The Division of Labour within the Household: Is There any Escape from Traditional Gender Roles?

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Abstract

The effect of women's strong investment in career and her relative position in the household on the division of labour within the household particularly the share of male partner in the household work is an important but somehow unaddressed issue. This paper uses the French Time Use Survey to identify the indicators of strong female investment in career, focusing on high-careered women, and looks into the possible effect on the gender division of labour particularly the male share of household work. The study focuses on the couples where both partners participate in the labour and suggests possible indicators of strong female investment in career. An index based on the identified indicators is also developed and tested for the possible influence on the gender division of labour within the household. The effect of any extra help available for housework is also considered in an extended model estimated by full information maximum likelihood method.

Introduction

Now that more and more time use surveys are available in more and more countries, international comparisons show that a new model of division of labour between men and women seems to be emerging. The women's participation rate in the labour market that was low in most countries at the beginning of the XXth century (Marchand et Thélot, 1991, Sofer, 2005), especially concerning salaried work, has been strongly increasing during the second half of the century. The picture emerging today, though, seems that besides this massive participation of women in the labour market in most developed countries, the sharing of time among men and women between market work and household work is still highly differentiated by gender (Goldschmidt-Clermont and Pagnossin-Aligisakis,1995, Rizavi and Sofer, 2008). In particular, women in Europe spend roughly between 60 and 70% of their working time doing household work and between 30 and 40% working in the market, while men devote between 55% and 65% of their working time to market work and thus between 35% and 45% only to household work, with a total working time generally higher for women

than for men (Winquist, 2004). Though it could be thought that observed differences between men and women in variables such as wages might explain, at least partly, that women invest less than their partner/companion in the labour market and more in the family (Becker, 1981, Lundberg and Startz, 1983, Coate and Loury,1993), the gender division of labour still remains a mystery, at least for an economist: education, wages or other measurable variables are found having a very small impact, if any, upon the sharing of household work (Hersch and Stratton, 1994, Anxo et Kocoglu, 2002, Aronsson et al, 2001, Rapoport and Sofer, 2005). Note that this result by itself might seriously challenge the often made assumption of Pareto-optimality of household decision making, notably in "collective" models (Chiappori, 1988, 1992, 1997).

The figures mentioned above are average values for households whose adult members are aged from 20 to 74 years. What has been already shown is that partners/companions whose wives participate into the labour market do more household work than those whose wives remains at home (Chadeau and Fouquet, 1998), which is not really surprising, of course. What we want to look at, here, is if we can explain, at least partly, why some couples have a less "traditional division of labour" and what variables, if any, are likely to drive this. The aim of this paper is to look more in depth at the sharing of work, including household work within the household. More precisely, as we know from the previous works cited above that looking at education and wages alone will not give the results we are looking for; we try to identify in a first stage couples of which the wives strongly invest in their professional life. We identify these women using several criteria, which are the following: they are spending more time than one's group average on the market; or they have reached a higher occupation than one's group average; or they have a higher wage than one's group average; or, finally, they have a higher wage than one's partner. As will be explained below, we tried several definition of one's "group". We use these variables separately as well as together with building an index of a strong professional investment. Then, in a second stage, we study, conditional on their wife's strong investment in professional life, how the partners spend their time, and, especially their time working at home. Do these households deviate from the "norm", i.e. show evidence of a more egalitarian division of domestic labour, in the sense that they share the time spent to household work more equally? Do partners in that case do more household work than average, or do a larger share of household work? Or does the household rather rely on an external help? Finally, in a last stage, as the decision making process implies making simultaneously all the choices relative to market and household work for both partner and wife (this is true for collective models including household work –see Apps and Rees, 1997,

1999, Chiappori, 1997-, but also for most other models, including those where the final allocation is possibly non optimal), all the choices mentioned above become endogenous.

To do this, we use the last French Time Use Survey available, the 1997-1998 Enquête Emploi du temps run by the INSEE.

In the first section we first give a description of a few stylised facts related to the gender division of labour. In a second section, we describe the data used in the estimations, and then suggest different indicators of the women's strong investment in professional life and later construct an index for this. In a third section, we estimate men's amount and share of household work using these indicators, as well as the index previously defined. We also run probit equations based on this index to determine which variables have an impact upon the choice of a career by women. In the last section, we estimate a complete model of simultaneous equations of both market and household work for both partners and wife, adding an equation for the choice of a strong investment of the wife in a career. We further extend this model to consider any kind of extra help available for household work to both the partners. The estimation in the last two models is done by the full information maximum likelihood method.

1- The gender division of labour within the household: A few stylised facts

Table 1 comes from a report of the European Commission (Winqvist, 2004). The authors report from Time Use Surveys run in a similar way in different countries. The information is especially reliable as the surveys include the filling of a diary by (at least) one member of each household interviewed. The diary describes the use of time every ten minutes The surveys described here have been run in ten European countries between 1998 and 2002: Belgium (BE), Germany (DE), Estonia (EE), France (FR), Hungary (HU), Slovenia (SI), Finland (FI), Sweden (SE), United Kingdom (UK) and Norway (N0).The survey methods that have been used in these countries follow very closely the guidelines on harmonised European time use survey published in September 2000. Therefore, the results can be considered comparable.

The different domestic tasks recorded are now standard in time use surveys and are described in Appendix 1.Let us look first at the sharing of household work, then at that of total work

1.1 The gender division of household work

The sharing of household work appears in table 1 below, which gives the time spent in domestic tasks by men and women aged 20 to 74 of the different countries mentioned.

Table 1 shows that the sharing of domestic work between men and women is remarkably stable among the different countries included in the survey: the women's share of household work is between 60 % and 2/3 of the total. Within this range, countries are more or less egalitarian: especially Sweden, and slightly behind, Nordic countries (here Norway and Finland), with Belgium are the countries where the sharing is the most equal. Conversely, France is the country where inequality is highest (with men doing only 34% of all domestic work).

Table 1. Domestic work total of persons aged 20 to 74 in 10 EU countries

	BE	DE	EE	FR	HU	SI	FI	SE	UK	NO
Hours and minutes per day										
Total	3.36	3.17	4.01	3.28	3.5	3.5	3.08	3.06	3.18	3.04
Women	4.32	4.11	5.02	4.30	4.57	4.57	3.58	3.42	4.15	3.47
Men	2.38	2.21	2.48	2.21	2.39	2.39	2.16	2.29	2.18	2.22
Share of total time spent by women and by men %										
Women	63	64	64	66	65	65	63	60	65	62
Men	37	36	36	34	35	35	37	40	35	38
Proportion of people who spent any time on the activity, % per day										
Total	94	92	93	89	92	90	94	95	93	95
Women	97	97	98	97	97	97	98	98	97	98
Men	90	88	87	81	86	82	90	92	88	93

Source: Winqvist, 2004 Table 5.1

This unequal sharing also corresponds to a strong specialization among domestic tasks, with women rather specialized in laundry and cooking, for example, and men rather in repairs. Only a few tasks, like shopping and gardening are shared quite equally. Also note the differences between countries in the total number of hours spent on domestic tasks, with much more time spent in eastern countries (Estonia, Slovenia and Hungary) than in Nordic Countries where it is the lowest.

The situation becomes still worse when considering time devoted to child care only. The comparison is made in table 2 below for 6 countries. Women spend a still larger share of the time spent in child care in any of the countries considered here. This remains true when both parents are employed. :

Table 2. Time spent by parents with children aged up to 9

	DE	SI	FI	SE	UK	NO
Hours and minutes per day						
All parents						
Total	5:37	5:14	6:21	6:06	7:03	5:24
Women	6:58	6:09	7:57	7:10	8:35	6:19
Men	4:06	4:07	4:24	4:56	5:10	4:22
Employed parents						

Total	3:58	5:02	5:35	5:56	6:19	5:10
Women	6:00	5:55	7:08	7:01	7:44	6:04
Men	4:46	4:05	4:18	4:50	5:09	4:20

Note : Time spent with children aged up to nine living in the same household was measured with a separate diary column. Being together covered doing things together, or just being in the same place or room as the child. Sleeping time was excluded. Minor differences in the measurement of time spent with children occurred between the countries that limit accurate cross-national comparisons, for example, in the United Kingdom, being together covered being in the same house, which may have resulted in over-reporting. This table includes parents with children aged up to 9.

