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On the dynamics of gender differences in preferences

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Abstract

A growing literature highlights the role played by gender differences in preferences in the persistence of gender inequality, making it crucial to investigate the dynamics of the gender gap in preferences. To that end, we propose a two-sex cultural evolution model in which individuals may be either family-oriented or market-oriented. Preferences evolve jointly within the populations of males and females, and the dynamics of gender differences in preferences is shaped by the outcome of the household decision-making process. In particular, the long-run persistence of gender differences in preferences depends on the home production technology, the degree of patriarchy, or the level of the gender wage gap. We also show that, when the intra-household bargaining power or the gender wage gap are endogenous, the appearance and persistence of gender differences in preferences are crucially affected by initial conditions.

JEL classifications: D13, J16, Z10.

1. Introduction

At the beginning of the twenty-first century, the persistent inequalities between men and women were mainly attributed to two factors: discrimination against women and gender differences in human capital accumulation. A decade later, while the relevance of these traditional factors is not disputable, our understanding of the sources of gender inequality has significantly evolved. In particular, recent advances in behavioural and experimental economics conclusively highlight the existence of gender differences in preferences. An abundance of laboratory experiments show that women adopt less risky and less competitive behaviours than men and hypothesize that these differences may partly explain the persistence of gender inequality.[1] Several recent papers conclude that differences in preferences

1 The large number of recent surveys devoted to these results testifies the vitality of this field of research (see, for instance, Croson and Gneezy, 2009; Bertrand, 2011; Azmat and Petrongolo, 2014; Niederle, 2016).

matter in the field. Buser *et al.* (2014) consider secondary school students in the Netherlands and show that, for a similar level of academic ability, boys are more likely to choose academic tracks that are more science intensive. Then, they show that the gender gap in competitiveness (as measured in the lab) accounts for a substantial part of this difference. Zafar (2013) also finds evidence of the role gender differences in preferences play in explaining the gender gap in choice of college major among students at Northwestern University. In particular, he concludes that these choices are partly driven by the fact that males care more about the pecuniary outcomes in the workplace while females care more about the non-pecuniary outcomes such as the possibility to conciliate work and family life. Bosquet *et al.* (2018), in a study focusing on academic promotion in France, argue that gender differences in competitiveness partly explain why female professors remain under-represented in French universities. De Paola *et al.* (2017) reach similar conclusions through a natural experiment based on the Italian promotion system for associate and full professor positions. Finally, Flory *et al.* (2014) use a field experiment to show that the stronger male inclination towards competition and their lower aversion to uncertainty compared to women shape job entries and then the gendered composition of labour markets. This body of findings makes it crucial to study the evolution of the gender gap in preferences in order to have a full understanding of the dynamics of gender inequality. Our paper contributes to this line of research by proposing a cultural transmission model designed to analyse the evolution of gender differences in preferences and the conditions of their persistence.

The debate about the origins of gender differences in preferences focuses on the distinction between nature and nurture: Do gender differences in preferences come from biological factors or do they have cultural roots? On the nature side, some studies highlight the role of testosterone in competitiveness (Batesup *et al.*, 2002; Archer, 2006) or risk taking (see Apicella *et al.*, 2015, for a survey). On the other side, a large set of studies provide evidence that nurture, and thus culture, plays a role. Following the pioneering work of anthropologists like Mead (1935),[2] Gneezy *et al.* (2009) study the roots of gender differences in competitiveness within two distinct cultures: the patriarchal society of the Massai in Tanzania and the matrilineal society of the Khasi in India. The authors show that, in the patriarchal Massai society, men compete more than women; but the result is reversed among the Khasi.[3] These findings suggest that gender differences in preferences are not only due to biological or evolutionary reasons, but are also shaped by the environment. Even more striking evidence of the role of nurture is provided by Andersen *et al.* (2013). They study gender differences in the willingness to compete of children aged seven to 15 in both matrilineal (Khasi) and patriarchal (Kharbi) villages in Northeast India. They show that, in both societies, there are no gender differences at the age of seven. However, in the patriarchal society, 15-year-old boys are significantly more likely to compete than seven-year-old boys, and the reverse is true for girls. Conversely, in matrilineal society the average behaviour of

2 From 1935 and based on her observations of three New Guinea peoples, Mead states that cultural factors are more important than biological ones in shaping male and female behaviours.

3 In a similar spirit, Gong *et al.* (2015) compare gender differences in social preferences between two Chinese ethnic groups: the matrilineal Mosuo and the patriarchal Yi. In a dictator experiment, they find that men are more prone to share their payoffs than women within the Mosuo society, while they find no gender differences in Yi society. Gong and Yang (2012) find that women are more risk-averse than men in both societies, but that the gender gap is smaller in the Mosuo society.

children does not change. These results emphasize the role played by the socialization process in the emergence of gender differences in preferences.

Based on these findings, our article provides a theoretical framework to model the cultural emergence and evolution of gender differences in preferences. We consider that individuals (men and women) can be either *market-oriented* or *family-oriented*. Market-oriented individuals may be viewed as more competitive and less risk-averse, such that the relative disutility they associate with market work vs. housework is low compared to family-oriented individuals. Our cultural evolution process is built on the socialization model proposed by Besley (2017). Preferences are transmitted from parents to children, and the probability for a child to adopt a specific preference is positively related to the expected utility gain associated with this trait. We allow for the fact that this gain differs for males and females. Moreover, as men and women are matched together to form a household and take their decisions jointly within the household they form, the expected utility gain for a woman (resp. a man) depends on the distribution of preferences within the population of men (resp. women). We are then able to characterize the joint dynamics of preferences within both populations of males and females. We show that this dynamics is driven by the outcome of the household decision-making process. In turn, this outcome depends on technology, institutions, as well as more deeply rooted gender differences. In this sense, we do not deny the role played by nature, since the socialization process may reinforce biological differences.

Let us now present the household decision-making process in more detail. Once matched together, the two members of a household collectively decide the time that each of them has to spend on market activities and home production. Family-oriented and market-oriented individuals differ in their relative disutility for each activity so that household decisions, and the associated indirect utilities for each spouse, depend on the cultural composition of the couple. In this framework, we analyse how these indirect utilities (the outcome of the household decision-making process) and, accordingly, the long-run distribution of preferences is affected by parameters related to the technology, the degree of patriarchy in the society, or the gender wage gap. In particular we show that, for low household productivity, the economy converges towards an equilibrium in which men and women display distinct preferences. However, a technological improvement may destabilize the inegalitarian equilibrium and induce the progressive convergence towards an equilibrium in which both men and women are market-oriented. Along the convergence path, the gender gap in occupation is progressively filled. We also emphasize the consequences that an inegalitarian distribution of bargaining powers within the household may have on the long-run distribution of preferences. We show that, everything being equal, a patriarchal society, where men have a higher bargaining power than women, is more likely to reach an equilibrium in which women are family-oriented and men market-oriented than a society where bargaining powers are equally distributed. This last result echoes the previously cited experimental findings of Gneezy *et al.* (2009), Gong *et al.* (2015), Andersen *et al.* (2013), and Gong and Yang (2012). It also implies that a given technological shock would have different consequences on the dynamics of preferences in two societies which differ in their level of patriarchy. Finally, we introduce an exogenous gender gap that could be rooted in biological differences between males and females. We show that nurture may complement nature since cultural evolution mechanisms may magnify this biological difference by widening the initial inequality between gender.

All the comparative static results summarized above are obtained in a framework where the outcome of the household decision-making process is not affected by the distribution of preferences within the society. In a second step, we relax this assumption. In particular, we consider that the intra-household bargaining powers may depend on the average labour supply behaviour of males and females. In this case, the distribution of preferences, by shaping these behaviours, determines the relative bargaining power of men and women and affects the outcome of the household decision-making process. It implies that long-run steady-states characterized by persistent gender differences in preferences may co-exist with a stable equilibrium in which men and women exhibit similar preferences. Then, two countries initially characterized by distinct technologies may end up with a quite different gender gap in preferences even if their technological discrepancies caught up afterwards. The same kind of result is obtained when we endogenize the gender wage gap. This path-dependency result may be related to a recent set of studies which show that historical events in the distant past may have persistent effects on gender roles (see Bauernschuster and Rainer, 2012; Alesina *et al.*, 2013; Grosjean and Khattar, 2018; Teso, 2018).

Our article relates to the body of theoretical works linking cultural evolution to the evolution of gender inequality (see Escriche *et al.*, 2004; Fernández *et al.*, 2004; Escriche, 2007; Hiller and Baudin, 2016). Escriche (2007) and Escriche *et al.* (2004) apply the cultural transmission model proposed by Bisin and Verdier (2001) to explain the evolution of family-related preferences among women and how this evolution may interact with labour market discrimination and the training policies of firms. We are interested in the dynamics of the same kind of preference as in these two papers. However, we endogenize the distribution of preferences within both the populations of males and females, while Escriche (2007) and Escriche *et al.* (2004) consider men's preferences to be exogenous.[4] In this respect, the current article is more closely related to Hiller and Baudin (2016), in which we model a joint cultural dynamics within the population of males and females. However, our present article differs from Hiller and Baudin (2016) along several important lines. The main point of difference lies in the fact that our previous work focused on the evolution of cultural views about the role of women in society and is not suited to account for the dynamics of gender differences in preferences. Indeed, in the framework we developed in Hiller and Baudin (2016), there is no stable equilibrium in which the distribution of cultural traits within the population of females clearly differs from the distribution of cultural traits within the population of males. Conversely, such a steady-state could be stable in the model we propose in the current paper. Hence, this paper is well designed to explicitly tackle the issue of the evolution and the persistence of gender differences in preferences. Given the importance of issues related to gender inequalities and their evolution, our paper fills an important theoretical gap in the literature.

