Allocation of resources within couples: some new evidence about the sharing rule*

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Abstract

This paper investigates the causes of "who gets what" within couples; that is, the determinants of the so-called sharing rule. Using a rich French time-use dataset, I construct a measure of the sharing of time and money between partners, taking into account personal expenditures and leisure time of both the man and the woman. This is the "empirical sharing rule", according to which women receive on average 45% of the household full income. First, I examine the influence of traditional economic variables on the allocation of resources. Then I analyse in what extent this empirical sharing rule and its determinants are close to predictions of the collective model, the most widespread representation of household decision-making. Finally, I test the relative influence of non-traditional variables on the empirical sharing rule, and particularly I investigate whether introducing them as distribution factors in the collective model brings better estimates closer to this empirical sharing rule. Results show that the collective model seems to overestimate the effect of variables on the share the woman receives. Introducing new distribution factors does not allow to improve the convergence between the empirical and the theoretical sharing rule, but factors related to biographic characteristics of both partners do matter in the decision-making of couples.

Keywords: Intra-household allocation, sharing rule, collective model, relative expenditure, time use.

JEL classification: D13, J21, J22

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1. Introduction

Decision making within couples has been widely studied by economists within the framework of the Collective Model (Chiappori, 1988, 1992, Apps and Rees, 1988). This theoretical representation allows for different preferences concerning the allocation of time and money within the family. The considerable advantage of the Collective model consists in minimalist assumptions: the decision-making process is only assumed to be Pareto-optimal, and the only observation of individual labour supplies (in the case of the Collective model of labour supply) allows estimation of individual shares of the household income, according to the so-called "sharing rule". Actually this notion in a sense captures the idea of respective decision powers of each partners. The sharing rule is a very usefull measure as it can be estimated through empirical data, so we are able to recover information about the economic well-being of household members. Implications are very informative, as for example, the sharing rule allows to study inequalities across individuals rather than across households (Lise and Seitz, 2011). This is particularly relevant for policy makers, especially in the introduction on targeting benefits or taxes to particular household members, as we have now tools to understand how reforms may increase the members negotiation weight and the impact on decisions.
However, this sharing rule is most of the time identified up to a constant, given that private expenditures of each partners are generally unknown. Indeed, consumption information contained in household surveys are generally collected only at the household level but not at the individual level, making impossible to assign expenditures to each partner. Thus most papers cannot retrieve the exact level of this sharing rule but rather its derivatives. Chiappori (1992) demonstrates that the unidentified constant is welfare irrelevant, in the sense that changing the constant affects neither the comparative statics nor the welfare analysis derived from the model. However, if the objective is to study the intrahousehold inequality, the Collective Model can identify the changes affecting intrahousehold inequality, but not its initial level, which can be usefull. Indeed, many of the uses of sharing rule estimates, such as calculation of poverty lines, indifference scales, and distributions of income and welfare, depend on the level of the sharing rule (Cherchye and al., 2012).

Very recently, four main household surveys have tried to go beyond this difficulty, by asking precisely the amount of personnal expenditure to each partner. The first three surveys are all based on the Danish population. The first was conducted by Browning and Bonke who have

added a supplement to the Danish Household Expenditure Survey (DHES) for 1995 to 2005. Then the Danish Time Use Survey (DTUS) of 2001 was mainly used by Browning and Gortz (2012). And Cherchye, De Rock and Vermeulen (2012) used the new LISS (Longitudinal Internet Studies for the Social sciences) Panel representative of Dutch population, in which they added a module on time use and consumption. Finally, the last survey is based on the French population: the new French Time Use Survey of 2010. Since expenditures are allocated in these data, a sharing rule can be constructed for each household. This allows for the identification of the location of the sharing rule as well as its dependence on distribution factors. Furthermore, consumption and time use information usually make the object of two different surveys. Collecting both types of information for the same household, which is the case in the French Time Use survey, the DTUS and the LISS, has the great advantage to modelise and estimate together the allocation of expenditures and time within couples, and investigate very precisely "who gets what" within couples.

In addition to assignable expenditures, a notable feature of the new French Time Use survey and the DHES is that they contain very precise and novative information on decision process for the surveyed households, providing a rich set of potential distribution factors. Consequently it is now possible to study the allocation of resources within couples using a large set of sociological and psychological determinants.

In this paper, I exploit the richness of the last french Time Use Survey conducted in 2009-2010 to analyze intra-household allocation of resources. This paper contains three main ideas.

The first idea is to describe the level of the sharing rule (allowed by the richness of our data), that I call the "empirical sharing rule", and that represents partners' shares of household full income. Each share is the sum of personal expenditures plus leisure time valued at the wage rate. I examine the distribution of the observed sharing of resources within households and its general economic determinants.

The exact level of the sharing rule has already been computed in some previous works, but only considering the sharing of expenses. The first paper was led by Browning and al. in 1994, using Canadian Family Expenditure Survey data on men and women's clothing. Then Bronwing and Bonke (2009) use a supplement to the Danish Household Expenditure Surveys for 1995 to 2005 in which respondents record for every expenditure in an expenditure diary for whom the item was bought. Browning, Chiappori and Lewbel (2009), Couprie (2007) and Lewbel & Pendakur (2008)

also estimate the location of the sharing rule, making the strong assumptions that the preferences of singles and married people are the same. Kalugina et al. (2009a, 2009b) also retrieve the sharing rule itself using subjective data on income satisfaction or life satisfaction in Russia, by assuming a correspondence between, first, the perception of income that household members report and their true income sharing, and, second, between their answer to a satisfaction question and their utility. Alessie, Crossley, & Hildebrand (2006), Bonke & Browning (2009) use answers to financial satisfation questions as direct measures of the utility derived from consumption to estimate parameters of the sharing rule.
The novelty of my approach here is to take into account, in a simple way, both the allocation of time and money, leading to a more complete and precise representation of decision-making within families.

The second general idea is to compare this "empirical sharing rule" observed in our data with the predictions of the Collective Model. Indeed, the computation of empirical shares does not refer to a particular model of decision-making within couples, as this sharing rule could be the result of a collective decision process, but also a non-cooperative process for example (Ulph, 1988, Carter et Katz, 1997, Konrad et Lommerud, 2000), or even an unitary process (Samuelson, 1956, Becker, 1974, 1981). Investigating how much the sharing rule revealed by the data and predictions of the Collective Model are close provides a quite direct and simple test of the Collective Model, at least according to French data. Such an analysis has not been carried out before.
Thus in a second section, I use a Collective Model to estimate derivatives of the sharing rule, as if I did not have information about private expenditures and I call it the "theoretical sharing rule". It allows me to compare directly this "theoretical sharing rule" with the "empirical sharing rule".

The last idea is to test the relevance of non-traditional economic variables compared to more classical variables usually used in household studies, to explain the sharing rule. This is now possible with the novative module of the French survey, entirely focused on decision-making inside couples, with questions about financial arrangements, negociation between partners, harmony between partners and biography elements (about parents, conjugal past, beginning of the partnership). Actually, this amounts to introduce more distribution factors, not necessarily related to the marriage market, as is usually done. I include variables similar to those used by Browning and Bonke in 1999 (if partners' mothers worked full time when they were 16 years

old and if they have child from past partnership), and some new distribution factors about the number of years since partners live together, the professional situation of partners when they met for the first time, the distribution of personal assets between partners, and the level of education of partners' mothers. I investigate the influence of these variables on the empirical sharing rule, and then I examine if adding them in a collective model as distribution factors allows to bring better estimates of sharing rule, in the sense that they are closer to what I observe in the survey.

Leading such a synthesis about the sharing rule appears really important since as explained by Browning, Chiappori and Weiss (2011), there is no coherent theory of the sharing rule. Indeed, potential distribution factors differ widely across different data sets and the excluded distribution factors could be correlated with the included ones. The new French Time use survey solves in a sense this difficulty, as the "Decision-Making Module" includes a really broad set of variables, among them most of distribution factors previously used in other studies and new one. Comparisons across countries and surveys become now possible, providing a quite good test of the validity of these new kind of distribution factors.
In addition, as said before, I compare in this paper predictions of the Collective Model with the empirical sharing rule, to test to what extent this theoretical representation is close to what I observe in the survey. But on the other hand, including some new distribution factors within the empirical sharing rule allows me to test their relevance by comparing results with predictions of the Collective Model which is the best well-established intra-household decision-making model. In all, I am able to test the global coherence of both approaches one over the other.

To carry out this study, I develop a Collective model of labour supply with household production. Most of Collective Models define the sharing rule on non-labour income, which means that they study how non-labour income is shared between partners. However, the empirical sharing rule I compute is based on shares of the full income minus the other expenditures that are not exclusive (the full income contains non-labour income plus the maximum amount of labour income that could be earned by partners). Thus in order to compare directly the theoretical and the empirical sharing rule, I need to develop a Collective Model which leads to a theoretical sharing rule defined on full income minus the other goods that are not exclusive. In this objective, I use a version of the Collective Model developed by Rapoport, Sofer and Solaz (2011), that I modify in that sense. I also use literature about Collective Models including public goods, as

Donni (2009) and Couprie (2007). I show that the theoretical sharing rule is also identified in this case.

Both in the empirical and theoretical analysis, I consider two different models, one defined in a framework without considering domestic production in the household, and the other taking into account this household production. The first version considers that domestic work time is actually pure leisure time, while in the second version, domestic work is added to labour market time, and not considered as leisure anymore. In fact, these two measures refer to two versions of the Collective Model of labour supply, without domestic production (Chiappori, 1992, 1998, Fortin and Lacroix, 1997, Chiappori and al., 2002) and with domestic production (Apps and Rees, 1997, Chiappori, 1997, Aronsson, Daunfeldt and Wickstrom, 1999, Bourguignon and Chiuri, 2005, Rapoport, Sofer and Solaz, 2011). Many papers show that results differ significantly considering domestic work as pure leisure or not, the first assumption leading to under-estimate inequalities within household. Moreover, collective model including domestic production have been shown to bring more precise estimates of the sharing rule.

This paper is organized as follows. The first part develops the version of the collective model on which I base my paper. In a second part, I examine the distribution of the empirical sharing rule and its classical economic determinants, as own's and partner's wage, household non labour income, sex ratio, age difference and ratio of diploma. Main results show that the level of this empirical sharing rule is in the range of previous estimated sharing rules since I find that the woman's share represents 45 % of the household full income, on average. Own wages and the presence of children remain the principal determinants of the sharing rule. Furthermore, knowing the exact amount of household sharing provides a quite direct test of the theoretical sharing rule implied by the collective model. So in a third part, I will compare the empirical sharing rule with derivatives of the sharing rule estimated in the framework of the collective model. In the last part, I test the relevance of non-traditional variables compared to more classical variables usually used in household studies. I investigate whether including such variables in the collective model brings better estimates of the theoretical sharing rule closer to what I observe in my data.

2. The Collective Model and characterization of the theoretical sharing rule

2.1. General considerations and specific assumptions

The main objective of this paper is to compare an empirical sharing rule directly observable from the data, with a theoretical one derived from the collective model. The empirical sharing rule is defined as the share received by each partner, which is equal to his/her personal expenditures plus his/her leisure time valued at his/her wage rate. Indeed, the opportunity cost of a person's time is determined by the person's wage. The objective of this first part of the paper is to develop a Collective Model of labour supply leading to a theoretical sharing rule directly comparable with this empirical one, at least in its derivatives.

Thus the theoretical sharing rule is based on the Collective Model framework (Chiappori, 1988, 1992, Apps and Rees, 1988), the most widespread representation of household decision-making. This model has the great advantage to avoid making strong *ad hoc* assumptions on the household decision process. The only assumption consists in assuming that decisions are Pareto efficient, which means that whatever the way couples make decisions (bargaining, formal rules or others), the resulting choices are Pareto efficient. Moreover, a very interesting result is that the decision process can be decentralised. Indeed, thanks to the Second Fundamental Theorem of Welfare Economics, any efficient outcome can be decentralized by a choice of prices and the (re)distribution of income. According to the decentralization procedure, each person is given a share of the total household income and allowed to spend it on their own private goods, using their own private sub-utility function. More precisely, when all commodities are privately consumed, the decision process can be decomposed into two phases: a sharing phase in which partners determine the sharing rule and a consumption phase, in which they allocate their share between the various commodities available. Thus only the second phase relates with efficiency: whatever the sharing rule, the resulting allocation will be efficient provided that agents maximize their utility during the consumption phase. The first stage relates with the collective part of the process (a review about Collective Models in found in Browning, Chiappori, Weiss, 2011).

As is usually done, I assume here that the household production function exhibits constant

returns to scale. Indeed, a standard problem in household economics is that the production function cannot be estimated independently of the utility function unless the home produced commodities are independently observable (Pollak and Wachter, 1975, Gronau, 2006). The output may be observable in agricultural production or children's health and education, but it is impossible for domestic tasks, as cleaning for instance. Nevertheless, when outputs are not observable, under the assumption of constant returns to scale and no joint production (in the sense that partners' domestic times do not appear directly in the utility function), we are able to recover information about the technology provided that the input supply (as a function of relative wages) are observed (Pollak and Wachter, 1975, Gronau, 2006).

In addition, as in Chiappori (1997), Chiappori and al. (2002), and Rapoport and al. (2011), I make the assumption that household production is marketable. This means that domestic goods have perfect market substitutes and that domestic production in any quantity can be bought and sold at market prices by all households. Thus the price of the domestic good is exogeneous for the household.

In the alternative situation, the non-marketable case, the price of the household commodity is endogenous to household decisions and has to be estimated (as a function of wages and incomes). Actually, a consequence of missing markets is that the separability property, which implies that the demand side is totally divorced from production, no longer holds. Estimation of nonseparable models is much more difficult. Particularly, Chiappori (1997) shows that in this case, if the household production exhibits constant returns to scale, the sharing rule can be recovered only up to an additive function of wages. Thus endogeneity of the domestic price has a cost in terms of identification.

Admittedly, the marketability assumption is quite strong, at least in developed market economies. Indeed, a majority of the population of a developing economy typically work in agriculture, often producing marketable commodities at the household level, but in other contexts, it appears quite unusual that people think of selling their domestic production, as cleaning services for instance. Nevertheless, almost all usual domestic goods produced within the household have nearly perfect market substitutes that are widely bought by households. But if domestic goods can only be purchased but not sold, some households may reach a corner solution, in which the market purchase of domestic goods is nil, and the normalized marginal productivity of a person's domestic work exceeds the person's wage. This is equivalent to the domestic good not being

marketable (Browning and al, 2011).