Source : Winqvist, 2004 Table 5.14

One reason for this, as we are going to see below, is that on average women spend less hours in the market than men. Part time work is very common among mothers of young children, especially in countries such as Sweden or the United Kingdom. This can be seen in table 3 below which shows the sharing of each type of work between men and women..

1.2. The gender division of total work

Table 3. Gainful and domestic work of persons aged 20 to 74

	BE	**DE**	**EE**	**FR**	**HU**	**SI**	**FI**	**SE**	**UK**	**NO**
	Hours and minutes per day									
Women										
Gainful work	1 :53	1 :52	2 :27	2 :17	2 :19	2 :42	2 :33	2 :53	2 :24	2 :38
Domestic work	4 :32	4 :11	5 :02	4 :30	4 :57	4 :57	3 :56	3 :42	4 :15	3 :47
Total work	6 :25	6 :03	7 :29	6 :47	7 :16	7 :39	6 :29	6 :36	6 :39	6 :25
Men										
Gainful work	3 :15	3 :20	3 :35	3 :48	3 :34	3 :54	3 :48	4 :11	4 :10	4 :04
Domestic work	2 :38	2 :21	2 :48	2 :21	2 :39	2 :39	2 :16	2 :29	2 :18	2 :22
Total work	5 :53	5 :41	6 :23	6 :09	6 :13	6 :33	6 :04	6 :41	6 :29	6 :26
	BE	**DE**	**EE**	**FR**	**HU**	**SI**	**FI**	**SE**	**UK**	**NO**
	Shares of gainful and domestic work, %									
Women										
Gainful work	29	31	33	34	32	35	39	44	36	41
Domestic work	71	69	67	66	68	65	61	56	64	59
Total work	100	100	100	100	100	100	100	100	100	100
Men										
Gainful work	56	59	56	62	57	60	63	63	65	63
Domestic work	44	41	44	38	43	40	37	37	35	37
Travail total	100	100	100	100	100	100	100	100	100	100

Note : Gainful work includes hours worked in first and second jobs, overtime, work brought home, training during working hours and business trips. Working hours do not include lunch breaks and daily travel to and from work. Domestic work includes work done for own household. Source : Winqvist, 2004

Table 3 shows that even if women work more hours at home, conversely men work longer hours in the market, often even twice more than women, as in Belgium, in Germany, or in the U.K. However, almost everywhere, women spend more time than men in total work: more than one extra hour on average in eastern countries (Slovenia, Estonia and Hungary), nearly 45 minutes more in France. Only very few countries show a more equal division of labour:

Norway with a difference between men and women of 1 minute, Sweden, which is the only country in the list (and probably the only one in the world) where men work –slightly- more than women. It can also be noted that domestic work represents between 56 % and slightly more than 70 % of women's total work while the corresponding figures for men are 35 % to 45 % of total work spent at domestic work.

In spite of the now massive participation of women in the labour market, the gender division of labour, though it generally does not imply anymore a complete specialization still remains highly differentiated by gender. Is it only a result obtained on average, possibly due to average differences in women's and men's wages, for example? Or are usual economic variables of little help in explaining this phenomenon. This is what we are going to study now.

2- Women strongly investing in a career: data and indicators

2.1. The data

The French Time-Use survey (Enquête Emplois du temps) is the survey used for France in the previous tables. Is is this survey which we use here for the empirical work. It was conducted by INSEE in 1998-99 and aimed to measure daily activities as precisely as possible. This survey is the one used fro France in the previous section? It was conducted in successive stages throughout the year, so as to avoid seasonal effects. On the day of the survey, the respondents write down their activities, indicating the time spent on each activity, according to 10-minute time periods. Several activities may be performed at the same time; in this case, two activities are listed, one being considered as the main activity and the other as secondary. All household members above 15 are surveyed.

The survey includes:

- A base of 8,186 households, of which 7,460 are complete (i.e. in which all household members filled in a time use booklet and an individual questionnaire);

- A base of 20,370 individuals, among whom 16,442 are at least 15-year old;

- A base of activities, containing one observation per completed booklet line, with 316,097 observations. 144 different types of activities are listed. They have been regrouped on the basis of activities of the same type by INSEE. The list of the activities which are used here is given in Appendix 1.

Table 4 below gives a brief statistical description of the sample of couples where both partners participate in the labour market activities. It also includes a distribution of the sample across different categories of the indicators of strong female investment in career. It also shows the percentage of female and male respondents having different levels of education. Out of the seven indicators given in this table, five were selected later for use in the construction of the indices of strong female investment in career.

Table 4. Description of the sample of 1737 couples (French time use survey 1998)

Variable	Observations	Mean (weighted)	Standard Deviation
Male hourly wage	1520	62.244	36.255
Female hourly wage	1561	53.150	34.929
Male monthly salary	1523	10913.500	5775.131
Female monthly salary	1573	7641.064	4112.082
Ratio of monthly salary (M/F)	1447	1.893	2.732
Ratio of male to female hourly wage	1435	1.382	1.026
Employment in labour market in minutes per day (men)	1737	293.546	248.478
Employment in labour market in minutes per day (women)	1737	237.665	227.451
Time spend in household work in minutes per day (men)	1737	158.655	142.826
Time spend in household work in minutes per day (women)	1737	259.282	157.652
Difference in household working minutes (male minus female)	1737	-100.628	179.312
Ratio of household working minutes per day (male/female)	1737	0.926	1.733
Number of children up to 3 years of age	1737	0.128	0.351
Number of children from to 3 to 15 years of age	1737	1.209	1.068
Age of Male	1737	41.343	8.983
Age of female	1737	39.239	8.777
Percentage according to different dummy variables			
Education		**Female**	**Male**
Without diploma/CEP/DFEO		17.16	18.6
BEPC,CAP,BEP		38.23	43.75
BAC (general and technical)		15.83	12.61
Bac+2 and Greater		28.79	25.04
Percentage of individual (females) identified by indicators of investment in career			
	0 = No	**1 = Yes**	

Salary>husband	78.58	21.42
Diploma>husband	67.01	32.99
position>husband	88.72	11.28

2.2. Indicators of a female strong investment

In order to develop the indicators in the shape of dummy variables that indicate the strong female investment in career, keeping in mind the limitations of the Time Use Survey, we identified four factors that, in any way, may reflect the fact that a woman invests strongly in her career. They can, alternatively, be: working more, have higher salaries, have higher education levels and may have better occupational status than their reference group/person.

We looked into three types of reference groups. The first one is based on the education levels and the second based on their respective occupational status or type of profession. A third reference for the woman is her partner, we consider this possibility also.

The survey used here reports the monthly salary of all individuals in the sample. Women with higher investment in career may be earning more than their 'type' in each of the respective reference groups based on diploma, occupational status or partner, as classified below.

Also, the women that strongly invest in their career may have the tendency even before starting the career and hence may have already invested in the shape of attaining higher education levels than their reference group/person.

Finally, it may be thought that the women strongly investing in career would be in a better occupational status as compared to the average of their reference group or to their partner. The following indicators were developed based on the above mentioned idea. We further dropped from the tables those which were never significant in the regressions.

