

Stereotypes upon Abilities in Domestic Production and Household Behaviour

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Abstract

Collective and Cooperative models assume that decisions taken inside the family are Pareto optimal. However, empirical studies cast doubts about the efficiency assumption, especially on the production side of household decision making. In this paper, we present a model of household behaviour in which a stereotype about relative ability of men and women in domestic work prevents decisions from being efficient. We assume that the distribution of abilities in domestic production of men and women is the same, but this distribution is unknown by individuals. According to a stereotype, people believe that women are more capable than men to produce domestic goods, on average. At the beginning of couple formation, one couple's member is chosen to make an investment in domestic production, which increases his/her productivity. Couples decide who will invest by taking into account wage differential, spouses' signal about their ability and the stereotype about abilities. We show that wage differential between men and women, and the prevalence of the stereotype lead to a very weak investment of men in the society. Even though spouses aim at maximizing the household's welfare, the resulting allocation is not Pareto efficient. This result leads to examine the role of public policies to restore the first best optimum.

Keywords: Stereotypes, household production, time allocation, household behavior, intra-household decision-making

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Introduction

In order to analyze intra-household decision-making, economists have developed several models, particularly Collective Models and Cooperative Models. These two types of models assume efficiency in the consumption and production side of the household (domestic tasks and child care). It means that an increase in female relative human capital leads to decrease woman domestic work time. In the same way, according to comparative advantages theory of the household, the sharing of time inside the household becomes more egalitarian if woman human capital increases. Efficiency within the household is obtained by a specialization between spouses: the partner with the lowest opportunity cost, so the lowest human capital, specializes more in domestic production. This partner spends more time producing domestic goods, and less time on the labor market (Becker, 1981).

However, empirical evidence seems to contradict this implication, and doubts about the efficiency assumption can be expressed, especially on the production side of household decisions. Women's domestic time fails to decrease despite an increases in women's relative earnings.

Indeed, participation of women in the labour market has strongly increased during the second half of the century (Marchand & Thélot, 1991, Sofer, 2005). Today, women participate more in the labour market, but they are still in charge of majority of domestic work inside the household. 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, Aguiar and Hurst, 2006, 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 in household work, with a total working time generally higher for women than for men (Winqvist, 2004). Moving to some facts from France, INED (The French National Institute for Demographic Studies) has presented a study showing that French women contribute to around 80% from the domestic tasks. In addition, they show that children's arrival accentuate the inequalities.

We could think that division of labour inside the household might be explained by usual economic variables, as wages, education, or other measurable variables, but these variables are far from completely driving the phenomenon (Hersch & Stratton, 1994, Anxo & Kocoglu, 2002, Aronsson et al, 2001, Rapoport and Sofer, 2005, Kalenkoski, Ribar and Stratton, 2009, Sofer and Rizavi, 2008). According to Sofer and Rizavi (2008), women investing a lot in their career decrease their share in the household work which is substituted not only by men's household work but also by external help. When the woman earns a higher wage, instead of minimizing costs in the sharing of tasks between partners, the household will turn to external help. In addition, Sofer and Rizavi (2008) show that woman's investment in career does increase her partner's household work and decreases hers but the sharing of work within the household still seems to be non-egalitarian. Women continue to do the major

part of household work even though they participate in the labour market with a strong intensity, and earn a higher wage than their partner. So these results challenge the assumption of Pareto-optimality of household decision making, which is the basis of the Collective Model. Hochschild and Machung (1989) have also showed that when a wife works more hours than her husband outside the home, she still undertakes a larger share of housework. Akerlof and Kranton (2000) reach the same conclusion using PSID data (Panel Study of Income Dynamics, United States). In addition, several other studies (Udry, 1996, Duflo and Udry, 2004, Aguiar and Hurst, 2007) cast also some doubts about the efficiency assumption, especially on the production side of household decisions. So these results contradict the collective model (Chiappori, 1988, 1992, 1997, Bourguignon and Chiappori, 1992), the minimalist hypothesis of which assuming that decisions taken inside the household are efficient.

Facts above can be explained by several assumptions.

Gender division of labour could come from non economic variables, as social norms or stereotypes. Social norms represent rules of behavior imposed inside the society, and it is costly to deviate from the social norm, given the conformism of individuals. For example, a social norm could be that women must be specialized in domestic production while men in work in the labor market. Non cooperative household models including social norms have been developed by Carter and Katz (1997) and by Cudeville and Recoules (2009).

Stereotypes are beliefs grounded in the society. For example, and this is our main assumption here, people could believe that in average, women are more talented than men concerning domestic work and child care. A model of discrimination in the labour market involving stereotypes has been developed by Coate and Loury (1993), who were interested in stereotypes coming from employers, about the productivity of black and white workers, but has never been introduced in household economics.

The sharing of time between spouses could also be explained by individual preferences towards domestic work. For instance, women could have a lower disutility making domestic tasks than men. However, Fernandez and Sanz (2006) explain that under this assumption, we would not be able to explain the empirical regularity that women with higher earnings than their husbands do not only do relatively more housework than them (as in Akerlof and Kranton's findings), but also do relatively more housework than women whose earnings are lower than their husbands. Fernandez and Sanz (2006) add that in the US and Australia, woman's relative share of housework decreases as her relative earnings go up, but only up to the point when she contributes the same as her husband to the family income. When her contribution to the total household income goes beyond fifty percent, her housework share increases as her earnings go up (Brines, 1994, Greenstein, 2000, Gupta, 1999 and Bittman et al., 2001). So like Fernandez and Sanz (2006), we emit doubts about the fact that preferences are an explanation of the allocation of time inside the household.

Here, we analyse the division of work inside the household considering two types of explanations: an economic variable, individual wages, and a non economic variable, stereotypes. We do not deny the prevalence social norms to explain the allocation of time in families, but we do not include them in this analysis, in order to concentrate on the effect of the stereotype.

In this paper, we develop a model of household behaviour including a stereotype about relative ability of men and women to produce domestic goods. We use the theoretical methodology developed by Coate and Loury (1993) in order to introduce the stereotype in the analysis.