To conclude, from a theoretical point of view, not to make the assumption of marketable domestic production strongly complicates the analysis. With the objective to compare a theoretical sharing rule in a simple form, derived from the collective model, with the empirical one, as it is usual in the literature, I assume in the following that household production is marketable.

Finally, I assume that goods can be either public or private, and the last fundamental assumption consists in assuming a separability in the individual utilities between the public goods and the private sphere that involves consumption and leisure. The maximization of the utility on private goods conditionally to public goods is the same than the maximization of the non-conditional utility on private goods. This assumption allows me to not explicitely take into account the presence of public good that are produced and publicly consumed within the household, since my data do not contain information about partners' contribution to the public good. In addition, including public goods within the collective framework much more complicates the analysis. When a good is private, all agents face the same price and choose different quantities, while with public goods, they all consume the same quantity but would be willing to pay different marginal prices for it. In this paper, I will assume that the domestic goods are publicly consumed within the family.

2.2. The definition of the theoretical sharing rule

The estimation of the theoretical sharing rule is based on the version of the Collective Model developed in Rapoport, Sofer, Solaz (2011). This is a Collective Model of labour supply, including household production. I also use some of the literature on collective models including public goods (Donni, 2009, Couprie, 2007).

However, in Rapoport, Sofer, Solaz (2011), but also in most of empirical applications of the Collective Model, the sharing rule is defined on the "non-labour income", which means that in the first stage of the decision process, the couple agree on the sharing of the non-labour income between them. Assuming ψ_f the share of the woman, and ψ_m the share of the man, ψ_f [ψ_m] can be considered as the extra income allocated to the wife [husband] from the sharing of "non labour-market income". This definition of the theoretical sharing rule does not allow me to make direct comparison with the empirical one. Thus rather than considering the allocation of the non-labour income, I will consider here the allocation of the full income, in order to have a theoretical sharing

rule consistent with the data. The full income is defined as the sum of non-labour income plus the maximum amount of labour income that could be earned if spouses would spend all time working on the labour market. In the case of the collective model with household production, the profit from this production is included to full income.

Considering that the household consists of two indiviudals i, male ($i = m$) and female ($i = f$), total time available is denoted by T, w_f and w_m are the wage rates of f and m, respectively. y is the non-labour income, and Π the profit from household production.
Thus the full household income $\sum_{i=f,m} Tw_i + y + \Pi$ is divided between partners, and each partner's share is used for his/her personal consumptions C_i^m (the Hicksian composite good bought on the market, whose price is assumed to be equal to 1) and C^d (consumption of the good produced at home, whose price p is the same for all households as domestic production is assumed to be marketable) and leisure l_i whose price is the individual wage rate, such that:

$$\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i + pC^d = \sum_{i=f,m} Tw_i + y + \Pi$$

Note that the full income includes the profit from household production, although largely unobserved. But let's remember that the household production function is assumed to exhibit constant returns to scale, which implies that the profit is zero, and removes the problem.

Moreover, a more complete definition of full income would include public goods C^P, and other kinds of expenditures:

$$\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i + pC^d + PC^P + rC^C + S = \sum_{i=f,m} Tw_i + y + \Pi$$

Indeed, the household also makes expenditures for market public goods C^P (such as housing, insurance payments, heating, etc.), expenditures for the community C^C, which will be privately consumed (food is the typical example), and savings S. The exogeneous price for market public goods is P, and r for common goods. However, the French time use survey does not provide information about these three kinds of expenses. Note also that the consumption of the domestic good C^d is not observable. Thus the sum of the two empirical shares $\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i$ is not strictly equal to the full income $\sum_{i=f,m} Tw_i + y + \Pi$. However, in addition to the assumption that the public good is separable from the other goods, I will also assume that the sum of the

"other" goods (including market public goods, expenditures for the family, savings, and the good produced at home) is separable from exclusive (or assignable) goods (Donni, 2009). Thus derivatives of the sharing rule based on the full income and derivatives of the sharing rule based on the remaining income (the full income minus the other expenses) are the same.

2.3. Development of the Collective Model

Formally, the household consists of two individuals i, male ($i = m$) and female ($i = f$). Their own utility function $U_i(l_i, C_i^m, C^P, C^C, C^d)$ is defined on observed own leisure, l_i, consumption of a Hicksian composite good bought on the market, C_i^m, usually unobserved in most surveys, market public goods C^P, the common good C^C, and the domestic good produced at home and publicly consumed C^d. The price of C_i^m is assumed to be equal to 1.

A major assumption is to assume a separability in individual utilities between the private sphere (consumption and leisure) and the "other" goods (public goods, common goods, domestic good produced at home). The marginal rate of substitution between personal consumption and leisure is not affected by the level of "other" consumptions. Separability imposes:

$$U_i(l_i, C_i^m, C^p, C^c, C^d) = W_i[u_i(l_i, C_i^m), C^p, C^c, C^d]$$

where u is the individual's sub-utility from exclusive goods consumption.

The quantity of home-produced goods is denoted by Q and produced by time inputs of household members, t_i, according to the production function $F(t_f, t_m)$. As discussed before, I assume that this household production function exhibits constant returns to scale.

Profit, Π, or net value of domestic production, is given by:

$$\Pi = Q - w_f t_f - w_m t_m$$

where w_f and w_m are the wage rates of f and m, respectively.

Total time available is denoted by T, market labour supply by L_i and total working time (domestic labour + market labour supply) by H_i. Thus we obtain the time constraint $H_i + l_i = T$, where $H_i = t_i + L_i$.

Conditional on public expenditures, the allocation of exclusive expenditures is Pareto-optimal.

The household maximizes a generalised weighted utilitarian household welfare function:

$$(P0) \quad \max_{l_i, C_i^m} \mu(.)\, u_f(l_f, C_f^m) + (1 - \mu(.))\, u_m(l_m, C_m^m)$$

subject to the constraint

$$\begin{aligned} &\sum_{i=f,m} C_i^m + C_i^d + C^P + C^C = \sum_{i=f,m} L_i w_i + y + F(t_f, t_m) \\ \Leftrightarrow &\sum_{i=f,m} C_i^m + A = \sum_{i=f,m} L_i w_i + y + F(t_f, t_m), \\ &with\ A = C_i^d + C^P + C^C \end{aligned}$$

where A represents the sum of the other expenditures. $\mu = \mu(w_f, w_m, y, s_1, ..., s_r, ..., s_R)$ is a continuously differentiable weighting factor contained in [0,1]. $\mathbf{s}$ is a R-vector of distribution factors. By definiton, the vector $\mathbf{s}$ only appears in $\mu(.)$. As such, changes in the $\mathbf{s}$ variables do not affect the Pareto frontier but only the equilibrium location on it, through the resulting changes in shares of full income.

The above constraint can be rewritten as:

$$\begin{aligned} &\sum_{i=f,m} C_i^m + A = \sum_{i=f,m} H_i w_i + y + \Pi \\ \Leftrightarrow &\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i = \sum_{i=f,m} T w_i + y + \Pi - A \\ \Leftrightarrow &\sum_{i=f,m} C_i^m + \sum_{i=f,m} l_i w_i = Y - A \end{aligned}$$

Contrary to Chiappori and al. (2002) and Sofer and al. (2011), I consider that the theoretical sharing rule applies to $Y - A$, the household full income net of savings[1], minus the "other" expenditures. I assume a separability between personal goods C_i^m and l_i on the one hand, and the other goods A, on the other hand.

Let us describe formally each step of the decision process. Assuming that good C^d is marketable, efficiency and further separability between consumption and production have an immedi-

[1]I do not modelize intertemporel behavior in this paper. Contributions extending the collective model to an intertemporal setting are mainly due to Mazzocco (2004, 2007)

ate implication, namely profit maximization. Specifically, t_f and t_m must solve

$$(P1) \quad \max_{t_f, t_m} \Pi = Q - w_f t_f - w_m t_m$$

which gives solutions:

$$t_f = t_f(w_m, w_f)$$
$$t_f = t_f(w_m, w_f)$$
$$\Pi^* = \Pi(w_m, w_f)$$

According to Donni (2009) and Couprie (2007), in a decentralized fashion, we obtain that each individual maximises his/her individual sub-utility, given the conditional sharing rule ρ_i:

$$\max_{l_i, C_i^m} u_i(l_i, C_i^m)$$

under the member-specific budget constaint:

$$w_i l_i + C_i^m = \rho_i$$

where ρ_i is the sharing rule, i.e. the proportion of exclusive expenditures (total full income minus "other" expenditures) going to individual i within the family, such that $\rho_f + \rho_m = Y - A$.
The separability principle implies that the demand side is totally separated from production and "other" goods consumption decision. All occurs *as if* the household maximizes the profit from household production on one hand, makes decisions about the "other" expenditures A on the other hand, and then each partner separately chooses his/her consumption of exclusive good and leisure time.

Thus there exists two functions $\rho_f(w_f, w_m, y, \mathbf{s})$ and $\rho_m(w_f, w_m, y, \mathbf{s})$, and in the following, I set $\rho = \rho_f$. ρ is the share of the full income minus other expenditures allocated to the wife. Thus the shares are a function of wages, non-labour income, and distribution factors.

The identification results are developped below. Total labour supplies have the form:

$$H^f = L^f(w_f, \rho(w_f, w_m, y, \mathbf{s})) \tag{1}$$

$$H^m = L^m(w_m, \Pi(w_f, w_m) + y + (w_f + w_m)T - \rho(w_f, w_m, y, \mathbf{s}) - A) \tag{2}$$

I now show that derivatives of the sharing rule are identified up to a constant, which means that we can compute its derivatives[2].

I define:

$$A = \frac{\partial H^f/\partial w_m}{\partial H^f/\partial y}$$
$$B = \frac{\partial H^m/\partial w_f}{\partial H^m/\partial y}$$
$$C = \frac{\partial H^f/\partial s_r}{\partial H^f/\partial y}$$
$$D = \frac{\partial H^m/\partial s_r}{\partial H^m/\partial y}$$

whenever $\partial H^f/\partial y \neq 0$ and $\partial H^f/\partial y \neq 0$ for $r = 1, ..., R$. Note that all these variables are observable and can thus be estimated.

Assuming that $C \neq D$, we find derivatives of the sharing rule (where the subscript $r = 1$ has been removed for notational covenience):

$$\frac{\partial \rho}{\partial y} = \frac{D}{D - C} \tag{3}$$

$$\frac{\partial \rho}{\partial s} = \frac{CD}{D - C} \tag{4}$$

$$\frac{\partial \rho}{\partial w_m} = \frac{AD}{D - C} \tag{5}$$

$$\frac{\partial \rho}{\partial w_f} = \frac{BC}{D - C} - t_f + T \tag{6}$$

Details about calculations are in Appendix 1. Thus only one distribution factor is sufficient to identify the sharing rule up to an additive function.

[2]The sharing rule being conditional to the level of the "other" expenditures, A is a constant and is removed in the derivatives of labour supplies.

Note that, with reference to derivatives of the sharing rule found in Rapoport, Sofer, Solaz (2011) (in which the sharing rule is based on the non-labour income), only the derivative with respect to w_f changes. The fact that derivatives with respect to y and s are not impacted is not surprising. Indeed, an increase in y leads to an increase in the full income (minus "other" expenditures) and in the non-labour income exactly in the same level, and a variation in s has no impact on the level of household full income. The derivative with respect to w_f changes, in the sense that the term T is added. Indeed, an increasing in w_f leads to an increasing in household full income, which modifies the effect of the wife's wage on the sharing rule defined on full income compared to non-labour income. What's more surprising is that the derivative with respect to w_m does not change, while the full income becomes higher following w_m increase. But actually, what's happen is that this increase in wage's partner has an impact on negociation powers of both partners, but this impact appears in the full income as in non-labour income exactly in the same way.
Finally, the sharing rule is also identified up to a constant when it is defined on full income minus "other" expenditures rather than non-labour income, and only the derivative with respect to w_f is changed.

With no domestic production, $\Pi = 0$, and $\frac{\partial \Pi}{\partial w_f} = 0$, and thus Y is now non-labour income plus maximum of labour market income. In this case, $\frac{\partial \rho}{\partial w_f}$ reduces to:

$$\frac{\partial \rho}{\partial w_f} = \frac{BC}{D - C} + T$$

Finally, the theoretical sharing rule defined in this part corresponds exactly to the empirical sharing rule, in level, and in its derivatives.
The next part focuses on how I measure this empirical sharing rule from the French time use survey.

3. Distribution of the empirical sharing rule and its economic determinants

3.1. Data: the French Time Use Survey

Time Use surveys are now generalised in more and more countries, and european countries have led a harmonization work to make cross-country comparison more relevant. These surveys consist in collecting very precise information about daily activities. Interviewed household members write down their activities in a booklet, indicating the time spent on each activity, according to a certain time periods (10-minutes in France for example). In France, time use surveys are implemented almost every each ten years. The last survey (on which this paper is based) is very recent and has been developed in 2009-2010. This new french Time Use Survey contains a traditional section common to each existing time use survey, plus a very innovative section called "Couple Decision-Making Module" (*Module Décision dans les Couples*).

The classical part of the survey is composed of a "household" questionnaire and one "individual" questionnaire for each member of the couple, with many information about family, place of residence and its caracteristics, professional situation of family members, wages, total income of the family etc. This classical part of the survey contains 12069 households and 18521 individuals.

Respondants filled two daily time-use booklets, one on a week day, the other on a week-end day. But if the household agrees to answer the "Decision-Making Module", they only fill one time-use booklet, during a day of the week or the week-end. On the day(s) of the survey, respondants wrote down their activities, indicating the time spent on each activity, according to 10-minutes time periods. 27 903 booklets have been completed. A subsample of time use booklets has been enriched with the evaluation by individuals about the pleasant or unpleasant nature of the moment, but I do not use this information here.

As for the "Couple Decision-Making Module", it deals with financial arrangements, daily family management, sharing of responsibilities and decisions, and biography elements. Only a subsample of couples replied to this module: those having accepted to answer it, and on this basis, three conditions had to be satisfied: both partners live in the same housing since at least one

year; neither of the two is a student; and at most one of them is retired. Thus 2349 households and 4371 individuals answered the "Couple Decision-Making Module", which contains four parts. A "household level" questionaire includes information about couple formation and financial arrangement between spouses. An "individual level" questionaire, separately asked to each spouse, collects biography items, personal activities and social relations information, relations with partner, decision-making on several areas, independance in money use. Last but not least, a self-administered questionnaire (a couple part and an individual part) gathers information about individual and common property, and bank organisation of the couple. Our key variable is included in the individual self-administered questionnaire and asks to each partner: "Last month, how do you have spent for personal purchases ?". In a second variable, the respondant tells if this is representative of monthly usual expenditures, more, or less.