1. ***More work/diploma:*** We classified the women by distributing them into four different levels of education, corresponding to the highest diploma obtained. The four levels used were without diploma/

CEP/DFEO, BEPC/CAP/BEP, BAC (general and Technical) and Bac+2 and greater, all based on French education system. In each sub-group we identified the women whose number of weekly working hours is greater than the average plus standard deviation of their respective sub-group. These women were assigned a value '1' in the dummy variable 'More work/diploma'.

2. ***High wage/diploma:*** Based on the above classification of women by their education levels, we identified the women who earn a higher monthly salary than the average plus standard deviation of the women in each sub-group of education. They are assigned a value '1' in the dummy variable 'High wage/diploma. This indicator was never found significant, though, and hence was dropped later on in the presentation of the tables.

3. ***More work/position:*** By position we mean the occupational status identified by the variable *'position professionnelle de l'emploi'*. Initially, the variable identifies 5 positions (from unqualified blue collar to manager –cadre supérieur, profession libérale-), to which we added a sixth category for independent work. After this re-grouping, we identified the women whose number of weekly working hours is greater than the average plus standard deviation of their respective sub-group of occupational status.

4. ***High wage/position:*** Based on the above classification of women by their occupational status, we identified the women who earn a higher monthly salary than the average plus standard deviation of the women in each sub-group of occupational status. They are assigned a value '1' in the dummy variable 'High wage/position.

5. Higher relative position: It may be thought that the women strongly investing in their career may be in higher relative position when compared to the sub-group having the same education level like her. This indicator was never significant either, and hence was dropped from the tables.

The three last indicators consider the partner as the reference person. Here, as each of these indicators implies a higher cost of time of the woman as compared to the man, as well as a better bargaining power, we would expect a higher investment of the male partner in household work, at least compared to hers.

6. Higher education than the life partner: A dummy was developed to identify the women who posses a higher education level than their life partner.

7. Higher salary than the life partner: Another dummy was developed to identify the women who earn a higher monthly salary than their life partner.

8. Better occupational status than the life partner: Finally, a dummy indicates whether the woman has a higher occupational status than her partner.

We also constructed an index based on the previous indicators of strong investment in career. This was done by adding some or all dummy variables mentioned above, taking into

account their effects as measured in OLS regressions (see tables in section 3 below). Different indices were tried and the one retained is addition of the following dummy variables:

Index: (ISP567): *For details please see the appendix.*

The index we suggested was constructed in two steps.

Step I: First The hourly salary in each group of occupational status was considered. . In each group of occupational status, we allocated scores on the basis of where the hourly salary of the women lies based on four cut-off values that depend on the average and standard deviation of the hourly salary of women in each subgroup of her employment position (See appendix for details on employment position and construction of the index. This score show where a women is located within her type of occupational status according to her hourly salary.

Step II: Additional scores were given according to the three indicators related to the partner (where her monthly salary, employment position and educational levels are better than her partner) i.e. the indicators that show the women's relative position with her partner. This new sum was remapped from 0 to 4 to generate five values or levels.

We consider that the women who tend to invest intensively in their career would be located in higher hourly salaries as compared to other women in the same occupational status.

In the table below we give the figures for women having wages or work greater than average plus standard deviation in their respective group. Others like falling in different locations like being above average plus one standard deviation or above average plus two standard deviations are not shown in order to keep the table simple.

Table 5. Average household work (minutes per day) by different indicators of female investment in career

	0		1	
INDICATORS	**Female**	**Male**	**Female**	**Male**
High Wage/position	**266.27**	**161.85**	**222.70**	**156.13**
High Wage/education	**264.73**	**162.54**	**232.40**	**151.25**
More Work/position	**263.11**	**161.36**	**234.26**	**133.22**
More Work/education	**265.06**	**162.77**	**213.72**	**119.22**
Salary>husband	**264.97**	**161.28**	**238.81**	**173.23**
Diploma>husband	**268.65**	**153.93**	**252.67**	**169.60**
position>husband	**264.98**	**158.03**	**248.27**	**186.81**
	Index (ISP567)			
Status	**Female**		**Male**	
0	**320.15**		**155.15**	
1	**273.16**		**156.81**	

2	**243.94**	**159.14**
3	**249.33**	**172.00**
4	**255.68**	**179.82**

Both indexes take values 0 to 4, a higher value indicating a better situation in the labour market relative to the reference group (same diploma for Index-1, same occupational status for Index-2, and relative to the partner.

Table 5 above shows the sample average of household work for both women and men by different indicators of strong female investment in career. The first observation can easily be made that the female possessing the characteristic identified by any indicator work less at home than the females not in the sub-group identified by the indicators.

Table 6. Cross frequency tables for seemingly related Indicators

		Diploma>partner	
	Corr. coefficient= 0.195	**0**	**1**
Salary>partner	**0**	**813**	**324**
	1	**152**	**158**
		Diploma>partner	
	Corr. coefficient= 0.242	**0**	**1**
position>partner	**0**	**913**	**384**
	1	**44**	**95**
		Salary>partner	
	Corr. coefficient= 0.298	**0**	**1**
position>partner	**0**	**1018**	**215**
	1	**57**	**80**
		Higher Wage/position	
	Corr. coefficient= 0.110	**0**	**1**
Salary>partner	**0**	**1031**	**98**
	1	**256**	**52**
		Higher Wage/position	
	Corr. coefficient= -0.026	**0**	**1**
position>partner	**0**	**1109**	**132**
	1	**127**	**11**
		Higher Wage/position	
	Corr. coefficient= 0.061	**0**	**1**
Diploma>partner	**0**	**942**	**98**
	1	**451**	**70**
		Higher Wage/diploma	
	Corr. coefficient= 0.100	**0**	**1**
Salary>partner	**0**	**1038**	**91**
	1	**261**	**47**
		Higher Wage/diploma	

	Corr. coefficient= 0.058	**0**	**1**
position>partner	**0**	**1132**	**109**
	1	**118**	**20**
		Higher Wage/diploma	
	Corr. coefficient= -0.015	**0**	**1**
Diploma>partner	**0**	**936**	**104**
	1	**474**	**47**

This average is also well below the female average of the entire sample shown in table 4. Secondly, with few exceptions, the male average household work also decreases a bit if the female belongs to a high-careered group identified by an indicator. The reason may be the marriage selection model according to which women with better education or career growth potential select partners of the same type and hence the males as well work less then the overall average indicated in table 4.

But the difference in the average household work of men and women decreases if the female belongs to the so called high-careered sub-group. If we look at the indices, we may notice that, somehow, as the index value increases, the differences in household work of male and female partners decreases. This can be a two way phenomenon; the male participation in the household work may increase along with a decrease in a 'high-careered' female.

We checked if the selected indicators used to build the indexes were highly correlated, or not: are women who have a higher diploma relative to their partner generally also have a higher wage? or higher status? Do women who have a higher wage than their peers with the same diploma also generally have a higher wage than their partner? We present in table 6 cross tabulations and correlation coefficients for couples of indicators which might, at first sight at least, thought to be strongly correlated. As appears in the table 6, it appears that it is not necessarily the case. The highest correlation is found between having a higher wage than one's male partner and having a higher position than him. However, the correlation coefficient is less than 0.3 in that case.

Two negative correlations (but very close to 0) are even found: the first one for having a higher position than one's partner and having a higher wage as compared to other females in the same position, and the second one for having a higher diploma than one's partner and having a higher wage as compared to other females with the same diploma.

3- Estimation results

Here we present the estimation results based on a simple model but in section 4 we will deal with a model that considers the simultaneity of decisions in the labor market and the

household. The household members decisions relative to work in the market and at home are taken simultaneously and the corresponding complete model will be estimated in the next section. In this section we estimate simple models, considering the woman's investment in a work career as exogenous in the first estimations, and running simple probit estimations in order to explain her choice in a second stage.