The stereotype considered here is the belief that women are more talented than men, while we assume women and men are equally productive. Of course, some authors (including Becker, 1981) have assumed that women are “naturally”, or as a result of a specific training of little girls (compared to little boys) more productive, on average, in domestic production. We are not convinced by this latter assumption: in developed countries at least, boys and girls are now educated in very similar conditions, with the perspective that both genders in adulthood will work in the market, on the one hand. On the other hand, most domestic tasks do not need any more specific qualifications or training, because most households now benefit from equipment in durable goods: no specific training is needed to push the button “on” of a washing machine, for example. Moreover, most fathers are now involved in the caring of children of any age, including babies, so that, again, systematic productivity differences between genders do not seem likely to occur in the raising of children either. Hence, we assume that men and women are *potentially* equally productive, on average, in domestic production, but, according to a stereotype, people believe that women are on average more capable than men.

The model developed below is the following: at the beginning of couple formation, a choice of relative specialization is made within the household. One of the two spouses will make an investment in domestic production, in order to improve his/her productivity in domestic production. Therefore the first decision of the household consists in choosing which of the two spouses will invest. The objective is to choose the partner who allows to obtain the highest profit from household production. However, abilities are assumed not to be known nor immediately observable by the spouses. Couples can only observe noisy signals about them. So households decide which partner will invest by taking into account variables defining the opportunity cost from investment in domestic production: wages, and variables linked to abilities: spouses’ signals and the stereotype, as abilities are unknown. Once couples have chosen who invests, the investment is made and one spouse improves his/her productivity. Then they take daily household decisions about domestic times, consumption and leisure, in an optimal way, given that one spouse is more productive than the other, according to a household model with domestic production, as a Collective Model (Apps et Rees 1997, Chiappori 1997, Aronsson, Daunfeldt and Wikstrom 2001, Bourguignon F. and M.C. Chiuri 2005, Rapoport, Sofer and Solaz 2011), or a cooperative model, also called Nash

bargaining model (Mc Elroy et Horney, 1981, Manser and Brown, 1980, Lunberg and Pollak, 1993).

We show that because of wage differential between men and women, women are more often than men chosen by couples to invest in domestic production. The stereotype amplifies this effect, and finally very few men are chosen to invest. Consequently, at the end of the decision process, women become really more productive than men, because of both wages and the stereotype. Even if a wife earns a higher wage than her husband, even though her husband has the same potential of domestic productivity, it is possible that the woman be chosen to invest in domestic production, though the first best optimal choice would have been to choose the husband in that case.

In the model, everybody believes that decisions are taken in an efficient way, but stereotypes bias the solution, and this could explain why we observe in the data that the sharing of time is not efficient. This result leads to examine the role of public policies to restore the first best optimum. We particularly interest in wage policies promoting wage equality, and family policies (paternity leaves...).

Our analysis proceeds as follows. In section 1, the household decision process defining our model is presented. In section 2, we present the model, so we show how the household chooses who invests. In section 3, we develop the comparative-static analysis. Section 4 presents the discussion on the role of public policies. Then we conclude.

1. Household Decision Process

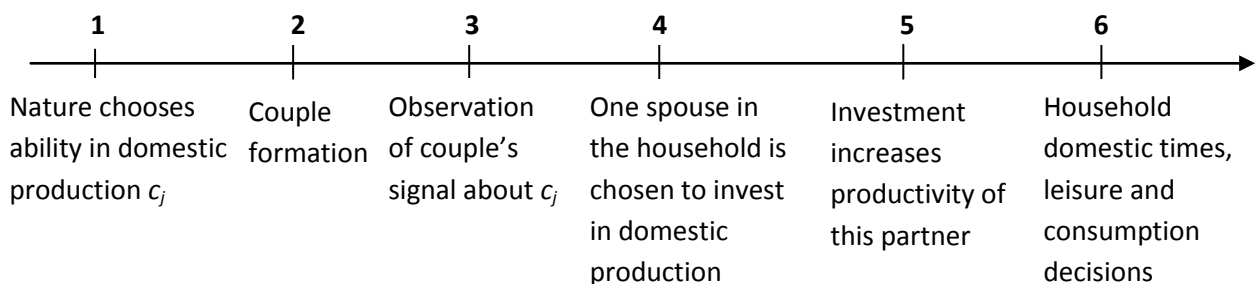


Figure 1 : Sequence of actions

We imagine a population of couples, composed by a man and a woman. Men are indexed by $j=m$ and women by $j=f$. The timing of decisions is summarized in Figure 1. Each member of the household has a certain level of ability in domestic production c_j , which corresponds to the capacity to make an investment in domestic production and reach a high level of productivity. Each individual in the population has a different level of ability c_j . The more c_j is

high, the more the individual is talented to produce domestic goods, and we define by $(-c_j)$ the cost of investment in domestic production.

A key assumption here is that before the investment made, all people, men as well as women, have the same distribution of ability in domestic production. However, at the beginning of marriage, nobody knows and can measure exactly one's own ability, nor that of one's spouse. Moreover, nobody knows that initially, the distribution of abilities is the same for men and for women. People (women as men) believe instead that, on average in the population, women are more able than men for domestic production. So this is the stereotype. The stereotype is about the difference of abilities of spouses. For simplicity, we shall assume that the stereotype shifts to the right the distribution of women abilities. We call c_f and c_m , true abilities in domestic production, and \tilde{c}_f and \tilde{c}_m , false abilities in domestic production, according to the belief in the society.

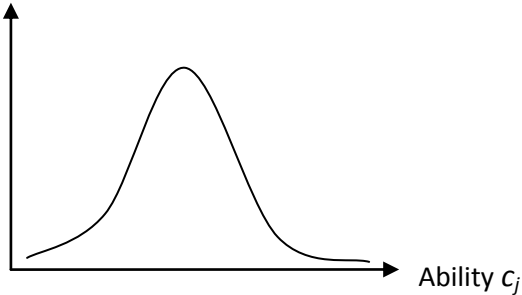


Figure 2: True distribution of ability in domestic production for men and for women, in the whole population

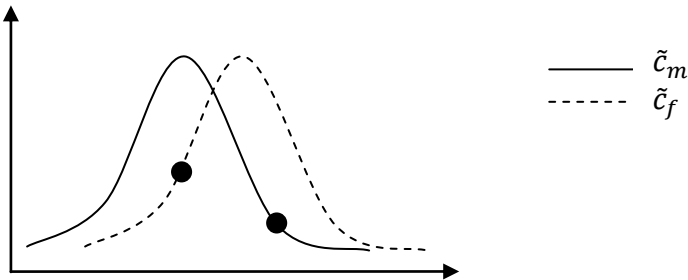


Figure 3: False distribution of ability \tilde{c}_f and \tilde{c}_m , according to the stereotype

Hence, on average, people believe that women are more able than men, but in a given household, the couple can (rightly) believe that the man is more able than the woman (cf the two points in the figure 3). All individuals believe that woman distribution of abilities is displaced in this way, that's why this belief can be called a stereotype.