Importantly enough, in Hiller and Baudin (2016) we consider a much simpler household decision model in which the decision process is non-cooperative. On the contrary, the cultural evolution model we propose here is sufficiently tractable to allow for the adoption of a more standard collective model which gives a key role to the distribution of bargaining powers between genders. It enables us to assess the role played by patriarchy in the persistence of gender differences in preferences in line with the previously cited experimental findings. In addition, the outcome of the household decision-making process may depend on

4 In a different framework, Fernández *et al.* (2004) propose a model in which men's disutility from a working wife is endogenous, while the preferences of women are exogenous and stable.

the distribution of preferences (when the intra-household bargaining power or the gender pay gap are endogenous) while it remains exogenous in Hiller and Baudin (2016). This new feature paves the way to path-dependency phenomena through the co-existence of stable equilibria in which males and females exhibit different preferences with other stable equilibria in which there are no gender differences in preferences. Finally, the tractability of our framework also allows us to relax the assumption of random matching between spouses. Our results hold unchanged when we explicitly solve the marriage market equilibrium.

The rest of the paper is organized as follows. Section 2 presents the cultural evolution model and the household decision-making process. The long-run distribution of preferences is analysed in Sections 3 and 4. Section 5 concludes. The proofs of the propositions are gathered in an Online Appendix.

2. The model

We consider an economy populated by non-overlapping generations of males and females. At each date t two populations co-exist: a unit mass of males (m) and a unit mass of females (f). Each individual lives for exactly one period. At the beginning of their life (once they have acquired their preferences), each male is randomly matched with a female to form a household.[5] At the end of the period, each household has two children (one boy and one girl) and then dies. Within each population there are two preference traits: market-oriented preferences (trait $\overline{\mathbf{M}}$) and family-oriented preferences (trait $\underline{\mathbf{M}}$).[6] Type-$\overline{\mathbf{M}}$ individuals represent a share q_t^s of the population $s \in \{m, f\}$.

Individuals face a two-step decision process during their lifetime. First, at the beginning of their life they acquire one of the two preference traits though a socialization process described in Section 2.1. Then, within the household, spouses cooperatively choose their level of participation to market vs. housework activities. The household decision-making process is presented in Section 2.2.[7]

2.1 The socialization process

Each child $s \in \{m, f\}$ acquires his/her preferences through the joint action of the family and society. A girl (boy) is first exposed to the preferences of her mother (his father): the parental role model. She (he) also randomly picks a role model within the whole population of females (males): the external role model. The assumption according to which children are only influenced by same-sex parent and same-sex role models is a simplifying one. Nevertheless, several papers show that the intergenerational transmission of attitudes is stronger between children and their same-sex parent than between children and their opposite-sex parent (see, for instance, Loureiro *et al.*, 2010; Alan *et al.*, 2017).

5 The assumption of random matching between spouses is made for the sake of simplicity. We relax this assumption in Appendix 1, where we define a marriage market equilibrium as a situation in which no pair of individuals of the opposite sex prefers to marry each other than to keep their current assignment. Then we show that our results hold unchanged when we consider this notion of marriage market equilibrium instead of random matching.

6 The precise meaning of each preference trait will be detailed in Section 2.2.

7 As will become clear below, children choose their preferences by comparing the utility associated with each preference trait within the generation of their parents. Hence the socialization process and the decision of participation in the labour market can be analysed separately.

Moreover, studies in sociology and psychology conclude that girls are much more likely to choose female role models, while the opposite is true for boys (see, for instance, Gilbert *et al.*, 1983; Wohlford *et al.*, 2004; Bricheno and Thornton, 2007). Our preference transmission process consists in a generalization of the framework proposed by Besley (2017) (see also Besley and Ghatak, 2016; Besley and Persson, 2017) to two populations.[8] A child 'chooses' her/his preferences through the observation of the preference trait of both the parental and the external role models. If the two models have the same preference, the child adopts this preference trait with probability one. Otherwise, the child has to choose between the two preference traits. This choice is based on a noisy comparison between the expected utilities associated with each preference.[9] Formally, denoting $V_t^{s,i}$ the expected utility of an individual s holding preference i at date t, and $\Delta V_t^s \equiv V_t^{s,\overline{\mathbf{M}}} - V_t^{s,\underline{\mathbf{M}}}$, a child who receives a mixed influence (i.e. for whom the parental and external models have different preferences) chooses the market-oriented preference ($\overline{\mathbf{M}}$) if:

$$V_t^{s,\overline{\mathbf{M}}} + \varepsilon \geq V_t^{s,\underline{\mathbf{M}}} \qquad \Leftrightarrow \qquad \varepsilon \leq \Delta V_t^s$$

with ε a 'noise' that follows a symmetric probability distribution with zero mean. Hence, denoting $\phi(\cdot)$ the cumulative distribution function of ε, the probability that a child for whom the parental and the external model exhibit different preferences adopts the trait $\overline{\mathbf{M}}$ equals $\phi(\Delta V_t^s)$. This probability is obviously increasing in ΔV_t^s with $\phi(0) = 1/2$.

Given this process, the fraction of individuals of type $\overline{\mathbf{M}}$ evolves according to the following equation:

$$q_{t+1}^s = \left(q_t^s\right)^2 + 2q_t^s\left(1 - q_t^s\right)\phi(\Delta V_t^s) \tag{1}$$

The first term of the right-hand side of the equation above corresponds to the probability, for a child, to have a parental and an external model who are both market-oriented. In that case, the child adopts this preference trait with probability one. The second term equals the probability for a child to have a parental and an external role model with different preferences ($2q_t^s(1 - q_t^s)$) multiplied by the probability to adopt the preference $\overline{\mathbf{M}}$ in that case, which equals $\phi(\Delta V_t^s)$.

As previously explained, the preference choice is based on the comparison of the expected utilities $V_t^{s,\underline{\mathbf{M}}}$ and $V_t^{s,\overline{\mathbf{M}}}$. We assume that expectations are myopic such that the expected utility $V_t^{s,i}$ is evaluated based on the current distribution of preferences.

8 In Appendix 2, we relate our cultural transmission model to alternative approaches. In particular, we show that a model of strategic parental socialization (with perfect altruism) or a model of imitation (in the spirit of Schlag, 1998) leads to a cultural evolution process qualitatively similar to ours.

9 Alternatively, we could have assumed that the child learns only the realized utilities of both the parental and the external models. This would heavily complexify the analysis since those realized utilities depend on the composition of the couples of the parental and the external model, respectively. Our assumption is similar to the one adopted by Besley and Ghatak (2016) in a different framework. Indeed, they consider that a worker may adopt the preference of her/his co-worker with a probability that is increasing in the expected (ex-ante), rather than realized (ex-post), utility of this co-worker (see also Besley, 2017; Besley and Persson, 2017).

Besley (2017), Besley and Ghatak (2016), and Besley and Persson (2017) adopt a similar simplifying assumption. Under myopic expectations, $V_t^{s,i}$ writes as:

$$V_t^{s,\overline{\mathbf{M}}} = q_t^{-s} u^{s,\overline{\mathbf{M}}}(\overline{\mathbf{M}}) + (1 - q_t^{-s}) u^{s,\overline{\mathbf{M}}}(\underline{\mathbf{M}}) \tag{2}$$

$$V_t^{s,\underline{\mathbf{M}}} = q_t^{-s} u^{s,\underline{\mathbf{M}}}(\overline{\mathbf{M}}) + (1 - q_t^{-s}) u^{s,\underline{\mathbf{M}}}(\underline{\mathbf{M}}) \tag{3}$$

with $u^{s,i}(j)$ the indirect utility that an adult s with preferences $i \in \{\overline{\mathbf{M}}, \underline{\mathbf{M}}\}$ derives from sharing her/his life with an adult of type $j \in \{\overline{\mathbf{M}}, \underline{\mathbf{M}}\}$ and q_t^{-s} the proportion of $\overline{\mathbf{M}}$ individuals within the population $-s$ (with $-s \in \{m, f\}$ and $-s \neq s$) at date t. This indirect utility results from the household decision-making process which will be presented in detail in the next section. Even if males and females have the same preferences, they do not necessarily get the same indirect utility ($u^{m,i}(j)$ and $u^{f,i}(j)$ can be different). These differences may either come from biological discrepancies between males and females or from the unequal treatment of men and women within the household or within society.[10] Let us also underline that, while in this section we consider the indirect utility $u^{s,i}(j)$ as a constant, they could depend on the distribution of preferences. This is the case in the two applications we propose in Sections 3.2 and 4.2.

Using (2) and (3), we obtain the following expression for the difference between the expected utility of the two types of agents within the population s:

$$\Delta V_t^s = q_t^{-s} \Delta u^s(\overline{\mathbf{M}}) - (1 - q_t^{-s}) \Delta u^s(\underline{\mathbf{M}}) \tag{4}$$

with

$$\Delta u^s(\overline{\mathbf{M}}) \equiv u^{s,\overline{\mathbf{M}}}(\overline{\mathbf{M}}) - u^{s,\underline{\mathbf{M}}}(\overline{\mathbf{M}}) \qquad \text{and} \qquad \Delta u^s(\underline{\mathbf{M}}) \equiv u^{s,\underline{\mathbf{M}}}(\underline{\mathbf{M}}) - u^{s,\overline{\mathbf{M}}}(\underline{\mathbf{M}}) \tag{5}$$

where $\Delta u^s(\overline{\mathbf{M}})$ accounts for the utility gain, for an individual s, of being market-oriented ($\overline{\mathbf{M}}$) rather than family-oriented ($\underline{\mathbf{M}}$) when matched with a market-oriented mate and $\Delta u^s(\underline{\mathbf{M}})$ accounts for the utility gain, for an individual s, of being family-oriented rather than market-oriented when matched with a family-oriented mate. Hence, ΔV_t^s measures the expected utility gain, for an individual s, of being $\overline{\mathbf{M}}$ rather than $\underline{\mathbf{M}}$ as a function of the distribution of preferences within the population $-s$. To clarify the exposition of our dynamical results, we adopt the terminology proposed in Hiller and Baudin (2016):

Definition 1 We say that:

i. Market-oriented preference dominates within population s if: $\Delta u^s(\overline{\mathbf{M}}) > 0$ and $\Delta u^s(\underline{\mathbf{M}}) < 0$.
ii. Family-oriented preference dominates within population s if: $\Delta u^s(\overline{\mathbf{M}}) < 0$ and $\Delta u^s(\underline{\mathbf{M}}) > 0$.
iii. Within population s, there exists symmetric complementarity between preferences if: $\Delta u^s(\overline{\mathbf{M}}) > 0$ and $\Delta u^s(\underline{\mathbf{M}}) > 0$.
iv. Within population s, there exists asymmetric complementarity between preferences if: $\Delta u^s(\overline{\mathbf{M}}) < 0$ and $\Delta u^s(\underline{\mathbf{M}}) < 0$.