3.1 Probit estimations of a strong female investment in market work: Who invests?

First we present some binary and ordered probit estimates that may enable us to look into the fact that which type of women tent to be a part of the strong investors in career. Table 10 provides the binary probit estimates of four of the indicators of strong female investment in career that have been used in the construction of our first index of female investment in career. Later, table 8 will provide an ordered probit estimate of one of the indices of female investment in career. It is evident that the presence of children in the household, both below three and from three to fifteen years of age, plays a role in the decision to invest strongly in career. The educational variables are also highly significant. Another variable that indicates any regular external aid for house work shows a very good significance although one may fear that there may a problem of endogeneity.

Table 7. Probit Estimates for various indicators of female investment in career

Dependent Variables in first row	Diploma>husband		position>husband		Salary>husband		Higher Wage/position	
Children>3	-0.2157**	-0.3226***	-0.0675	-0.2042	-0.0227	-0.182	0.2435*	0.2578*
	[2.26]	[2.99]	[0.57]	[1.40]	[0.21]	[1.46]	[1.90]	[1.89]
Children 3 to 15	-0.0068	0.009	-0.0844**	-0.0649	-0.0916**	-0.0719	-0.1069**	-0.0773
	[0.21]	[0.25]	[1.98]	[1.27]	[2.39]	[1.57]	[2.45]	[1.62]
Age (Female)	-0.0085**	-0.0062	0.006	0.0069	-0.0013	-0.0011	0.0420***	0.0469***
	[2.01]	[1.32]	[1.10]	[1.08]	[0.27]	[0.19]	[7.32]	[7.47]
Rural (Yes/no)	0.1990***	0.2045**	0.1352	0.1558	0.0378	-0.033	-0.2674***	-0.3053***
	[2.68]	[2.45]	[1.37]	[1.35]	[0.43]	[0.32]	[2.58]	[2.73]
BEPC,CAP,BEP	0.7724***	0.8163***	0.3038*	0.4746**	0.2480**	0.2294	0.9288***	0.8434***
	[6.20]	[5.68]	[1.78]	[2.08]	[1.99]	[1.52]	[5.41]	[4.65]
BAC (Gen & Tech)	1.5804***	1.6697***	0.6734***	0.8960***	0.0945	0.0602	1.0886***	1.0731***
	[11.48]	[10.52]	[3.63]	[3.68]	[0.63]	[0.33]	[5.76]	[5.35]
Bac+2 and Greater	1.4017***	1.3915***	1.1684***	1.3117***	0.7484***	0.5093***	1.0540***	0.8113***
	[10.94]	[9.39]	[7.03]	[5.85]	[5.88]	[3.32]	[6.02]	[4.35]
External aid for housework	0.4660***	0.4050**	-0.195	-0.5075	0.5579***	0.5170**	0.2841	0.1542
	[2.69]	[2.07]	[0.80]	[1.61]	[2.88]	[2.42]	[1.30]	[0.64]
Log of ratio of		-0.4574***		-0.8832***		-2.1662***		-0.7060***

hourly wages (Male/Female)		[5.75]		[7.71]		[16.73]		[6.83]
Constant	-1.1589*** [5.17]	-1.2076*** [4.85]	-2.0418*** [6.93]	-2.2492*** [6.33]	-1.0227*** [4.29]	-0.8961*** [3.21]	-3.5842*** [11.15]	-3.6216*** [10.49]
Observations	1736	1434	1639	1416	1446	1434	1572	1434

Absolute value of z statistics in brackets

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

Table 8 gives the ordered probit estimate of one of the index of strong female investment in career. The importance of children less than the age of three is as expected. Age and education seem to strongly influence the probability of a women being an investor in career. External aid received is also found to be relevant. On the other hand, the ratio of wages may reflect the phenomenon that the more the male partner has an upper hand in the household (reflected, as we assume, by the ratio of wages), the less the chances for the female to be a strong investor in career. In the third model we find that the difference in household work and the relative professional position of women with respect to her partner is important in determining the women's investment in her career.

Table 8. Ordered Probit Results for Index of women's investment in career

	Dependent Variable: Index of investment in career		
	I	**II**	**III**
Children<=3	-.2027469 **	-.2021865 **	-.1570851 *
Children 3 to 15	-.0335178	.0122884	-.0178303
Log of hourly salary	2.344248 ***	1.633872 ***	2.501893 ***
Age (Female)	-.0129144 ***	.004678	-.0148242 ***
BEPC,CAP,BEP	.4059148 ***	.5917348 ***	.3861516 ***
BAC (Gen & Tech)	.6313655 ***	1.053455 ***	.5490213 ***
Bac+2 and Greater	.0891467	.5105584 ***	-.146339
External aid for housework	.506786 *	.3811738 **	.6332715 ***
Log of ratio of hourly salary (m/f)		-1.258629 ***	

Household work difference in minutes (Man – woman)			.0003325 **
Women's professional position better than man (Dummy)			1.257052 ***
Observations	1418	1416	1360

Absolute value of z statistics in brackets

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

3.2 A 2SLS simultaneous model of household division of labour

The following table shows the results of the 2SLS simultaneous estimation of the parameters of both the household work of men and women. Few conclusions can be drawn at first sight. We can see that children play an important role in the household division of labor. Both men and women seem to increase household work when they have children. The increase is larger in case of children of less than three years of age. The increase in household work of women is much larger and significan. Educational levels have different effect. The men tend to work a little bit more in the household with higher educational levels which is significant in some cases.

Table 9: 2SLS Simultaneous estimation of household work of men and women

	Equation 1 - ***Dependent Variable : Household Work of Men***	**Equation 2 -** ***Dependent Variable : Household Work of Women***
Children < 3	45.08 *	118.41 *
Children 3-15	12.83 *	27.29 *
Rural	16.59 ***	8.23
Age (Man)	1.01 **	
Age (Woman)		1.16 **
BEPC,CAP,BEP (Man)	21.50 **	
BAC (Gen & Technical) - (Man)	21.42	
Bac+2 and Greater - (Man)	2.10	
BEPC,CAP,BEP (Woman)		-22.97 ***
BAC (Gen & Technical) - (woman)		-23.23
Bac+2 and Greater - (Man)		-37.34 *
Week Day	-71.20 *	-60.62 *
Index (remapped)	14.98 ***	-25.09 *
Constant	124.78 *	239.87 *

** Significant at 1%, ** Significant at 5%, *** Significant at 10%*

On the other hand, women tend to reduce their household work load with higher educational levels which may be due to increases participation in the Labour market. During weekdays both men and women work lesser within the household. The coefficient of the index is also significant. Here we have remapped the index to generate a binary variable where an original value of zero or one is given an value zero and those of 2 or above are mapped to unity showing that the women is a strong investor in her career. We can observe that if the women is a strong investor in her career then she decreases the household work. On the other hand the man increases the household work but not as much as the decrease by women.

4- A more complete model

A more complete model reflects the simultaneity of the decisions taken in the household concerning the different types of labour of both its members. We use two cases; one without the second equation related to help and the second by including any help available to the couple for household work. What we estimate is:

$$I = \begin{cases} 0, \\ 1, \\ 2, \\ 3, \\ 4 \end{cases}$$

I = Index of female career investment

$$H = \begin{cases} 0, \\ \text{or} \\ 1 \end{cases}$$

H =1 for help available for household work : used in case 2

$TD_f = \boldsymbol{\alpha}_{fs}\boldsymbol{X}_f$ are domestic work by the female and the male

$TD_m = \boldsymbol{\alpha}_{ms}\boldsymbol{X}_m$

$TM_m = \boldsymbol{b_m Y_m}$ is the male market work

where $\boldsymbol{\alpha}_{is}$ ($i = f, m$) and $\boldsymbol{b_m}$ are the parameter vectors, $\mathbf{X}_i$ ($i = f, m$) and $\boldsymbol{Y_m}$ are the vectors of individual specific characteristics and household-specific productivity factors.