Then couples form, and household members do not observe their true ability to make an investment in domestic production, but only noisy signals about it. At the beginning of

couple formation, a relative specialization occurs between spouses: one spouse specializes more in the labor market, and the other specializes more in domestic production. In order to proceed to this specialization, one of the two household members is chosen to make an investment in domestic production, and this investment allows him to increase his productivity in domestic production. So finally, one spouse becomes more productive than the other. This investment may be thought as spending a lot of time in household production and developing habits. We assume that there exist two levels of productivity to produce domestic goods among all the population: q and nq . q is the level of productivity of the household member who has invested in domestic production, and nq is the level of productivity of the spouse who has not invested. All spouses in the society who have invested have the same productivity q , and all partners in the population who have not invested have the same productivity nq , with $q > nq$. So there is a high and low level of productivity in the society. What's differs between all individuals is the ability (c_j) to reach the high level of productivity q . The higher the initial individual ability, the lower the investment costs in order to reach the post-investment productivity.

As household members do not observe their true ability to make this investment, but only signals about it, these signals, wages, and beliefs about abilities (the stereotype) help them to determine who invests.

The framework used here is a household general equilibrium model, in which the household profit from household production is maximized. So our model is compatible with a collective model (Apps et Rees 1997, Chiappori 1997, Aronsson, Daunfeldt and Wikstrom 2001, Bourguignon F. and M.C. Chiuri 2005, Rapoport, Sofer and Solaz 2011), or a cooperative model, also called Nash bargaining model (Mc Elroy et Horney, 1981, Manser and Brown, 1980, Lunberg and Pollak, 1993).

Once the choice of which partner invests and the investment made, individual domestic times, leisure and consumption decisions are taken optimally, according to a household model with domestic production, given that one spouse has increased his/her productivity.

We develop here an example of household general equilibrium model, the Collective Model with household production (Apps and Rees 1997, Chiappori 1997), in which our model with stereotype can fit, to show how individual domestic times, leisure and consumption decisions are taken, once the investment in domestic production is made.

According to the collective model extended to household production, the household maximizes a generalized weighted utilitarian household welfare function:

$$\max_{L_f C_f Y_f L_m C_m Y_m} (\mu_f (\cdot) U_f(L_f, C_f, \mathbf{Y}_f, \mathbf{z}) + \mu_m (\cdot) U_m(L_m, C_m, \mathbf{Y}_m, \mathbf{z}))$$

subject to $C_f + C_m + \mathbf{p}\mathbf{Y}_f + \mathbf{p}\mathbf{Y}_m + L_f w_f + L_m w_m \leq T w_f + T w_m + y + \pi(w_f, w_m, \mathbf{p})$

L_j represents leisure, C_j , the consumption of private goods, and \mathbf{Y} the vector of domestic goods, with $\mathbf{Y} = h(t_f, t_m; \mathbf{z})$. t_j is member j 's household work devoted to household

production, T the total time available, \mathbf{z} represents part of the individual heterogeneity, y the household's non-labour income, w_m and w_f are the wage rates, and $\mu_j = \mu_j(w_f, w_m, y, \mathbf{z})$ are weighting factors contained in $[0,1]$, with $\mu_m + \mu_f = 1$. $\pi(w_f, w_m, \mathbf{p})$ is the profit function from the household production.

The household maximization program can be decentralized in three steps. All occurs as if, in a first stage, the household would maximize the profit from household production:

$$\max_{t_f, t_m} \pi = pY - w_f t_f - w_m t_m$$

This allows to determine t_f and t_m , domestic work times.

In a second stage, spouses agree on the sharing of full income. Full income contains household non labor income and profit from household production. Each spouse receives the share Ψ_j .

In the third stage, the man and the woman separately maximizes their own utility function, under their own budget constraint, in order to determine quantities of leisure L_j and consumption C_j .

$$\begin{aligned} \max_{L_j, C_j, Y_j} U_j(L_j, C_j, Y_j, z) \\ C_j + pY_j + L_j w_j &\leq \Psi_j + w_j h_j \\ L_j + h_j + t_j &= T \end{aligned}$$

where h_j represents the time spent by individual j in the labor market.

Consequences of investment in domestic production from one of the two spouses appear in stage one of the decentralized decision process. One of the two spouses becomes more productive than the other, so it has consequences on the determination of t_f and t_m .

Here are presented some basic statistics, justifying our objective to introduce a stereotype in a household model. We use the French Time Use Survey 1998-99 by INSEE (1999) (Enquête Emploi du Temps), which provides data collection for household time use.

The partner making more domestic work than the other is the spouse who has invested in domestic production. We can consider there is an investor inside the family if one partner make 10 % hours of domestic work more than his partner. In a sample of married or cohabiting couples, in which at least one spouse reports a paid activity, 76,70 % of households have chosen the woman as investor, 16,88 % have chosen the man, and the other households have not chosen an investor. If we just select bi-active couples, 74,65% of investors are women and 18,76 % are men.

Concerning wages, the wife earns higher wage than her husband in 23,73 % of households forming our sample. If we restrict it to bi-active couples, 26,66 % of households have this property. Statistics about wages are given in *Table 1*.

Hourly Wage Rate (in Euros)	At least one spouse works in the market	Bi-active Couples
Men	11.46	11
Women	8.58	9.06

Table 1: Hourly Wage Rate, in Euros

Now, we present a limited illustration. If we consider that only wages determine who is the investor (without considering couples' signals and the stereotype), the "good choice" would be to choose the partner who earns the weaker wage, as the investor.

