective values for men are 0.5 and 0.7. Regarding the labour supply, women spend on average 3.1 hours per day and men 5.3 hours. This gives a first impression of the household behaviour in Iraq, where women spend significantly a higher portion of their daily time on household chores and caring for other family members and much less time on labour market than husbands do. The average leisure time is rather similar between the couples, as the average age is. The education level and specifically the higher education between the spouses is similar. However, the percentage rates of illiteracy for men are lower. About the university degree the differences are rather small, where men are more likely to have a university degree at 18 per cent versus the 14 per cent for women. This may indicate that the assortative mating condition may hold, where the spouses choose each other based on common traits. Also we observe that the 32 per cent of the wives earns the wage from agriculture and the husbands at 39 per cent. The remained percentage is employed to public or other industries in the private sector.

We should mention that in 2007 the female labour market participation was only 18 per cent, while males' participate rate was 81 per cent (United Nations, 2010). Our data show that in 2012 only the 21 per cent of the women is working or actively seeking for job, while the respective percentage for men reaches the 82.8. However, this percentage refers to women of any kind of marital status, including married, single, divorced, separated and windows. When we consider only the married women then female labour supply reaches only the 2.7 per cent. Therefore, we find that is more relevant for policy making to explore the participation and non-participation of wives on the labour market. Also in our analysis we exclude those who are students, old age-retired and non-adults and the polygamous families.

In table 2 and panels A-B we present the characteristics of 35,824 couples where the husband participates in the labour market and women do not. Similarly, we report the summary statistics in panels C-D of 632 couples, where the wives participate in the labour market, but husbands do not. It becomes clear that there are large differences among the wives who participate in the labour market, according to table 1, and those who do not, based on the panel A of table 2. Wives that participate in the labour market, including those who are unemployed, spend on average 3 hours, while they spend almost 6.5 hours per day in household chores and caring of children and elderly family members. On the other hand, wives that do not participate spend 9 hours in household chores and caring. Also the leisure time is rather similar which can be explained by the fact that women who do not participate in the labour market devote some time on leisure, while the wives who participate have not enough time to allocate in leisure activities. Another remarkable finding is the large gap on education level between those two samples. While the elementary and high school graduates present similar percentage rates, the women who do not participate in the labour market are more likely to be illiterate by 6 percentage points more and for university degree 2.5 points. Similarly for men we observe large differences, as the 28 per cent of those whose wife does not participate completed the elementary school at 27 per cent versus 31.7 per cent for the two-earner couples. As both samples present similar percentage rates for high school and university degree, husbands whose wives do not participate in the labour market completed a postgraduate higher education by almost triple.

We observe the opposite situation when wife participates in the labour market, but husband no. In this case the illiteracy rate of wives is much lower compared to the other samples, while the percentage rates of university and higher education degrees is significantly larger. Also we observe that wives participate more hours in the labour market and less in household chores and caring as it is expected. Furthermore, there is a large education-gender gap as wives at 46 per cent have completed tertiary education only the 20 per cent of husbands have accomplished the same education level. However, as we mentioned earlier the percentage of husbands that do not participate in the labour market is very low at only 2.9 per cent and for this reason we will not explore this case.

We can derive some initial concluding remarks from the correlation matrix presented in table 3. The first remark is that age, education and wages are positively correlated, both between and within partners. Both spouses' education level is positively associated with the wife's time spent in labour market. This may imply that first; more educated women are more likely to work more hours resulting also to higher wage rates. Second, more educated husbands may allow or encourage their wives to actively participate more in the labour market. Next we examine the relationship between spouses' wage, time used on household chores and the labour market and the household non-labour income. We observe a negative association between the partners' time used on household chore-caring and the time spent on labour market. This relationship is predicted by the standard neoclassical theory, because in this setting wages play an important role in the time allocated to household work, since wages are the opportunity costs of hours spent on this activity. A higher wage of both partners is associated with higher time

use to labour market and less time spent on household production-chores. However, we observe a cross-wage effect for women, where the male's wage influences the female's working time on labour market and domestic production. More specifically, the male's wage has a negative relationship with female's participation time on labour market, while her wage is positively correlated with her labour supply. Also, the male's wage is positively associated with the female's time spent on household chores and caring, while the association between her wage and time spent on household production is negative. Another remarkable finding, which is not presented in table 2, is that education level, wages and leisure time are positively correlated, indicating that the more educated couples are more likely to be involved in physical, mentally or other leisure activities in comparison with lower educated couples. Earlier studies found that education is strongly associated also with health-related behaviours, including time spent in leisure time physical activities (Adler et al., 1994; Cohen et al., 2013) Compared to those with lower education, highly educated individuals are more likely to present better health levels and healthier lifestyle (Adler et al., 1994; Fujiwara and Kawachi, 2009; Groth et al., 2014). However, this is out of the current study's topic, but it can be a subject for future research and application in emerging and developing economies.

The non-labour income of the household is positively and significantly correlated to spouses' education, male's wage and female's age. This shows that the more educated couples report a higher non-labour income and higher wages are correlated with higher non-labour income. Even though we do not explore the causal path among these variables, it can be the case where additional education and wages increase the non-labour income of the household, such as investments and savings. However, inheritance from relatives, including land and properties may indicate rich families and more opportunities for the children to achieve higher education levels and having more labour opportunities, and therefore higher earning potentials. Also the association between non-labour income and partners' labour supply is negative, indicating that the couples with high non-labour income are less in need to work.

Regarding the disability status, both spouse's wage, education level and time spent on labour market and household domestic production are higher when are non-disabled. However, a cross-effect in the time use is observed for women. For example, non-disabled women are more likely to spend more hours to household production, but their partner spends less time on household chores, which may be explained by the fact that non-disabled women contribute more in household in terms of both labour supply and household domestic production. Women, whose husband is disabled, work 0.6 hours per day more than the average wife with non-disabled husbands, while they participate in the household domestic production more by 1.3 hours. Similarly, for husbands whose wives are disabled, they devote 0.9 more hours in the labour market and 0.5 in household work than the average husband. The findings are consistent with the study by Gallipoli and Turner (2009), who found that the wife of a currently disabled husband working 45 hours a week performs on average 1.6 hours more housework per week.

The correlation between spouses' age and disability status is negative, indicating that younger people are healthier. This is expected as both physical and mental health decline with age, at least in terms of the inability to function independently concerning the basic activities of daily living. The most common symptoms and cases of disability that are associated with age include cardiovascular diseases, hypertension, stroke, diabetes, cancer, chronic obstructive pulmonary disease, muscular-skeletal conditions, such as arthritis and osteoporosis, and mental health conditions, such as dementia and depression, blindness and visual impairment among others.