The model will be estimated by maximum likelihood method (ML). This method allows estimating simultaneously the ordered and continuous parts of the model in order to provide consistent standard errors.

Let g* be a criterion function associated with the intensity of the female investment:

$$g^* = \boldsymbol{\gamma}'\mathbf{Z} + u_1,$$

where **Z** is a vector of household-specific characteristics and female characteristics which are assumed to influence her choice of a career.

The index function can then be written as:

$$I = \begin{cases} 0, \text{ if } g^* \le \kappa_1, \\ 1, \text{ if } \kappa_1 < g^* \le \kappa_2, \\ 2, \text{ if } \kappa_2 < g^* \le \kappa_3, \\ 3, \text{ if } \kappa_3 < g^* \le \kappa_4, \\ 4 \text{ if } g^* > \kappa_4, \end{cases}$$

where k_1 ,k_2 ,k_3 and $k_4$are unknown parameters to be estimated.

Similarly let h* be a criterion function associated with the help available to the couple for household work as defined earlier:

$$h^* = \eta'Y + u_2,$$

The index function can then be written as:

$$H = \begin{cases} 0, \text{ if } h^* \le 0, \\ \text{ and} \\ 1 \text{ otherwise} \end{cases}$$

The system becomes:

$$I = \begin{cases} 0, \text{ if } g^* \le \kappa_1, \\ 1, \text{ if } \kappa_1 < g^* \le \kappa_2, \\ 2, \text{ if } \kappa_2 < g^* \le \kappa_3, \\ 3, \text{ if } \kappa_3 < g^* \le \kappa_4, \\ 4 \text{ if } g^* > \kappa_4 \end{cases}$$

$$H = \begin{cases} 0, \text{ if } h^* \le 0, \\ \text{and} \\ 1 \text{ otherwise} \end{cases}$$

and

$$TD_f = \boldsymbol{\alpha}_{fs}\boldsymbol{X}_f$$

$$TD_m = \boldsymbol{\alpha}_{ms}\boldsymbol{X}_m$$

$$TM_m = \boldsymbol{b}_m\boldsymbol{Y}_m$$

The error terms u_1, u_2, u_3, u_4, u_5 follow a 'penta-variate' standard normal distribution with zero mean and a positive semi-definite covariance matrix **Σ** (the variance of error term of equation describing the qualitative variables I and H are normalised to 1, ($Var(u_1) = Var(u_2) = 1$)[1]:

$$\sum = \begin{bmatrix} 1 & \sigma_{12} & \sigma_{13} & \sigma_{14} & \sigma_{15} \\ \sigma_{12} & 1 & \sigma_{23} & \sigma_{24} & \sigma_{25} \\ \sigma_{13} & \sigma_{23} & \sigma_3^2 & \sigma_{34} & \sigma_{35} \\ \sigma_{14} & \sigma_{24} & \sigma_{34} & \sigma_4^2 & \sigma_{45} \\ \sigma_{15} & \sigma_{25} & \sigma_{35} & \sigma_{45} & \sigma_5^2 \end{bmatrix}$$

with $\sigma_{ij} = \text{cov}(u_i, u_j)$, I, j=1, 2, 3, 4, 5 and $i \neq j$; $\sigma_i^2 = Var(u_i)$, $i = 3,4,5$

[1] For the reduced and simpler model we can simply delete the second column and second row of the covariance matrix and will be left with a four by four covariance matrix.

The maximum likelihood function corresponding to the system of equations and the relevant derivations of the conditional means and variances can be seen in the appendix.

Where we here is take index as a remapped summation of a salary based index by six professional positions and three indicators of comparison with the partner by education, monthly salary and professional position.

Table 12: Estimation results for quadri-normal simultaneous maximum likelihood model with wages and non-salary revenue

Log likelihood = -28711.161

Observations: 1416
Wald chi2 (10): 195.16
Prob > chi2: 0.0000

Dependent variables: →	Equation 1 Women's household work	Equation 2 Man's household work	Equation 3 Man's market work	Equation 4 Index of investment in career
Log of hourly salary- Men			-19.35342	-1.306713 ***
Log of hourly salary- women			12.58185	2.89695 ***
Non-salary revenue			-.0001961	-6.55e-06
Children >3	118.6698 ***	43.07488 ***	-3.51989	-.1688452 *
Children 3-15	28.30678 ***	12.7738 ***	-10.15662 *	.0038374
Age (man)		1.919538	10.9588 *	
Age-(man) squared		-.0117466	-.1421299	
Age (woman)	-.7955735			.032289
Age-(woman) squared	.0213115			-.0003196
BEPC,CAP,BEP	-31.37167 ***	21.81935 **	-28.72175 *	.6062566 ***
BAC (Gen & Tech)	-34.68828 **	20.88041	-44.19284 **	1.096976 ***
Bac+2 and Greater	-49.98828 ***	7.454615	-16.18515	.5544882 ***
Age difference (M-Femal)				.0146982 *
Rural dummy	8.787773	17.97489 **	-27.49376 **	
Week day	-63.51538 ***	-71.8357 ***	320.8124 ***	
Number of rooms in household	2.7318	-1.086967	11.87027 **	
Index value is 1		20.52883		
Index value is 2		32.00919 *		
Index value is 3		34.13179 *		
Index value is 4		40.19231 *		
Constant	266.7115 ***	91.13715	-112.3147	
Cut Value-1				4.464681 ***
Cut Value-2				6.660918 ***
Cut Value-3				7.923122 ***
Cut Value-4				8.824496 ***

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

Table 12 and 13 show the estimation results of a simultaneous quadric-normal maximum likelihood estimations. Table 12 includes wages in the male labour market equation and the index equation. The wages were removed in the next table with the view that, in a way, the

Table 13: Estimation results for quadri-normal simultaneous maximum likelihood model without wages and non-salary revenue

Log likelihood = **-29234.447**

Observations: **1419**
Wald chi2 (10): **189.68**
Prob > chi2: **0.0000**

Dependent variables: ⟶	Equation 1 Women's household work	Equation 2 Man's household work	Equation 3 Man's market work	Equation 4 Index of investment in career
Children >3	118.1456 ***	42.36143 ***	-3.357416	.0446603
Children 3-15	28.09132 ***	13.58854 ***	-10.15239 *	-.0675062 **
Age (man)		.8397432	10.60929 *	
Age-(man) squared		.0002318	-.1389608 *	
Age (woman)	-.8928635			.0939923 ***
Age-(woman) squared	.0227048			-.0009729 **
BEPC,CAP,BEP	-29.53958 **	16.54385	-22.63285	.6832851 ***
BAC (Gen & Tech)	-33.21897 **	12.50803	-35.64789 *	1.162691 ***
Bac+2 and Greater	-48.62446 ***	-5.602147	-7.409809	1.315302 ***
Age difference (M-Femal)				-.0058821
Rural dummy	8.101045	17.8007 **	-23.87145 **	
Week day	-62.46724 ***	-71.41318 ***	321.4648 ***	
Number of rooms in household	2.223687	-1.268186	10.16124	
Index value is 0		reference		
Index value is 1		40.86847 **		
Index value is 2		63.55503 **		
Index value is 3		74.77207 **		
Index value is 4		92.73884 **		
Constant	268.9518 ***	89.40671	-133.2058	
Cut Value-1				1.006665 *
Cut Value-2				2.479622 ***
Cut Value-3				3.372561 ***
Cut Value-4				3.9858 ***

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

female wages have been used in the creation of the index of female investment in career and may be affecting the results. This removal improves the results but does not heavily change the coefficients magnitude or significance.

The estimation is simultaneous and hence takes care of the interrelationships between the variables within the household and provides us the estimation in a framework of the collective model. The coefficients related to children and education dummies are significant in most of the cases. The coefficients of the index dummies show that as a woman strongly invests in her career, there is a significant increase in the male household work that increases from 20 to 40 minutes depending on the intensity of women's investment in career. Some of these coefficients are significant in case of table 12 and all are significant in the second case where we remove wages from the equations.