10 For instance, differences between $u^{m,i}(j)$ and $u^{f,i}(j)$ may come from an unequal distribution of bargaining powers within the household (see Section 3) or the existence of a gender wage gap (see Section 4).

Considering the population f, when a preference dominates, women are better off when holding this preference rather than the other one, whatever the preference of her spouse. When preferences exhibit symmetric (resp. asymmetric) complementarity, women are always better off (resp. worse off) when holding the same preference as her partner, whatever this preference trait.

Rearranging equation (1) and combining this equation with expression (4), we derive the joint law of motion of $\left(q_t^m, q_t^f\right)$:

$$\begin{cases} \Delta q_t^m = q_t^m(1-q_t^m)\{2\phi\left(q_t^f[\Delta u^m(\overline{\mathbf{M}}) + \Delta u^m(\underline{\mathbf{M}})] - \Delta u^m(\underline{\mathbf{M}})\right) - 1\} \equiv g^m\left(q_t^m, q_t^f\right) \\ \Delta q_t^f = q_t^f\left(1-q_t^f\right)\{2\phi\left(q_t^m[\Delta u^f(\overline{\mathbf{M}}) + \Delta u^f(\underline{\mathbf{M}})] - \Delta u^f(\underline{\mathbf{M}})\right) - 1\} \equiv g^f\left(q_t^m, q_t^f\right) \end{cases} \tag{6}$$

with $\Delta q_t^s \equiv q_{t+1}^s - q_t^s$.

2.2 The household decision-making process

Once adult, men and women are randomly matched to form a household. Within a household, each spouse is endowed with one unit of time that is shared between work on the market and housework; $l^{s,i}$ denotes the housework time of the spouse of preference type i and gender s. We assume that the couple has to devote a minimum time period $\lambda \in (0,1)$ to housework, no matter how the burden is shared. The parameter λ corresponds to the minimum amount of time required to maintain the home and care for the family. It can be viewed as a technological parameter since a technological shock (like the spread of new household appliances) can lower it. The time which is not devoted to housework is spent in the workforce.

As already introduced, individuals can be either family-oriented or market-oriented. The two types of individuals differ according to the relative disutility they associate with market work vs. housework. We consider that market-oriented (resp. family-oriented) individuals experience disutility only during housework (resp. market work). Let us point out the fact that considering differences in preferences that are directly associated with the disutility coming from each kind of activity may be viewed as a short-cut to a more general model in which differences in preferences would be associated with risk aversion and/or taste for competition. As the labour market is a more competitive and risky environment than the household, individuals who are more averse to risk and/or competition (type $\underline{\mathbf{M}}$) would prefer to stay at home, while the reverse is true for individuals who are less averse to risk and/or competition (type $\overline{\mathbf{M}}$).

Formally, the preferences of an individual of gender s with preferences i are:

$$v^i\left(c^{s,i}, l^{s,i}\right) = u\left(c^{s,i}\right) - F_i\left(l^{s,i}\right) \tag{7}$$

with $c^{s,i}$ the level of consumption, $l^{s,i}$ the housework time, $u(c^{s,i})$ the utility derived from consumption, and $F_i(l^{s,i})$ the disutility associated with the time spent in housework (for $i = \overline{\mathbf{M}}$) or on the market (for $i = \underline{\mathbf{M}}$). We choose the following functional form for this disutility term:

$$F_i(l^{s,i}) = \begin{cases} (l^{s,i})^2 & \text{if} \quad i = \overline{\mathbf{M}} \\ (1 - l^{s,i})^2 & \text{if} \quad i = \underline{\mathbf{M}} \end{cases} \tag{8}$$

We consider that males and females have the same productivity at home, but we allow for wages to differ between gender: w^s will denote the wage rate of an individual of gender s.

In order to model the household decision process, we adopt the collective approach proposed by Chiappori (1988, 1992).[11] This approach only imposes that the decisions of the couple lead to a Pareto-efficient outcome. In practice, the household maximizes a collective utility function which is a weighted average of the utilities of the two spouses under income pooling. Here, a couple composed of a male of type i and a female of type j aims at maximizing the following household utility function with respect to $\{c^{m,i}, c^{f,j}, l^{m,i}, l^{f,j}\}$:

$$W_t^{i,j}\left(c^{m,i}, c^{f,j}, l^{m,i}, l^{f,j}\right) = \mu v^i\left(c^{m,i}, l^{m,i}\right) + (1-\mu)v^j\left(c^{f,j}, l^{f,j}\right) \tag{9}$$

with $\mu \in [0,1]$ the weight put on the utility of the husband, which accounts for the bargaining power of males in the society.

The household decision-making process consists in maximizing (9) under the following household time and budget constraints:

$$l^{m,i} + l^{f,j} \geq \lambda \tag{10}$$

$$c^{m,i} + c^{f,j} = (1 - l^{m,i})w^m + (1 - l^{f,j})w^f \tag{11}$$

In the two sections below, we will consider the impact of a change in our parameters on the long-run distribution of preferences reached by the economy and, in particular, on the emergence and persistence of gender differences in preferences. In our first application (Section 3), we will be interested in the effect of the technology (λ) and the degree of patriarchy measured by the relative bargaining power (μ). In a first step (Section 3.1), this bargaining power will be considered as exogenous, while it will be endogeneized in Section 3.2. In our second application (Section 4), we will analyse the effect of the gender wage gap ($w^m - w^f$). Once again, this gap will be first considered as exogenous (Section 4.1) and then as endogenous (Section 4.2).

3. The long-run impact of technology and patriarchy

In order to obtain analytically tractable solutions, we choose a log-specification for the utility derived from consumption: $u(c^{s,i}) = \ln c^{s,i}$. Moreover, as we focus on the role played by the technology and the degree of patriarchy, we assume that men and women earn the same wage: $w^m = w^f = w$ such that the budget constraint (11) becomes

$$c^{m,i} + c^{f,j} = (2 - l^{m,i} - l^{f,j})w \tag{12}$$

Finally, we assume that

Assumption 1 $\lambda > (3 - \sqrt{5})/2$

This condition simplifies the exposition of our results by ensuring that the time constraint (10) is always binding[12] such that the budget constraint (12) simply becomes: $c^{f,i} + c^{m,j} = (2 - \lambda)w$.

11 This approach has received an important empirical support (see, for instance, Bobonis, 2009) and is extensively used in applied theoretical works (see, among others, the recent articles by Baudin *et al.*, 2015, 2018).

12 The time constraint is not binding for too low values of λ. Indeed, since family-oriented individuals experience disutility when working on the market, they could choose to stay at home for a period longer than λ.

3.1 Exogenous patriarchy

In this section, we consider that μ is exogenously given. In line with Doepke and Tertilt (2009) or Fernández (2014), we assume that it constitutes a measure of the level of patriarchy of the society. This view is consistent with the differences between matrilineal Khasi and patriarchal Kharbi societies as reported by Andersen *et al.* (2013):

> The Khasi husband dwells in a household in which he has no authority or property [...] The Kharbi society, on the other hand, is organized in the usual patriarchal structure, in that men possess ownership of the land and have power over monetary decisions of the households.

Shu *et al.* (2013) also report that patriarchal institutional arrangements are among the most salient factors underlying marital power.

3.1.1 Household's decisions Let $x^{s,i}(j) = \left(c^{s,i}(j), l^{s,i}(j)\right)$ be the set of economic choices made by an agent of gender s with preference i who is matched with an agent of type j. Simple algebra leads to the following consumption choices:

$$c^{m,i}(j) = \mu(2-\lambda)w \quad \text{and} \quad c^{f,i}(j) = (1-\mu)(2-\lambda)w \quad \text{for all} \quad i,j \in \{\overline{\mathbf{M}}, \underline{\mathbf{M}}\}^2 \tag{13}$$

These decisions are independent from the cultural composition of the household. Indeed, the time constraint (10) is binding, making the income of the household independent from the distribution of housework time, and there is no gender difference in preferences with respect to consumption. Nevertheless, consumption is unequally distributed when the two spouses do not have the same bargaining power ($\mu \neq 1/2$).

Let us turn now to labour supply decisions. They crucially depend on the cultural composition of the household. Within homogamous $\{\overline{\mathbf{M}}, \overline{\mathbf{M}}\}$ and $\{\underline{\mathbf{M}}, \underline{\mathbf{M}}\}$ couples, the sharing of housework depends on each spouse's relative bargaining power:

$$\begin{aligned} l^{f,\overline{\mathbf{M}}}(\overline{\mathbf{M}}) &= \mu\lambda, \qquad l^{f,\underline{\mathbf{M}}}(\underline{\mathbf{M}}) = \begin{cases} \lambda & \text{if} \quad \mu < \hat{\mu}_1(\lambda) \\ 1-\mu(2-\lambda) & \text{if} \quad \mu \in [\hat{\mu}_1(\lambda), \hat{\mu}_2(\lambda)] \\ 0 & \text{if} \quad \mu > \hat{\mu}_2(\lambda) \end{cases} \\ l^{m,\overline{\mathbf{M}}}(\overline{\mathbf{M}}) &= (1-\mu)\lambda, \quad l^{m,\underline{\mathbf{M}}}(\underline{\mathbf{M}}) = \begin{cases} 0 & \text{if} \quad \mu < \hat{\mu}_1(\lambda) \\ \mu(2-\lambda)+\lambda-1 & \text{if} \quad \mu \in [\hat{\mu}_1(\lambda), \hat{\mu}_2(\lambda)] \\ \lambda & \text{if} \quad \mu > \hat{\mu}_2(\lambda) \end{cases} \end{aligned} \tag{14}$$

with

$$\hat{\mu}_1(\lambda) \equiv \frac{1-\lambda}{2-\lambda} \qquad \text{and} \qquad \hat{\mu}_2(\lambda) \equiv \frac{1}{2-\lambda} \tag{15}$$