Statistics about the relevance of the choice are given in *Table 2*.

		At least one spouse works in the market	Bi-active Couples
Investor	Choice	en %	
Woman	Good	58,41	54.58
Man	Good	4.56	5.57
Woman	Bad	17.74	19.20
Man	Bad	12.17	12.94
Other: no investor or equal wage		7.12	7.7

Table 2: Relevance of the choice of the investor, just considering wages

According to Table 2, concerning the first sample, 58,41 % of households have chosen the wife to invest, and that's the "good choice" because she earns the lowest wage. 17,74 % of households have chosen the woman but that's the "bad choice" because she earns the highest wage, so it would have been more judicious to choose her husband to invest. When the man invests, that's more a bad choice than a good choice.

Now we select a sample in which spouses earn almost the same wage (the ratio of spouses' wages is less than 10 %). The sample contains 531 households. In these couples, wage effect does not intervene in the choice of the investor.

Investor	At least one spouse works in the market	Bi-active Couples
Man	19.40 %	22.55 %
Woman	73.63 %	70.11 %
No investor	6.97 %	7.34 %

Table 3: Choice of the investor, if spouses earn the same wage

We observe that really more women invest than men again. So there are other explanations than wages, as stereotypes.

2. Which of the two spouses will invest ?

How does the household decide who will invest in domestic production, at the beginning of couple formation? We are inspired by Coate and Loury's methodology (1993).

Each household must choose the man or the woman, in order to make an investment in domestic production. The objective of the household is to choose the partner who allows to obtain the highest profit from household production. The error would be to choose one partner, while the other would have allowed to obtain a higher profit. However, the couple cannot measure correctly levels of abilities to make an investment in domestic production, so he does not know which of the two spouses is more talented to make this investment.

The profit if the man invests in domestic production is the following:

$$r_m = p^* h(t_f^{ni}, \rho t_m^i) - w_f t_f^{ni} - w_m t_m^i - (-c_m)$$

The profit if the woman invests in domestic production is the following:

$$r_f = p^* h(\rho t_f^i, t_m^{ni}) - w_f t_f^i - w_m t_m^{ni} - (-c_f)$$

w_f and w_m are respective wages of f and m , and p^* , the implicit price of domestic production, which is determined within the household since household production is not traded externally. c_j is the measure of j 's initial ability in domestic production. $(-c_j)$ represents the cost of investment in domestic production. The more c_j is high, the easier an individual acquires the high level of productivity. We index t_j by t_j^{ni} for the spouse who has not invested in domestic production (*ni: no investment*), and t_j^i for the spouse who has invested in domestic production (*i: investment*). $h(\rho t^i, t^{ni})$ is the household production function. Domestic time spent by the spouse who has invested is multiplied by $\rho > 1$, given that the investment allows to increase productivity in domestic tasks. The level of ρ is the same for all spouses in the population.

In the following, we assume that there exist only two levels of t^i and t^{ni} in the population. It means that all spouses who have invested in the population make the same amount of domestic work t^i and all spouses who have not invested spend t^{ni} unit of time making domestic tasks. Consequently, $h(\rho t^i, t^{ni})$ is the same for all households in the society, whatever the man or the woman invests. We also assume that p^* is the same for all couples. So what's differ between all couples are wages w_f and w_m , and abilities c_f and c_m .

The objective of the household is to obtain the highest profit from household production. So household's choice about who invests is made by comparing r_m and r_f . If r_m is higher than r_f , the net benefit from household production is higher when the man invest rather than when the woman invests, so the man is chosen to invest.

The man invests in domestic production if and only if

$$\begin{aligned} & r_m > r_f \\ \Leftrightarrow & p^*h(t_f^{ni}, \rho t_m^i) - w_f t_f^{ni} - w_m t_m^i - (-c_m) > p^*h(\rho t_f^i, t_m^{ni}) - w_f t_f^i - w_m t_m^{ni} - (-c_f) \end{aligned}$$

As $p^*h(t_f^{ni}, \rho t_m^i) = p^*h(\rho t_f^i, t_m^{ni})$,

$$\begin{aligned} & r_m > r_f \\ \Leftrightarrow & -w_f t_f^{ni} - w_m t_m^i + c_m > -w_f t_f^i - w_m t_m^{ni} + c_f \\ \Leftrightarrow & c_m - c_f > w_m(t_m^i - t_m^{ni}) + w_f(t_f^{ni} - t_f^i) \end{aligned}$$

We know that $t_m^{ni} - t_m^i = t_f^{ni} - t_f^i = t^{ni} - t^i$, and that $t^{ni} - t^i$ is a constant.

So

$$\begin{aligned} & r_m > r_f \\ \Leftrightarrow & (t^i - t^{ni})(w_m - w_f) < c_m - c_f \end{aligned}$$

In order the man invests, c_m must be superior to c_f by a certain level $(t^i - t^{ni})(w_m - w_f)$. However, the couple does not know true distributions of c_m and c_f , they believe that the distribution of abilities are \tilde{c}_f and \tilde{c}_m . In addition, they only observe noisy signals about c_m and c_f : θ_f and θ_m . We work on signal's difference. The distribution of $\theta_m - \theta_f$ depends on the true distribution of $c_m - c_f$. The stereotype does not act on $\theta_m - \theta_f$, because signals only result of observation by the household. But the stereotype acts through \tilde{c}_f and \tilde{c}_m , via the deformation of distributions of c_m and c_f .

Intuitively, the stereotype, by moving the distribution of capacities of women into the right, leads to a decrease of $c_m - c_f$, according to the belief of couples. So inequality $[(t^i - t^{ni})(w_m - w_f) < c_m - c_f]$ is satisfied with more difficulty.

We formally define couple decision process now.

In the following, we denote wage differential $(w_m - w_f)$ by W , ability differential $(c_m - c_f)$ by C , and signal differential $\theta_m - \theta_f$ by θ . The inequality for an investment by the man becomes: $(t^i - t^{ni})W < C$

Let $F_q(\theta)$ [$F_u(\theta)$] be the probability that signal difference of the couple does not exceed θ , given that $(t^i - t^{ni})W < C$ [$(t^i - t^{ni})W > C$] and let $f_q(\theta)$ and $f_u(\theta)$ be the related density functions. Define $\varphi(\theta) \equiv f_u(\theta)/f_q(\theta)$, to be the likelihood ratio at θ . We assume that $\varphi(\theta)$ is nonincreasing, which implies $F_q(\theta) \leq F_u(\theta)$ for all θ . So higher values of signals θ are more likely if $(t^i - t^{ni})W < C$, and for a given prior, the posterior likelihood that $(t^i - t^{ni})W < C$ is larger if couple signal θ takes a higher value.