In this paper, I use the sample of individuals who answered the "Couple Decision-Making Module". I select people living in a couple, with or without children, reporting a professional activity, that is 1163 households, so 2326 spouses. I drop 77 couples in which at least one of the spouses did not report monthly wage or hours of work per week, making it impossible to compute an hourly wage for them. In addition, in 124 couples, at least one of the members did not report the amount of monthly personal purchases, so that I drop these households. I also drop 22 couples for which personal expenditures were excessively high. In all, my final sample contains 940 couples, so 1880 individuals.

3.2. Personal expenditures

In the French Time Use survey, respondents to the "Decision Making Module" recorded the amount of personal expenditures during the last month. This question was adressed in the self-administered part of the module. Instruction was given to couples to fill in the questionnaire separately, and each partner had his own envelope to insert the document.
The question was the following: "Last month, how much did you spend on your personal purchases?". Another question asked whether this amount is representative of his/her usual monthly expenditures, and possible answers was: Yes / More than usual / Less than usual. No particular instruction was given to respondents to record their purchases, meaning that they take into account all items bought for themeselves, more precisely all items they feel they bought for

themselves, without any restriction. In order to estimate a sharing rule, we need expenditures that are *assignable* to husband and wife. As in Browning and Bonke (2009), I define as *assignable* any expenditure that respondents say was bought for himself or herself. This excludes all items bought for the household, even if they are privately consumed. The general formulation of the question in the survey is very convenient for me, because it avoids the problem of the classification of some goods in a precise category, as assignable or not: respondents make that imputation themselves in the survey. For example, food is likely to be bought for the household, even if it is strictly a private good in the sense that there is rival consumption, so food should be considered as a non assignable good. However, it does not exclude that sometimes in a couple, food is bought for oneself (at home or in a restaurant), and that the respondent considers this purchase as a personal expenditure. Thus private goods that are bought exclusively for one person or another are defined to be assignable goods, whereas private goods that are bought for the household are defined to be non-assignable (Browning and Bonke, 2009). For all these reasons, I believe that the expenditure variable of the french time use survey represents quite well the sharing of assignable expenditures between partners.

The Danish surveys including assignable expenditures use different methods to collect this information. The Danish Household Expenditure Survey (DHES), mainly used by Browning and Bonke (2009), takes the form of respondents recording for every expenditure in a conventional expenditure diary for whom the item was bought: mainly for the household, for the husband, for the wife, for the children and outside the household. In the Danish Time Use Survey of 2001 (DTUS), mainly used by Browning and Gortz (2011), the following questions were asked to the respondent: "When you think of your own personal expenditures, how much do you estimate it is normally on the following items during one month: clothing and shoes; leisure activities, hobbies, etc. (e.g., sports, sports equipment and club membership); other personal consumption (e.g., cigarettes, perfumes, games, magazines, sweets, bars, and cinema)". The respondent was then asked the same questions for their spouse/cohabitant. One advantage of the French survey consists in each spouse reporting his own expenditures, very likely reducing measurement errors. In addition, the amount of assignable expenditures is not delimited by particular categories. On one hand, reporting expenses in a broad category appears quite difficult as it requires to remember all expenses during the last month, and breaking down in several items eases the task, but on the other hand, answers of respondents are not constrained by specific categories.

Table 1: Monthly Personal Expenditures (in Euros)

	French survey 2009-10 *940 couples*		**DHES 1995-05** *1537 couples*		**DTUS 2001** *615 couples*	
	Men	Women	Men	Women	Men	Women
Mean	190.1	197.6	183.3	192	163,5	161,2
(Std Err)	(202.0)	(201.0)				
Median	120	150				

Table 1 shows that on average, the amount of assignable expenditures reported in the French Time Use Survey is very closed to amounts recorded in the two Danish surveys, particularly in the DHES. In the three surveys, women and men expenditures are very close on average. In the french survey and in the DHES, women's expenditures are a little higher than men's (7,5 additional euros for women in France, 8.6 additional euros in the DHES), but this is very close. These figures are obviously not comparable as they are collected in different time periods and different countries, thus the share of personal expenses in the total household budget is more informative. We observe that in french data, total assignable expenditures of men and women represent 10,5 % of the total household income (non-labour income + both monthly wages). Assignable goods accounts for 11 % of disposal income according to the DHES. In all, our personal expenditures seem to be in the range of earlier Danish studies.
Another way to check the validity of expenditure responses would be to compare them to the french Family Budget Survey ("Budget des familles", 2011). [*Forthcoming*]

As for french data, table 1 shows that women and men expenditures are very closed in mean, with female expenditures a little higher than male expenditures, and the median is 30 euros higher for women. However, this hides a very large dispersion for both groups. Note that the distribution of expenditures for men and women is very similar (Kernel density, graph 1 at the top left).

Let's investigate more precisely the intrahousehold share of expenditures between partners. Within couples, it seems that the more one partner spends, the more the other spends, with a correlation of 0.49 and a t-value of 17.03. However, the graph at the top right shows that the allocaton of expenditures within households is very dispersed. Note that 87 men and 38 women report a monthly personal expenditure equal to 0. In 22 couples, both members report a nul personal expenditure. In order to compute relative expenditures of couples (expenditure of the wife / expenditure of the husband), I set a purchase of 1 euro for these individuals reporting no

purchase. Note also that for 177 couples, the man and the woman report the same amount of personal expenditure, that is 18.8 % of the sample.

Figure 1: Monthly Personal Expenditures (in Euros)

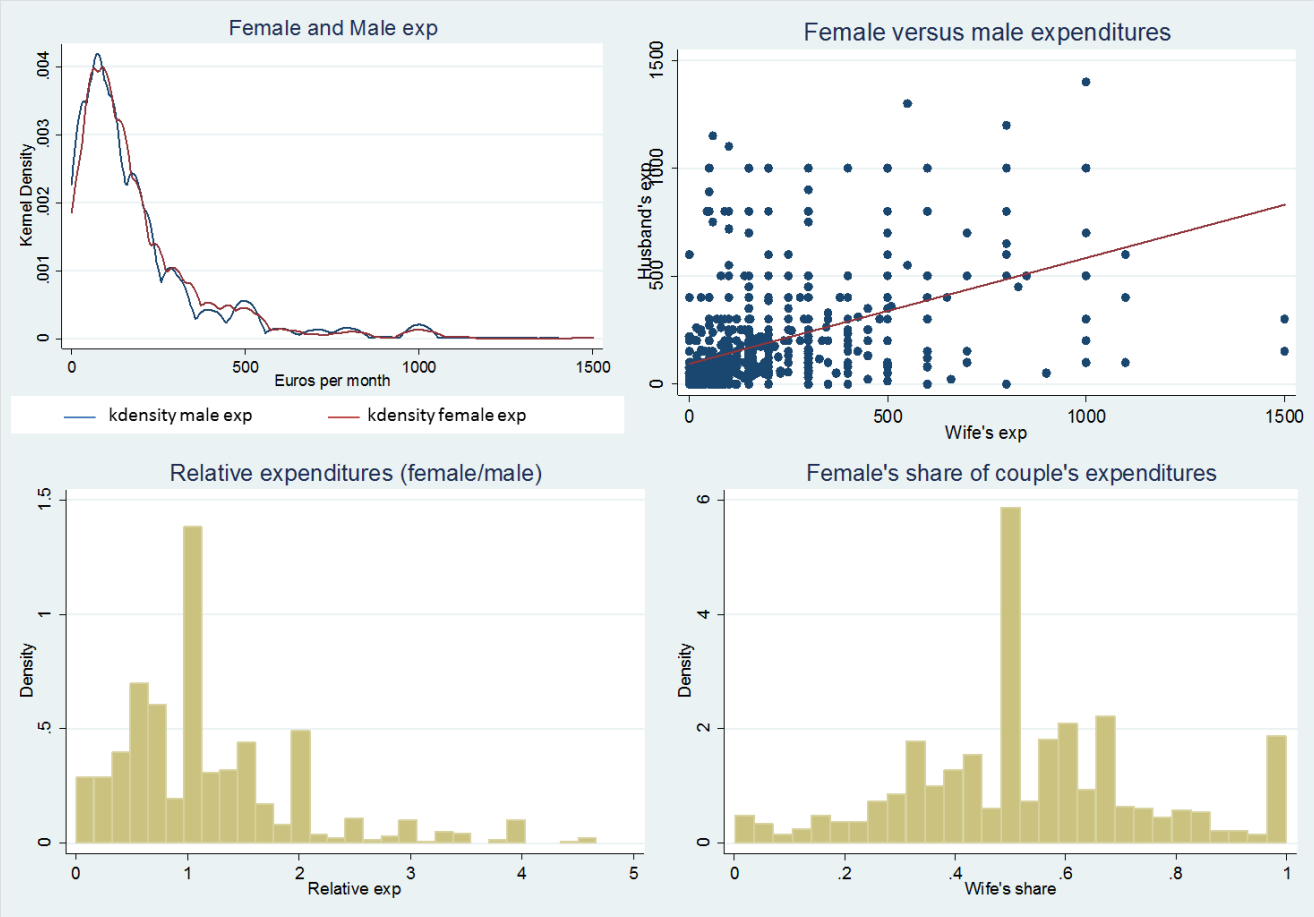


Table 2: Allocation of personal expenditures within couples

Percentile	**Wife's share**	**Relative exp (f/m)**
1 %	1.0 %	0.01
5 %	17.6 %	0.2
10 %	28.6 %	0.4
25 %	40.0 %	0.6
50 %	50.0 %	1
75 %	66.7 %	2
90 %	83.3 %	5
95 %	98.0 %	50
99 %	99.3 %	150

Number of couples: 940

The distribution of the wife's share in the total amount of personal expenditures of the couple (in %), with $Woman's\ share = \frac{expenditure_f}{expenditure_f + expenditure_m} \times 100$ (f for women, m for men), and

relative expenditures, with $rel\ expenditure = \frac{expenditure_f}{expenditure_m}$, are shown in Table 2 and figure 1. Two highlights appears. First, the mode is unity for relative expenditures, reflecting the high proportion of households reporting the same value of expenditures. Does it mean that expenditures are really shared in an equality way in these couples ? This variable comes from the self-administered questionnaire. As said before, separate questionnaires were adressed to the man and the woman in the couple and they had to fill in it separately. Actually we have no information about whether or not they respected instructions. Perhaps some couples answered together to this part of the survey, and there is a bias towards equality. But we could think that reporting the same expenditures could reflect a global equal sharing within the couple, or at least a feeling of equality between partners. However, at the same time, table 2 and graph 1 show a large dispersion of expenditure shares and a wide variety of situations among couples. Indeed, 25 percent of households have a relative expenditure above 2 (the wife's share is above 67%), and 25 percent have a value below 0.6 (the wife's share is below 40%), so that close to half of households have one partner receiving twice as much as the other.

3.3. Relative leisures

I consider two measures of leisure, which refer to Model 1 and Model 2 all along the paper. Model 1 implicitly assumes that non-market time is leisure, and therefore leisure includes domestic work and childcare, whereas Model 2 excludes them from leisure. This refers to the definition of the collective model without domestic production (Model 1), and the collective model including domestic production (Model 2). Physiological activities (sleeping, personal and medical care) are not included in leisure time in both models.

According to Table 3, as expected, we observe really different patterns considering domestic work as leisure time or not. Considering only "pure" leisure (Model 2), leisure time is shared in a more inequality way than personal expenditures, in favour of the man. However, including household work time in leisure time leads to the opposite: the wife spends more time making "leisure" activities than men, because she devotes more time making domestic tasks. The difference of means in absolute value is higher in Model 1 (65 min) than in Model 2 (37.8 min). Leisure time of the man is very correlated with leisure time of his wife, in both specifications, but in larger extent in Model 2 (the ordinary least-squares (OLS) value is 0.62 and the t-value of 20.89 for Model 2, and OLS value of 0.43 and t=13.78 with Model 1). This could be the result of

Table 3: Daily leisure time

Model:	**1. without domestic prod**		**2. with domestic prod**	
Leisure time (in minutes/day)				
	Men	**Women**	**Men**	**Women**
Mean	564.3	629.4	427.9	390.1
(Std Err)	(230.6)	(218.5)	(185.3)	(167.0)
Median	490	650	390	360
Relative leisure (f/m)				
Mean	1.290		1.006	
(Std Err)	0.791		(0.503)	
Median	1.050		0.934	
Wife's share of leisure				
Mean	53%		47%	
(Std Err)	(11%)		(10%)	
Median	51%		48%	

Number of couples: 940

Figure 2: Male and female leisure time

assortative mating on wages (so that two partners with high wages will both take more or less leisure), or assortative mating on preferences for leisure or complementarities in leisure (Browning and Gortz, 2012).

3.4. The empirical sharing rule

The empirical sharing rule I consider in this paper takes into account both the sharing of time and money between partners, leading to a quite complete representation of the allocation of resources within couples. This approach is quite new in the literature, as previous estimations of the location of the sharing rule were only about the sharing of money (Browning and Bonke, 2009, Browning, Chiappori and Lewbel, 2013).

I compute the empirical household resources share of each partner (according to a sharing rule) as the sum of his/her personal expenditures plus his/her leisure time valued at his/her wage rate. Thus the empirical sharing rule includes both measures of personal expenditures and leisure time described in the last two sections. I measure two different shares according to the definition of leisure (Model 1 or 2).