For their part, heterogamous couples are always characterized by a specialization of tasks: $\overline{\mathbf{M}}$-type agents fully specialize in labour market activities, as they do not experience any loss coming from this activity, while $\underline{\mathbf{M}}$-type agents carry out all the domestic duties, as this activity is not a source of disutility for them:

$$l^{f,\overline{\mathbf{M}}}(\underline{\mathbf{M}}) = l^{m,\overline{\mathbf{M}}}(\underline{\mathbf{M}}) = 0 \qquad \text{and} \qquad l^{f,\underline{\mathbf{M}}}(\overline{\mathbf{M}}) = l^{m,\underline{\mathbf{M}}}(\overline{\mathbf{M}}) = \lambda \tag{16}$$

By plugging the optimal behaviours (14) and (16) into the utility function (7), we obtain each individual's indirect utility as a function of her/his preferences and the preferences of her/his partner. Then, we deduce the following expressions for $\Delta u^f(\overline{\mathbf{M}})$, $\Delta u^m(\overline{\mathbf{M}})$, $\Delta u^f(\underline{\mathbf{M}})$ and $\Delta u^m(\underline{\mathbf{M}})$:

$$\Delta u^f(\overline{\mathbf{M}}) = -\mu^2\lambda^2 + (1-\lambda)^2, \qquad \Delta u^f(\underline{\mathbf{M}}) = \begin{cases} -(1-\lambda)^2 & \text{if} \quad \mu < \hat{\mu}_1(\lambda) \\ -\mu^2(2-\lambda)^2 & \text{if} \quad \mu \in [\hat{\mu}_1(\lambda), \hat{\mu}_2(\lambda)] \\ -1 & \text{if} \quad \mu > \hat{\mu}_2(\lambda) \end{cases}$$

$$\Delta u^m(\overline{\mathbf{M}}) = -(1-\mu)^2\lambda^2 + (1-\lambda)^2, \quad \Delta u^m(\underline{\mathbf{M}}) = \begin{cases} -1 & \text{if} \quad \mu < \hat{\mu}_1(\lambda) \\ -\mu^2(2-\lambda)^2 & \text{if} \quad \mu \in [\hat{\mu}_1(\lambda), \hat{\mu}_2(\lambda)] \\ -(1-\lambda)^2 & \text{if} \quad \mu > \hat{\mu}_2(\lambda) \end{cases} \tag{17}$$

Two motives should be distinguished in order to figure out the determinants of preference choice. First, the preference trait adopted by an individual affects the task assigned to her/him, as expressed in (16). However, her/his preference also affects the disutility associated with this task. Expressions (17) encompass these two interrelated forces.

3.1.2 Dynamics Adding expressions (17) into equation (6), we obtain the preference dynamics in the economy. In order to describe the long-run properties of this dynamical system, let us define the two functions:

$$\tilde{\mu}_1(\lambda) \equiv \frac{1-\lambda}{\lambda} \qquad \text{and} \qquad \tilde{\mu}_2(\lambda) \equiv \frac{2\lambda-1}{\lambda} \tag{18}$$

with the following four sets:

$$\mathcal{S}_1 \equiv \left\{(\lambda,\mu) \in [0,1]^2 : \lambda \in (3/2-\sqrt{5}/2, 2/3] \text{ and } \mu \in [\tilde{\mu}_2(\lambda), \tilde{\mu}_1(\lambda)]\right\}$$

$$\mathcal{S}_2 \equiv \left\{(\lambda,\mu) \in [0,1]^2 : \lambda \in (2/3, 1] \text{ and } \mu \in [\tilde{\mu}_1(\lambda), \tilde{\mu}_2(\lambda)]\right\}$$

$$\mathcal{S}_3 \equiv \left\{(\lambda,\mu) \in [0,1]^2 : \lambda \in (3/2-\sqrt{5}/2, 1] \text{ and } \mu \geq \max\{\tilde{\mu}_1(\lambda), \tilde{\mu}_2(\lambda)\}\right\}$$

$$\mathcal{S}_4 \equiv \left\{(\lambda,\mu) \in [0,1]^2 : \lambda \in (3/2-\sqrt{5}/2, 1] \text{ and } \mu \leq \min\{\tilde{\mu}_1(\lambda), \tilde{\mu}_2(\lambda)\}\right\}$$

and

$$\bar{q}^s \equiv \frac{\Delta u^{-s}(\underline{\mathbf{M}})}{\Delta u^{-s}(\overline{\mathbf{M}}) + \Delta u^{-s}(\underline{\mathbf{M}})}$$

Then we can claim that:

Proposition 1 Under Assumption 1 we have:

i. If $(\lambda,\mu) \in \mathcal{S}_1$: one unique globally stable steady-state $(q_t^m, q_t^f) = (1,1)$ co-exists with three unstable steady-states: $(q_t^m, q_t^f) = (0,0)$, $(q_t^m, q_t^f) = (1,0)$ and $(q_t^m, q_t^f) = (0,1)$.
ii. If $(\lambda,\mu) \in \mathcal{S}_2$: two locally stable steady-states $(q_t^m, q_t^f) = (1,0)$ and $(q_t^m, q_t^f) = (0,1)$ co-exist with three unstable steady-states: $(q_t^m, q_t^f) = (0,0)$, $(q_t^m, q_t^f) = (1,1)$ and $(q_t^m, q_t^f) = (\bar{q}^m, \bar{q}^f)$.

iii. If $(\lambda, \mu) \in \mathcal{S}_3$: one unique globally stable steady-state $(q_t^m, q_t^f) = (1, 0)$ co-exists with three unstable steady-states: $(q_t^m, q_t^f) = (0, 0)$, $(q_t^m, q_t^f) = (1, 1)$ and $(q_t^m, q_t^f) = (0, 1)$.
iv. If $(\lambda, \mu) \in \mathcal{S}_4$: one unique globally stable steady-state $(q_t^m, q_t^f) = (0, 1)$ co-exists with three unstable steady-states: $(q_t^m, q_t^f) = (0, 0)$, $(q_t^m, q_t^f) = (1, 1)$ and $(q_t^m, q_t^f) = (1, 0)$.

Let us first underline that, in each configuration, the dynamical system exhibits four steady-states, all characterized by an absence of heterogeneity within each sub-population: (0, 0), (0, 1), (1, 0), and (1, 1).[13] Indeed, when the economy reaches one of these configurations, the probability for a child to have a parental and an external model who share the same preference trait is equal to one. Hence, parental preferences are directly transmitted to children. However, the stability property of each of these steady-states and, consequently, the precise equilibrium that will be reached in the long run depends on the signs of the parameters $\Delta u^f(\overline{\mathbf{M}})$, $\Delta u^m(\overline{\mathbf{M}})$, $\Delta u^f(\underline{\mathbf{M}})$, and $\Delta u^m(\underline{\mathbf{M}})$ and then on the nature of the complementarity resulting from the household decision-making process. A simple inspection of (17) leads to the conclusion that $\Delta u^f(\underline{\mathbf{M}})$ and $\Delta u^m(\underline{\mathbf{M}})$ are both negative, meaning that, when matched with a family-oriented spouse, it is always preferable to be market-oriented. This fact directly comes from the result of full specialization within heterogamous couples: if an $\overline{\mathbf{M}}$-type agent is matched with an $\underline{\mathbf{M}}$-type one, he will specialize in labour market activities which do not constitute a source of disutility. Conversely, if an $\underline{\mathbf{M}}$-type is matched with another $\underline{\mathbf{M}}$, then each of them spends some time on the labour market and experiences the associated disutility. The signs of $\Delta u^f(\overline{\mathbf{M}})$ and $\Delta u^m(\overline{\mathbf{M}})$ depend on parameter values. In particular, $\tilde{\mu}_1(\lambda)$ and $\tilde{\mu}_2(\lambda)$ are defined such that $\Delta u^f(\overline{\mathbf{M}})$ is positive if and only if $\mu \le \tilde{\mu}_1(\lambda)$ and $\Delta u^m(\overline{\mathbf{M}})$ is positive if and only if $\mu \ge \tilde{\mu}_2(\lambda)$. Then we have:

$$(\lambda, \mu) \in \mathcal{S}_1 \Leftrightarrow \{\Delta u^f(\overline{\mathbf{M}}) \ge 0, \Delta u^m(\overline{\mathbf{M}}) \ge 0, \Delta u^f(\underline{\mathbf{M}}) < 0, \Delta u^m(\underline{\mathbf{M}}) < 0\} \tag{19}$$

$$(\lambda, \mu) \in \mathcal{S}_2 \Leftrightarrow \{\Delta u^f(\overline{\mathbf{M}}) < 0, \Delta u^m(\overline{\mathbf{M}}) < 0, \Delta u^f(\underline{\mathbf{M}}) < 0, \Delta u^m(\underline{\mathbf{M}}) < 0\} \tag{20}$$

$$(\lambda, \mu) \in \mathcal{S}_3 \Leftrightarrow \{\Delta u^f(\overline{\mathbf{M}}) < 0, \Delta u^m(\overline{\mathbf{M}}) \ge 0, \Delta u^f(\underline{\mathbf{M}}) < 0, \Delta u^m(\underline{\mathbf{M}}) < 0\} \tag{21}$$

$$(\lambda, \mu) \in \mathcal{S}_4 \Leftrightarrow \{\Delta u^f(\overline{\mathbf{M}}) \ge 0, \Delta u^m(\overline{\mathbf{M}}) < 0, \Delta u^f(\underline{\mathbf{M}}) < 0, \Delta u^m(\underline{\mathbf{M}}) < 0\} \tag{22}$$

Thus, when $(\lambda, \mu) \in \mathcal{S}_1$, market-oriented preference dominates within the two populations, meaning that both men and women are always better off when holding the preference $\overline{\mathbf{M}}$. Hence this trait diffuses over time within both populations and the economy ends up at the egalitarian (1, 1) equilibrium.