We define $\Phi \in (0,1)$, the probability that in a representative couple $(t^i - t^{ni})W < \tilde{C}$, according to the belief in the population about C , and before the observation of signals.

The true probability that $(t^i - t^{ni})W < C$ is $P((t^i - t^{ni})W < C)$.

This probability distorted by the stereotype is $\Phi = P((t^i - t^{ni})W < \tilde{C})$.

In other words, Φ is the prior probability that the profit is higher when the man invests, so that the man be chosen to invest, in a representative household, and according to the belief. This probability depends on four distributions: the distributions of w_m , w_f , and the distribution of \tilde{c}_m and \tilde{c}_f , in the whole population. So Φ is a distribution of probability, and not a parameter, because it depends on specific wage values of the household. But all people have the same belief about the gap between c_m and c_f (the stereotype). So the stereotype intervenes through this probability Φ . Signals do not act on this probability, because it is define anterior to observation of signals.

Now for a given couple, if he “emits” the signal $\theta_m - \theta_f$ then, using Bayes’ Rule, the couple’s posterior probability that $(t^i - t^{ni})W < C$ is the number $\xi(\Phi, \theta_m - \theta_f)$ given by

$$\begin{aligned} \xi(\Phi, \theta_m - \theta_f) &= P((t^i - t^{ni})W < \tilde{C} | \theta_m - \theta_f) \\ &\equiv \frac{\Phi f_q(\theta_m - \theta_f)}{\Phi f_q(\theta_m - \theta_f) + (1 - \Phi) f_u(\theta_m - \theta_f)} \\ &= \frac{1}{1 + \frac{1 - \Phi}{\Phi} \varphi(\theta_m - \theta_f)} \end{aligned}$$

This posterior probability (posterior to the observation of signals) depends on prior probability Φ and on couple’s signal. So the stereotype has an impact on $\xi(\Phi, \theta_m - \theta_f)$ through Φ , but the stereotype has no impact on observed couple’s signal $\theta_m - \theta_f$.

To make it clear, the stereotype is defined by the shift between the distribution of abilities of women compared to men. According to our assumption, true probability that $(t^i - t^{ni})W < C$, given that $w_m = w_f$ is equal to $\frac{1}{2}$.

$$\begin{aligned} &P((t^i - t^{ni})W < C | w_m = w_f) \\ &= P(0 < C) \\ &= P(c_f < c_m) \\ &= 0,5 \end{aligned}$$

Now, according to belief in the society, this probability become lower, for example 0,3.

$$\begin{aligned}
S &= P((t^i - t^{ni})W < \tilde{C} | w_m = w_f) \\
&= P(\tilde{c}_f < \tilde{c}_m) \\
&= 0,3
\end{aligned}$$

This false probability is believed by all people in the society. All individual think that 30 % of men in the population are more talented than women in domestic production. So the stereotype is defined by this deformation of probabilities. For example, a probability of 0,2 corresponds to a strong stereotype, while a probability of 0,4 corresponds to weaker stereotype.

The stereotype is defined on beliefs about abilities c_m and c_f , so \tilde{c}_f and \tilde{c}_m , but the couple decision is based on both abilities \tilde{C} and wages W , about the probability that $(t^i - t^{ni})W < \tilde{C}$, given the observation of signals.

Now, how does a household decide which partner is the most appropriate to make this investment? For a given household, wage difference W is known. So in the following, we reason with W fixed. We denote Φ_W , the probability Φ for a given couple, so with W fixed. Φ_W is a scalar. We also denote $\varphi_W(\theta_m - \theta_f)$, the likelihood ratio if W fixed.

The man will be chosen to invest if $\xi(\Phi_W, \theta_m - \theta_f) > \frac{1}{2}$, because it means that posterior probability that the profit is higher when the man invests $\xi(\Phi_W, \theta_m - \theta_f)$, is superior to posterior probability that the profit is higher if the woman invests $(1 - \xi(\Phi_W, \theta_m - \theta_f))$.

$$\begin{aligned}
&\xi(\Phi_W, \theta_m - \theta_f) > \frac{1}{2} \\
\Leftrightarrow &\frac{1}{1 + \frac{1 - \Phi_W}{\Phi_W} \varphi_W(\theta_m - \theta_f)} > \frac{1}{2} \\
\Leftrightarrow &\frac{1 - \Phi_W}{\Phi_W} \varphi_W(\theta_m - \theta_f) < 1 \\
\Leftrightarrow &\varphi_W(\theta_m - \theta_f) < \frac{\Phi_W}{1 - \Phi_W}
\end{aligned}$$

So the decision process of the household is the following:

The man invests if and only if

$$\varphi_W(\theta_m - \theta_f) < \frac{\Phi_W}{1 - \Phi_W} \quad (1)$$

As a result, the household combines the stereotype, signals and wages in order to take his decision.

3. Comparative-Static Analysis

- For a given couple:

		$\frac{\Phi_W}{1 - \Phi_W}$	$\varphi_W(\theta_m - \theta_f)$	Investment the man
Increasing of	Φ_W	+	\emptyset	<i>easier</i>
	w_f	+	\emptyset	<i>easier</i>
	w_m	-	\emptyset	<i>more difficult</i>
	θ_f	\emptyset	+	<i>more difficult</i>
	θ_m	\emptyset	-	<i>easier</i>

If woman's wage w_f increases, it leads to a decrease of $w_m - w_f$, so probability Φ_W that $(t^i - t^{ni})W < \tilde{C}$ is higher. Consequently, inequality (1) becomes easier to be satisfied and the man is chosen more easily.

Considering signals, if the signal of the man increases, $\varphi_W(\theta_m - \theta_f)$ decreases because $\varphi_W(\theta_m - \theta_f)$ is decreasing with $\theta_m - \theta_f$. Inequality (1) logically becomes easier to be satisfied.