One issue is how convincible can be the disability to serve as a potential distribution factor. Our argument lies on the fact that as in the case of education differences between household members used as a distribution factor, it does not affect directly the preferences, but influences the household allocation decisions. Thus, we claim that disability is an exogenous variable,

especially in the case of war and armed conflicts. This assumption holds well for the two-earner couples, as the non-labour income of the households with disabled wives is 2,350, while the respective income in households with non-disabled wives is 2,400. Also the average daily wage rate of the disabled wives is 22.5, while the respective wage rate of non-disabled wives is 27. On the other hand, in the full sample, we cannot claim that the household budget constraint is similar between the two samples-disabled and non-disabled wives- and therefore, the use of disability as distribution factor may not be robust. More specifically, the non-labour income of households with disabled and non-disabled wives is respectively 2,100 and 1,700 ID, while the respective average daily wage rates are 0.9 and 1.81. Thus, we limit our main interest of analysis in the two-earner couples which fits also better the methodological framework of the studies by Chiappori (1988; 1992) and Rapoport et al. (2011). However, the differences are also present if we consider the education differences between the couples, as a distribution factor. In particular, in households with large education differences, the average daily wage rate of wives is 0.8, while when we consider small education differences the wage rate is increased at 3.5.

Overall, one of the main elements of the distribution factor independence hypothesis (DFI) and which has received a lot of attention in the literature is to test the unitary model by the income pooling condition. This states that the household choices are independent on who receives the non-labour income. However, rejections of the income polling cannot necessary imply also rejections of the unitary model. More specifically, there could be models and cases where the incomes are pooled, but the household choices depend on other distribution factors (Browning et al., 2006; Crespo, 2009). One possible objection to the use of a distribution factor based on the individual's disability status level is that does not enter preferences, whereas disability can be a preference factor. Nevertheless, even though the disability status may enter the individual's utility function, the partner's level does not. Furthermore, the correlation between the disability status and the spouses' market and household labour supplies, as we have shown in the table 3, could be explained by their relative differences in disability. Therefore, lower levels of disability severity or absence will imply a stronger dedication to the labour market and thus, a higher number of working hours. Additionally, in this study we consider the hours spent in the household-domestic production, as we described earlier in the methodology section. So, wives with lower disability levels will spend more hours in the labour market and household chores than their disabled counterparts, and their husbands. This implies a higher relative bargaining and decision power for the wife allowing her to claim a larger share of the non-labour income (Browning et al., 2006; Crespo, 2009). This then may lead to a lower number of working hours as a result of the income effect assuming that leisure is a normal good. However, the cross-sectional data used in our analysis does not allow us to investigate the dynamic income and substitution effects and this is one of the main important drawbacks of our study, which is discussed in more details in the next sections. Following the same argument, the husband's labour supply function will have the opposite sign. According to the assumptions and arguments discussed so far, disability status, similarly with differences in education level, age, and sex ratio, can be considered as a potential distribution factor.

5. Empirical Results
In this section we present and discuss the empirical results. Before proceeding to the estimates of the collective model described in the methodology section, we estimate a two-step Heckman selection model (Heckman, 1979) to explore the determinants of the woman's participation in the labour market and the wages. As we discussed earlier we estimate only the labour market participation of wives. In column 1 of table 4 we present the selection-participation equation, while in column 2 the estimated coefficients of the wage equation are reported. As we mentioned earlier, only the married couples are considered. In this case the fraction of women participating in the labour market reaches the 2.7 per cent. Various concluding remarks can be

derived by the estimates in table 4. First the wife's age and labour supply present a non-monotonic relationship, illustrating an inverted U-shaped curve. This indicates that the positive relationship between labour supply and age is expected to weaken when the individuals become older, because of the diminishing returns. The age where the curve presents the maximum point is 48 years old. On the other hand, the husband's age is negative and insignificant. We have tested also quadratic or higher polynomial terms of the male's age and are insignificant. This can be due the fact that in table 4 we estimate the labour supply of women. Both partners' education level is positively related to the probability of labour participation. Thus, wives who are highly educated are more likely to have access to better information related to labour market opportunities, better skills and higher chances of being employed. Additionally, as we discussed earlier, more educated people are more likely to follow healthier lifestyle and be more productive, and able to work less hours enjoying higher earning potential compared to the average low-educated individuals. Moreover, the positive association between females' market participation and the males' education level may be attributed to the so-called "assortative mating", where people tend to mate with other individuals sharing similar characteristics. The household non-labour income and the urban area are insignificant. More specifically, we observe the expected negative relationship between non-labour income and labour supply, but this association is insignificant. Another factor we include into the estimates is the number of children and we show that is a significant determinant of the woman's labour participation. More specifically, the number of children aged 0-15 years are negatively associated with the probability of the women to be involved in the labour market. The last factor we include into the analysis is a dummy variable indicating whether the wife reports disability problems. As we expected, the coefficient sign is negative and significant, indicating that disabled wives are less likely to participate in the labour market.

About the wage equation that is equation (16), we observe that there is a quadratic relationship between wages and age, where women up to a certain degree earn more. Education level coefficients are positive and significant and their relationship with the wages is monotonic. This shows that more educated wives have access to better jobs and higher potential earnings. As it was expected the disability has a significant and negative effect on wages earned by wives, while the number of children and the area coefficients are insignificant.

In table 5 we present the GMM estimates for the labour supply equations (11)-(12). We observe that husband's and wife's wage has respectively a negative and positive effect on the female's labour supply, and we show that the wife's share is positively associated with increases in the husband's wage. The consequence of this increase is the wife's labour supply reduction, since the leisure is a normal good. We observe that a cross-wage effect is present where increases of one spouse's wage leads to decrease in the labour supply of the other. However, the effect is lower in female's labour supply, indicating that the husband is less affected by increases in wife's wage rates. The coefficient of the non-labour income is negative as it was expected, indicating that wives in wealthier households are more likely to reduce their time use in the labour market. Regarding the number of the children, both men and women are more likely to reduce the labour supply, when the children are younger than 6 years old. This indicates that the spouses devote more time for children's' caring and less time in the labour market. On the other hand, the effect of the number of children 6-15 years old is positive and significant on the labour supply for males. The findings are consistent with earlier studies, where the young children have a negative impact on men's labour supply, and the number of elder children has insignificant effect on women's hours worked in the labour market (Carlin and Flood, 1997; Lundberg, 2002, Wilfred et al., 2005). Urban area is insignificant for both partners, when we consider only the time use on labour market. The age and education are significant factors and increase their participation time to labour market, as we found also in the estimates illustrated

in table 4. We observe that disabled women reduce their labour supply, while their disability status has no effect on male's labour supply. An inverse effect is observed for disabled males.