The index itself is affected by variables like existence of children below and above the age of three years and educational status of the woman. Remember that the equation on the index includes the female educational status. The intensity of investment in career shown here by the index seems to be positively affected by age of women. The coefficient is significant. This may be due to the fact that as the woman's age increases, the children grow up and woman may enter in a phase where no more children are born, enabling her to invest in her career.

The dummies for different values of index of female investment in career are included in the equation of the man's household work in order to gauge the influence of woman's investment in career on the man's household work. It is not included in the woman's household work equation because we create the index based on the other independent variables in the same equation and that can create problems because if it is done, the model may not converge at all.

The next table presents the final results of the extended or full model where we include another equation for any kind of help available for household work to the partners within the household. We include any unpaid external help available to them and/or any help available from their own children within the household. This variable is a binary dummy that is included as equation two in this model. This time we include the log of the ratio of hourly salary of man to woman to avoid any possible multicolinearity caused by including both their hourly wages in the same equation. We include the hourly salary of man only in the equation for the labour market work of men. The log of ratio of hourly salary of man to woman is significant in both the index and the help equation and shows that as the man's hourly salary is relatively greater than the woman, the women has less tendency to invest in her career. The

Table 14: Maximum likelihood estimation of household model with help						
Number of observations = 1076, Log likelihood = -22608.329		Wald chi2(9) = 605.41, Prob > chi2 = 0.0000				
Dependent variable → Independent Variables ↓		Index	Help	Household work-woman	Household work- man	Labour market work -man
Log of ratio of hourly salary (man/women)		-1.9278 ***	-0.1681 **	.4030153	12.3867	
Log of hourly salary -man						-11.2148
Non-salary revenue		0.0000135	8.20e-06	-.0038274 ***	-0.00022	-0.00041
Children up to 3 years		-0.1171	0.3273 **	96.20984 ***	22.8107	1.9122
Children(4 to 15 years)		-0.0233	0.1306 **	29.58452 ***	9.6105	-11.9364
Age- Woman		0.0322 ***	-0.0232 ***	-7.862693		
Age women squared				.0915122		
Age- Man					-4.1968	16.9005 **
Age Man squared					.0471	-0.2056 **
Woman's Education	No education or less then BEPC,CAP,BEP	reference		reference		
	BEPC,CAP,BEP	0.7837 ***		-28.26565 **		
	BAC (Gen & Technical)	1.5955 ***		-16.65272		
	Bac+2 and Greater	1.3406 ***		-46.54109 ***		
Man's Education	No education or less then BEPC,CAP,BEP	reference		reference		
	BEPC,CAP,BEP				22.7007 *	-27.9750 *
	BAC (Gen & Technical)				40.0610 **	-50.3519 **
	Bac+2 and Greater				2.3976	4.0575
Age difference = man - woman		0.0175 *				
Number of rooms in household			0.0978 ***	-.7242677	-2.5007	10.1749 *
Weekdays				-58.17899 ***	-72.6655 ***	322.7772 ***
Rural dummy			-0.2250 **			-8.0773
Presence of children 15 and above- dummy			0.8728 ***			
Dummies based on index value (I) of woman's investment in career	I = 0				reference	
	I = 1				37.8382	
	I = 2				58.2791 *	
	I = 3				74.7373 *	
	I = 4				72.4522	
Constant			0.0078	453.4267 ***	234.051 *	-231.8057
threshhold-1		-0.6448 **				
threshhold-2		1.3390 ***				
threshhold-3		2.4703 ***				
threshhold-4		3.3226 ***				

* significant at 10%, ** significant at 5%, significant at 1% , For estimated correlations and standard deviations please see the appendix

woman is a stronger investor in career if any kind of extra help is available for household work.

Woman's age also plays a role in determining her intensity of investment in career. We also find that higher the education level of women, the greater is the tendency to invest in career. All the coefficients related to educational dummies for women are significant in the index equation. Another interesting finding is that women in households where there is greater age difference in the partners, i.e. the woman is relatively younger, have a greater intensity of investment in her career. Number of children play the usual role and increase the woman's household work. The equation related to man's household work shows that as women are stronger investors in career, the men increase their share of household work. Two out of four dummies of woman's investment in career are significant in the man's household work equation.

Table 15 shows the estimated variances and correlations from the final MLE.

Table 15: Variances and correlations for the household model with help

Variances	Coefficients	Correlations	Coefficients	Correlations	Coefficients
Variance- 3	149.8178 ***	ρ_{12}	-0.0207284	ρ_{24}	0,0046305
Variance- 4	145.8497 ***	ρ_{13}	-0.0654698 **	ρ_{25}	-0,000021
Variance- 5	191.3734 ***	ρ_{14}	-0,0321613	ρ_{34}	0.2185347 ***
		ρ_{15}	-0,0603912	ρ_{35}	-0.1200746 ***
		ρ_{23}	-0,0538596	ρ_{45}	-0.6006267 ***

* Significant at 10%, significant at 5%, significant at 1%

Note: Subscripts correspond to the equation number in the model; variances and correlations are related to errors of the equations.

5. Conclusion

The effect of strong female investment in career on the household division of labour particularly the share of male partner in the household work is an important but somehow unaddressed issue. This paper uses the French Time Use Survey to identify the indicators of strong female investment in career, focusing on working couples and identifying women who strongly demonstrate a tendency to invest in their career. We also look into the possible effect on the gender division of labour particularly the male share of household work. The couples where both partners participate in the labour market were selected and the possible indicators of strong female investment in career were identified. Some indices based on the identified

indicators were also developed and tested for the possible influence on the gender division of labour within the household.

It is evident that women's tendency to invest in her career is strongly affected by the factors like presence of children in the household, educational and occupational status within same 'type' of women, and age. The tendency of woman's investment in career is also influenced by any extra help available for household work. Woman's education and age are significant in the index equation whatever model used.

Women's investment in career increases her partner's household work. She still works more at home than he does, whatever her wage compared to his, i.e. the sharing of work within the household does not seem to be efficient.

This may force us to conclude that the male household, no doubt, increases with the woman's high intensity to invest in the labour market but still the gender role remains traditional in the sense that the woman continues to do the major part of household work even though she participates in the labour market with a strong intensity.

The same work can be replicated to data on time use of other countries where we are able to know the amount of household and labour market work of both partners in the household; a limitation we find in most of the surveys on time use. Although we may need to change the way how the index in created, due to the fact that surveys in different countries may have different symbolic indicators of woman's strong investment in her career, we may still be able to compare the effect of investment in career by women on the man's household work across countries.

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Appendix I

The maximum likelihood function corresponding to the system of five equations can be given as:

$$L = \prod_{I=0,H=0} P(u_1 < k_1 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 \le 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=1,H=0} P(k_1 - \boldsymbol{\gamma}_i'\mathbf{Z}_i \le u_1 \le k_2 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 \le 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=2,H=0} P(k_2 - \boldsymbol{\gamma}_i'\mathbf{Z}_i \le u_1 \le k_3 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 \le 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=3,H=0} P(k_3 - \boldsymbol{\gamma}_i'\mathbf{Z}_i \le u_1 \le k_4 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 \le 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=4,H=0} P(u_1 > k_4 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 \le 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=0,H=1} P(u_1 < k_1 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 > 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=1,H=1} P(k_1 - \boldsymbol{\gamma}_i'\mathbf{Z}_i \le u_1 \le k_2 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 > 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=2,H=1} P(k_2 - \boldsymbol{\gamma}_i'\mathbf{Z}_i \le u_1 \le k_3 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 \le 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=3,H=1} P(k_3 - \boldsymbol{\gamma}_i'\mathbf{Z}_i \le u_1 \le k_4 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 > 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

$$\times \prod_{I=4,H=1} P(u_1 > k_4 - \boldsymbol{\gamma}_i'\mathbf{Z}_i, u_2 > 0, u_3 = TD_f - \boldsymbol{\alpha}_f\mathbf{X}_f, u_4 = TD_m - \boldsymbol{\alpha}_m\mathbf{X}_m, u_5 = TM_m - \beta_m Y_m)$$

The likelihood function for the reduced model can be obtained by containing only the first five lines of the above function and by removing the second part of each line which is related to u_2 , the error term of the help equation.