What's the impact of a lightening of the stereotype, and consequently an increasing of Φ_W ? $\frac{\Phi_W}{1 - \Phi_W}$ increases, so the right of the inequality (1) increases. Consequently, the inequality (1) is easier to be satisfied, and the man will be chosen more easily.

We conclude that if the stereotype is strong inside the society, for a couple who emits the signal $\theta_m - \theta_f$, it will be more difficult that condition (1) be realized, and as a result, the woman will invest more often. The stereotype decreases the right of condition (1), so in order the man be chosen, $\varphi_W(\theta_m - \theta_f)$ must be weak. Since $\varphi_W(\theta_m - \theta_f)$ is a decreasing function of $\theta_m - \theta_f$, the couple will need to observe a θ_m sufficiently high relative to θ_f in order to believe that the man is really as, or more able than his wife and deserves the investment which will be made, because of the stereotype.

Differences of domestic times $t^i - t^{ni}$ is not a variable, but we notice that if the gap between t^i and t^{ni} is high, Φ_W decreases. If chosen spouse makes really more domestic work than the other, so if specialization between partners is strong, fewer men are chosen in order to invest.

- **For the whole population:**

In a given household, the belief about difference of abilities between men and women, together with market wages and signals, determine which partner they choose to invest in domestic production. Considering all couples in the society, this will, in turn, determines the fraction of men who become qualified, and, hence, who specialize in domestic production. On average, according to empirical evidence on aggregate data, women earn lower wages than men. So in average, it leads to a decrease of Φ , and consequently more women are chosen to invest rather than men in the population. The effect of the stereotype is amplified.

The stereotype is defined by the deformation of distribution about abilities and can be represented by this probability: $P((t^i - t^{ni})W < \tilde{C} | w_m = w_f)$.

We note $G(W, \theta, \Phi)$ the proportion of men in the society who are chosen to invest.

- If $w_m > w_f$ on average in the population,

$$G(W, \theta, \Phi) < P((t^i - t^{ni})W < \tilde{C} | w_m = w_f) = S$$

- If $w_m = w_f$ on average in the population,

$$G(W, \theta_m - \theta_f, \Phi) = P((t^i - t^{ni})W < \tilde{C} | w_m = w_f) = S$$

This last case, in which $w_m = w_f$ on average in the population, corresponds to a situation in which the stereotype is self-fulfilling. A belief for households about the difference of abilities between men and women will be self-confirmed if households induce men to invest at precisely the rate postulated by the beliefs. This is precisely the case when W is 0 in average in the population, so if wages does not intervene in the decision process.

In this case,

$$S = P((t^i - t^{ni})W < \tilde{C} | w_m = w_f) = \frac{\% \text{ of men who invest}}{100}$$

Two important results can be drawn. Given that in average, women earn lower wages than men (according to empirical evidence on aggregate data), mixed with the fact that people believe that women are more talented than men to produce domestic goods, lead women to invest more in domestic production, and become more productive than men. Furthermore, even if a woman earns a higher wage than her husband, and abilities of the two spouses are equal, the couple can believe its optimal the wife invests in domestic production, because of the stereotype.

Finally, very few men are chosen to invest in domestic production, given that they earn more in the labor market, and that the stereotype prevails in the society, and the resulting resource allocation is Pareto inefficient. By introducing inertia in household decisions, the stereotype creates a second best Pareto inefficiency. Negative prior beliefs about ability of men will bias the assignment process.

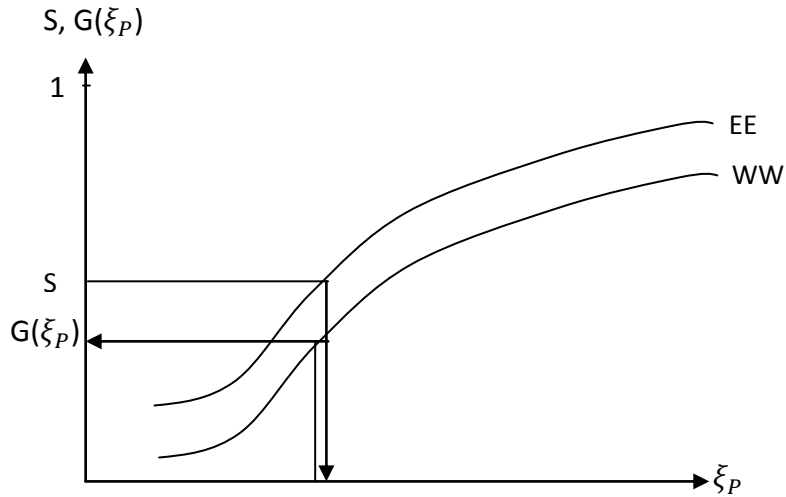


Figure 4: $w_m > w_f$, on average

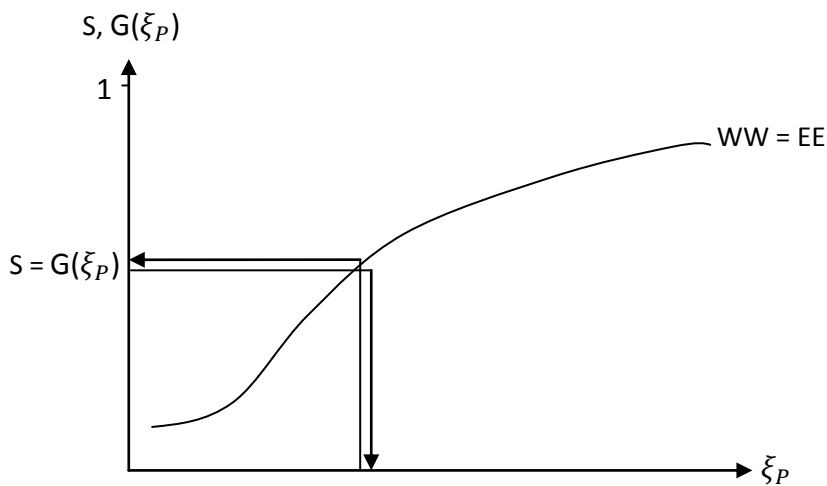


Figure 5: $w_m = w_f$, on average

Figures 4 and 5 illustrate the analysis graphically, in the whole population. The horizontal axis measures the average value of posterior probability in the population $\xi_p(\Phi_W, \theta_m - \theta_f)$, and vertical axis measures a proportion of men in the population. So it can measure the percentage of men more able than their wife in domestic production, and the percentage of men who really invest. The upward-sloping curve EE is the graph $\{(\xi_p, S) | \xi_p = \xi_p(S)\}$, depicting posterior probability-stereotype pairs consistent with optimal household behavior. Indeed, when the stereotype is strong in the society (Φ decreases), ξ_p decreases. The upward-sloping curve WW is the graph $\{G(\xi_p)\}$, which represents ‘posterior probability-proportions of men investing’ pairs consistent with optimal household behavior. Indeed, when ξ_p is high, many men invest in domestic production. The figure assumes $G(\cdot)$ to be continuous.