In the columns (3)-(4) we report the estimates when we consider additionally the time devoted to household domestic production, which includes chores and child caring. The male's wage has a positive effect on his labour supply, however is smaller since it includes also the time spent on household production. On the other hand, male's wage coefficient in the wife's labour supply equation is negative, implying that cross-wage effects are present. However, the coefficient is lower, compared to the wage coefficient in the female's labour supply, when only the time spent on labour market is considered. The reason is that women spend less time on household chores when they work. The coefficients of age and number of children remain similar, but the effect of number of children 0-5 years old on the labour supply of women is lower. This may imply two concluding remarks: First, married and employed women spend more time in the labour market, and second because the husband also contributes to child caring. The urban area becomes now negative and significant, indicating that when we consider also the household chores, couples located in urban areas are less likely to spend more time in the domestic production. About disability, the results remain the same for the female's labour supply equation, and the effect becomes higher at -2.75 hours from -2.5 hours we found in column (2). Also, in the male's labour supply equation, the coefficient of the women who are disabled becomes significant and positive. This shows that husbands with disabled wives are more likely to spend additional time on both labour market and household production. In all cases, the null hypothesis for the endogeneity test is accepted implying that the instruments employed are exogenous, which include the partners' age in quadratic terms, employment sector, such as whether the respondent is employed in the public or private sector and the geographical area expressed by the governorate (Rapoport et al., 2011). As we discussed in the previous sections, the unobserved individual characteristics associated to labour supply may also be correlated with the wages and the non-labour income. For this reason, we apply the GMM method and the regressors are instrumented with variables that generally have been found to be correlated with both wages and non-labour income (Kooreman and Kapteyn, 1986; Blundell et al., 1998; Devereux, 2004; Donni and Moreau, 2007; Rapoport et al., 2011). These include the employment sector, such as whether is public, private or self-employed, the geographical area, like living in city, town or village and the governorate. Also we allow for a flexible functional form of age and specifically quadratic terms to proxy for the working experience that explain wages and asset accumulation which refers to the non-labour income. Moreover, according to Hansen's J test statistic, we conclude that the excluded instruments are valid instruments and uncorrelated with the error term.

A simple test on whether the household labour supply in the study examined is characterised by the unitary model is to empirically measure the distribution of the bargaining power between the spouses that affect the labour supply. In other words, if the unitary model holds, then changes in the bargaining power between the spouses or changes in the distribution factor should have no effect on the wife's labour supply. As we can see in the table 5, disability affects the labour supply and both partners' labour supply when we consider additionally the time use to household domestic production.

The partial derivatives in the panel B of table 5 represent the change in the non-labour market income share that each of the partners can claim, as a function of changes in the spouses' wages, the non-labour income and the distribution factor of disability. In the panel B of table 5 we report the results of the collective rationality test, which shows whether the collective model is preferred to the unitary model. In our case we accept the null hypothesis, based on the p-values, and the collective model is preferred. The collective rationality test implies that:

$$\frac{\partial \phi_{w_m}}{w_f} = \frac{\partial \phi_{w_f}}{w_m} \tag{18}$$

Relation (21) implies the equality of the second order cross-derivatives. Recalling equations (A21)-(A24) in appendix A and taking the estimated parameters from equations (11)-(12) we have:

$$\frac{\partial}{\partial w_f}\left(\frac{b_5(a_1+a_3\log w_f)}{\Delta w_m}\right) = \frac{\partial}{\partial w_m}\left(\frac{a_5(b_1+b_3\log w_m)}{\Delta w_f}\right) \tag{19}$$

The test of collective rationality is:

$$\frac{a_3 b_5}{w_f w_m \Delta} = \frac{a_5 b_3}{w_f w_m \Delta} - \frac{\partial t_f}{\partial w_m} \tag{20}$$

Where $\Delta = a_4 b_5 - b_4 a_5$ using the estimated parameters of labour supply functions (11)-(12) (see Chiappori et al., 2002). About the last term we consider a household domestic-labour supply function and is evaluated simultaneously with the functions (11)-(12). We observe that relation (20) holds and the equality of the ratio on distribution factor, which is the disability status, is accepted implying that the unitary model is rejected and thus, the collective model is a better approximation of the household behaviour in the case examined.

Regarding the sharing rule based on equations (A21)-(A24) in appendix A, we have the following results. Disabled wives reduce their share by 1,135 ID (0.96$). Increases in the wife's wage lead to an increase in her share by 1,250 ID (1.1$) and increase in the husbands' share by 330 ID (0.3$). On the other hand, increase in the husband's wage have no significant effect on the wife's share when we consider only the labour market time, while it increases his share by 925 ID (0.8$). When we consider only the labour market time, the wife's sharing rule on non-labour income is insignificant, while husbands increases his share by 0.445 and is significant.

In the columns (3)-(4) considering the housework time we observe the sharing rule of the non-labour income for wives becomes significant and a one ID increase, raise the share by 0.42. Wives can claim 1,470 ID (1.25$) and 600 ID (0.48$) respectively with increases in their wage and the husbands' wage. Disabled wives in this case reduce even more their share of the full income by 1,300 ID ((1.1$) compared with the share of 1,135 ID (0.96$) when only the labour market time is considered. The results show that when the household domestic production or household chores are included in the total working supply equations the sharing rules become larger. The sharing rule of women, in terms of her wage and the non-labour income, is higher, even though they consume less leisure, because the value of their labour in the domestic production is added to their labour market earnings. On the other hand, the sharing of disabled spouses is decreased even more, when we consider also the household domestic production, since they may have more leisure, such as care and resting, but they contribute also additionally to both domestic and market labour, increasing their bargaining power. The findings suggest that when we consider the whole process of working decisions, including market and household domestic labour, and the exchange within this process has a significant impact on both partners' sharing rule. Increases in wife's wage results to increase of both partners' share and reduction of husband's labour supply, associated with additional participating hours of wife in the labour market. On the contrary, while increase on the husband's wage rate will lead to increase of the share for both partners, the wife will decrease her labour supply, while the husband will participate more in the labour market. As we observe

in table 5, when we consider both market and domestic labour supply, the share of the woman is increased, while increases in the husband's wage rate are associated with lower levels of full income that the wife can claim.

Overall, we observe that the coefficient estimates for education and age of the couples and for the disability status confirm the theory of the distribution factors. More specifically, we conclude that these factors strongly influence both partners' labour supplies according to the interpretation of the distribution factor, and hence, the estimates support the hypothesis that there are factors that may influence the household decisions through their impact on the intra-household allocation process. Regarding the wage effect, we show that both partners work more hours when their own wages increase and reduce their time use in the labour market when the spouse's wage increase. So far our findings are consistent with the results of earlier studies, regarding the impact of distribution factors, the wage and non-labour effects, but also the relationship between the number of children and spouses' participation and time use in the labour market (Fortin and Lacroix, 1997; Browning et al., 1994; Browning and Chiappori, 1998; Chiappori et al., 2002; Bourguignon et al., 2009).

In figures 1-3 we present the locally weighted smoothing non-parametric regressions for the disabled and non-disabled women's share to labour supply, the spouses' share relatively to women's wage share and the share respectively on labour supply and the domestic production. More specifically, in the *x-axis* we present the female wage share, which is defined as the ratio of female's wage over the sum of partners' wages. In the vertical *y-axis* we present the predicted shares of women participation on the total working supply equations, including both labour and domestic production time use, and have been derived by the GMM estimates in table 5.

In figure 1 we present the non-disabled wives' and husbands' labour supply share. We can see that increasing the woman's wage share her labour supply is increased and reaches the husbands' share at around 0.58 based on the intersection of the two lines. On the other hand, in figure 2 we present the labour supply of disabled women and their husbands and we observe that the intersection of the two lines take place at 0.83 in terms of the wife's share indicating that disabled women require higher wage shares to participate more in the labour market. In figure 3 we present the wife's labour supply according to her wage share over the full wage for disabled and non-disabled women. It becomes obvious that the gap is large and the share of disabled women is significantly lower.