Table 4: The sharing rule

Model:	**1. without domestic prod**		**2. with dom production**	
The sharing rule, in Euros per month				
	Men	Women	Men	Women
Mean	3889.2	3892.0	2999.0	2506.8
(Std Err)	(3717.2)	(5083.9)	(3061.8)	(3166.9)
Median	3005.4	3009.3	2285.0	1917.7
Woman's share				
Mean	49.4 %		45.1 %	
(Std Err)	(15.4)		(15.2)	
Median	50 %		44.7 %	
Hourly wage				
	Men		Women	
Mean	12.80		11.21	
(Std Err)	(10.28)		(12.09)	

Number of couples: 940

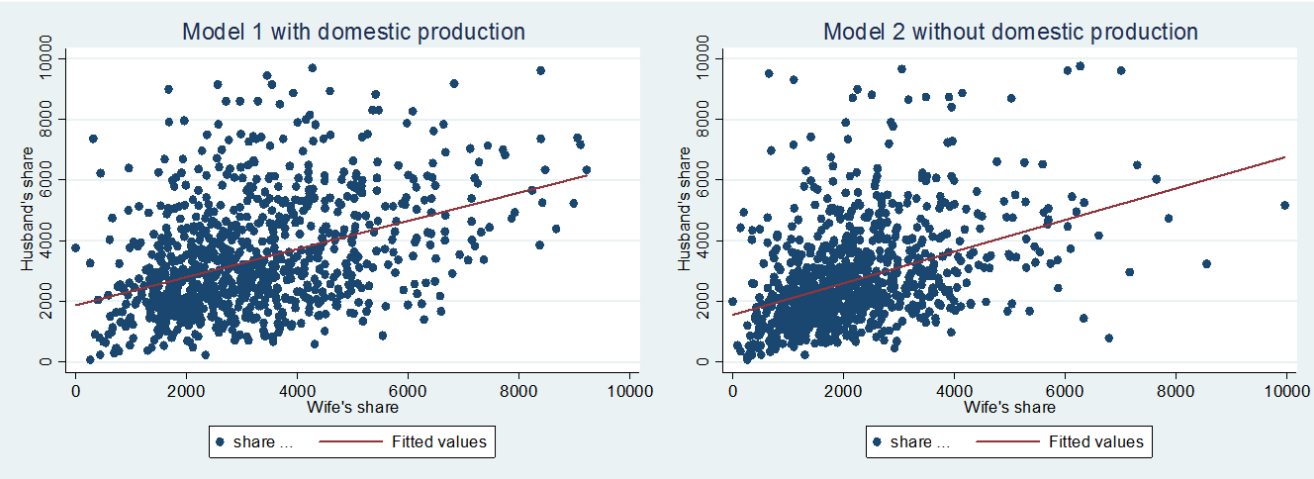
Table 5: The sharing rule

Model:	**1. without domestic prod**		**2. with domestic prod**	
Percentile	Wife's share	Relative shares (f/m)	Wife's share	Relative shares (f/m)
1 %	10 %	0.11	10 %	0.12
5 %	24 %	0.32	19 %	0.24
10 %	30 %	0.43	26 %	0.36
25 %	39 %	0.65	35 %	0.54
50 %	50 %	1.00	44 %	0.80
75 %	58 %	1.42	55 %	1.24
90 %	68 %	2.18	64 %	1.79
95 %	76 %	3.27	70 %	2.36
99 %	87 %	7.28	84 %	5.54

Number of couples: 940

Table 4 displays some general statistics about the shares. The man receives a higher share than his wife in the second model, with a difference of 492.2 euros, while they receive very similar shares in the first model. According to model 1, the wife receives 49.4% of the household full income, on average, and 45.1% according to model 2. Table 5 shows that Model 1 over-estimates the share of the wife compared to the second model, in each percentile of the distribution. Particularly, according to the second model, we observe that in half of households, the woman receives less

Figure 3: Female versus male share (Absolute shares, in Euros per month



than 44% of resources. In addition, model 2 shows that in 25% of households, she receives more than 55%, and in 25% of households, she reveives less than 35%, depicting a somewhat unequal intra-household repartition of income. Graph 3 shows that the amplitude of partners' shares are positively correlated within household, in a higher extent in Model 2 (OLS value of 0.14 and t=4.6 in Model 1 against OLS value of 0.09 in Model 1 with t=4.04). Couple allocations are more dispersed with Model 1 than Model 2.

3.5. Traditional determinants of the empirical sharing rule

Let's now investigate if traditional variables usually founded to exert an influence on the theoretical sharing rule have a direct impact on the level of the empirical sharing rule. Main variables are the following:

- Wife's hourly wage and husband's hourly wage (plus an interaction term of wife and husband wages).
- The household non labour income. Note that total household income is collected only at the household level. I compute monthly non-labor income as the difference between this total income minus monthly spouses' earnings on the labor market. If the difference was found to be negative, I set the non-labour income equal to 0 (this is the case for 101 households, that is 10,5% of the sample).
- The sex ratio, computed at the "departemental" level from the French National Statistics in 2009. Considering X_m, the number of men in the department of the same age as the

husband in a couple, and X_f, the number of women of the same age as his wife, the sex ratio is computed as $\frac{X_m}{X_m+X_f}$. Data about age are given in 5-years intervals. The sex ratio is of very high theoretical importance: it is most of the time used in the collective model literature as a distribution factor, which influences decision process, so negociation powers of each partner (Pareto weights), but without affecting neither preferences nor budget constraints (Browning and al, 1994, Chiappori, Fortin, Lacroix, 2002). Such a variable has great properties, and facilitate the identification of the sharing rule. Until now, most of distribution factors used to estimate the Collective Model refer to the marriage market. Indeed, according to Becker (1991), marriage market is an important determinant of intra-household decision process, in the sense that negociation powers are linked to the situation outside the couple. If the situation in case of divorce is more favorable for one partner than the other, this confers to the first partner a higher negociation power, as his/her divorce threat becomes more credible. That's why the sex ratio has been largely used in the literature as it summarizes the state of the mariage market for a man and a woman, with the advantage to be exogeneous and easily available. If for instance, the number of women is lower than the number of men in the society, then women are "scarce" and it will be more difficult for a man to find a partner, but easier for a woman to get married. Then divorce threat for women is stronger, as women can threat their partners to leave and easily find another man in case of strong disagreement.[3] Thus the sex ratio has good qualities to be considered as distribution factors since it influcences decision process without influencing the budget constraint nor preferences.

- Age difference between partners: $age_f - age_m$.
- The ratio of years of education: $\frac{Educ_f}{Educ_m}$.

I also add controls about the number of children below 3 and the number of children between 3 and 18 years old, a dummy variable if the couple lives in a rural area and another if the couple lives in Paris, a dummy if the couple is homeowner, a control about the day partners fill in the diary (weekday or week-end day). Descriptive statistics about our variables are shown in Table 6.

I estimate male share and female share equations simultaneously, using the generalised method of moments (GMM). This method allows to take into account the possibly correlation between

[3]Legislation governing divorce has been also used as a distribution factor (Chiappori, Fortin, Lacroix, 2002) to represent the situation of partners outside the couple.

Table 6: General Descriptive statistics

	Men	**Women**
Individual level		
Hourly wage	12.80	11.21
	(10.28)	(12.09)
Monthly wage	2138.3	1526.9
	(1304.7)	(804.3)
Age	41.9	40.0
	(9.48)	(9.56)
DIPLOMA, *expressed in years of educ*		
Without diploma	9.93 %	9.19 %
Brevet	3.87 %	5.79 %
CAP/BEP (Before Bac)	41.49 %	28.95 %
Bac (general & technical)	10.47 %	14.77 %
Bac + 2	16.39 %	19.53 %
Bac + 3	6.76 %	11.99 %
Master and PhD	11.10 %	9.78 %
Working time (min/day)	349.0	255.2
	(259.2)	(242.8)
Domestic time (min/day)	136.3	239.3
	(137.4)	(160.8)
Total work (labor market+domestic)	485.4	494.6
	(211.1)	(191.7)
Leisure time (min/day)	427.9	390.0
	(185.3)	(167.0)
Household level		
Non-labour income	259.0	
(in euros per month)	(480.3)	
Sex ratio $\frac{X_m}{X_m+X_f}$	0.495	
	(0.020)	
Age diff $age_f - age_m$	-1.857	
	(4.196)	
Ratio diplom $\frac{Diplom_f}{Diplom_m}$	1.058	
	(0.302)	
Rural	27.43 %	
Paris	10.18 %	
Owner	70.26 %	
Nb of children<3	0	85.58 %
	1	14.22 %
	2	0.19 %
Nb of children 3-18	0	46.40 %
	1	25.60 %
	2	22.10 %
	>3	5.90 %

Number of couples: 940. Values in (.) are standard errors.

the error terms of the two equations. Another important advantage is that GMM computes efficient estimators even when errors are heteroskedastic of an unknow form (which is not the case for 3SLS or simulated maximum likelihood).

I instrument wages and non-labour income, as unobserved individual characteristics explaining shares may also be correlated with these variables. In addition, as the individual wage is the price of leisure, the wage rate is included in the dependent variable, that is the share received by each partner. Consequently, the wage rate (as an explanatory variable) is correlated with the error term of the equation, and the wage rate has to be instrumented by some variables explaining the wage but not the share of the income received by each partner, which is a difficult task as the wage enters the share. Nevertheless, wages are endogeneous by construction, and I will still use some instruments for wages and non-labour income usually used in labour supply equations, and specific instruments for the non-labour income.

I include as instruments variables about employment sector (public sector, private sector or self-employed). I also include variables about geographical area: region dummies and a dummy for living in a small town, as opposed to living in a big town (in which wages are higher on average) and the countryside, and dummies indicating whether or not the workers are foreign-born (to capture some possible discrimination on the labour market). I use a more flexible functional form of age and education in specifying the equations for wages and non-labour income than for the shares (a fourth-order polynomial of age and a second-order polynomial of education).

Of course these instruments have their limitations[4]. Nevertheless, I will show estimations using exogeneous wages and non-labour income to make the comparison, even if wages are correlated with the error term of the equation by definition.

I include new specific instruments for household non-labour income. The first instrument is related to the assets of the household, which are correlated with higher non-labour income. The new french Time Use Survey includes unique information about the amount of household common assets, and the amount of personal assets of each partner. These three variables include real properties (except main housing), savings account, equity savings plan, life assurance, investment security, work of art and jewels etc. These assets bring information about general wealth of the couple and thus explain well the level of non-labour income[5]. They are given in brackets, so I

[4]Using some variables related with experience and seniority would have constituted quite good instruments, as retaled with wages, but certainly not with the share received by each partner.

[5]This variable constitutes a good instrument for non-labour income in labour supply equations, but still contains some quite strong limitations in the share equations.

compute for each of them the middle of the bracket. Then I use the logarithm of the sum of the three amounts to instrument the non-labour income. Later I will use information about the division of personal assets as a distribution factor.

Information about parents are often used as good instruments for non-labour income. Unfortunately, the survey does not include variables about inheritance. We have information about the level of education of the father of both partners, but it does not significantly explain non-labour income.

One concern with assets is that they seem to be good instruments for non-labour income in a higher extent for wealthy households, who are more likely to have income from capital than other households. For more modest couples, non-labour income is more likely to come from state allowances and benefits. So I add to instruments a dummy variable indicating if the household receive benefits or not. These benefits include child benefit or sickness allowance for example.

The Hansen test does not reject the over identification restrictions. Table 7 presents some general descriptive statistics about the instruments for wages and non-labour income used in this paper.

Table 7: Descriptive statistics about instruments of wages and non-labour income

	Men	**Women**
Individual level		
French born	94.99 %	94.05 %
Public sector	19.64 %	28.07 %
Private sector	67.79 %	63.18 %
Self-employed	12.57 %	8.75 %
Personal assets (in Euros)	48409.1	35939.9
	(120703.9)	(91805.9)
Household level		
Common assets (in Euros)	73991.6	
	(146126.4)	
Benefits	44.9 %	
Little town	16.59 %	
Region		
1: Paris and its region	37.90 %	
2: North	6.20 %	
3: East	8.75 %	
4: West	13.87 %	
5: Southwest	11.79 %	
6: Center East	11.59 %	
7: Mediterranean	9.90 %	

Number of couples: 940

Values in (.) are standard errors.

Table 8: The empirical sharing rule, GMM estimation of the husband's and wife's share (Absolute shares, in Euros per month)

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
w_m	326.26	-7.16	184.90	-12.32
	(38.42)***	(32.12)	(36.21)***	(26.32)
w_f	16.11	350.47	-76.27	210.96
	(47.11)	(40.87)***	(40.88)*	(33.78)***
$w_m \times w_f$	-1.64	1.91	3.18	1.31
	(2.14)	(1.94)	(2.10)	(1.51)
Non-labour inc	0.36	0.22	0.09	0.41
	(0.41)	(0.30)	(0.33)	(0.26)
Sex ratio	4,318.66	3,001.28	3,876.59	-838.81
	(3392.93)	(2554.83)	(2911.63)	(1971.69)
Child<3	297.91	438.50	-282.38	-355.60
	(179.49)*	(153.86)***	(145.14)*	(125.40)***
Child<18	-13.41	26.73	-175.84	-157.42
	(62.17)	(55.92)	(51.19)***	(43.67)***
Age (m;f)	2.90	-1.12	13.04	-9.67
	(8.80)	(8.18)	(7.33)*	(6.68)
Age diff (f-m)	4.38	10.07	10.20	-0.60
	(14.56)	(15.20)	(12.03)	(11.11)
Educ (m;f)	-19.91	-42.36	30.44	-11.44
	(39.94)	(25.66)*	(35.52)	(20.78)
Ratio educ (f/m)	205.81	51.31	161.18	-2.57
	(222.48)	(196.36)	(175.50)	(146.15)
Rural	-71.85	254.94	112.51	21.35
	(141.33)	(105.67)**	(132.62)	(77.45)
Paris	170.75	-17.40	165.37	66.42
	(234.28)	(226.66)	(190.43)	(140.18)
Owner	133.66	-348.43	-12.58	-128.66
	(138.27)	(121.68)***	(117.57)	(87.45)
Weekday	-1965.55	-1221.09	-1179.12	-866.45
	(135.16)***	(97.22)***	(121.01)***	(84.27)***
Constant	-1161.54	-246.03	-1109.16	1823.84
	(1757.43)	(1343.10)	(1516.10)	(1047.32)*
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Results about the GMM estimation of the empirical sharing rule are presented in Table 8. The first two columns show results based on Model 1, and the two other columns results based on Model 2. The two dependent variables represent the amount of the household full income the husband and the wife receive, in Euros per month. The construction of this variable was described in previous part of this section. Thus leisure time is now expressed in hours per month.

We observe that in both specifications, partners' shares increase with own's wage. According to Model 2, an increase in female hourly wage by 1 euro leads to an increase in her share by 227.7 Euros (computed at the mean male wage[6]), and an increase in male hourly wage increases his share by 220.54 Euros (computed at the mean female wage). Considering domestic work as pure leisure (Model 1), we find higher sensitivity of shares with own's wage: a 1-euro increase in female wage increases her share by 374.9 Euros, and a 1-euro increase in male wage increases his share by 307.8 Euros. So in Model 1, we find that the sensitivity of the woman's share with her wage is higher than the sensitivity of the man's share with his wage (the difference between coefficients is really small in Model 2). Note that these effects are consecutive to a one-euro increase per hours of work, wich is a really strong wage rise.
As for cross wage effects, we find that the individual share decreases as the wage of his/her partner increases (almost not significantly), except for the husband's share in Model 1, in which the coefficient of female wage is positive, meaning that the man performs more domestic work as his wife's wage increases, but in a no significantly way. However, we observe that the man's share decreases significantly as his wife's wage is increasing.
Thus as usually found, own's wages are a very important determinant of the sharing rule, but partner's wages exert a small effect, surprisingly.