When $(\lambda, \mu) \in \mathcal{S}_2$, there exists asymmetric complementarity within the two populations, meaning that both men and women are worse off when exhibiting the same preference as his/her spouse. As claimed in Proposition 1 (point *ii*), in that case, the long-run situation reached by the economy, (0, 1) or (1, 0), crucially depends on the initial distribution of preferences. Let us assume, for instance, that the initial distribution of preferences is not too far from (1, 0) meaning that a majority of men are market-oriented while a majority of women are family-oriented. In that case, the probability for a woman to be matched with an $\overline{\mathbf{M}}$-type spouse is high and, since $\Delta u^f(\overline{\mathbf{M}})$ and $\Delta u^f(\underline{\mathbf{M}})$ are negative, the expected utility of a woman is higher when holding preferences $\underline{\mathbf{M}}$. The reverse is true for men such that

13 This is a standard feature of the cultural transmission model proposed by Besley (2017).

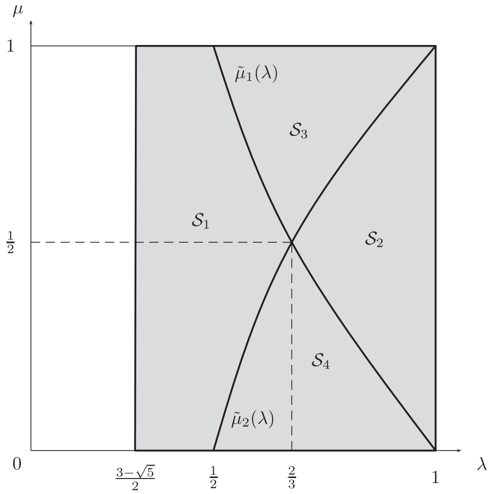


Fig. 1. Sign of $\Delta u^f(\overline{\mathbf{M}})$ and $\Delta u^m(\overline{\mathbf{M}})$ as a function of λ and μ.

family-oriented preferences spread among the population of women while market-oriented preferences diffuse among the population of men. Hence, the (1, 0) equilibrium is locally stable. A symmetric reasoning applies for an initial condition not too far from (0, 1). In any case, the long-run equilibrium reached by the economy is characterized by a clear gender gap in preferences.

When $(\lambda, \mu) \in \mathcal{S}_3$, market-oriented preferences dominate within the population of males, while preferences exhibit an asymmetric complementarity within the population of females, meaning that men are always better off when being market-oriented while women are better off when exhibiting the opposite preference trait than the one that her spouse holds. Hence, in that case, the preference $\overline{\mathbf{M}}$ diffuses within the population of men. Then, it becomes more and more beneficial for women to hold the trait $\underline{\mathbf{M}}$ and the economy ends up in the (1, 0) equilibrium. The configuration $(\lambda, \mu) \in \mathcal{S}_4$ constitutes the symmetric case in which the economy ends up in (0, 1).

Figure 1 depicts the partition of the plane (λ, μ) into the four regions $\mathcal{S}_1$, $\mathcal{S}_2$, $\mathcal{S}_3$, and $\mathcal{S}_4$.[14] It allows us to assess the impact of a change in these two variables on the dynamics of gender differences in preferences.

3.1.3 Comparative statics: technology and patriarchy Let us first consider the impact of λ under the assumption of equal bargaining powers, $\mu = 1/2$.[15] When λ is high, $\Delta u^f(\overline{\mathbf{M}})$ and $\Delta u^m(\overline{\mathbf{M}})$ are negative, while they both become positive if λ becomes low enough. Indeed, when an agent is matched with a market-oriented mate, she/he will necessarily have to participate in both housework and the workforce. Then, if the agent is market-oriented too, she/he will suffer from the amount of time she/he devotes to housework (increasing in λ). Conversely, if the agent is family-oriented, she/he will suffer from the amount of time spent on the market (decreasing in λ). So, if $\lambda > 2/3$, the first effect overcomes the second one

14 The area in grey represents the set of values $(\lambda, \mu) \in [0, 1]^2$ such that Assumption 1 holds.

15 In this specific case, there are no ex-ante differences between men and women: $\Delta u^f(\overline{\mathbf{M}}) = \Delta u^m(\overline{\mathbf{M}})$ and $\Delta u^f(\underline{\mathbf{M}}) = \Delta u^m(\underline{\mathbf{M}})$.

and the agent is better off if she/he is of type $\underline{\mathbf{M}}$ (parameters belong to Region $\mathcal{S}_2$). Conversely, if $\lambda \leq 2/3$, it is preferable to be an $\overline{\mathbf{M}}$-type agent and to share housework time with the partner (parameters belong to Region $\mathcal{S}_1$).

We can now describe the impact of a technological shock increasing the productivity of housework activities. Such a shock corresponds to a fall in λ. Consider that, initially, the productivity of household appliances is low ($\lambda > 2/3$). As depicted in Fig. 1, the economy belongs to Region $\mathcal{S}_2$ such that preferences exhibit asymmetric complementarity. Hence, the economy converges towards a situation in which each gender specializes in one kind of occupation (housework or market) and gendered preferences sustain this separation of tasks. *A priori*, we do not know which gender is specialized in which task; to comply with historical observation, let us consider that the economy converges towards the (1, 0) equilibrium. The fact that the economy ends up in the (1, 0) rather than the (0, 1) equilibrium may come from the fact that, initially, the proportion of $\overline{\mathbf{M}}$ trait is more common within the population of males such that (q_0^m, q_0^f) is located in the basin of attraction of the (1, 0) equilibrium.[16] Consider now an increase in the productivity of housework activities coming from, for instance, the introduction of new household appliances allowing for a reduction of the time devoted to maintaining the home. Such a shock corresponds to a decrease in λ. If this decrease is large enough (after the shock, $\lambda \leq 2/3$), it destabilizes the (1, 0) equilibrium. Since market-oriented preferences dominate, the economy converges towards the (1, 1) equilibrium. Hence the proportion of women who prefer to work in a competitive environment increases and the gender gap in housework participation is progressively filled. Obviously, during the transition to the new steady-state, the average participation time of males in housework activities increases, while the average participation time of women decreases. Indeed, due to the rise in q_t^f, the proportion of males involved in housework activities increases, as well as the proportion of females who only do half of the housework tasks.[17]

Let us now analyse the impact of μ on the long-run distribution of preferences. We know from Proposition 1 that, for balanced values of λ, the economy will converge towards the equilibrium (1, 0) (resp. (0, 1)) when μ is high (resp. low), while for intermediate values of μ the unique steady-state is (1, 1). Hence, the distribution of bargaining powers affects gender differences in preferences in the long run. The level of patriarchy also determines which kind of inegalitarian equilibrium is reached ((1, 0) or (0, 1)). When μ is high, the share of housework activities completed by males within homogamous $\{\overline{\mathbf{M}}, \overline{\mathbf{M}}\}$ couples is low so that, when matched with a market-oriented woman, a man is better off when being market-oriented himself ($\Delta u^m(\overline{\mathbf{M}}) \geq 0$). Conversely, within an $\{\overline{\mathbf{M}}, \overline{\mathbf{M}}\}$ couple, the wife would be in charge of most housework activities. Consequently, when matched with a market-oriented man, a woman is better off when being family-oriented ($\Delta u^f(\overline{\mathbf{M}}) < 0$). Then the proportion of type $\overline{\mathbf{M}}$ men (resp. women) increases (resp. decreases) over time and

16 We define the *basin of attraction* of a steady-state as the set of points in the plane (q_t^m, q_t^f) such that any initial condition in this set evolved towards this particular steady-state.

17 Bianchi (2011) estimates that, from 1965 to 2008, American mothers divided their housework time by almost half (from 31.9 hours per week to 17.4), while American fathers more than doubled their participation in housework activities (from 4.4 hours per week in 1965 to 9.5 hours in 2008). Although we will not provide any quantitative exercise here, our simple model is able to qualitatively reproduce this pattern.

the economy converges towards the equilibrium (1, 0). A symmetric reasoning applies for low values of μ such that the economy converges towards (0, 1).

Then, everything being equal, a patriarchal society in which men have a higher bargaining power than women is more likely to end up in an equilibrium in which women are family-oriented and men market-oriented than a society in which bargaining powers are equal. This last result echoes experimental findings (Gneezy *et al.*, 2009; Gong and Yang, 2012; Andersen *et al.*, 2013; Gong *et al.*, 2015) showing that market-oriented preferences, such as a low degree of risk aversion or a high taste for competition, tend to be more prevalent within the population with the higher bargaining power. Our result also implies that a given technological shock would have different consequences on the dynamics of preferences in two societies that differ in their level of patriarchy. Indeed, for a given fall in λ, the likelihood to remain trapped in an inegalitarian equilibrium is increasing in the degree of inequality that characterizes the distribution of power within the household.

3.2 Endogenous patriarchy

Up to now, we have identified the relative intra-household bargaining power with the exogenously given degree of patriarchy within the society. Recent studies recognize that this bargaining power may be, at least partly, shaped by endogenous forces, such as the gender gap in labour supply (see, for instance, Basu, 2006). In this section, we propose a simple way to endogenize μ and study the consequences for the long-run evolution of gender differences in preferences.