So wages are not represented in these two graphs, but they intervene to fix the gap between EE and WW. In figure 4, $w_m > w_f$, on average. So curve EE is above WW, which implies that the proportion of men investing is lower than the proportion of men believed as more able than their wife in domestic production. The stereotype is amplified. In figure 5, women's wages and men's wages are equal on average, so curves EE and WW merge and the stereotype is self-fulfilling.

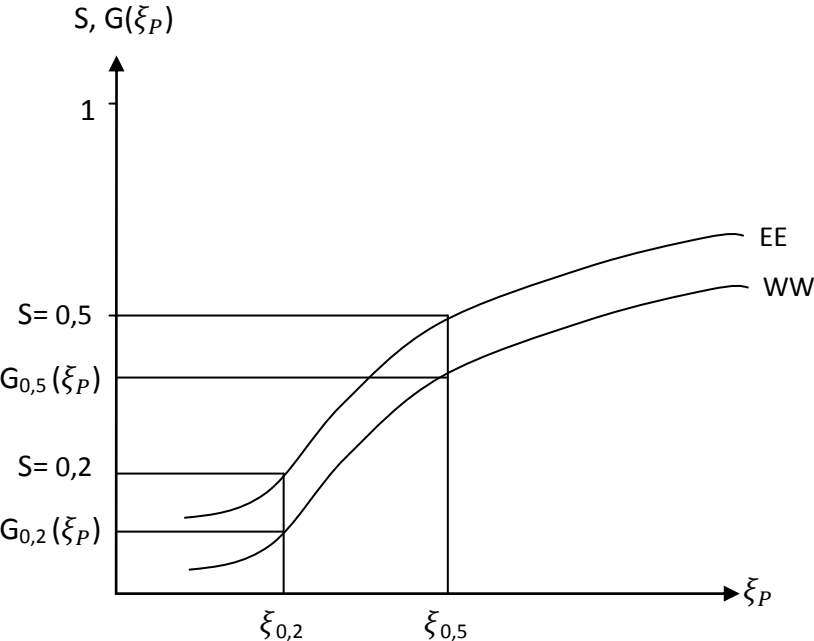


Figure 6: Different levels of the stereotype, if $w_m > w_f$, on average

Figure 6 shows different situations, according to the prevalence of the stereotype. We place in case in which women's wages are lower than men's wages. Two levels of the stereotype are represented here. In the first situation, the stereotype is strong because people think that 20 % of men have a higher capacity than women ($S=0,2$), and in the second situation, the stereotype disappear since half of the men are believed more talented than women ($S=0,5$). On average, $\xi_{0,5}$ is higher than $\xi_{0,2}$, and more men are chosen to invest when $S=0,5$.

4. Public Policies Implications

The inefficiency result opens a discussion about the role public policies might play to restore the first best optimum. Does political economy can shape the stereotype, in order to obtain a different allocation of time inside the household?

First, the choice of the investor in the household depends on wages. We have concluded that women are more often chosen to invest, partly because they are less paid in the labor

market than men. Consequently, wage policies promoting wage equality may lead men and women to share household duties more equally. Men could have a higher probability to be chosen to invest and increase their productivity. However, the stronger the stereotype is, the less efficient wage policies are in changing household allocation decisions, and the specialization of spouses in market and household activities.

We also wonder if the stereotype can be shaped, and how doing it. It requires to use a dynamic reasoning. Again consider wage policies promoting wage equality. More men invest in domestic production in that case, and increase their productivity in domestic production. Once the investments made by chosen spouses, people realize that their belief about the difference of ability between men and women is false, and the stereotype is less prominent inside the society.

Apart wages, the objective would be to reveal in a better way abilities: paternity leaves, as well as strong incentives for a sharing of parental leave between mother and father (as in some Northern countries, for example) would result in decreasing the strength of the stereotype in showing to both parents that, in fact, their abilities in household production are very often more similar than what they thought. At the same time, this would decrease $g(c_m)$, the cost of production of men's household productivity.

Another types of political measure could directly act on the stereotype, as broadcasting advertisements promoting a better sharing of tasks between spouses (advertisements showing men making domestic tasks as instance), or encouraging little boys to play with usual toys for girls and connected with domestic tasks (doll's tea sets, etc.).

Conclusion

The model presented in this paper aims at introducing a stereotype about relative abilities of men and women, in a household behaviour model. Under the assumption that abilities in domestic production are imperfectly known by spouses, we show how the intra-household decision-making process is biased by the stereotype, and we try to explain empirical findings showing that the allocation of time inside couples is not efficient.

We consider that a relative specialization occurs inside the household: one of the two spouses is chosen to specialize more in domestic work, by making an investment in domestic production. We show that both wage gap between men and women, and the stereotype, lead to a very weak investment in domestic work from men. As a result, women are really more often chosen, and become more productive than men. Even if a woman earns a higher wage than her husband, and abilities of the two spouses are equal, the couple can believe its

optimal the wife invests in domestic production, because of the stereotype. We prove that, even when men and women are equally endowed ex ante, stereotype can bring about a situation in which households (correctly) perceive the groups to be unequally productive, ex post.

Public policies might restore the first best optimum, by an action on wages in order to diminish wage gap between men and women, or a direct action on the stereotype: paternity leave as instance.