Household non-labour income is associated with higher shares for both partners, although the effects are not statistically significant, and the coefficient is very low for the man in Model 2. In model 1, a one-euro rise in non-labour income increases wife's share by 0.22 Euros, and husband's share by 0.36 Euros (although not significant). The remaining 0.42 euros not used for personal expenditures should be devoted to saving, public goods or common expenses.

Theory predicts that the share of the wife should increase as the sex ratio is increasing,

[6]The effect of female wage, computed at the mean male wage, is obtained in the following way: [coefficient of w_f] + [coefficient of $w_m \times w_f$] $\times$ [mean of w_m]

and the opposite for the husband's share. In model 1, coefficients of the sex ratio are positive both for men and women and not significant. In model 2, they have the opposite sign, but in the 'wrong' direction compared to the theory. Thus french data does not confirm the use of the sex ratio as a distribution factor.

The influence of the presence of children in the family is different according to the model used. Note that child care time is included in the shares of model 1, but not in model 2. The presence of children of any age decreases what's receive the man and the woman according to model 2, as they have less time to spend on leisure and perhaps less money to spend on personal expenditures. The presence of children below 3 decreases in a higher proportion the amount received by partners than the presence of older children. Interestingly, woman's share decreases more than man's share with the presence of very young children, and we find the opposite for older children (but the difference is very small in this case). Now in Model 1, shares are significantly and positively impacted by the presence of very young children, and the impact is really stronger for women. This is not surprising as domestic time increases considerably with the presence of children (due to child care time) and women devote more time than men doing child care. The presence of older children does not exert an influence.

Age variables do not exert any impact, except that in model 2, the man increases his share as he becomes older. This is quite unexpected for the age difference because several studies (Browning and al. 1994, for example) have shown that this variable exerts an influence on household decision process. Diploma has a very weak impact, except that women with a high level of education receive a lower share according to Model 1, meaning that higher educated women spend less time making domestic tasks.

In all, own's wages and the number of children are found to be the main determinants of the empirical sharing rule.

Table 9 shows the results if I do not instrument wages and non-labour income. I only show key variables. The coefficients of own wage are higher in amplitude. The effect of the wage of the woman is significantly related with a higher share for the man, while this coefficient was negative and significant in the second model. The effect of the man's wage in explaining the share

of the woman is always not significant, but positive (negative considering wages as endogeneous). The coefficient of non-labour income is really low compared with the endogeneous case. The sex ratio explain now significantly the wife's share.

Table 9: The sharing rule, Seemingly unrelated regression of the husband's and wife's share. Exogeneous wages and non-labour income (Absolute shares, in Euros per month)

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
w_m	341.83	7.63	274.95	25.56
	(43.46)***	(11.82)	(47.27)***	(17.69)
w_f	44.18	434.56	27.26	294.08
	(22.89)*	(27.17)***	(14.44)*	(43.52)***
$w_m \times w_f$	-2.96	-1.66	-2.17	-2.73
	(1.31)**	(1.24)	(0.82)***	(1.72)
Non-labour inc	0.09	0.04	-0.00	-0.00
	(0.14)	(0.10)	(0.10)	(0.08)
Sex ratio	6,269.68	-284.42	5,530.03	-1,276.77
	(3,988.01)	(2,902.86)	(3,329.53)*	(2,080.81)
Constant	-2,020.81	879.49	-1,885.65	1,324.32
	(2,136.64)	(1,501.47)	(1,780.14)	(1,155.60)
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

In the next part, I will use the Collective Model of labour supply presented in section 2 in order to estimate derivatives of the sharing rule with respect to wages, non-labour income and the sex ratio. This allows me to compare these derivatives with direct results about determinants of the empirical sharing rule, that is coefficients obtained in Table 8.

4. Which links between the empirical sharing rule and predictions of the Collective model ?

In this part, I will first develop the methodology to compute derivatives of the theoretical sharing rule from the Collective Model. Then I present results and comparisons with the coefficients of the empirical sharing rule.

4.1. Estimation of the Collective Model: Econometric specification

As in Rapoport, Sofer and Solaz (2011), I estimate female and male labour supply (model 1) and total work equations (model 2) of the following form, where for convenience and to reflect the

empirical analysis of this section, one distribution factor is assumed:

$$H^f = f_0 + f_1\, lnw_f + f_2\, lnw_m + f_3\, y + f_4\, s + \mathbf{f_5}\, \mathbf{z} + f_6\, lnw_f\, lnw_m \tag{7}$$

$$H^m = m_0 + m_1\, lnw_f + m_2\, lnw_m + m_3\, y + m_4\, s + \mathbf{m_5}\, \mathbf{z} + m_6\, lnw_f\, lnw_m \tag{8}$$

$\mathbf{z}$ is a K-vector of preference factors, such as age and education of the two agents.
From these equations and from derivatives of the sharing rule obtained in section 2, I can compute:

$$A = \frac{\partial H^f/\partial w_m}{\partial H^f/\partial y} = \frac{f_2 + f_6\, lnw_f}{f_3\, w_m}$$
$$B = \frac{\partial H^m/\partial w_f}{\partial H^m/\partial y} = \frac{m_1 + m_6\, lnw_m}{m_3\, w_f}$$
$$C = \frac{\partial H^f/\partial s}{\partial H^f/\partial y} = \frac{f_4}{f_3}$$
$$D = \frac{\partial H^m/\partial s}{\partial H^m/\partial y} = \frac{m_4}{m_3}$$

If I let $\Delta = f_3 m_4 - m_3 f_4$, then I obtain the following expressions for derivatives of the theoretical sharing rule based on the full income:

$$\frac{\partial \rho}{\partial y} = \frac{D}{D-C} = \frac{f_3 m_4}{\Delta} \tag{9}$$

$$\frac{\partial \rho}{\partial s} = \frac{CD}{D-C} = \frac{f_4 m_4}{\Delta} \tag{10}$$

$$\frac{\partial \rho}{\partial w_m} = \frac{AD}{D-C} = \frac{(f_2 + f_6 lnw_f) m_4}{w_m \Delta} \tag{11}$$

$$\frac{\partial \rho}{\partial w_f} = \frac{BC}{D-C} - t_f + T = \frac{(m_1 + m_6 lnw_m) f_4}{w_f \Delta} - t_f + T \tag{12}$$

All derivatives of the sharing rule based on the household full income are computed at sample means using these expressions, from the estimation of partners labour supplies. In the derivative of ρ with respect to w_f, the term $-t_f + T$ appears. T is total time available for each individual. It is equal to the total amount of hours available during one month, that is 732 hours, minus "physiologic time", devoted to sleeping and personal care. I assume that an individual needs 8 hours per day for sleeping and personal care, so that T is equal to 488 hours (per month). t_f is the mean of female domestic work time, that is 121.4 hours per month.
Note that if domestic production is not taken into account (Model 1), only $\frac{\partial \rho}{\partial w_f}$ is changed and is equal to $\frac{(m_1 + m_6 lnw_m) f_4}{w_f \Delta} + T$.

As in Sofer and al. (2011), and as in the estimation of the empirical sharing rule, I estimate male and female labour supply equations simultaneously, using the generalised method of moments (GMM), considering wages and non-labour income as endogeneous. Market and domestic work are computed from the activities booklet. I control if the booklet has been filled during a week day or a week-end, by adding a dummy variable that takes a value of 1 if the day of observation is a week day. As before, Model 1 implicitly assumes that non-market time is pure leisure, and therefore excludes domestic work from labour supply variable, whereas model 2 takes time inputs in household production into account, so that we add domestic work in labour supply variable.

4.2. Determinants of the labour supplies

I start with estimation of men and women labour supplies. Then I will use estimated parameters in order to compute derivatives of the theoretical sharing rule (in the next part).

Results about male and female labour supplies are presented in Table 10. I find that the amplitude of wage coefficients is lower in model 2. Male labour supply decreases with both own's and partner's wages, with the second coefficient lower than the first. Female labour supply appears inelastic to own's wage and partner's wage. Although not significant, both coefficients are positive in Model 2, while Sofer and al. (2011) found negative wage coefficients also for women labour supply. Suprisingly, non-labour income does not influence labour supplies here.

According to the theory, the sex ratio should influence labour suplies of the man and the woman in the opposite direction, with a rise in female labour supply as the sex ratio decreases. Although in both models, coefficients have the opposite sign in male and female labour supply, they take the "wrong" direction, and are not significant. Thus once again, the sex ratio does not seem to exert the theoretical expected role in my data.

The presence of children has a major impact. Having children increases female and male labour supplies in model 2, because child care time increases, and having children decreases labour supplies in Model 1. Note that these effects are higher in absolute value with the presence of very young children compared with older children, and that women always adjust more their time compared to the man with the presence of children of any age.

The ratio of female years of education on male years of education exerts a noticeable impact on male labour supply in model 1: the man reduces his work time as his partner has a higher level of education compared to him. This ratio also has a negative impact in model 2, although not

Table 10: GMM estimates of men's and women's working times. In hours per month

Model:	**1. without domestic prod**		**2. with domestic prod**	
	Men	Women	Men	Women
lnw_m	-351.45	-91.36	-159.75	4.61
	(96.02)***	(70.25)	(67.07)**	(55.86)
lnw_f	-247.95	-23.42	-130.13	4.09
	(90.90)***	(75.37)	(61.11)**	(60.77)
$lnw_m \times lnw_f$	139.10	32.06	66.53	-4.86
	(42.08)***	(35.46)	(29.36)**	(29.36)
Non-labour inc	0.01	0.04	0.03	0.01
	(0.04)	(0.03)	(0.02)	(0.02)
Sex ratio	-216.27	95.49	-159.02	78.78
	(252.60)	(193.50)	(194.92)	(149.52)
Child<3	-32.70	-52.40	17.74	25.53
	(14.43)**	(14.24)***	(10.10)*	(9.89)***
Child<18	-4.33	-8.68	8.33	12.75
	(5.46)	(4.72)*	(3.97)**	(3.30)***
Age (m;f)	-1.32	-1.00	-0.70	0.76
	(0.79)*	(0.85)	(0.58)	(0.61)
Age diff (f-m)	-0.48	1.33	0.25	0.45
	(1.34)	(1.19)	(1.06)	(0.93)
Educ (m;f)	-5.63	-0.97	-3.61	0.73
	(3.42)*	(3.02)	(2.61)	(2.45)
Ratio educ (f/m)	-59.27	13.24	-22.28	-3.64
	(25.32)**	(19.08)	(17.48)	(16.13)
Rural	9.31	-28.26	4.23	-9.38
	(10.49)	(9.31)***	(7.49)	(6.91)
Paris	0.47	-6.66	3.75	2.08
	(19.95)	(16.65)	(13.74)	(10.65)
Owner	-8.24	21.15	8.75	19.14
	(12.85)	(11.60)*	(9.77)	(8.79)**
Weekday	193.66	149.70	139.06	110.40
	(9.71)***	(8.59)***	(8.04)***	(7.43)***
Constant	985.84	115.30	616.07	77.91
	(248.63)***	(180.28)	(184.01)***	(141.35)
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

significant. Owner women work significantly more than other women in both specifications, but there is no effect for men. In the next section, I use these parameters to compute derivatives of the theoretical sharing rule according to wages, non-labour income and the sex ratio.

4.3. Parameters of the theoretical sharing rule

Table 11 shows results about tests of the collective rationality and the computation of derivatives of the theoretical sharing rule. In the first row of Table 11, we observe that collective rationality cannot be rejected at the 10% level in both specification. Next rows present partial derivatives of the sharing rule, and the χ^2 statistics ot the Wald test of the null hypothesis. The partial derivatives represent the change in the household full income share that the wife can claim, as a function of changes in the male wage, the female wage, non-labour income and the sex ratio. In model 2, full income includes the profit from household production, while there is no such profit in model 1.

Table 11: Estimation of the woman's share (marginal effects)

Model:	**1. without domestic prod**		**2. with domestic prod**	
Derivatives of woman's share	$\frac{\partial \rho}{\partial variable}$	(χ^2)	$\frac{\partial \rho}{\partial variable}$	(χ^2)
w_f	405.3	(-0.03)	305.1	(0.12)
w_m	-38.4	(0.00)	-7.16	(-0.00)
Non labour income	0.93	(-0.02)	0.32	(0.03)
Sex ratio	2376.1	(-0.01)	3787.6	(0.05)

* significant at 10%

Derivatives of the theoretical sharing rule must be interpreted cautiously as no parameter is found to be significant in both models. In both models, the woman's share seems to increase (not significantly) as her own's wage increases, meaning that if the woman hourly wage increases by 1 euro, she will receive 305 extra euro of the household full income, according to model 2. The sign of the derivative with respect to w_m is negative in both models. If the hourly wage of her partner increases by 1 euro, her full income share decreases by 38.4 euros according to model 1, and by 7.1 according to model 2. This seems to indicate that wages have an impact on power: the more she earns, the more she gets, but the more he earns, the less she gets (although not significant here).

The woman's share of a 1-euro rise in non-labour income is estimated to be 93 cents in model 1, which is really high. Indeed, she receives almost the totality of this additional income. Model

2 predicts a lower increasing of the share of the wife: she gets 32 cents of a 1-euro increase in non-labour income. The effect of the sex ratio is higher in model 2 than 1, with the "good" sign here according to the theory. Globally, except for derivatives with respect to the sex ratio, parameters are higher in absolute value in the first model, showing that not taking into account domestic production could over-estimate the share of the woman, and under-estimate inequalities within couples.

If we compare these results with derivatives obtained in Rapoport, Sofer and Solaz (2011), we observe different patterns. This is due to the fact that variables exert different effects on labour supplies in 1999 compared to 2010 (according to the french time use survey). It appears that labour supplies are quite inelastic in 2010 compared to 1999, particularly we find that female labour supplies are really less elastic to wages in 2010 compared to 1999. So computation of derivatives of the sharing rule is mainly based on non-significant coefficients in 2010, while it was mainly based on significant coefficients in 1999, making impossible to compare derivatives between the two studies, even taking into account that one is computed from full income and the other on non-labour income.