Next we present the labour supply equations for married couples, considering also when the wife does not participate in the labour market. As we mentioned in the methodology section, the wife's decision to participate in the labour market should be modelled using the reservation wages which is the minimum wage indicating the initial point that she will be willing to work (Cogan, 1981). This hypothesis implies that the wife enjoys the same level of utility whether she participates in the labour market or not and the husband must receive the same share of income whatever is the wife's decision. The distribution of the labour market and domestic labour supply hours may change even his hours of total work remains unaffected. We examine only wife's decision to participate, as we discussed in the previous parts, because the case of the married couples where only the wife participates in the labour market is very low which does not make a significant contribution considering it, at least in Iraq. In panel B we report the sharing rules. The results show that when the wife does not work, the bargaining power is lower compared to the two-earner married couples. More specifically, the shares of the non-labour income range between 0.31-0.36, while in the case of the women who work the shares reach at 0.42. A similar situation is observed for increases at both spouses' wages, where the share for women is lower. About our main distribution factor of interest that is the disabled women, we illustrate in table 6 that the share is 1,646 ID (1.4$) while the respective share was

1,135 ID (0.96$). As before, including the household domestic production, the share of the wife that she can claim for one unit increase in non-labour income reaches the 0.36 which is lower than the 0.42 found for the two-earner couples. We should notice also that the number of observations and couples in table 4 differs from the sample size in table 6 due to missing data on household domestic production time use. More specifically, the Heckman model in table 4 considers also the female participation, but it does not include the time use in labour market and household chores.

We conclude that female labour participation increases her bargaining power in terms of wages, non-labour income and disability status. While the main topic of the study is limited to disability and bargaining power using wages and non-labour income, household domestic production and female labour supply participation can be extended to investigate many other empirical applications. Their effect on various outcomes can be explored, including the gender-wage gap, domestic violence, expenditures allocated to health and education and children, shaping of both mothers' and children's gender role attitudes, as well health and education outcomes. Earlier empirical evidence shows the differences in patterns of men's and women's labour market participation and expenditures allocation (Behrman 1988, Pitt and Rosenzweig, 1990, Quisumbing and Maluccio 1999, Lundberg et al., 1997). Thus, based on this evidence, ignoring the intra-household collective model estimates and intra-household inequality in various welfare outcomes could underestimate the overall level of inequality in country level (Sahn and Younger, 2009).

Overall, the main concluding remarks so far are the following: First, the unitary model is rejected and the household collective model is the preferable one, since the labour supply, household domestic production and the total labour supply of both spouses depend on the spouses' wages. Second, the distribution factor-disability- employed in this study is significant and has an impact on the spouses' labour supply choices; suggesting that the collective household model is the appropriate approach for the two-earner couples in Iraq, but also when we include the case of female non-participation in the labour market. Third, considering additionally the domestic production as a non-pure leisure time and as a production of marketable goods and services that are produced in the household, the share or the bargaining power of female is higher in terms of her wage and non-labour income.

As we mentioned, the study has a main limitation that the model set up and its empirical strategy relies on cross-sectional data ignoring the dynamic effects of spouses' participation in the labour market and domestic production, wage, non-labour income and health status. Therefore, a panel data set or repeated cross-sectional data could be very useful to estimate these relationships, the share of income and the bargaining power of women within a dynamic framework providing more precise and insightful estimates. Moreover, a proper matching comparing households with and without disabled members is necessary to estimate the additional costs related to disability and the resource allocation within the couples using income equivalence scales. Based on Engel curves and expenditure data the disability related costs can be calculated which can be useful for policy makers, in terms of the design of disability benefits and social policies, and the re-integration of disabled people in the labour market. Moreover, one important drawback of the analysis is the disability severity which information is unavailable in the data we use. In particular, the disability registration does not imply that the severity is homogenous among the households. Therefore, alternative health and disability measures can be used, including the EQ-5D, which is a generic instrument that assesses the health related quality of life (HRQoL) in terms of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (EuroQol Group, 1990; Brooks, 1996; Rabin and de Charro, 2001). The second popular measure is the EQ-VAS which records the self-rated health on a vertical and visual analogue scale where the endpoints are labelled "best imaginable health state" and "worst imaginable health state". These measures provide more information on the

disability degree and its impact on household expenditures, disability costs and labour supply. Furthermore, the absence of panel data limits the analysis of investigating the disability shocks or the transition from healthy to disabled states and their impact on labour participation. Furthermore, future research may incorporate disabled children as individual agents and estimating the additional disability related costs, as in the case of the parents. Future research studies can be applied in emerging and developing economies, to account for the interaction of the dynamic human capital accumulation motives that link the wages to labour supply and the selection of the individuals to select into and out of marriage. In addition, future studies may investigate the disability shocks and their effects on fertility, costs and savings. Another point that this research has not examined is that children are modelled as household attributes and not as separate economic agents with individual utility functions. Even though children may not express their own preferences when they are young, it is reasonable to assume that the parents allocate resources to maximise their children's utility, especially when they are ill or disabled.

6. Conclusions

The study showed the definitions of the intra-household resource allocation considering the female non-participation in the labour market and the disability status. The setting and estimation of this model can be useful for designing and implementing efficient welfare policies related to the reduction of inequality and child poverty and the incentives of female labour supply. This is feasible if the intra-household resource allocation is known in terms of income and time use. As we thoroughly discussed in this study, the traditional economic approaches have considered the household as the basic and unique entity. However, this approach presents various weaknesses both theoretically and empirically. The choice of this framework is justified by the wide concept of the full income within the collective household model and the assumption of testing whether the time allocation of the couples is driven by other factors besides the market wage. In fact, the findings suggest that the female market wage is an important factor explaining the woman's bargaining power in the family, as also whether there are very young children in the family indicating, that males have also to devote more time to the children's' caring.

The findings support the household collective model, while the unitary model is rejected. More specifically, the assumption that changes on the non-labour income or distribution factors do not influence the labour supply choices is rejected. The results show that the spouses' wages are significant factors of bargaining power, as increases of one per cent on the female's daily wage increases her share of full income by 1,250 ID, corresponding to $1.1 in 2012. It reaches the 1,470 ID (1.25$) when we include also the labour domestic production, while respective increases in male's wage increase her share are insignificant. However, when the labour domestic production is considered the share becomes significant and estimated at 600 ID (0.48$). Increases on non-labour income correspond to increase of female's share by 0.42. About the impact of disability status on intra-household distribution, we find that disabled women decrease their share by 1,135 ID (0.96$) and the negative share becomes larger with the inclusion of the household domestic production at 1,300 ID (1.1$).

When wife non-participation in the labour market is considered, the results show that she can claim 0.31 of the non-labour income and increases at 0.36 when the household domestic production is included. The disability has even a larger effect compared to the two-earner couples and her share is reduced by 1,640 ID (1.4$) and the loss becomes even larger when the household domestic production is included reaching the 1.920 ID (1.6$). This may be explained by the fact that a sample of the wives that do not participate can be severely disabled and thus, better information and measures about the disability status should be included. Therefore, the conclusion is that disabled women are in a more vulnerable position compared to the healthier

women and those who are able to participate in the labour market. Moreover, the non-disabled people may have access to jobs of better quality, be more productive and have higher potential earnings. Increases in her wage are associated with increase in the bargaining power by 990 ID (0.83$) and 1,200 ID (1$) considering respectively only the labour supply time and the household domestic production time additionally. Similarly, she can claim 460 ID (0.38$) with increases in husband's wage rates when the household domestic labour is accounting for, while the estimated sharing rule when only the labour supply time is obtained, becomes insignificant. Overall, disability is an important and crucial factor that determines and affects both labour market household domestic production. Furthermore, it is important to consider also for non-participation, since the bargaining power of the wives is significantly reduced.