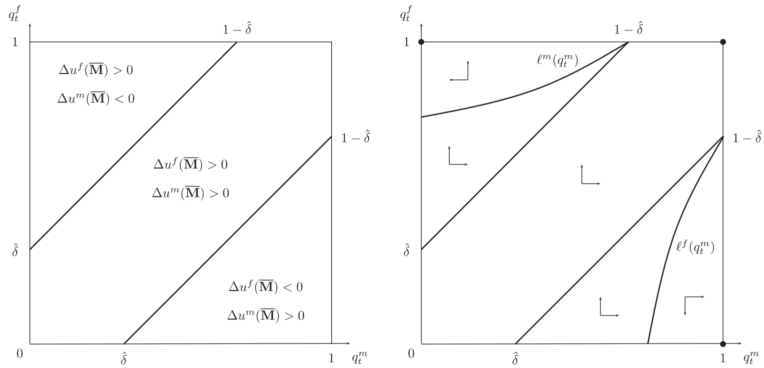
Let us consider the previous model and assume that the following condition applies:

Assumption 2 $\lambda \in (1/2, 2/3)$

We restrict our attention to this parameter configuration for expositional purposes. Under Assumption 2, the type of complementarity arising within households crucially depends on the value of μ. More precisely, according to the value of μ the economy could belong to Region $\mathcal{S}_1$, $\mathcal{S}_3$, or $\mathcal{S}_4$ (see Fig. 1). Finally, it directly comes from (15) and (18) that Assumption 2 implies:

$$\hat{\mu}_2(\lambda) > \tilde{\mu}_1(\lambda) > 1/2 > \tilde{\mu}_2(\lambda) > \hat{\mu}_1(\lambda) \tag{23}$$

Following Komura (2013), we assume that the intra-household bargaining power, while exogenous at the family level, is endogenous at the society level. We consider that the average labour supply behaviours of males and females translate into social norms defining the respective roles of men and women that ultimately affect the distribution of the decision power within each household. Formally, μ is a function of the difference between the average labour supply behaviours of males and females. To keep the analysis as simple as possible, we assume that it depends on the difference between the number of males and females who spent their entire period of time on the labour market. Let us denote this difference $\delta_t \equiv n_t^m - n_t^f$, with $n_t^s \in [0, 1]$ the number of individuals spending their entire period of time on the labour market within population s. The relative bargaining power at date t, μ_t, will be related to δ_t through the function $\mu(\delta_t)$ with $\mu : [-1, 1] \rightarrow [\underline{\mu}, \bar{\mu}]$, $\mu'(\cdot) > 0$ and $\mu(0) = 1/2$. These properties of $\mu(\cdot)$ mean that the bargaining powers are equally distributed if and only if men and women have, on average, the same labour supply behaviour. Moreover, the bargaining power of a man (resp. a woman) increases with the relative participation of men vs. women in the whole society.



(a) Nature of complementarity **(b)** Phase diagram

Fig. 2. Endogenous bargaining power.

We also assume that:

Assumption 3 $\bar{\mu} \in (\tilde{\mu}_1(\lambda), \hat{\mu}_2(\lambda))$ and $\underline{\mu} \in (\hat{\mu}_1(\lambda), \tilde{\mu}_2(\lambda))$

The restrictions $\bar{\mu} < \hat{\mu}_2(\lambda)$ and $\underline{\mu} > \hat{\mu}_1(\lambda)$ avoid a corner solution on $l^{f,\underline{\mathbf{M}}}(\underline{\mathbf{M}})$ or $l^{m,\underline{\mathbf{M}}}(\underline{\mathbf{M}})$ (see expression (14)). Assumptions $\bar{\mu} > \tilde{\mu}_1(\lambda)$ and $\underline{\mu} < \tilde{\mu}_2(\lambda)$ ensure that there exist some values of δ_t such that we have $\Delta u^f(\overline{\mathbf{M}}) < 0$ and $\Delta u^m(\overline{\mathbf{M}}) > 0$ or $\Delta u^f(\overline{\mathbf{M}}) > 0$ and $\Delta u^m(\overline{\mathbf{M}}) < 0$ (see Fig. 1).[18] Finally, let us define $\hat{\delta}$ as the threshold value of δ_t such that $\mu(\hat{\delta}) = \tilde{\mu}_1(\lambda)$ or equivalently $\mu(-\hat{\delta}) = \tilde{\mu}_2(\lambda)$.

From expressions (14) and (16) and under Assumption 3, only individuals of type $\overline{\mathbf{M}}$ matched with a type $\underline{\mathbf{M}}$ spouse will specialize in market activities. Then we have:

$$n_t^m = q_t^m\left(1 - q_t^f\right) \qquad \text{and} \qquad n_t^f = q_t^f(1 - q_t^m) \qquad \text{such that} \qquad \delta_t = q_t^m - q_t^f \tag{24}$$

Then, through the properties of the function $\mu(\delta_t)$, we get that:

- If $q_t^f < q_t^m - \hat{\delta}$: $\mu(\delta_t) > \tilde{\mu}_1(\lambda) \Leftrightarrow (\lambda, \mu(\delta_t)) \in \mathcal{S}_3$
- If $q_t^f \in [q_t^m - \hat{\delta}, q_t^m + \hat{\delta}]$: $\mu(\delta_t) \in [\tilde{\mu}_2(\lambda), \tilde{\mu}_1(\lambda)] \Leftrightarrow (\lambda, \mu(\delta_t)) \in \mathcal{S}_1$
- If $q_t^f > q_t^m + \hat{\delta}$: $\mu(\delta_t) < \tilde{\mu}_2(\lambda) \Leftrightarrow (\lambda, \mu(\delta_t)) \in \mathcal{S}_4$

Then the plane $\left(q_t^m, q_t^f\right)$ may be partitioned into three regions which differ according to the kind of complementarity which prevails within the household. When $q_t^f < q_t^m - \hat{\delta}$, the number of men specialized in market work is much higher than the number of women. As a consequence, the relative bargaining power of males is so high (higher than $\tilde{\mu}_1(\lambda)$) that preferences become asymmetric complements within the population of females ($\Delta u^f(\overline{\mathbf{M}}) < 0$ and $\Delta u^m(\overline{\mathbf{M}}) > 0$). Through similar reasoning we conclude that, when $q_t^f > q_t^m + \hat{\delta}$, $\Delta u^f(\overline{\mathbf{M}}) > 0$ and $\Delta u^m(\overline{\mathbf{M}}) < 0$, and when $q_t^f \in [q_t^m - \hat{\delta}, q_t^m + \hat{\delta}]$, both $\Delta u^f(\overline{\mathbf{M}})$ and $\Delta u^m(\overline{\mathbf{M}})$ are positive. This partition is illustrated in Fig. 2(a). The dynamical consequences are summarized in the following proposition:

Proposition 2 Under Assumptions 2 and 3, three locally stable steady-states (1, 0), (0, 1), and (1, 1) co-exist with one unstable steady-state (0, 0).

18 If these assumptions do not hold, (1, 1) is the unique globally stable steady-state whatever the value of δ_t.

As claimed in Proposition 2 and illustrated in the phase diagram depicted in Fig. 2(b), the three equilibria (0, 1), (1, 0), and (1, 1) are locally stable.[19] The reason behind this result is that the outcome of the household decision-making process and, accordingly, the nature of complementarity within the household depends on the distribution of preferences: (i) (1, 1) belongs to a region where preference $\overline{\mathbf{M}}$ dominates for both genders; (ii) (0, 1) belongs to a region where there is asymmetric complementarity for men, while preference $\overline{\mathbf{M}}$ dominates among women; and (iii) (1, 0) belongs to a region where there is asymmetric complementarity for women, while preference $\overline{\mathbf{M}}$ dominates among men.

The multiplicity of equilibria implies that initial conditions are fundamental. Indeed, assume that two countries, $\mathcal{A}$ and $\mathcal{B}$, have the same technology. Assume also that in country $\mathcal{A}$, gender differences in preferences are initially widespread, while in country $\mathcal{B}$, the initial distribution of preferences is close within both populations. Then, in country $\mathcal{A}$, the labour supply behaviours of males and females tend to be quite different so that the intra-household bargaining power tends to be unequally distributed. In this case, the population with less decision power is better off when holding different preferences than the other population, and (q_t^m, q_t^f) converges to an inegalitarian equilibrium. Alternatively, in country $\mathcal{B}$, the market-oriented preference always dominates and gender differences in preferences tend to vanish over time. This simple example illustrates that two countries, characterized by the same technological level, may converge towards a quite different situation in terms of gender differences in preferences.

The multiplicity of equilibria can also imply path dependency in the sense that initial technological differences may generate long-lasting discrepancies in preferences between genders. Assume now that in country $\mathcal{A}$, λ is initially smaller than in country $\mathcal{B}$. A smaller λ induces a larger value of $\hat{\delta}$ and a smaller size of the basins of attraction of inegalitarian equilibria in country $\mathcal{A}$.[20] As a consequence, even if the distribution of preferences is initially the same in both countries, in some cases, country $\mathcal{B}$ converges towards an inegalitarian equilibrium while country $\mathcal{A}$ ends up in the (1, 1) equilibrium. As these equilibria are locally stable, discrepancies between the two countries will perpetuate themselves even if they adopt the same technology afterwards. These results are discussed in light of existing empirical evidence in Section 5.

4. The long-run impact of the gender wage gap

Let us come back to our baseline framework (see Section 2.2) and assume that $u(c^{s,i}) = c^{s,i}$ and that males and females have equal bargaining powers ($\mu = 1/2$). We denote by $\Omega \equiv w^m - w^f$ the gender wage gap.

4.1 Exogenous gender wage gap

In this section, the gender wage gap Ω will be considered as fully exogenous. It may, for instance, come from gender discrimination by firms or a productivity differential between men and women.

19 See Appendix 4 for a formal derivation of this phase diagram. In this diagram, the curves $\ell^m(q_t^m)$ and $\ell^f(q_t^m)$ are respectively the stationary locus of q_t^m and the stationary locus of q_t^f (expressed as a function of q_t^m), which are both unstable.

20 To see this, note that $\tilde{\mu}_1(\lambda)$ is decreasing in λ, $\mu(\delta_t)$ is increasing in δ_t, and $\hat{\delta}$ is defined as $\mu(\hat{\delta}) = \tilde{\mu}_1(\lambda)$.

4.1.1 Household's decisions Each couple maximises the collective household utility function (9) under the time constraint (10) and the budget constraint (11). Due to the linearity of the utility function, the consumption sharing between men and women remains indeterminate. However, bargaining powers being equal, it seems reasonable to assume that spouses share consumption equally, such that $c^{m,i} = c^{f,j}$. Hence, using the budget constraint and assuming the saturation of the time constraint,[21] we obtain:

$$c^{m,i} = c^{f,j} = \frac{1}{2}[(1-\lambda)w^m + w^f + (w^m - w^f)l^{f,j}] \tag{25}$$

and the problem of the household simplifies to:

$$l^{f,j}(i) = \arg\max_{l^{f,j}} \quad (1-\lambda)w^m + w^f + (w^m - w^f)l^{f,j} - \frac{1}{2}F_i(\lambda - l^{f,j}) - \frac{1}{2}F_j(l^{f,j}) \tag{26}$$

Moreover, let us assume that Assumption 2 as well as the following condition apply:

Assumption 4 $|\Omega| < 1 - \lambda$

Assumptions 2 and 4 ensure that the result of full specialization within heterogamous couples, and only within heterogamous couples, still holds. Moreover, under Assumption 2, when men and women receive the same wage ($\Omega = 0$), preference $\overline{\mathbf{M}}$ dominates within the two populations (see Fig. 1).