4.4. Comparison of the theoretical sharing rule with the empirical sharing rule

In this part, I compare results about the empirical sharing rule obtained in section 3, with results about the theoretical sharing rule computed in the previous part, in the framework of the Collective Model. Indeed, coefficients of Table 8 are directly comparable with coefficients of Table 11, as they represent the effect of a change of the variable (wages, non-labour income or the sex ratio) on the full income share received by the woman, in euros by month.

Table 12: Parameters of the empirical and theoretical sharing rule

Model:	**1. without domestic prod**		**2. with domestic prod**	
Sharing rule	Theoretical	Empirical	Theoretical	Empirical
Derivative w.r. to:				
w_f	405.3	374.9***	305.1	227.7***
w_m	-38.4	17.28	-7.16	4.44
Non-labour inc	0.93	0.22	0.32	0.41
Sex ratio	2376.1	3001.28	3787.6	-838.81

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 12 summarizes these coefficients. Derivatives of the empirical sharing rule with respect to w_f and w_m are computed at sample mean wage. We observe that the Collective Model and the empirical sharing rule lead to very closed derivatives with respect to w_f (particularly in model 1), except that the Collective Model predicts a non-significant impact while our data shows very significant effects. Derivatives of female share with respect to w_m are very different according to the empirical and theoretical method, with different signs, but they are insignificant in all cases. Derivatives with respect to non-labour income are very different in the first model, as the collective model predicts that the woman receives 93 cents following an increase in non-labour income by 1 euro, while the empirical sharing shows that she gets only 22 cents. Both coefficients get closer in the second model, although the empirical sharing rule predicts that the women receives 9 extra-cents compared with the theoretical sharing rule (41 cents with the empirical rule, and 32 cents with the theoretical one). The estimated impacts of the sex ratio are really similar according to model 1, but not significant, while they have an opposite direction in model 2 (the theoretical rule presents a 'correct' sign according to the theory).

In all, predictions of the Collective Model and what we observe in our data show quite different patterns. In particular, the effects of male wage, non-labour income (in model 1) and the sex ratio (model 2) are very different. Nevertheless, the effects of female wage on what she gets are noticeably similar according to both estimations, particularly in model 1.

However, it seems hard to draw conclusions at this stage. Indeed, estimations here only involve economic variables (wages and non-labour income) and one distribution factor related to the marriage market. Such a model seems quite restrictive to analyse the sharing of resources within couples and the distribution of powers between partners. Intra-household decision making could be more complex, involving variables more closely related to individual, in addition to the sex-ratio, and non-economic variables. In the last section, I will try to take into account more information about the couple to better understand the allocation of resources within couples, and investigate whether including more precise distribution factors helps the convergence of the estimation of the theoretical sharing rule from the Collective Model and the empirical sharing rule from observed data.

5. The influence of monetary versus non-monetary variables in explaining the sharing rule

Let's remind that a distribution factor is a variable affecting Pareto weights in a household's optimization model but not the preferences of individual household members or the household budget set. In the collective model, changes in distribution factors lead to variations in outcomes while the set of efficient allocations remains unchanged. Thus distribution factors provides very useful information on the decision process in the household, and it is in general crucial to explicitly take them into account in the model.

Until now, most of distribution factors used to estimate the Collective Model refer to pure economic variables (as relative wages of partners, relative income or unearned income, relative education) or to the marriage market. However, including only factors related to divorce threat appears quite restrictive and extreme. Indeed, it seems quite unexpected that negociation involves systematically divorce threat, except for couples in which harmony between partners is bad and the last alternative of divorce could be really considered. But in most cases, threats and processes at stake could be not too extreme and perhaps more internal to the household and related to cultural determinants, more precisely habits, elements of context and biography of each partner. In addition, summarizing decision making and distribution of powers only with pure financial outcomes (particularly their division between partners) seems quite restrictive, as non-economics factors are likely to influence intra-household decision-making.

In order to go beyond the sex ratio and financial outcomes as distribution factors, the household black-box has to be opened to find information that could proxy the way partners negociate. This becomes possible with the new french Time Use Survey as these data contain a rich set of potential distribution factors. Information are collected about current partnership (harmony within couples, financial arrangement), health information, details about beginning of the relationship, fertility histories of the two partners, division of assets, information about education and labor force participation of mothers' partners, etc. In this section, I will estimate the dependance of the empirical sharing rule on these non-traditional distribution factors. Then I will include them as distribution factors in the collective model and investigate whether this brings better estimates of the theoretical sharing rule.

Indeed, as seen before, the Collective Model brings predictions quite distant from what we observe

(at least according to our french data and the definition of the empirical sharing rule), and one objective here is to analyze whether adding information about intra-household negociation within a Collective Model improves its predictions. The Collective Model is constructed on minimalist assumptions, but adding more information through distribution factors could help predictions.

Browning and Bonke (2009) were the first to test some new non-economic distribution factors on the level of a sharing rule defined on the allocation on expenditures within couples, using data from the DHES. The novelty of my approach is to test the relevance of non-economic variables on the level of a sharing rule defined not only on the allocation of money but also of time. In addition, rather than only investigating the impact of these new variables on an observed empirical sharing rule, I also analyze whether these new distribution factors might improve the convergence of the sharing rule estimated through the Collective Model towards the observed one.

I test here similar distribution factors as in Browning and Bonke (2009), but also new factors related to the division of assets, if he/she worked or not when partners met for the first time, the level of education of the mother of each partner, and the number of years since they live in the same housing. [7] A 'good' distribution factor should impact in the opposite direction the share received by the woman and the share received by the man, or at least impact one partner's share without influencing the other.

Note that some potential distribution factors I test (particularly the first two variables) may be finally though in term of (indirect) economic or divorce determinants in a sense. These factors are the following:

- A dummy variable if the couple is married or not. Actually, the influence of this variable may be related to the marriage market, but also to economic considerations. The cost of seperation is higher if couples are married, and may be different for the wife and the husband,

[7] Many other types of information are given in our data, but they are likely to suffer from an endogeneity bias, so I do not include them: financial arrangement (income is pooled or not, they do accounts regularly or not, they make precise budgets, they have a joint account), possession of a common real property, global harmony between partners and frequency of quarrels, if he/she feels one makes more concessions than the other, frequency of contacts with friends. Other variables could have constituted good exogeneous distribution factors, but as they appear insignificant to explain the empirical sharing rule or are highly correlated with other distribution factors, I do not include them in this analysis: partners lived with family when they met, religious ceremony for the marriage if any, they moved in the woman's housing when they began to live together / man's housing / a new housing, Body Mass Index, he/she has already lived in a couple before the current partnership, the number of years since they first met until the moved together.

influencing differently partners' negociation powers. This variable may also capture some traditional behaviours. However, a dummy variable about whether a religious ceremony occured did not exert a significant impact.

- The repartition of personal assets between partners. Usually, the repartition of non-labour income is included to study the allocation of resources within couples, but the repartition of assets is quite unique. I use the ratio of the logarithm of female assets on the logarithm of male assets. This variable is related to economic determinants of powers, but also to divorce as the share of assets each partner keeps in case of divorce may matter.

- Two variables about the mother of each partner: the mother worked full time or not when the partner was 16 years old, and the level of education of the mother[8]. I add interaction terms of man and woman variables. Browning and Bonke (2009) also used full time employment of the mother, but not her diploma. These two variables may impact partners' values, particularly opinion about women independence. Thus a man or a woman (or both) having a mother with a high level of education and who worked full time may be a characteristics in favour of the woman, perhaps because the man is less reluctant to "give more" to his wife, and/or this confers a higher decicion power to the women. On the other hand, men in this situation may be more desirable partners (perhaps because they contribute more to domestic work) and receive a higher share of household income (Browning and Bonke, 2009, Fernandez and al., 2004).

- A dummy variable for children from past union + an interaction term for the man and the woman. This is also a variable used in Browning and Bonke's (2009) paper. There is no theory providing explanation whether this variable may be related with decision powers of each partner. Actually, previous children of a woman are more likely to live with her, so with the current couple, while previous children of the man are likely to live with the ex-wife. Consequently, a man having a child from a past union is likely to pay an alimony, but if this is his wife who has a previous child, the man is more likely to live with this child. Thus we may think that having previous child does not exert the same impact for men and women. In addition, this may increase conflicts within couples. In all, this variable may exert a different impact on decision powers of the man and the woman.

- A dummy if the partner had a stable work when the couple first met + an interaction term for

[8]As in the level of education of partners, the level of education of the mother is expressed in years of education.

the man and the woman. The idea here is to capture some information about the beginning of the relationship, that may create habits for future and become rooted with impact on decision powers.

- The number of years since they live together. Browning and Bonke have tested the number of years of the current partnership (founded to have no impact, which is also what I find with french data), but not the number of years since they live in the same housing, which exerts an influence here. We may think that specialization and habits between partner become stronger over the years with direct and differentiated impact on individual decision powers.

We can notice here that some distribution factors appear less exogeneous than other. Especially, the variable indicating whether they had a stable job when the couple met for the first time may not be entirely exogeneous, and provide more information about who are these people rather than about powers. Indeed, there is a selection issue, as women who worked at this time may not be the same than the other women who did not work. That is why we must be cautious about the interpretation of this variable. In addition, some other distribution factors may be challenged because possibly related with preferences. Particularly, it could be the case with the 'married' dummy. Globally, there is a trade-off between pure exogeneous factors as the sex ratio and legislation about divorce for instance, and more precise variables about negociation, but not entirely exogeneous.
Descriptive statistics about these variables are given in Table 13.

In a general setting, Bourguignon, Browning and Chiappori (1995) show that testable restriction arises on labour supplies, when there are at least two distribution factors:

$$\frac{\partial H^f/\partial s_r}{\partial H^f/\partial s_1} = \frac{\partial H^m/\partial s_r}{\partial H^m/\partial s_1} \quad \forall r = 2, ..., R \tag{13}$$

This result says that distribution factors affect consumption and labor supply choices only through the location chosen on the Pareto frontier or, equivalently, through the implicit weighthing of each spouse's utility. Since this weighting is unidimensional, this implies that the ratios of the impacts of all distribution factors on the two labor supplies are equal. These restrictions provide a test for Pareto efficiency in a collective model of labour supply.

If there are several distribution factors ($r = 1, ..., R$), Chiappori, Fortin and Lacroix (2002) show that the partial derivatives of the sharing rule with respect to the additional distribution

Table 13: Descriptive statistics about non-traditional distribution factors

	Men	**Women**
Individual level		
Personal assets, in	48409.1	35939.9
	(120703.9)	(91805.9)
Mother worked	47.09 %	47.72 %
Both mothers worked	26.13 %	
MOTHER DIPLOMA, *expressed in year of education*		
No diploma	43.40 %	36.06 %
Primary educ	25.39 %	25.57 %
Brevet	5.98 %	5.97 %
CAP/BEP	10.70 %	15.77 %
Bac (General or Techn)	6.48 %	7.00 %
Bac +2	3.50 %	3.56 %
Bac >2	4.55 %	6.07 %
Children from past union	11.17 %	10.89 %
Both had children	5.80 %	
Worked when they met	57.60 %	42.25 %
Both worked	35.83 %	
Household level		
Married couples	70.65 %	
$\frac{ln(female\ assets)}{ln(male\ assets)}$	1.16	
	(1.79)	
Years life together	15.79	
	(10.09)	

Number of couples: 940
Values in (.) are standard errors.

factors are given by

$$\frac{\partial \rho}{\partial s_r} = \frac{C_r D_r}{D_r - C_r}, \quad \forall r = 2, ..., R \tag{14}$$

An additional set of necessary and sufficient conditions are (Chiappori and al., 2002) :

$$\frac{C_r}{D_r} = \frac{C_1}{D_1}, \quad \forall r = 2, ..., R \tag{15}$$

Theoretical results of the Collective Model are not changed with several distribution factors. Labour supplies have now the following form:

$$H^f = f_0 + f_1\, lnw_f + f_2\, lnw_m + f_3\, y + \sum_{r=1}^{R} f_{4(r)}\, s_r + \mathbf{f_5}\, \mathbf{z} + f_6\, lnw_f\, lnw_m$$

$$H^m = m_0 + m_1\, lnw_f + m_2\, lnw_m + m_3\, y + \sum_{r=1}^{R} m_{4(r)}\, s_r + + \mathbf{m_5}\, \mathbf{z} + m_6\, lnw_f\, lnw_m$$

There are now as many parameters C and D as distribution factors:

$$C_r = \frac{f_{4(r)}}{f_{3(r)}} \quad and \quad D_r = \frac{m_{4(r)}}{m_{3(r)}}, \quad \forall r = 1, ..., R$$

and

$$\frac{\partial \rho}{\partial s_r} = \frac{C_r D_r}{D_r - C_r}, \quad \forall r = 1, ..., R$$

In addition, we have seen that we can test the collective model using an additional set of necessary and sufficient conditions, given in equation (15), which implies here that:

$$\frac{f_{4(r)}}{f_{4(1)}} = \frac{m_{4(r)}}{m_{4(1)}}, \quad \forall r = 2, ..., R \tag{16}$$

Estimation results including these distribution factors are presented in next tables. Table 14 presents estimations of the empirical sharing rule, Table 15 estimation results of labour supplies, and Table 16 results about the theoretical sharing rule.

5.1. Impact of non-traditional distribution factors on the empirical sharing rule

Table 14 shows impact of these "non-traditional" distribution factors on the empirical sharing rule, and to what extent traditional variables are changed when including this new kind of information.

We observe that impacts of own's wage are the same compared to previous estimations without non-traditional distribution factors. The negative impact of the woman's wage on the man's share in model 2 remains. But other cross-wages always do not exert an influence on shares. The influence of non-labour income is a little smaller in amplitude in all specifications, although still insignificant. The sex ratio takes the same sign as before, and it is now significant in explaining the husband's share in both models, with the 'good' sign. The sex ratio only exerts the 'wrong' direction in model 1 in explaining the wife's share. Finally, the sex ratio seems to play the anticipated role in model 2, although not significant in the wife's share. The presence of children in the household has similar impacts too.