Overall, there are still issues about the disability rights and policies in Iraq. The information about the persons' disability status and situation should be improved for policy purposes. Furthermore, a system for quantitative and qualitative data collection and analysis should be put in place, disaggregated by age, sex and other socio-economic groups, and respectful of privacy and confidentiality standards, based on internationally agreed indicators wherever appropriate. Disabled people should be actively involved in the design and delivery of all policies aimed at their benefits and well-being improvement. Public education campaign implemented by the government in partnership with disabled people and their families, focusing on the awareness of disabled persons' rights should be developed and encouraged. Another issue is that practical interventions eliminating the physical and attitudinal obstacles that create or sustain disability have been ignored and are missing. Practical measures that improve specialized health care, including psychosocial support, for disabled people need to be developed.

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Table 1. Summary Statistics for Married two Earner Couples in Iraq

Variables	Average	Standard Deviation	Minimum	Maximum
			Panel A: Spouses Characteristics	
Female Wage (in 1,000 ID)	25.366	40.099	0.40	1,220
Male Wage (in 1,000 ID)	28.264	45.821	0.33	1,360
Female Age	36.522	13.183	18	64
Male Age	41.033	14.246	18	67
Female Education				
No-certificate -Illiterate	36.81%	Elementary school	34.21%	
High School	13.58 %	University Degree	14.11%	
Postgraduate and Higher Education	1.29%			
Male Education				
No-certificate -Illiterate	30.66%	Elementary school	31.66%	
High School	16.94%	University Degree	17.80%	
Postgraduate and Higher Education	2.94%			
Female Time Use on Household Chores	4.194	1.721	0	9
Male Time Use on Household Chores	0.537	0.651	0	6
Female Time Use on Caring of Children and Elderly	2.568	1.132	0	7
Male Time Use on Caring of Children and Elderly	0.785	0.912	0	5
Female Time Use on Labour Market	3.153	1.892	1	7
Male Time Use on Labour Market	5.254	3.146	1	9
Female Time Use on Leisure	2.125	2.570	0	7
Male Time Use on Leisure	3.281	2.497	0	8
Female Wage from Agriculture	0.322	0.349	0	1
Male Wage from Agriculture	0.395	0.371	0	1
			Panel B: Household Characteristics	
Non-Labour Income	3,070.1	11,812.7	0	210,000
Number of Children 0-5 years old	0.515	0.709	0	2
Number of Children 6-15 years old	1.121	0.893	0	3
Urban Area	0.497	0.493	0	1
Total observations	948			

Notes: ID denotes Iraqi Dinars, Time use on labour market, household production, leisure and wage rates are expressed on daily basis

Table 2. Summary Statistics for Married Couples Non-Participating in the Labour Market

Variables	Average	Standard Deviation	Minimum	Maximum
		Panel A: Husband participates in the labour market but wife no		
		Panel A1: Spouses Characteristics		
Male wage	27.307	41.428	0.714	1,300
Female Age	36.933	13.615	18	64
Male Age	42.116	13.513	18	67
Female Education				
No-certificate -Illiterate	42.46%	Elementary school	35.20%	
High School	13.53%	University Degree	8.63%	
Postgraduate and Higher Education	0.18%			
Male Education				
No-certificate -Illiterate	33.46%	Elementary school	27.83%	
High School	21.44%	University Degree	16.10%	
Postgraduate and Higher Education	1.17%			
Female Time Use on Household Chores	5.549	1.910	0	8
Male Time Use on Household Chores	0.226	0.622	0	5
Female Time Use on Caring of Children and Elderly	3.425	1.545	0	7
Male Time Use on Caring of Children and Elderly	0.446	0.859	0	6
Male Time Use on Labour Market			1	
Female Time Use on Leisure	1.824	2.487	0	7
Male Time Use on Leisure	1.620	2.838	0	8
Male Wage from Agriculture	0.410	0.488	0	1
		Panel A2: Household Characteristics		
Non-Labour Income	2,238.3	9,162.8	0	154,000
Number of Children 0-5 years old	1.706	1.625	0	3
Number of Children 6-15 years old	1.487	1.575	0	3
Urban Area	0.495	0.499	0	1
Total observations	35,824			
		Panel B: Wife participates in the labour market but husband no		
		Panel B1: Spouses Characteristics		
Female Wage	26.792	44.048	2.85	723
Female Age	38.921	10.569	18	62
Male Age	40.142	12.215	20	67
Female Education				
No-certificate -Illiterate	13.68%	Elementary school	18.42%	
High School	21.58%	University Degree	44.74%	
Postgraduate and Higher Education	1.58%			
Male Education				
No-certificate -Illiterate	31.20%	Elementary school	31.29%	
High School	17.88%	University Degree	18.90%	
Postgraduate and Higher Education	0.73%			
Female Time Use on Household Chores	3.603	1.404	0	7
Male Time Use on Household Chores	1.375	1.263	0	6
Female Time Use on Caring of Children and Elderly	1.983	1.422	0	5
Male Time Use on Caring of Children and Elderly	0.902	1.021	0	5
Female Time Use on Labour Market	4.283	2.780	1	9
Female Time Use on Leisure	1.226	2.367	0	7
Male Time Use on Leisure	1.919	3.196	0	7
Female Wage from Agriculture	0.243	0.155	0	1
		Panel B2: Household Characteristics		
Non-Labour Income	3,035.7	13,161.7	0	175,000
Number of Children 0-5 years old	0.812	0.391	0	1
Number of Children 6-15 years old	0.640	0.245	0	1
Urban Area	0.292	0.394	0	1
Total observations	632			