By using the method described in Green (2000), we found the conditional mean and variance vector for u_1 u2 conditional of u_3, u_4 and $u_5$of this penta-normal distribution that are given below.

The covariance matrix is as follows:

$$\sum = \begin{bmatrix} 1 & \sigma_{12} & \sigma_{13} & \sigma_{14} & \sigma_{15} \\ \sigma_{12} & 1 & \sigma_{23} & \sigma_{24} & \sigma_{25} \\ \sigma_{13} & \sigma_{23} & \sigma_3^2 & \sigma_{34} & \sigma_{35} \\ \sigma_{14} & \sigma_{24} & \sigma_{34} & \sigma_4^2 & \sigma_{45} \\ \sigma_{15} & \sigma_{25} & \sigma_{35} & \sigma_{45} & \sigma_5^2 \end{bmatrix}$$

with $\sigma_{ij} = \text{cov}(u_i, u_j)$, *I, j*=1, 2, 3, 4, 5 and $i \neq j$; σ_i^2 =*Var*(u_i), i = *3,4,5*

The above matrix can be partitioned as follows:

$$\Sigma_{11} = \begin{bmatrix} 1 & \sigma_{12} \\ \sigma_{12} & 1 \end{bmatrix}, \quad \Sigma_{12} = \begin{bmatrix} \sigma_{13} & \sigma_{14} & \sigma_{15} \\ \sigma_{23} & \sigma_{24} & \sigma_{25} \end{bmatrix}$$

$$\Sigma_{21} = \begin{bmatrix} \sigma_{13} & \sigma_{23} \\ \sigma_{14} & \sigma_{24} \\ \sigma_{15} & \sigma_{25} \end{bmatrix} \quad \text{and} \quad \Sigma_{22} = \begin{bmatrix} \sigma_3^2 & \sigma_{34} & \sigma_{35} \\ \sigma_{34} & \sigma_4^2 & \sigma_{45} \\ \sigma_{35} & \sigma_{45} & \sigma_5^2 \end{bmatrix}$$

Then the mean and variance can be derived as

$$\mu = \mu_1 + \sum_{12} \sum_{13}^{-1} (x_2 - \mu_2)$$

and $$\sigma^2 = \sum_{11} - \sum_{12} \sum_{22}^{-1} \sum_{21}$$

where μ_1 and μ_2 are vectors containing zeros as the means of errors are assumed to be zero.

After derivation and manipulation, we get the following estimations of mean and variance of both the errors of the index equation (μ_I and σ_I^2) and the help equation (μ_H and σ_H^2):

Let $\rho_{ij} = \rho(u_i, u_j)$ where $i \neq j$ and i,j = 1 to 5

Also let $d = 1 + 2\rho_{34}\rho_{35}\rho_{45} - \rho_{35}^2 - \rho_{35}^2 - \rho_{45}^2$

then

$$\mu_I = \left(\frac{1}{d}\right) * \left[\left(\frac{u_3}{\sigma_3}\right)\left(\rho_{13}\left(1-\rho_{45}^2\right) + \rho_{14}\left(\rho_{35}\rho_{45} - \rho_{34}\right) + \rho_{15}\left(\rho_{34}\rho_{45} - \rho_{35}\right)\right)\right.$$

$$\left. + \left(\frac{u_4}{\sigma_4}\right)\left(\rho_{14}\left(1-\rho_{35}^2\right) + \rho_{13}\left(\rho_{35}\rho_{45} - \rho_{34}\right) + \rho_{15}\left(\rho_{34}\rho_{35} - \rho_{45}\right)\right)\right.$$

$$+\left(\frac{u_5}{\sigma_5}\right)\left(\rho_{15}\left(1-\rho_{34}^2\right)+\rho_{13}\left(\rho_{34}\rho_{45}-\rho_{35}\right)+\rho_{14}\left(\rho_{34}\rho_{35}-\rho_{45}\right)\right)\Bigg]$$

and

Variance is as follows:

$$\sigma_I^2 = 1-\left(\frac{1}{d}\right)*\left\{\rho_{13}^2\left(1-\rho_{45}^2\right)+\rho_{14}^2\left(1-\rho_{35}^2\right)+\rho_{15}^2\left(1-\rho_{34}^2\right)\right.$$
$$-2\left(\rho_{13}\rho_{14}\rho_{34}+\rho_{13}\rho_{15}\rho_{35}+\rho_{14}\rho_{15}\rho_{45}\right)$$
$$\left.+2\left(\rho_{13}\rho_{14}\rho_{35}\rho_{45}+\rho_{13}\rho_{15}\rho_{34}\rho_{45}+\rho_{14}\rho_{15}\rho_{34}\rho_{35}\right)\right\}$$

Similarly for the help equation,

$$\mu_H = \left(\frac{1}{d}\right)*\left[\left(\frac{u_3}{\sigma_3}\right)\left(\rho_{23}\left(1-\rho_{45}^2\right)+\rho_{24}\left(\rho_{35}\rho_{45}-\rho_{34}\right)+\rho_{25}\left(\rho_{34}\rho_{45}-\rho_{35}\right)\right)\right.$$
$$+\left(\frac{u_4}{\sigma_4}\right)\left(\rho_{24}\left(1-\rho_{35}^2\right)+\rho_{23}\left(\rho_{35}\rho_{45}-\rho_{34}\right)+\rho_{25}\left(\rho_{34}\rho_{35}-\rho_{45}\right)\right)$$
$$\left.+\left(\frac{u_5}{\sigma_5}\right)\left(\rho_{25}\left(1-\rho_{34}^2\right)+\rho_{23}\left(\rho_{34}\rho_{45}-\rho_{35}\right)+\rho_{24}\left(\rho_{34}\rho_{35}-\rho_{45}\right)\right)\right]$$

and

Variance is as follows:

$$\sigma_H^2 = 1-\left(\frac{1}{d}\right)*\left\{\rho_{23}^2\left(1-\rho_{45}^2\right)+\rho_{24}^2\left(1-\rho_{35}^2\right)+\rho_{25}^2\left(1-\rho_{34}^2\right)\right.$$
$$-2\left(\rho_{23}\rho_{24}\rho_{34}+\rho_{23}\rho_{25}\rho_{35}+\rho_{24}\rho_{25}\rho_{45}\right)$$
$$\left.+2\left(\rho_{23}\rho_{24}\rho_{35}\rho_{45}+\rho_{23}\rho_{25}\rho_{34}\rho_{45}+\rho_{24}\rho_{25}\rho_{34}\rho_{35}\right)\right\}$$