As for new variables, we find that people in married couples spend less than unmarried couples with similar characteristics. This effect is higher in amplitude for men, and significant only for

Table 14: The empirical sharing rule, GMM estimation of the husband's and wife's share (in Euros per month)

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
w_m	331.19	3.70	184.75	-13.35
	(36.95)***	(33.49)	(37.58)***	(25.77)
w_f	37.39	350.62	-60.92	202.82
	(46.36)	(46.63)***	(36.20)*	(34.06)***
$w_m \times w_f$	-1.75	2.06	3.65	1.81
	(2.12)	(2.21)	(2.28)	(1.50)
Non-labour inc	0.32	0.17	0.03	0.36
	(0.41)	(0.32)	(0.34)	(0.26)
Sex ratio	6,025.85	3,351.97	5,486.22	-156.05
	(3,554.58)*	(2,784.64)	(2,901.70)*	(2,073.96)
Child<3	310.00	463.24	-258.85	-329.73
	(178.64)*	(158.53)***	(144.67)*	(132.11)**
Child<18	9.50	37.98	-182.32	-153.61
	(65.82)	(55.78)	(56.85)***	(44.55)***
Age (m;f)	-1.95	2.49	20.73	15.17
	(15.02)	(13.62)	(14.39)	(12.17)
Age diff (f-m)	0.59	2.76	3.66	-22.63
	(18.71)	(17.84)	(15.08)	(13.18)*
Educ (m;f)	-27.39	-51.73	27.56	-20.44
	(41.43)	(29.03)*	(37.59)	(22.99)
Ratio educ (f/m)	208.81	75.55	194.78	55.93
	(241.19)	(201.42)	(192.63)	(151.06)
Rural	-73.59	252.90	90.88	30.44
	(140.68)	(107.66)**	(127.99)	(74.78)
Paris	125.64	-24.91	136.41	53.16
	(239.75)	(230.84)	(195.70)	(148.10)
Owner	88.00	-378.30	-94.54	-122.09
	(152.71)	(129.77)***	(136.87)	(93.57)
Weekday	-1,966.46	-1,216.82	-1,181.13	-876.19
	(135.07)***	(105.48)***	(125.05)***	(83.82)***
Married	-252.38	-82.30	-152.97	-133.84
	(133.39)*	(121.59)	(111.44)	(85.69)
Ratio ln(assets) (f/m)	-93.93	3.04	-51.67	0.65
	(46.29)**	(31.08)	(37.06)	(23.59)

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Continuation of the Table

Model:	**1. without domestic production**		**2. with domestic production**	
	Husband's share	Wife's share	Husband's share	Wife's share
Educ mother (m)	-43.69	15.92	-15.44	29.02
	(36.65)	(30.66)	(31.20)	(23.32)
Educ mother (f)	-58.85	7.08	-30.27	9.01
	(32.15)*	(27.06)	(27.85)	(18.55)
Educ mother (m*f)	3.85	-1.43	0.47	-1.81
	(3.18)	(2.64)	(2.88)	(1.99)
Mother worked (m)	-226.27	-99.57	-207.92	-18.71
	(159.68)	(153.51)	(130.39)	(102.55)
Mother worked (f)	-269.77	-149.27	-148.16	-72.96
	(158.75)*	(148.96)	(137.45)	(100.32)
Mother worked (m*f)	364.19	216.58	380.05	95.73
	(229.13)	(197.05)	(198.36)*	(140.94)
Children before (m)	-230.30	-318.27	-721.21	-308.54
	(346.52)	(381.33)	(382.14)*	(298.42)
Children before (f)	-308.47	294.45	-186.29	261.30
	(242.22)	(216.49)	(206.42)	(168.01)
Children before (m*f)	231.81	-84.91	602.90	-236.45
	(469.10)	(464.33)	(445.87)	(371.14)
Worked begin (m)	113.41	-59.99	-172.78	-182.63
	(163.48)	(133.42)	(137.42)	(95.85)*
Worked begin (f)	243.23	-21.95	21.36	46.70
	(216.88)	(203.55)	(201.20)	(186.82)
Worked begin (m*f)	-296.07	104.69	-44.45	24.56
	(269.12)	(239.98)	(242.91)	(204.80)
Life together	7.64	-3.94	-2.71	-22.02
	(12.79)	(11.56)	(12.88)	(9.98)**
Constant	-1,092.13	-499.40	-1,565.03	929.76
	(1,797.19)	(1,463.09)	(1,464.81)	(1,151.91)
Observations	940	940	940	940

* significant at 10%; ** significant at 5%; *** significant at 1%

men in the first model (a married man spends on average 252 Euros less than an unmarried man living in a couple), meaning that he performs less domestic work when he is married. As the effect is strongly negative both for men and women, this variable can not be assimilated with a distribution factors correlated with partners powers, since we expect that a good distribution factor influences in an opposite direction the woman's share and the man's share.

The more the assets of the wife are important compared to those of her husband, the less he receives. This effect is significant only in model 1, although always negative in model 2. This has no significant effect on the amount received by the woman. Thus having more assets for a wife seems to lower negociation power of her partner.

The sign of the level of education of the mother of the man and the mother of the woman is neg-

ative in husband's share in both models, and significant only for the mother of his wife in model 1. This means that as the mother of the wife is more educated, the man performs less domestic tasks. No existing theory allows to explain this phenomenon. Note that the effect of the mother's education of one partner on the share receive by the other partner is always higher in amplitude than the effect on the share received by this partner. The effect on woman's share is positive but not significant. The sign of these coefficients would suggest that having a mother highly educated lowers negociation power of the man, and increase power of the woman. Perhaps partners in these couples have a better perception about the economic role of women, leading men to "accept" to allocate resources in a more equality way, and reduce their share. However, caution should be taken when interpreting this result as the effects are not statistically significant.

Results in model 1 suggest that if the mother of the wife worked full time when she was 16 years old, but not the mother of the husband, the man receives significantly less. But this effect disappears when mother of both partners worked full time. In model 2, we observe that the man seems to receive more as mother of both partners worked full time. This conclusion seems to confirm results by Browning and Bonke (2009) and Fernandez and al. (2004) who find that a husband having grown up in a household in which his mother was in full-time employment increases his share of expenditure. They explain this result by the fact that such men make more desirable husbands (perhaps because they contribute more in housework) and hence do better in any match. However, although not significant, the signs of the three coefficients related to mother employment are similar for the wife's share and the husband's share, making it difficult to interpret this variable as a distribution factor.

A man with chidren from a past partnership receives a strongly lower share than another man without this characteristic, only in the case where his wife does not have previous children, especially in the second model. We find that a man who has had a previous child and who is in a couple with a woman who has no previous child receives 721 euros less per month compared to another man without previous child. If this is the woman who has had a previous child but not him, his share is not impacted. However, if both partners have had previous child before, the negative effect for the man is strongly reduced. These variables have no significant impact on the share the woman receives. So what reason leads men to receive 721 euros less when they have had a previous child but not her current wife ? One explanation may be that previous child of the wife are more likely to live with her, while previous child of the husband are more likely to live with the ex-wife. Consequently, men in this case are more likely than women to have an alimony

to pay, and this certainly reduces their personal expenses. Note that Browning and Bonke (2009) found different patterns: if either the husband or the wife has a previous child then the wife's share is lower.

Now if the couple met while he had a stable job and she had not, she receives 182 euros less than a similar woman who had a stable job at this time, according to the second model. The same characteristic decreases also the man's share, but this is not significant. There is no significant effect if this is her who worked when the couple met for the first time while he did not work. A reason to this phenomenon could be that if he worked while she did not when they met for the first time, the beginning of the relationship is marked by a traditional gender role situation, in which the woman has a lower negociation power because no economic activity. This situation can create habits for future, and lead the woman to receive a lower share of the full income, even several years after they met. Note that in our sample, most of people who did not work when they met their partner were students. 49% of women in the sample were student when they met their partner, and 12% did not worked or had an insecure job. Men were respectively 36% in the first category and 9.9% in the second one. Women who were student at this time had anticipation about a future higher wage, but nevertheless they met their partner in an inegalitarian basis that lasts. Nevertheless, as said before, there are concerns over the exogeneity of this variable.

Finally, we find that the longer they live together, the less she receives, only in model 2. The number of years since they live together does not influence the man's share. Note that the duration of the partnership (the number of years since they met) was not significant, even when I dropped the first variable about the number of years since they moved in the same housing, which are highly correlated. This may mean that habits and specialization in leisure and expenses are increasing over time.

In all, we find that different distribution factors impact the amount received by the man and the amount received by the woman. Biography variables (information about mothers, child from past partnership) have a strong impact on the man's share, while the situation of partners when they met for the first time and the number of years since they live together noticeably impact what the woman gets.

Table 15: GMM estimates of men's and women's working times. In hours per month

Model:	**1. without domestic prod**		**2. with domestic prod**	
	Men	Women	Men	Women
w_m	-330.46	-76.07	-154.90	18.94
	(96.72)***	(75.68)	(70.06)**	(60.37)
w_f	-223.43	13.63	-110.37	36.14
	(94.59)**	(84.31)	(66.82)*	(68.15)
$w_m \times w_f$	128.20	16.33	60.47	-17.59
	(44.19)***	(40.28)	(32.46)*	(33.19)
Non-labour inc	0.01	0.03	0.04	0.02
	(0.04)	(0.03)	(0.03)	(0.02)
Sex ratio	-248.83	85.17	-177.02	72.41
	(258.39)	(200.36)	(200.67)	(151.02)
Child<3	-32.70	-49.44	15.19	25.84
	(13.95)**	(13.83)***	(10.03)	(9.93)***
Child<18	-4.88	-6.56	8.49	13.81
	(5.43)	(4.64)	(4.17)**	(3.55)***
Age (m;f)	-1.21	-0.52	-0.74	-0.70
	(1.29)	(1.33)	(0.97)	(1.02)
Age diff (f-m)	-1.19	1.29	0.14	1.78
	(1.55)	(1.37)	(1.18)	(1.06)*
Educ (m;f)	-5.65	-0.07	-4.50	2.39
	(3.35)*	(3.08)	(2.69)*	(2.45)
Ratio educ (f/m)	-60.42	8.40	-28.79	-12.73
	(24.21)**	(19.19)	(17.54)	(16.00)
Rural	7.95	-29.99	4.02	-11.25
	(10.23)	(9.41)***	(7.48)	(6.95)
Paris	6.85	1.72	2.27	6.74
	(19.10)	(16.52)	(13.93)	(10.87)
Owner	-10.26	21.32	7.38	16.76
	(14.12)	(12.82)*	(11.13)	(9.53)*
Weekday	191.09	148.52	138.04	111.43
	(9.65)***	(8.89)***	(8.15)***	(7.40)***
Married	9.13	2.63	8.33	3.76
	(12.02)	(11.32)	(9.42)	(8.52)
Ratio ln(assets) (f/m)	-0.70	-0.93	-0.68	-0.08
	(2.24)	(2.51)	(1.59)	(1.56)

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Model:	**1. without domestic prod**		**2. with domestic prod**	
	Men	Women	Men	Women
Educ mother (m)	4.18	1.42	0.20	-1.75
	(2.83)	(2.42)	(2.19)	(2.01)
Educ mother (f)	2.51	0.17	-0.02	-1.12
	(2.87)	(2.19)	(2.14)	(1.72)
Educ mother (m*f)	-0.26	-0.03	0.09	0.10
	(0.26)	(0.22)	(0.20)	(0.18)
Mother worked (m)	5.45	19.08	6.79	15.17
	(13.23)	(13.27)	(9.89)	(9.13)*
Mother worked (f)	13.05	10.36	6.38	11.52
	(12.43)	(11.33)	(9.49)	(8.46)
Mother worked (m*f)	-4.96	-9.11	-4.60	-14.76
	(17.86)	(17.50)	(13.49)	(12.65)
Children before (m)	-34.15	1.57	-7.77	14.47
	(31.40)	(22.33)	(23.36)	(17.37)
Children before (f)	16.23	-27.27	-7.68	-16.80
	(23.84)	(21.49)	(16.06)	(16.53)
Children before (m*f)	28.67	22.07	15.90	24.16
	(39.76)	(29.23)	(28.06)	(25.76)
Worked begin (m)	16.29	18.88	14.09	17.46
	(12.74)	(11.96)	(9.96)	(8.46)**
Worked begin (f)	-7.68	10.97	1.08	4.82
	(19.36)	(18.93)	(15.06)	(15.70)
Worked begin (m*f)	-14.54	-29.80	-13.10	-9.13
	(24.04)	(21.67)	(18.33)	(17.42)
Life together	0.18	0.26	0.03	1.62
	(1.08)	(1.18)	(0.83)	(0.85)*
Constant	902.90	29.67	600.32	57.58
	(243.92)***	(182.00)	(186.19)***	(146.28)
Observations	940	940	940	940

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

5.2. Impact of non-traditional distribution factors on the theoretical sharing rule

Table 15 presents estimation results of labour supplies including non-economic distribution factors. Traditional economic variables do not differ from previous estimations using only the sex ratio as distribution factor. Labour supplies appear insignificant to new distribution factors in model 1, while female labour supply is more elastic to these new factors in model 2. If the mother of her partner worked full time when he was 16 years old, but not her mother, she will work significantly more. As the effect is not significant in model 1, this means that she performs more domestic tasks in that case (note that working time in model 2 includes domestic work).

In addition, if she met her partner while he worked but she did not work, she spend more time working, meaning again that she performs more domestic work as this variable is not significant in model 1. We find the same conclusion for the variable 'number of year since they live together': she performs more domestic work over the years. Note that these two last variable were found to decrease the share received by the woman.

Table 16 shows results about the computation of the derivatives of the theoretical sharing rule with respect to traditional variables and new distribution factors, and tests of the collective rationality. The first row of the table shows that collective rationality is not rejected in both models at the 10 % level. Then, I present in the first column the theoretical derivative of the sharing rule with respect to different variables, in the second column the χ^2 statistic of the Wald test of the null hypothesis. In the third column, we find the χ^2 statistic for the additional test of the collective model from distribution factors (Eq (16)). These first three columns indicate results according with the Collective Model. Finally, to facilitate comparisons, I report results of the empirical sharing rule in the fourth column, founded in the last subsection (Table 14). Next four columns show the same results, but according to model 2.

We find that once again, theoretical derivatives with respect to w_f are quite close with the empirical sharing rule, while derivatives with respect to male wage are very different, with opposite signs. In the first model, the impact of non-labour income is found to be very different if we compare estimations from the Collective Model and estimations of the empirical sharing rule. The effects of the non-labour income are closer in model 2. However, the theoretical sharing rule in model 2 overestimate the amount got by the wife, as it predicts an egalitarian sharing of an extra non-labour income by 1 euro, while the empirical sharing rule predicts that the wife receives 36 cents. The two measures of the impact of the sex ratio are quite similar in model 1, but the similarity between coefficients in model 2 is worst than previous estimations without new distribution factors.
Let's now turn to new distribution factors. Globally, tests of equation (16) validate the collective model for all distribution factors. Nevertheless, no distribution factor is found to be significant according to the collective model. However, to what extent amplitude of these coefficients are similar in the empirical and the theoretical sharing rule ? Recall that distribution factors founded

to have an impact on the share received by the woman in model 2 were "her partner worked when they first met", and "the number of years since they live together". We find that the first impact is estimated in the same direction but with a higher amplitude: it predicts that having met her husband while he had a stable job but she had not decreases her share by 596 euros per month, while the empirical sharing rule predicts a decrease by 183 euros. The second effect is found to be very low according to the collective model, so very different compared to the empirical sharing rule. The three variables about full-time employment of mothers are found to be estimated in the same direction than the empirical sharing rule, but most of the time over-estimated compared to this empirical sharing rule. Most of the other variables are estimated in a very different way compared to the empirical sharing rule, in both models. Estimations in model 1 are even more distant from the empirical sharing rule compared with model 2.