Table 3. Correlation Matrix for Married two Earner Couples in Iraq

	Female Wage	Male Wage	Female Age	Male Age	Female Education	Male Education	Female Time Use on Chores and caring	Male Time Use on Chores and caring	Female Time Use on Labour Market	Male Time Use on Labour Market	Non-Labour Income	Non-Disabled Female
Male Wage	0.340***											
	(0.000)											
Female Age	0.030***	0.044**										
	(0.000)	(0.036)										
Male Age	0.017***	0.150***	0.118***									
	(0.0003)	(0.000)	(0.000)									
Female Education	0.241***	0.060**	-0.008*	0.056**								
	(0.000)	(0.013)	(0.083)	(0.021)								
Male Education	0.092***	0.054***	0.053*	0.198***	0.283***							
	(0.0026)	(0.004)	(0.084)	(0.000)	(0.000)							
Female Time Use on Chores-caring	-0.024**	0.007*	-0.145***	-0.037**	-0.035**	-0.015						
	(0.0035)	(0.071)	(0.0004)	(0.012)	(0.018)***	(0.626)						
Male Time Use on Chores-caring	-0.011	-0.028**	0.011**	0.159***	-0.011	0.048*	0.321***					
	(0.1652)	(0.015)	(0.024)	(0.000)	(0.645)	(0.087)	(0.000)					
Female Time Use on Labour Market	0.233***	-0.084**	0.093**	0.071***	0.338***	0.094**	-0.381***	0.003				
	(0.000)	(0.020)	(0.010)	(0.002)	(0.000)	(0.042)	(0.000)	(0.925)				
Male Time Use on Labour Market	-0.039	0.209***	-0.073**	0.276***	0.015	0.013	0.005	-0.145**	-0.020*			
	(0.376)	(0.000)	(0.029)	(0.000)	(0.828)	(0.805)	(0.659)	(0.001)	(0.074)			
Non-Labour Income	-0.003	0.012**	0.014***	0.005	0.028**	0.020***	0.016	-0.026**	-0.021**	-0.041*		
	(0.388)	(0.049)	(0.015)	(0.803)	(0.046)	(0.000)	(0.110)	(0.011)	(0.015)	(0.035)		
Non-Disabled Female	0.010**	0.008	-0.099***	-0.058**	0.042*	0.005	0.050***	-0.037*	0.014**	0.043	0.020**	
	(0.031)	(0.261)	(0.000)	(0.032)	(0.082)	(0.316)	(0.0004)	(0.077)	(0.019)	(0.233)	(0.016)	
Non-Disabled Male	0.018	0.018***	-0.051***	-0.147***	0.086***	0.082***	0.008	0.027**	0.064*	0.074***	0.008*	0.089***
	(0.368)	(0.0004)	(0.000)	(0.000)	(0.0004)	(0.0007)	(0.688)	(0.019)	(0.080)	(0.000)	(0.058)	(0.000)

p-values within brackets, ***, ** and * denote significance at 1%, 5% and 10%

Table 4. Determinants of Female Labour Market Participation

VARIABLES	Participation Equation Coefficients	Wage Equation Coefficients
Female Age	0.145***	0.020***
	(0.017)	(0.004)
Female Age Squared	-0.001***	2.2e-4*
	(2.1e-5)	(1.2e-4)
Male Age	-0.0009	
	(0.001)	
Female Education Level (reference=no certificate)		
Female Education Level (Primary-Elementary School)	0.249**	0.665
	(0.111)	(0.732)
Female Education Level (Secondary School)	0.961***	0.106**
	(0.110)	(0.047)
Female Education Level (University Degree)	2.521***	0.497**
	(0.105)	(0.205)
Female Education Level (Postgraduate Studies and Higher)	1.850***	0.528**
	(0.332)	(0.262)
Male Education Level (reference=no certificate)		
Male Education Level (Primary-Elementary School)	0.040	
	(0.092)	
Male Education Level (Secondary School)	0.098	
	(0.100)	
Male Education Level (University Degree)	0.620**	
	(0.303)	
Male Education Level (Postgraduate Studies and Higher)	0.542**	
	(0.233)	
Household Non-Labour Income	-0.025	
	(0.019)	
Number of children 0-5 years old	-0.191***	0.093
	(0.016)	(0.651)
Number of children 6-15 years old	-0.052*	0.090
	(0.027)	(0.080)
Female Disabled	-0.237**	-0.313**
	(0.102)	(0.144)
Urban Area	-0.109	0.036
	(0.084)	(0.062)
Fraction of wives participating in the labour market	948 (2.7 per cent)	
Observations		35,752
Wald chi-square statistic		556.39
		[0.000]
Rho test		52.71
		[0.000]

Standard errors within brackets, p-values within square brackets, ***, ** and * denote significance at 1%, 5% and 10%.

Table 5. GMM Estimates of the Labour Supply and Domestic Production Equations (11)-(12)

	Labour Supply		Labour Supply and Domestic Production	
			Panel A: GMM Estimates	
Variables	**Husband**	**Wife**	**Husband**	**Wife**
Log of female wage ln w_f	-0.810*	1.166**	-0.529*	0.656*
	(0.432)	(0.562)	(0.278)	(0.349)
Log of male wage ln w_m	3.297**	-3.269*	2.642**	-2.957**
	(1.588)	(1.755)	(1.222)	(1.412)
Interaction of spouse' wages ln w_m×ln w_f	0.580**	0.519*	0.524*	0.542**
	(0.261)	(0.275)	(0.262)	(0.212)
Non-labour income (y)	-0.035**	-0.033**	-0.041**	-0.038**
	(0.017)	(0.012)	(0.019)	(0.017)
Age	0.039***	0.123**	0.032**	0.139**
	(0.009)	(0.052)	(0.014)	(0.061)
Education	0.258	0.223**	0.272	0.175
	(0.185)	(0.091)	(0.193)	(0.133)
Number of children 0-5 years old	-0.450*	-0.983**	-0.232*	-0.574***
	(0.265)	(0.455)	(0.124)	(0.260)
Number of children 6-15 years old	1.174**	-0.288	1.335*	-0.344
	(0.043)	(0.203)	(0.723)	(0.373)
Disabled Female	1.148	-2.413**	1.745**	-2.752**
	(0.855)	(1.103)	(0.825)	(1.233)
Urban Area	-1.254	-1.547	-0.878	-0.954*
	(0.988)	(1.211)	(0.547)	(0.493)
No. observations	906	906	906	906
Hansen's J test statistic	4.779		7.067 [0.198]	
	[0.290]			
			Panel B: Sharing Rules for Wife	
	$\partial\varphi/\partial x$		$\partial\varphi/\partial x$	
w_f	1,244.914*		1,472.786**	
	(651.53)		(665.763)	
w_m	482.985		604.786*	
	(298.93)		(313.763)	
Non-labour income	0.384		0.421**	
	(0.253)		(0.205)	
Disability of Wives	-1,136.76*		-1,311.12**	
	(451.55)		(573.79)	
Collective rationality chi-square test	0.031		0.020	
	[0.853]		[0.881]	

Standard errors within brackets, p-values within square brackets, ***, ** and * denote significance at 1%, 5% and 10%.