The current extension of this work is a quantitative analysis using the French Time Use Survey 1998-99. A potential extension could be to study dynamic of the model, by modeling an overlapping generation structure.

References

Aguiar & Hurst (2007). "Measuring Trends in Leisure: The Allocation of Time over Five Decades," *The Quarterly Journal of Economics*, MIT Press, vol. 122(3), pages 969-1006, 08.

Akerlof, G., and R. Kranton (2000). "Economics and Identity", *Quarterly Journal of Economics*, Vol. 115, Issue 3: 715-753.

Anxo, D., Flood, D. and Kocoglu, Y. (2002). "Offre de travail et répartition des activités domestiques et parentales au sein du couple: une comparaison entre la France et la Suède." *Economie et Statistique*, 352-35: 127–150.

Apps, Patricia F. & Rees, Ray, (1988). "Taxation and the household," *Journal of Public Economics*, Elsevier, vol. 35(3), pages 355-369, April.

Apps, Patricia F. and Ray Rees. (1997). "Collective Labor Supply and Household Production." *Journal of Political Economy*, 105: 178–190.

Aronsson, Thomas, Daunfeldt, Sven-Olov, and Wikström, Magnus. (1999). "Estimating intrahousehold allocation in a collective model with household production." *Journal of Population Economics*, 14 no. 4 (December 2001): 569-584.

Becker, Gary S, (1981). "A Treatise on the Family," *NBER Books, National Bureau of Economic Research*, Inc, number beck81-1.

Bittman, M., England, P., Folbre, N., Sayer, L. and Matherson, G. (2003). "When Gender Trumps Money: Bargaining and Time in Household Work", *The American Journal of Sociology* 109:1, pp.186-214.

Bourguignon, Francois & Chiappori, Pierre-Andre, (1992). "Collective models of household behavior : An introduction," *European Economic Review*, Elsevier, vol. 36(2-3), pages 355-364, April.

Bourguignon, François & Chiuri, Maria Concetta, (2005). "Labor market time and home production: A new test for collective models of intra- household allocation," *CSEF Working Papers 131*, Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy.

Brines, J. (1994). "Economic Dependency, Gender, and the Division of Labor at Home" *American Journal of Sociology* 100, pp 652-688.

Carter M, Katz E (1997). "Separate Spheres and the Conjugal Contract: Understanding the Impact of Gender-Biased Development". In: *Haddad L, Hoddinott J, Alderman H (Eds). Intrahousehold Resource Allocation in Developing Countries: Methods, Models and Policies.*

Chiappori, Pierre-André. (1988). "Rational Household Labor Supply", *Econometrica*, 56: 63-89.

Chiappori, Pierre-André. (1992). "Collective Labor Supply and Welfare." *Journal of Political Economy*, 100: 437-467.

Chiappori, Pierre-André. (1997). "Introducing Household Production in Collective Models of Labor Supply", *Journal of Political Economy*, 105: 191-209.

Coate, Stephen & Loury, Glenn C, (1993). "Will Affirmative-Action Policies Eliminate Negative Stereotypes?," *American Economic Review*, *American Economic Association*, vol. 83(5), pages 1220-40, December.

Cudeville et Recoules (2009). "Household Behavior and Social Norms: A Conjugal Contract Model", *CES Working Papers* 2009.66

Duflo Esther & Udry Christopher, (2004). "Intrahousehold Resource Allocation in Cote d'Ivoire: Social Norms, Separate Accounts and Consumption Choices," *NBER Working Papers* 10498, National Bureau of Economic Research, Inc.

Fernandez, Cristina & Sevilla-Sanz, Almudena, (2006). "Social norms and household time allocation," *ISER Working Paper Series 2006-38*, Institute for Social and Economic Research

Goldschmidt, Clermont and Aligisakis E. Pagnossin. (1995). "Measures of unrecorded economic activities in fourteen countries." UNDP, Background Papers for the *Human Development Report*, New York: Oxford University Press: 105-155.

Greenstein, T. N. (2000). "Economic Dependence, Gender, and the Division of Labor in the Home: A Replication and Extension." *Journal of Marriage and the Family* 62, pp. 322-335.

Gupta, S. (1999). "Gender Display? A reassessment of the Relationship between Men's Economic Dependence and Their Housework Hours" *Paper presented at the annual meeting of the American Sociological Association, Chicago.*

Hersch, Joni and Stratton, Leslie S., (1994). "Housework, Wages, and the Division of Housework Time for Employed Spouses." *American Economic Review*, vol. 84(2): 120-25.

Hochschild and Machung, (1989). "The Second Shift: Working Parents and the Revolution at Home". *New York: Viking.*

Kalenkoski, Charlene M., Ribar, David C., and Stratton, Leslie S. (2009) "The Influence of Wages on Parents' Allocations of Time to Child Care and Market Work in the United Kingdom", *Journal of Population Economics*, 22 (2), 399-419.

Marchand, O. and Thelot, C. (1991). "Deux siècles de travail en France." *Population active*, INSEE, Paris.

Rapoport, Benoit and Catherine Sofer. (2005). "Pure Production Factors and the Sharing Rule: Estimating Collective Models with Household Production." *Document de travail, MSE, Université Paris 1-Panthéon-Sorbonne.*

Rapoport Benoît, Sofer Catherine and Solaz Anne, (2011). "Household production in a collective model: some new results", *Journal of Population Economics*, Volume 24, Number 1, 23-45.

Régnier-Loilier Arnaud, (2009), « L'arrivée d'un enfant modifie-t-elle la répartition des tâches domestiques au sein du couple ? » *Population et Sociétés, INED, No. 461*

Sofer, Catherine. (2005). "La croissance de l'activité féminine" in *Femmes, genre et sociétés: l'état des savoirs. La Découverte*, pp: 218-226.

Sofer and Rizavi (2008). "Household division of labor: Is there any escape from traditional gender roles?", *Working paper, Université paris 1.*

Udry, Christopher, (1996). "Gender, Agricultural Production, and the Theory of the Household," *Journal of Political Economy, University of Chicago Press*, vol. 104(5), pages 1010-46, October.

Winqvist, Karin. (2004). "How Europeans spend their time. Everyday life of women and men." *Rapport de la Commission européenne, Pocketbooks Edition, Luxembourg.*