Table 16: Estimation of the woman's share (marginal effects)

Model:	**1. without domestic prod**				**2. with domestic prod**			
Derivatives of woman's share	$\frac{\partial \rho}{\partial variable}$	(χ^2)	*Test Eq* (16)	Empirical	$\frac{\partial \rho}{\partial variable}$	(χ^2)	*Test Eq* (16)	Empirical
w_f	407.9	(0.06)	-	376.9***	328.7	(0.19)	-	225,9***
w_m	-98.01	(-0.01)	-	30.06	-48.0	(-0.02)	-	9,81
Non labour income	0.92	(0.03)	-	0.17	0.53	(0.07)	-	0.36
Sex ratio	2699.0	(0.01)	-	3351.97	2190.5	(0.04)	-	-156.05
Married	97.06	(-.042)	*0.14*	-82.30	7588.7	(-.766)	*0.26*	-133.8
Ratio ln(assets) (f/m)	-46.8	(.211)	*0.12*	3.04	-6.08	(.011)	*0.03*	0.65
Educ mother (m)	52.91	(-.037)	*0.42*	15.9	-4.97	(.002)	*0.14*	29.02
Educ mother (f)	6.08	(.004)	*0.14*	7.1	0.48	(.000)	*0.12*	9.01
Educ mother (m*f)	-1.14	(.002)	*0.19*	-1.44	-4.04	(-.003)	*0.20*	-1.81
Mother worked (m)	4238.5	(-2.279)	*0.21*	-99.5	-226.8	(.033)	*0.31*	-18.71
Mother worked (f)	439.7	(-.148)	*0.32*	-149.2	-226.9	(.014)	*0.30*	-72.96
Mother worked (m*f)	-562.4	(.202)	*0.14*	216.5	142.0	(-.019)	*0.24*	95.73
Children before (m)	53.12	(.008)	*0.09*	-318.2	164.3	(.030)	*0.09*	-308.5
Children before (f)	-665.5	(.106)	*0.10*	294.4	257.7	(-.062)	*0.26*	261.3
Children before (m*f)	930.0	(.081)	*0.26*	-84.9	-605.7	(.028)	*0.27*	-236.4
Worked begin (m)	900.0	(-.362)	*0.29*	-59.9	-595.8	(-.035)	*0.42*	-182.6*
Worked begin (f)	279.7	(-.091)	*0.05*	-21.9	-31.8	(.008)	*0.06*	46.7
Worked begin (m*f)	-2025.9	(.322)	*0.22*	104.6	1041.7	(-.121)	*0.26*	24.5
Life together	13.48	(-.116)	*0.04*	-3.9	-0.8	(.004)	*0.22*	-22.02**

* significant at 10%; ** significant at 5%; *** significant at 1%

5.3. Discussion about the relevance of including non-traditional distribution factors

Table 17: Summary of results: estimation of the woman's share

Model:	**1. without domestic prod**				**2. with domestic prod**			
	Only sex ratio		**Many dist fact.**		**Only sex ratio**		**Many dist fact.**	
	Theor	Emp	Theor	Emp	Theor	Emp	Theor	Emp
w_f	405.3	374.9***	407.9	376.9***	305.1	227.7***	328.7	225.9***
w_m	-38.4	17.28	-98.01	30.06	-7.16	4.44	-48.0	9.81
Non labour inc	0.93	0.22	0.92	0.17	0.32	0.41	0.53	0.36
Sex ratio	2376.1	3001.2	2699.0	3351.97	3787.6	-838.8	2190.5	-156.05

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 17 summarizes all main results about the comparison between the theoretical and the empirical sharing rule, in a configuration with only one distributon factor, the sex ratio, and another configuration with several non-traditional distribution factors. Let's remind that the general idea was to investigate whether adding information about negociation within couples helps the convergence between the allocation of resources observed in the data and prediction of the collective model. It appears that adding some new distribution factors does not change much results, and particularly the convergence between the empirical and the theoretical sharing rule.

In the first model, the impact of the woman's wage is really similar in all specifications (theoretical or empirical, with and without new distribution factors). The impact of the man's wage on the amount received by the woman shows opposite effects according to the empirical and theoretical sharing rule. This is even worst when new distribution factors are taken into account. The impact of an increase in the non-labour income is also very badly estimated by the collective model in the first model. The sex ratio exerts the theoretical expected impact as it increases the share of the woman, but this effect is never significant.

In the second model, adding some new distribution factors does not change the estimation of the woman's wage on her own share. We find the same problem as for the estimation of the effect of the man's wage. The impact of non-labour income is better estimated in model 2 than in model 1, but small differences appears, and adding some distribution factors does not improve the convergence. The estimation from the collective model under-estimates the woman's share compared with the empirical sharing rule, considering only the sex ratio, while it over-estimates the share when the new distribution factors are taken into account. The sex ratio takes the 'good'

sign according with predictions of the collective model, but the opposite sign according to the data.

Globally, the collective model appears to over-estimate the share received by the woman, in model 1 as in model 2, and adding some new distribution factors does not improve the estimation.

The estimation of derivatives with respect to distribution factors leads to quite mixed results. Even if the effects are sometimes in the same direction, we can say that the collective model predicts quite over-estimated effects compared to the empirical sharing rule. The collective model tends to overvalue the share of household full income received by the woman compared to what's data directly show. The divergence is stronger when we do not take into account domestic production.

Note that the theoretical estimation of the effects of these new distribution factors is mainly based on insignificant parameters in the labour supplies estimation. Actually, the derivatives with respect to distribution factors are computed from the coefficient of non-labour income in labour supplies equations, and the coefficient of each respective factor. However, except for professional situation when they met, the mother of the man worked, and the number of years since they live together, all other distribution factors are found to be insignificant in explaining labour supplies, as for non labour income. Consequently, the computation of these different effects from the collective model is very imprecise, and partly explains why predictions of the collective model are far from what we find in the data.

However, adding this new information about decision process within the couple helps to better understand how partners share resources, as shown by estimation of the empirical sharing rule. This particularly shows that biography elements may be quite strong determinants of individual decision powers and then the final allocation of resources within couples. These new variables may capture the effect of social norms, cultural determinants, that are found to impact decision-making within couples.

6. Conclusion

This paper provides, for the first time, direct comparisons between an empirical sharing rule directly available from the data, and a theoretical sharing rule computed in the framework of the Collective Model. Surveys usually do not provide enough information to compute directly who gets what within couples. However, the new french Time Use Survey provides unique information allowing to compute a sharing rule representing both the allocation of time and money within the household. According to this empirical sharing rule, women receive on average 45% of the household full income. Then it seems important to compare determinants of this empirical sharing rule with predictions of the Collective Model, the most widespread representation of decision-making within couples. A first comparison is based on a simple model using an unique distribution factor, the sex ratio. The second part tries to evaluate whether adding more information about negociation within the Collective Model allows to bring estimations closer to the empirical sharing rule.

The sex ratio is found to not exert the assumed theoretical role, and it seems very important to find new distribution factors. This paper highlights some already used and some new distribution factors which exert an influence on the decision process. Particularly, the man's share seems to be impacted by biography elements: the employment situation of his mother and partner's mother, and the presence of child from past partnership. Indeed, if the mothers of the man and the woman were both employed full-time, he receives a higher share of household income, and if he has a child from a past partnership, he receives a lower share. On the other hand, the woman's share in mainly influenced by the professional situation of partners when they met for the first time (if the man had a stable job when they met while the woman did not work or had an insecure job, she receives a lower share of the household income), and by number of years since they live together (she receives less over the years since they live together).

Several conclusions can be drawn. First, it appears that taking into account domestic production when analyzing the sharing of resources within couples largely matters. Indeed, predictions of the collective model and the empirical sharing rule are more divergent if we omit domestic production, both considering only usual determinants (wages, non-labour income and the sex ratio), but also considering additional information about non-traditional distribution factors. This confirms results of previous papers showing that domestic production matters and not taking it into account may bias results (Rapoport, Sofer and Solaz, 2011, for instance).

Then, globally, the Collective Model seems to overestimate the effect of variables on the share the woman receives, leading to underestimate intra-household inequalities within couples compared to the empirical sharing rule. Note however that this may be due to poor estimations from the collective model as they are mainly based on not-significant coefficients.
Finally, I show that even if adding some new distribution factors in the collective framework does not allow to improve the convergence with the empirical sharing rule, these new distribution factors do matter in the decision-making of couples. It appears that classical distribution factors explain well partners' labour supply, but as soon as we aim at better understanding negociation powers and decision-process within couples, economic variables are not enough. Indeed, non-monetary variables, as social norms, culture, gender roles are likely to influence decision powers, although not observable. However, it is shown in this paper that introducing some variables which partly capture these norms, particularly biography elements about partners, allows to better understand the empirical sharing rule as they constitute good determinants in explaining the allocation of resources. Moreover, the shares received by the woman and the man seem to be driven by different factors, which seems to indicate that social norms result in different observed determinants for the man and the woman. Thus, non-economic variables are a key determinant of the allocation of time and money within couples as they capture a part of these unobserved social norms.
In addition, we notice that the introduction of non-monetary determinants appears more significant in labour supplies of the second model, thus when domestic production is taken into account. Gender norms may also influence the determination of domestic work times of the man and the woman, and these new distribution factors allow to better represent the allocation of resources in model 2, in which domestic production in included.

Moreover, one reason why estimations of the collective model do not converge towards results from the empirical one may be that the efficiency assumption in which the collective model is based is not entirely satisfied. The estimation of the theoretical sharing rule is also based on quite strong assumptions, as the fact that the domestic good is marketable, there is a strict separability in the individual utilities between the "other" goods and the private sphere.

Finally, modelizations allowing the existence of social constraints leading to a second-best optimum, may be considered to better understand the whole allocation of resources within couples,

and constitutes a line for further research.

Appendix 1: Proof of derivatives of the theoretical sharing rule

Recall that $\rho = \rho_f$. By differentiation of the labour supply equations

$$H^f = L^f(w_f, \rho(w_f, w_m, y, \mathbf{s}))$$

$$H^m = L^m(w_m, \Pi(w_f, w_m) + y + (w_f + w_m)T - \rho(w_f, w_m, y, \mathbf{s}) - A)$$

we obtain:

$$\begin{aligned}
\frac{\partial H^f}{\partial w_m} &= \frac{\partial L^f}{\partial \rho}\frac{\partial \rho}{\partial w_m} \\
\frac{\partial H^m}{\partial w_f} &= \frac{\partial L^m}{\partial \rho_m}\left(\frac{\partial \Pi}{\partial w_f} - \frac{\partial \rho}{\partial w_f} + T\right) \\
\frac{\partial H^f}{\partial w_f} &= \frac{\partial L^f}{\partial w_f} + \frac{\partial L^F}{\partial \rho}\frac{\partial \rho}{\partial w_f} \\
\frac{\partial H^m}{\partial w_m} &= \frac{\partial L^m}{\partial w_m} + \frac{\partial L^m}{\partial \rho_m}\left(\frac{\partial \Pi}{\partial w_m} - \frac{\partial \rho}{\partial w_m} + T\right) \\
\frac{\partial H^f}{\partial y} &= \frac{\partial L^f}{\partial \rho}\frac{\partial \rho}{\partial y} \\
\frac{\partial H^m}{\partial y} &= \frac{\partial L^m}{\partial \rho_m}\left(1 - \frac{\partial \rho}{\partial y}\right) \\
\frac{\partial H^f}{\partial s} &= \frac{\partial L^f}{\partial \rho}\frac{\partial \rho}{\partial s} \\
\frac{\partial H^m}{\partial s} &= \frac{\partial L^m}{\partial \rho_m}\left(-\frac{\partial \rho}{\partial s}\right)
\end{aligned}$$

The sharing rule being conditional to the level of the "other" expenditures, A is a constant and is removed in the derivatives of labour supplies.

Note that, with reference to the results in Rapoport, Sofer and Solaz (2011), only $\frac{\partial H^m}{\partial w_f}$ and $\frac{\partial H^m}{\partial w_m}$ include a new specific term T.

We define $A = \frac{\partial H^f/\partial w_m}{\partial H^f/\partial y}$, $B = \frac{\partial H^m/\partial w_f}{\partial H^m/\partial y}$, $C = \frac{\partial H^f/\partial s}{\partial H^f/\partial y}$, $D = \frac{\partial H^m/\partial s}{\partial H^m/\partial y}$. The partial derivatives of the sharing rule with respect to wages, non-labour income and the distribution factor are given by: $\frac{\partial \rho}{\partial y} = \frac{D}{D-C}$; $\frac{\partial \rho}{\partial s} = \frac{CD}{D-C}$; $\frac{\partial \rho}{\partial w_m} = \frac{AD}{D-C}$. Only $\frac{\partial \rho}{\partial w_f}$ is modified. From Hotelling's lemma, we obtain : $\frac{\partial \Pi}{\partial w_f} = -t_f$, and then $\frac{\partial \rho}{\partial w_f}$ is given by: $\frac{\partial \rho}{\partial w_f} = \frac{BC}{D-C} - t_f + T$. Note that $-t_f + T$ is fully observed in the data.

If there are several distribution factors, then Chiappori, Fortin and Lacroix (2002) show that distribution factors can enter labour supply functions only through the same function ρ. This

implies that

$$\frac{\partial H^f/\partial s_r}{\partial H^f/\partial s_1} = \frac{\partial \rho/\partial s_r}{\partial \rho/\partial s_1} = \frac{\partial H^m/\partial s_r}{\partial H^m/\partial s_1}$$

for all r. Moreover, equations $\frac{\partial \rho}{\partial s_r} = \frac{C_r D_r}{D_r - C_r}, \quad \forall r = 2, ..., R$, are obtained in the same way as the equation for $\frac{\partial \rho}{\partial s}$ in the case of one distribution factor.

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