The solution of the problem (26) is:

$$l^{f,\overline{\mathbf{M}}}(\overline{\mathbf{M}}) = l^{f,\underline{\mathbf{M}}}(\underline{\mathbf{M}}) = \frac{\lambda}{2} + \frac{\Omega}{2}, \quad l^{f,\overline{\mathbf{M}}}(\underline{\mathbf{M}}) = 0, \quad l^{f,\underline{\mathbf{M}}}(\overline{\mathbf{M}}) = \lambda \tag{27}$$

$$l^{m,\overline{\mathbf{M}}}(\overline{\mathbf{M}}) = l^{m,\underline{\mathbf{M}}}(\underline{\mathbf{M}}) = \frac{\lambda}{2} - \frac{\Omega}{2}, \quad l^{m,\overline{\mathbf{M}}}(\underline{\mathbf{M}}) = 0, \quad l^{m,\underline{\mathbf{M}}}(\overline{\mathbf{M}}) = \lambda \tag{28}$$

Those results, associated with expression (25), yield the following values for $\Delta u^f(\overline{\mathbf{M}})$, $\Delta u^m(\overline{\mathbf{M}})$, $\Delta u^f(\underline{\mathbf{M}})$ and $\Delta u^m(\underline{\mathbf{M}})$:

$$\begin{aligned} \Delta u^f(\overline{\mathbf{M}}) &= -\frac{\lambda^2}{4} + (1-\lambda)^2 - \frac{3\lambda}{4}\Omega, \quad & \Delta u^m(\overline{\mathbf{M}}) &= -\frac{\lambda^2}{4} + (1-\lambda)^2 + \frac{3\lambda}{4}\Omega \\ \Delta u^f(\underline{\mathbf{M}}) &= -\frac{(2-\lambda)^2}{4} + \frac{4-\lambda}{4}\Omega, \quad & \Delta u^m(\underline{\mathbf{M}}) &= -\frac{(2-\lambda)^2}{4} - \frac{4-\lambda}{4}\Omega \end{aligned} \tag{29}$$

Let us first note that, under Assumption 4, $\Delta u^f(\underline{\mathbf{M}})$ and $\Delta u^m(\underline{\mathbf{M}})$ are always negative, while the signs of $\Delta u^f(\overline{\mathbf{M}})$ and $\Delta u^m(\overline{\mathbf{M}})$ depend on the technological parameter λ and the gender wage gap Ω. If we consider that the market wage is higher for men than for women ($\Omega \geq 0$), simple inspection of (29) allows us to conclude that, under Assumption 2, preference $\overline{\mathbf{M}}$ dominates within the population m ($\Delta u^m(\overline{\mathbf{M}}) > 0$ and $\Delta u^m(\underline{\mathbf{M}}) < 0$). We already know that it is the case when $\Omega = 0$. Moreover, an increase in Ω reduces the housework time of males (see expression (28)), leading to a reduction of both the utility of type $\underline{\mathbf{M}}$ men and the disutility of type $\overline{\mathbf{M}}$ men. Hence, the utility benefit associated with preference $\overline{\mathbf{M}}$ for men is obviously increasing in Ω. Then, the result according to which $\Delta u^m(\overline{\mathbf{M}}) > 0$ is all the more true when $\Omega > 0$. The effect of an increase in Ω is the opposite when considering women. As a consequence, if Ω becomes

21 The time constraint is binding as soon as the maximal income of the household $w^m + w^f$ is high enough.

too high, $\Delta u^f(\overline{\mathbf{M}})$ becomes negative. More precisely, we can define the following threshold on Ω:

$$\tilde{\Omega}(\lambda) \equiv \lambda - \frac{4}{3}\left(\frac{2\lambda - 1}{\lambda}\right)$$

such that when $\Omega \in \left[0, \tilde{\Omega}(\lambda)\right)$, $\Delta u^f(\overline{\mathbf{M}})$ is positive, while if $\Omega \geq \tilde{\Omega}(\lambda)$, $\Delta u^f(\overline{\mathbf{M}})$ is negative. For negative values of Ω, by symmetry, both $\Delta u^m(\overline{\mathbf{M}})$ and $\Delta u^f(\overline{\mathbf{M}})$ are positive when $\Omega \in \left(-\tilde{\Omega}(\lambda), 0\right]$, while $\Delta u^f(\overline{\mathbf{M}})$ is positive and $\Delta u^m(\overline{\mathbf{M}})$ negative when $\Omega \leq -\tilde{\Omega}(\lambda)$.

4.1.2 Dynamics We can now define the following three sets:

$$\mathcal{S}_1' \equiv \left\{(\lambda, \Omega) \in [0,1] \times \mathbb{R} : \lambda \in [1/2, 2/3] \text{ and } \Omega \in [\tilde{\Omega}(\lambda), 1 - \lambda)\right\}$$

$$\mathcal{S}_2' \equiv \left\{(\lambda, \Omega) \in [0,1] \times \mathbb{R} : \lambda \in [1/2, 2/3] \text{ and } \Omega \in (-\tilde{\Omega}(\lambda), \tilde{\Omega}(\lambda))\right\}$$

$$\mathcal{S}_3' \equiv \left\{(\lambda, \Omega) \in [0,1] \times \mathbb{R} : \lambda \in [1/2, 2/3] \text{ and } \Omega \in (\lambda - 1, -\tilde{\Omega}(\lambda)]\right\}$$

and claim that:

Proposition 3 Under Assumptions 2 and 4, we have:

- If $(\lambda, \Omega) \in \mathcal{S}_1'$: one unique globally stable steady-state (1, 0) co-exists with three unstable steady-states: (0, 0), (0, 1), and (1, 1).
- If $(\lambda, \Omega) \in \mathcal{S}_2'$: one unique globally stable steady-state (1, 1) co-exists with three unstable steady-states: (0, 0), (1, 0), and (0, 1).
- If $(\lambda, \Omega) \in \mathcal{S}_3'$: one unique globally stable steady-state (0, 1) co-exists with three unstable steady-states: (0, 0), (1, 0), and (1, 1).

The partition of the plane (λ, Ω) into the three regions $\mathcal{S}_1'$, $\mathcal{S}_2'$, and $\mathcal{S}_3'$ is depicted in Fig. 3.[22]

4.1.3 Comparative statics: the gender wage gap Here, the existence of a gender gap in preferences at the steady-state equilibrium crucially depends on the magnitude of the wage differential. Let us consider the case where $\Omega \geq 0$, if Ω is not too high ($\Omega < \tilde{\Omega}(\lambda)$ such that the economy belongs to Region $\mathcal{S}_2'$), the preference $\overline{\mathbf{M}}$ dominates within both populations and (q_t^m, q_t^f) converges towards the egalitarian equilibrium (1, 1). Otherwise, (the economy belongs to Region $\mathcal{S}_1'$) preference $\overline{\mathbf{M}}$ dominates within the population of males while preferences exhibit an asymmetric complementarity within the population of females and the economy ends up in the inegalitarian equilibrium (1, 0). Note that, when λ is close to 2/3, even a very limited gender wage gap has huge consequences on gender inequality, as it induces the convergence towards the equilibrium (1, 0), while (1, 1) is the unique globally stable steady-state when $\Omega = 0$.

The model presented in this section may be viewed as the illustration of a case in which nurture complements nature. Indeed, the wage gap may come from a productivity differential rooted in biological differences. Then, when $\Omega > \tilde{\Omega}(\lambda)$, even if the magnitude of this

22 The area in grey represents the set of values of λ and Ω such that Assumptions 2 and 4 are simultaneously satisfied.

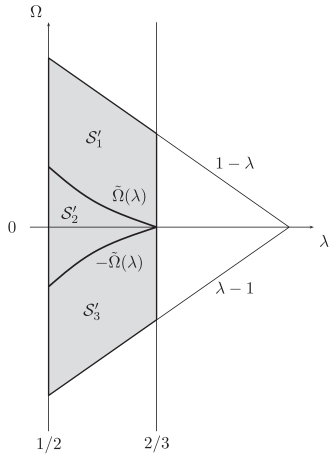


Fig. 3. Sign of $\Delta u^f(\bar{\mathbf{M}})$ and $\Delta u^m(\bar{\mathbf{M}})$ as a function of λ and Ω.

gap remains limited, cultural evolution mechanisms magnify this biological difference and are widening the initial inequality between gender.

4.2 Endogenous gender wage gap

Here we consider that w^f and w^m are no longer exogenously given but fixed by firms on purpose. Following Escriche *et al.* (2004), we assume that firms may create two kinds of jobs. Jobs j_1 are high-paid and potentially highly productive. However, the productivity in those occupations depends heavily on non-contractible workers' effort and involvement. Jobs j_2 are standardized low-paid jobs in which the productivity is weakly affected by workers' involvement. Wages in jobs j_1 (resp. j_2) are denoted w_1 (resp. w_2). Jobs j_2 yield a profit equal to h while jobs j_1 yield a profit equal to H if the employee's involvement is high and L if this involvement is low. Moreover we have:

$$H > h > L = 0 \qquad \text{and} \qquad w_1 > w_2 \tag{30}$$

Household decisions and work effort are related in the following way. In line with Escriche *et al.* (2004), we assume that a high involvement in jobs j_1 requires working extra hours and at the weekend, which is incompatible with housework. To simplify the analysis, we consider that an individual who spent some time on housework cannot achieve high effort in jobs j_1; this effort may be achieved only for housework time equal to zero.[23] Consequently, through expressions (27) and (28), only individuals of type $\overline{\mathbf{M}}$ matched with a type $\underline{\mathbf{M}}$ spouse will achieve the high effort level within jobs j_1.