Figure 1. Locally Weighted Smoothing for Labour Supply Share in Hours and Wage Share for Non-Disabled Men and Women
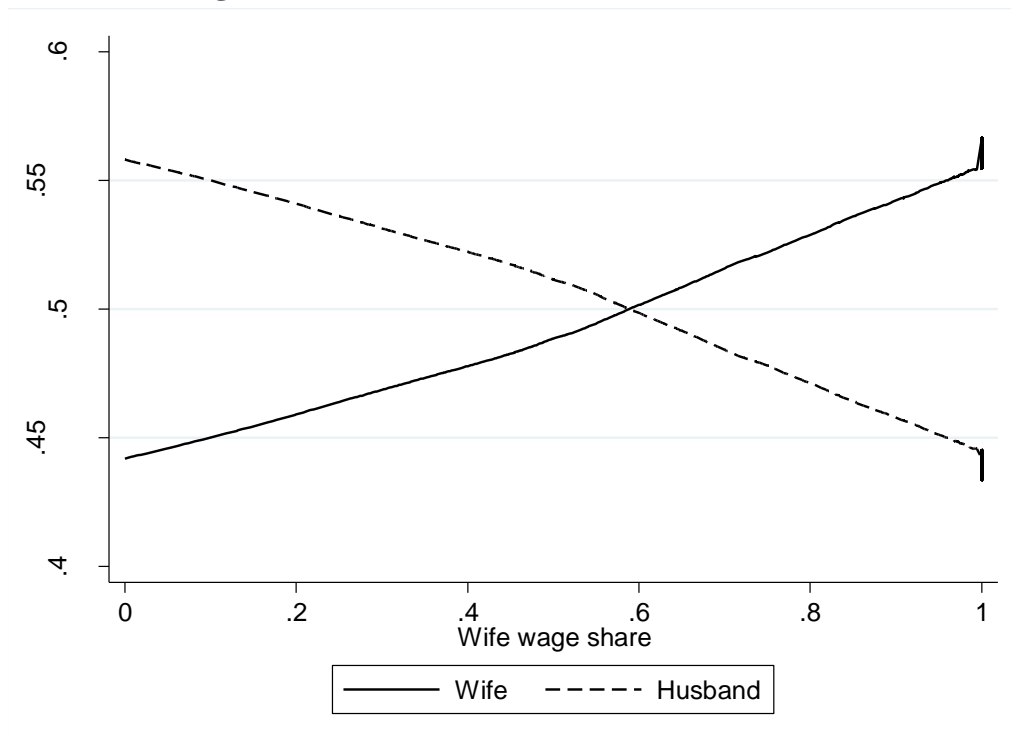

Figure 2. Locally Weighted Smoothing for Labour Supply Share in Hours and Wage Share for Men and Disabled Women
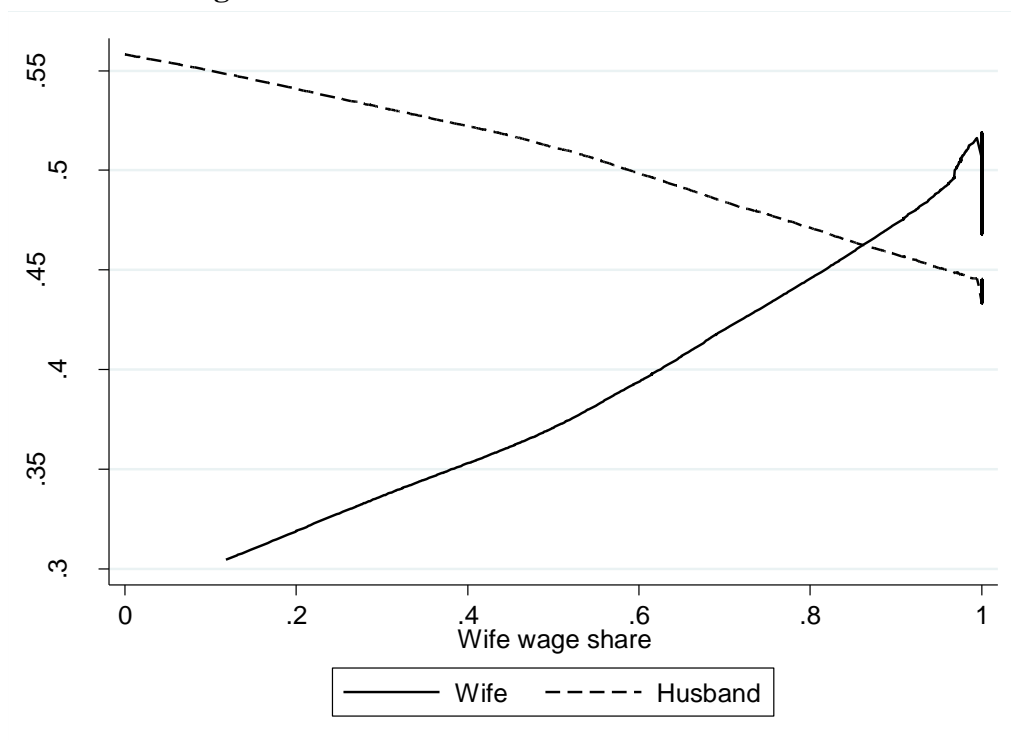
Figure 3. Locally Weighted Smoothing for Labour Supply Share in Hours and Wage Share for Disabled and Non-Disabled Women
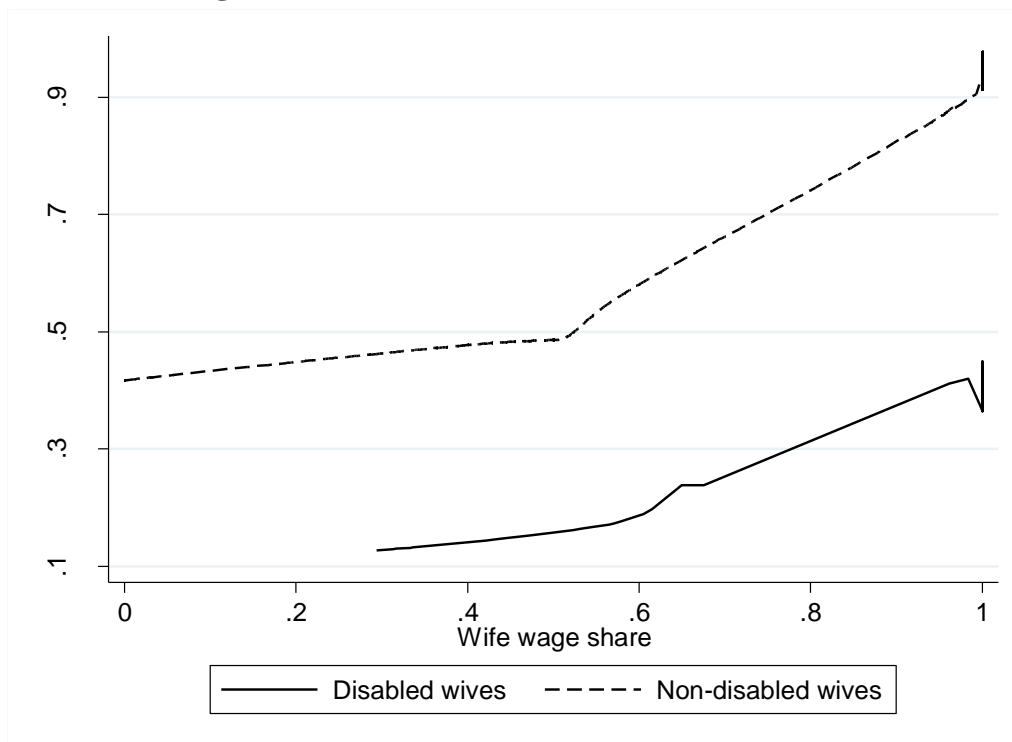
Table 6. GMM Estimates of the Labour Supply and Domestic Production Equations (11)-(12) with Female non-participation