For the simpler model we need the conditional mean and variance of u_1 given u_3, u_4 and u_5 which can be derived from the reduced four by four covariance matrix by using the method in Green (2000) which gives the following,

$$\mu = \frac{1}{1-\rho_{34}^2-\rho_{35}^2-\rho_{45}^2+\rho_{34}^2\rho_{35}^2\rho_{45}^2}\left[\frac{u_3}{\sigma_3}\left\{\rho_{13}\left(1-\rho_{45}^2\right)+\rho_{14}\left(\rho_{35}\rho_{45}-\rho_{34}\right)+\rho_{15}\left(\rho_{34}\rho_{45}-\rho_{35}\right)\right\}\right.$$
$$+\frac{u_4}{\sigma_4}\left\{\rho_{13}\left(\rho_{35}\rho_{45}-\rho_{34}\right)+\rho_{14}\left(1-\rho_{35}^2\right)+\rho_{15}\left(\rho_{34}\rho_{35}-\rho_{45}\right)\right\}$$
$$\left.+\frac{u_5}{\sigma_5}\left\{\rho_{13}\left(\rho_{34}\rho_{45}-\rho_{35}\right)+\rho_{14}\left(\rho_{34}\rho_{35}-\rho_{45}\right)+\rho_{15}\left(1-\rho_{34}^2\right)\right\}\right]$$

and

Variance is as follows:

$$\sigma^2 = 1-\frac{1}{1-\rho_{34}^2-\rho_{35}^2-\rho_{45}^2+\rho_{34}^2\rho_{35}^2\rho_{45}^2}\left[\rho_{13}^2\left(1-\rho_{45}^2\right)+\rho_{14}^2\left(1-\rho_{35}^2\right)+\rho_{15}^2\left(1-\rho_{34}^2\right)\right.$$
$$-2\left(\rho_{13}\rho_{14}\rho_{34}+\rho_{13}\rho_{15}\rho_{35}+\rho_{14}\rho_{15}\rho_{45}\right)$$
$$\left.+2\left(\rho_{13}\rho_{14}\rho_{35}\rho_{45}+\rho_{13}\rho_{15}\rho_{35}\rho_{45}+\rho_{14}\rho_{15}\rho_{34}\rho_{35}\right)\right]$$

where $\mathbf{u_i}$ are error terms of equation 2, 3 and 4; $\boldsymbol{\rho_{ij}} = \boldsymbol{\rho(u_i, u_i)}$ where $i \neq j$.

As we need the probabilities for a trivariate normal distribution for the conditional maximum likelihood problem, we use the equations given by Rose and Smith (1996, 2002) which is as follows:

$$P(u_3,u_4,u_5) = \frac{e^{-\frac{w}{2(\rho_{34}^2+\rho_{35}^2+\rho_{45}^2-2\rho_{34}\rho_{35}\rho_{45}-1)}}}{2\sqrt{2}\pi^{\frac{3}{2}}\sqrt{1-(\rho_{34}^2+\rho_{35}^2+\rho_{45}^2)+2\rho_{34}\rho_{35}\rho_{45}}}$$

where

$$w = u_3^2(\rho_{45}^2-1)+u_4^2(\rho_{35}^2-1)+u_5^2(\rho_{34}^2-1)$$
$$+2\left[u_3u_4(\rho_{34}-\rho_{35}\rho_{45})+u_3u_5(\rho_{35}-\rho_{34}\rho_{45})+u_4u_5(\rho_{45}-\rho_{34}\rho_{35})\right]$$

Appendix II

Description of domestic tasks

Domestic activities include all activities around:

- food and drink: preparation (cutting, cooking, making jam), presentation (laying the table), kitchen and food clean-up (washing up)
- housework: interior cleaning, clothes activities (laundry, mending, sewing, knitting, repairing and maintaining textiles), storing interior household items and tidying
- interior maintenance and repair of house and vehicles: repairing, water and heating upkeep
- Household management: financial (bills, count,...)
- shopping
- childcare: physical and medical care, reading, talking with and listening to children, homework help, picking up/dropping off children, playing and leisure with children
- care for household adults
- care for animals and pets
- lawn, garden and houseplants

Appendix III

Important Variables in the data set

Child<3 (enf3)	Number of children below 3 years old
Child 3-15	Number of children from 3 to 15 years old
Rural (Drural)	Dummy for Rural area residence (1=Rural residence)
Age F	Age of women of the household
Normal Day (joursem)	1= Monday to Friday
More work/diploma (Dtravmsddiplof)	Dummy; '1' means that the female works higher than the mean + standard deviation of her subgroup by diploma
High wage/diploma (DsalMmsddiplof)	Dummy; '1' means that the female earns a monthly salary more than the mean + standard deviation of her subgroup by diploma
More Work/position (Dtravmsdpositgf)	Dummy; '1' means that the female works higher than the mean + standard deviation of her subgroup by professional position of employment
High wage/position (DsalMmsdpositgf)	Dummy; '1' means that the female earns a monthly salary more than the mean + standard deviation of her subgroup by professional position of employment
Diploma>partner (Dhighfdiplo)	Dummy; female has earned a higher diploma than her partner
Salary>partner (Dsalmfh)	Dummy; female earns a higher monthly salary than her partner/partner
Position>partner (Dhighfposit)	Dummy: Indicates that the female is in a better occupational status as compared to her partner
Dedu1-Dedu4	Dummy variable for education levels (1= no diploma /CEP/DFEO, 2= BEPC,CAP,BEP, 3= BAC (Gen & Tech), 4= Bac+2 and Greater
Daid71	The household receives some kind of regular external aid for housework
ISP567	Please see the appendix on the next page
help	This is a dummy variable that includes any unpaid help available to the partners for household work including the help available from the children within the household.

Construction of the index of women's investment in career

The index we suggested was constructed in two steps.

Step I: First The hourly salary in each group of occupational status was considered. . In each group of occupational status, we allocated scores on the basis of where the hourly salary of the women lies based on four cut-off values that depend on the average and standard deviation of the hourly salary of women in each subgroup of her employment position (See appendix for details on employment position and construction of the index. This score show where a women is located within her type of occupational status according to her hourly salary.

Step II: Additional scores were given according to the three indicators related to the partner (where her monthly salary, employment position and educational levels are better than her partner) i.e. the indicators that show the women's relative position with her partner. This new sum was remapped from 0 to 4 to generate five values or levels.

Details

Firs we need to describe the professional position variable.

The 'employment status' of six different levels is based on the survey variable '*POSIT*'(*position professionnelle de l'emploi*) which was rearranged to create six different employment status levels.

The six levels (subgroups of professional position) are defined as follows:

Level I: Unskilled and Semi-skilled workers (OS1, OS2, etc in French system), skilled workers (P1,P2, TA, OQ etc. in French system), simple services like childcare (Category 'C' or 'D' of public service)

Level II: Agent de maîtrise dirigeant des ouvriers, maîtrise administrative ou commerciale

Level III: Agent de maîtrise dirigeant des technicians ou d'autres agents de maîtrise

Level IV: Technicien, dessinateur, VRP (non cadre) & School teacher, social assistants etc of category 'B' of public service.

Level V: Engineers or like cadre and persons working in category 'A' of public service

Level VI: Independent professionals

For each of the six above categories, we calculated four cut values of hourly salary of women giving points according to where the hourly salary lies within the 'professional status'. The cut values for each level are given below where 'sd' means standard deviation:

Cut values based on mean plus/minus standard deviation in each sub-group of professional position				
Professional position	**Salary >mean – sd (points=1)**	**Salary >mean (points=2)**	**Salary >mean + sd (points=3)**	**Salary >mean +2sd (points=4)**
1	23.90572	42.09508	60.28444	78.4738
2	42.5303	56.95031	71.37032	85.79033
3	-0.70759	96.87827	194.46413	292.04999
4	45.99346	64.58388	83.1743	101.76472
5	42.82714	93.22301	143.61888	194.01475
6	-18.42717	87.92063	194.26843	300.61623

Note: no point was given if the hourly salary was below 'mean – sd'

This gave a scale from 0 to 4 that was called ISP (index of salary by position). To create the actual index we gave additional points on the basis of three dummy variables showing the relative position with reference to the partner. (monthly salary> partner, educational level > partner & professional position better than partner). If we consider the marriage models then better professional position or salary may indicate both a desire and action of the woman to invest in her career. These additional scores increased the maximum score value to 7 which indicates eight different levels. These level were remapped to a 0-4 scale which gave the index that we used. The remapping was simple where a value 4 (high investment in career) was given to the women with a composite index of 4 or above.