Firms choose the type of job they will assign to each worker without observing workers' preferences. The only relevant information they observe is the gender of the worker and the distribution of preferences within each population. Then, a firm can adopt one of the four following policies: *Policy 1*, propose jobs j_1 to all workers such that $w^f = w^m = w_1$; *Policy 2*, propose jobs j_2 to all workers such that $w^f = w^m = w_2$; *Policy 3*, propose jobs j_1 to males and j_2 to females such that $w^f = w_2$ and $w^m = w_1$; *Policy 4*, propose jobs j_2 to

23 With this assumption we take a short-cut, abstracting from the incentive problem within the firm.

males and j_1 to females such that $w^f = w_1$ and $w^m = w_2$.[24] Expected firms' profits for each policy are, respectively:

$$\Pi_1 = [q_t^f(1-q_t^m) + q_t^m\left(1-q_t^f\right)]H \qquad \Pi_2 = 2h$$
$$\Pi_3 = q_t^m\left(1-q_t^f\right)H + h \qquad \Pi_4 = q_t^f(1-q_t^m)H + h$$

Let us define the two functions:

$$\phi(q_t^m) \equiv \frac{1}{1-q_t^m}\frac{h}{H} \qquad \text{and} \qquad \psi(q_t^m) \equiv 1 - \frac{1}{q_t^m}\frac{h}{H}$$

The following lemma describes the policy chosen by firms when H is not too large.

Lemma 1 Assume that $H < 4h$ and that Assumptions 2 and 4 hold, the policy chosen by the firm is the *Policy 3* if $q_t^f < \psi(q_t^m)$, the *Policy 4* if $q_t^f > \phi(q_t^m)$, and the *Policy 2* if $q_t^f \in \left[\psi(q_t^m), \phi(q_t^m)\right]$.

Proof. When $H < 4h$, $\phi(q_t^m)$ is always above $\psi(q_t^m)$. When $q_t^f < \psi(q_t^m) < \phi(q_t^m)$, we have $\Pi_3 > \Pi_2 > \Pi_4$ and $\Pi_3 > \Pi_1 > \Pi_4$. When $q_t^f > \phi(q_t^m) > \psi(q_t^m)$, we have $\Pi_4 > \Pi_2 > \Pi_3$ and $\Pi_4 > \Pi_1 > \Pi_3$. When $q_t^f \in \left[\psi(q_t^m), \phi(q_t^m)\right]$, we have $\Pi_2 \geq \Pi_4 > \Pi_1$ and $\Pi_2 \geq \Pi_3 > \Pi_1$. ■

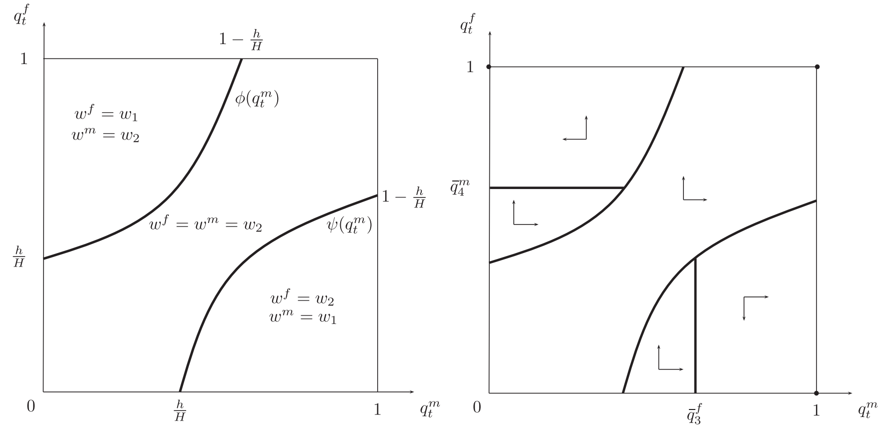
Let us now assess the dynamical consequences of this result. The plan (q_t^m, q_t^f) may be partitioned into three regions, each one corresponding to a specific firm policy and, consequently, to a given level of the gender wage gap (see Fig. 4(a)). This level determines, in turn, the kind of complementarity which arises within the household. Let us define $\Delta u^s(\overline{\mathbf{M}})_\pi$ and $\Delta u^s\left(\underline{\mathbf{M}}\right)_\pi$ as the values of $\Delta u^s(\overline{\mathbf{M}})$ and $\Delta u^s\left(\underline{\mathbf{M}}\right)$ when the *Policy* $\pi \in \{1,2,3,4\}$ is adopted. Under Assumption 2, $\Delta u^s\left(\underline{\mathbf{M}}\right)_\pi$ is negative for any s and π. If *Policy 2* is chosen, males and females receive the same wage such that the economy belongs to Region $\mathcal{S}_1'$. We know from Section 4.1 that, in this case, both $\Delta u^m(\overline{\mathbf{M}})_2$ and $\Delta u^f(\overline{\mathbf{M}})_2$ are positive. Finally, assuming that $w_1 - w_2 > \tilde{\Omega}(\lambda)$, the economy belongs to Region $\mathcal{S}_1'$ if *Policy* 3 is adopted by firms and to Region $\mathcal{S}_3'$ if *Policy* 4 is adopted. Thus, we have:

$$\Delta u^f(\overline{\mathbf{M}})_3 < 0,\ \Delta u^m(\overline{\mathbf{M}})_3 > 0 \ \text{ and } \ \Delta u^f(\overline{\mathbf{M}})_4 > 0,\ \Delta u^m(\overline{\mathbf{M}})_4 < 0$$

In that configuration, when *Policy 3* (resp. *Policy 4*) is implemented, preference $\overline{\mathbf{M}}$ dominates within the population of men (resp. women) and preferences exhibit asymmetric complementarity within the population of women (resp. men). The consequences in terms of the long-run distribution of preferences are summarized in the following proposition and illustrated by the phase diagram in Fig. 4(b).[25]

24 We assume that the values of w_1 and w_2 are compatible with Assumption 4: $w_1 - w_2 < 1 - \lambda$.

25 In the phase diagram, $\bar{q}_4^m = \Delta u^f\left(\underline{\mathbf{M}}\right)_4 / \left(\Delta u^f(\overline{\mathbf{M}})_4 + \Delta u^f\left(\underline{\mathbf{M}}\right)_4\right)$ and $\bar{q}_3^f = \Delta u^m\left(\underline{\mathbf{M}}\right)_3 / \left(\Delta u^m(\overline{\mathbf{M}})_3 + \Delta u^m\left(\underline{\mathbf{M}}\right)_3\right)$ are the stationary locus of q_t^f and q_t^m, respectively. They are constant, independent of the distribution of preferences. The direction arrows on the diagram are obtained by noting that: (i) if $q_t^f \in \left[\psi(q_t^m), \phi(q_t^m)\right]$ preference $\overline{\mathbf{M}}$ dominates within both populations such that q_t^m and q_t^f increase over time; (ii) if $q_t^f > \phi(q_t^m)$ preference $\overline{\mathbf{M}}$ dominates within the population of females while preferences exhibit asymmetric complementarity within the population of males such



(a) Firms' Policy **(b)** Phase diagram

Fig. 4. Discrimination.

Proposition 4 Assume that $H < 4h$, Assumptions 2 and 4 hold, and $w_1 - w_2 > \tilde{\Omega}(\lambda)$, then three locally stable steady-states (1, 0), (0, 1), and (1, 1) co-exist with one unstable steady-state (0, 0).

As in the case where the bargaining power is endogenous, initial conditions are crucial. If initial preferences are sufficiently equally distributed across gender, there is no discrimination, such that market-oriented preference dominates within both populations and the economy ends up in an egalitarian equilibrium. Conversely, if preferences are initially too unequally distributed between the populations of males and females, statistical discrimination by firms lead to a positive gender gap and the family-oriented preferences diffuse within the discriminated population. Thus, the economy remains trapped in a situation characterized by gender differences in preferences. As already discussed, this multiplicity result also gives room for path-dependency phenomena.

5. Conclusion and discussion

Recent findings in experimental economics have documented the existence of culturally determined gender differences in preferences. These results have important consequences for our understanding of the evolution of gender inequalities. Indeed, these evolutions may be, at least partly, driven by changes in men's and women's preferences. The aim of our article is to provide a tractable theoretical framework to model the dynamics of the gender gap in preferences. To this end, we propose a cultural evolution model in which preference distributions in the population of both males and females evolve jointly. This joint evolution is crucially shaped by the way spouses interact within the household. We provide a particular application focusing on the relative disutility associated with market work vs. housework. We show how technological or institutional changes, by transforming the

that q_t^f increases over time while q_t^m increases (resp. decreases) when q_t^f is higher (resp. lower) than $\bar{q}_4^m$; and (iii) if $q_t^f < \psi(q_t^m)$ preference $\overline{\mathbf{M}}$ dominates within the population of males while preferences exhibit asymmetric complementarity within the population of females such that q_t^m increases over time while q_t^f increases (resp. decreases) when q_t^m is higher (resp. lower) than $\bar{q}_3^f$.

outcome of the household decision-making process, may explain the evolution of gender differences in preferences. We also show that, when the outcome of the household decision-making process depends on the distribution of preferences (Sections 3.2 and 4.2), path-dependency phenomena are likely to arise.

This path-dependency result may be interestingly related to the recent empirical findings by Alesina *et al.* (2013), Grosjean and Khattar (2018), Teso (2018), or Bauernschuster and Rainer (2012). Alesina *et al.* (2013) show that countries initially characterized by agricultural technologies relying heavily on physical strength (such as plough cultivation) are more likely to display inegalitarian gender stereotypes today. As a result, even if technological disparities in agriculture have now disappeared among developed countries, views about gender roles may remain persistently different. In our set-up, these inegalitarian views are self-confirmed by persistent differences in preferences between men and women. Grosjean and Khattar (2018) are interested in the consequences of the heavily male biased sex ratios resulting from British migration to Australia in the late eighteenth and nineteenth century. Relying on spatial and time variation, the authors show that severe gender imbalance in the past has resulted in more conservative sex role attitudes and less opportunity for women today, after sex ratios have reverted back to parity. Teso (2018) reaches similar conclusions when studying the long-run effect of trans-Atlantic slave trade on the evolution of gender norms. In a similar spirit, Bauernschuster and Rainer (2012) argue that East and West Germans did not substantially differ in their views about sex role attitudes before the separation. They also note that East German institutions encouraged female employment much more than their counterparts in the West. Then they show that, despite a partial policy convergence, East Germans remain more likely to hold egalitarian sex role attitudes today.

Supplementary material

Supplementary material is available online at the OUP website. This material consists of an online appendix.

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