	Labour Supply		Labour Supply and Domestic Production	
			Panel A: GMM Estimates	
Variables	**Husband**	**Wife**	**Husband**	**Wife**
Log of female rate ln w_f	-0.585*	1.383**	-0.503**	0.948**
	(0.344)	(0.567)	(0.238)	(0.433)
Log of male wage ln w_m	3.326**	-3.564*	2.716*	-3.052*
	(1.544)	(1.947)	(1.393)	(1.645)
Interaction of spouse' wages ln w_m×ln w_f	0.455**	0.504*	0.443**	0.531*
	(0.227)	(0.264)	(0.184)	(0.302)
Non-labour income (y)	-0.043**	-0.025**	-0.048**	-0.032**
	(0.021)	(0.012)	(0.023)	(0.015)
Age	0.082**	0.094**	0.077*	0.125**
	(0.041)	(0.044)	(0.039)	(0.058)
Education	0.168	0.151*	0.145*	0.143
	(0.124)	(0.081)	(0.076)	(0.084)
Number of children 0-5 years old	-1.733	-2.297**	-0.365*	-1.272**
	(1.844)	(1.032)	(0.196)	(0.547)
Number of children 6-15 years old	0.748	-0.9437*	2.100	-0.478*
	(1.602)	(0.488)	(0.889)	(0.263)
Disabled Female	1.517*	-2.708**	3.256***	-2.911**
	(0.895)	(1.318)	(0.386)	(1.390)
Urban Area	0.947	1.227	-0.2236**	-0.316
	(1.194)	(1.013)	(0.1104)	(0.389)
No. observations	33,242	33,242	33,242	33,242
Hansen's J test statistic	8.4789		14.139	
	[0.4245]		[0.2258]	
			Panel B: Sharing Rules for Wife	
	$\partial\varphi/\partial x$	$\partial\varphi/\partial x$	$\partial\varphi/\partial x$	$\partial\varphi/\partial x$
w_f	993.811*		1,197.58**	
	(583.74)		(496.03)	
w_m	480.599		458.394*	
	(591.82)		(243.113)	
Non-labour income	0.312*		0.364**	
	(0.165)		(0.162)	
Disability of Wives	-1,646.1*		-1,926.34**	
	(907.69)		(841.689)	
Collective rationality chi-square test	0.03		0.05	
	[0.8594]		[0.7971]	

Standard errors within brackets, p-values within square brackets, ***, ** and * denote significance at 1%, 5% and 10%.

Appendix A. Differentiation of the labour supply equations

$$h^f = h^f\left(w_f, \phi(w_f, w_m, y, s)\right) \tag{A1}$$

$$h^m = h^m\left(w_m, \Pi(w_f, w_m) + y - \phi(w_f, w_m, y, s)\right) \tag{A2}$$

Considering the labour supply function (A1)-(A2) we have:

$$\frac{\partial h^f}{\partial w_m} = \frac{\partial L^f}{\partial \phi}\frac{\partial \phi}{\partial w_m} \tag{A3}$$

$$\frac{\partial h^m}{\partial w_f} = \frac{\partial L^m}{\partial \phi_m}\left(\frac{\partial \Pi}{\partial w_f} - \frac{\partial \phi}{\partial w_f}\right) \tag{A4}$$

$$\frac{\partial h^f}{\partial w_f} = \frac{\partial L^f}{\partial w_f} + \frac{\partial L^f}{\partial \phi}\frac{\partial \phi}{\partial w_f} \tag{A5}$$

$$\frac{\partial h^m}{\partial w_m} = \frac{\partial L^m}{\partial w_m} + \frac{\partial L^m}{\partial \phi_m}\left(\frac{\partial \Pi}{\partial w_m} - \frac{\partial \phi}{\partial w_m}\right) \tag{A6}$$

$$\frac{\partial h^f}{\partial y} = \frac{\partial L^f}{\partial \phi}\frac{\partial \phi}{\partial y} \tag{A7}$$

$$\frac{\partial h^m}{\partial y} = \frac{\partial L^m}{\partial \phi_m}\left(1 - \frac{\partial \phi}{\partial y}\right) \tag{A8}$$

$$\frac{\partial h^f}{\partial s} = \frac{\partial L^f}{\partial \phi}\frac{\partial \phi}{\partial s} \tag{A9}$$

$$\frac{\partial h^m}{\partial s} = \frac{\partial L^m}{\partial \phi_m}\left(-\frac{\partial \phi}{\partial s}\right) \tag{A10}$$

Then we define the following using the parameters of the labour supply functions (11)-(12) in the text

$$A = \frac{h^f_{w_m}}{h^f_y} = \frac{a_2 + a_3 \ln w_f}{a_4 w_m} \tag{A11}$$

$$B = \frac{h^m_{w_m}}{h^m_y} = \frac{b_1 + b_3 \ln w_m}{b_4 w_f} \tag{A12}$$

$$C = \frac{h^f_s}{h^f_y} = \frac{a_5}{a_4} \tag{A13}$$

$$D = \frac{h_s^m}{h_y^m} = \frac{b_5}{b_4} \tag{A14}$$

In this study we assume one distribution factor-disability- and the partial derivatives with respect to non-labour income, distribution factor and wages will be:

$$\frac{\partial \phi}{\partial y} = \frac{D}{D-C} \tag{A15}$$

$$\frac{\partial \phi}{\partial s} = \frac{CD}{D-C} \tag{A16}$$

$$\frac{\partial \phi}{\partial w_m} = \frac{AD}{D-C} \tag{A17}$$

$$\frac{\partial \phi}{\partial w_f} = \frac{BC}{D-C} \tag{A18}$$

From the Hotelling's lemma we have:

$$\frac{\partial \Pi}{\partial w_f} = -t_f \tag{A19}$$

$$\frac{\partial \phi}{\partial w_f} = \frac{BC}{D-C} - t_f \tag{A20}$$

$$\frac{\partial \Pi}{\partial w_m} = -t_m \tag{A19}$$

$$\frac{\partial \phi}{\partial w_m} = \frac{AD}{D-C} - t_m \tag{A20}$$

$$\phi_y = \frac{D}{D-C} = \frac{a_4 b_5}{\Delta} \tag{A21}$$

$$\phi_s = \frac{CD}{D-C} = \frac{a_5 b_5}{\Delta} \tag{A22}$$

$$\phi_m = \frac{AD}{D-C} - t_m = \frac{b_5(a_2 + a_3 \ln w_f)}{\Delta w_m} - t_m \tag{A23}$$

$$\phi_f = \frac{BC}{D-C} - t_f = \frac{a_5(b_1 + b_3 \ln w_m)}{\Delta w_f} - t_f \tag{A24}$$

Appendix B.

Table B1. Target population and sample size of the estimates

Tables	Target population	Total Sample Size
Tables 1 & 3	Married two Earner Couples	948
Table 2 Panel A	Married Couples-Husband participates in the labour market, but wife no	35,824
Table 2 Panel B	Married Couples: Wife participates in the labour market, but husband no	632
Table 4	Married Couples: Husband always participates in the labour market, wife can either participate or not.	35,572
Table 4	Fraction of women participate in the labour market	948 (2.7 per cent)
Table 5	Married two Earner Couples	906
Table 6	Married Couples: Husband always participates in the labour market, wife can either participate or not.	33,242
Table 6	Fraction of women participate in the labour market	906 (2.8 per cent)

Note: The samples differ because of the estimating equations that differ in the samples in tables 2 and 4. Also in tables 1 and 3 the sample size is larger relative to table 5 because we consider the wage rates in levels and not logarithms. The estimations in table 5 drop the zero wage rates.