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Endogenous Gender Power : The Two Facets of Empowerment*

Victor Hiller[†] and Nouhoum Touré[‡]

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Abstract

A large body of evidence suggests that women's empowerment, both within the household and in politics, benefits to children and has the potential to promote economic development. Nevertheless, the existing interactions between these two facets of empowerment have not been considered thus far. The aim of the present paper is to fill this gap by proposing a theoretical framework in which women's bargaining power within both the private sphere and the public sphere is endogenous. We show that the mutual interplay between the evolution of women's voice in the family and in society may lead to the emergence of multiple equilibria and path-dependency phenomena. We also discuss policy interventions that are the most suitable to promote women's empowerment when its multidimensional nature is taken into account.

Keywords : Female Empowerment, Intrahousehold Bargaining Power, Institutional Bargaining Power, Gender Inequality, Economic Development.

JEL Classification : J13, J16, O11, O43, P16

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1 Introduction

Women’s empowerment in developing countries has emerged as a key objective for international organizations and policy makers. As a striking illustration, “empower all women and girls” is identified as part of the fifth sustainable development goal by the United Nations (see United Nations 2018). This has been justified not only to achieve equity but also as a necessary step to promote economic development. A rising body of empirical work supports this view by reporting a positive impact of female empowerment on human capital formation. For instance, Aidt et al. (2006), Miller (2008), Clots-Figueras (2011 and 2012), Bhalotra and Clots-Figueras (2014), Carruthers and Wanamaker (2015), Brollo and Troiano (2016) and Kose et al. (2020) show that a rise in women’s political participation results in larger public spending targeted towards children, while Hoddinot and Haddad (1995), Lundberg et al. (1997), Allendorf (2007), Schady and Rosero (2008), Rublacava et al. (2009) and Calvi et al. (2018) conclude that an improvement in the intrahousehold bargaining position of women changes household spending in a way that benefits to children. Those empirical findings have offered a rationale for public policies intended to promote female empowerment both in politics¹ and within the household² in developing countries. These policies, as well as their empirical basis, give rise to two views of women’s empowerment, each associated with a specific sphere : the intrahousehold empowerment associated with the private sphere (the family or the household) and the institutional empowerment associated with the public sphere (society or politics). These two views capture two different facets of the empowerment phenomenon. Indeed, the economic emancipation of women, which is largely considered a determinant of women’s bargaining position within the household, does not necessarily improve the ability of women to have a voice in society and to influence policy³; in turn, improved participation by women in the political decision-making process does not mechanically translate into their empowerment within the household (see Beath et al. 2013).

International organizations recognize the importance of considering the two spheres and the existing interactions between them as they may contribute to the emergence of gender inequality traps (World Bank 2006 and 2012).⁴ However, the existing theoretical literature focuses on one single dimension and, typically, associates women’s empowerment with an increase in their relative intrahousehold bargaining power. Hence, the feedbacks between different aspects of empowerment

1. As reported by van der Windt et al. (2018), in 2018, half of the countries used some type of electoral gender quotas for their parliament.

2. Microcredit schemes or conditional cash transfer programs are directed almost exclusively at women (Duflo 2012). A stated justification for this targeting strategy is that it might improve the bargaining power of women within the family (see Fiszbein and Schady 2009).

3. Duflo (2012) notes that, compared to economic opportunities, education and legal rights, the gender gap in political participation has narrowed the least between 1995 and 2005.

4. An emergent empirical literature also emphasizes the multidimensional nature of women’s empowerment and the interactions between the different facets of this phenomenon (see Mabsout and van Stereven 2010, Gottlieb and Robinson 2019 or Brulé and Gaikwad 2020).

has not been considered thus far. The aim of the present article is to fill this gap. To that end, we provide a stylized model in which, if only one dimension of empowerment is endogenous, the economy converges towards one unique steady-state. Then we show that, when women's bargaining power within both the private and the public spheres is endogenous, the interactions between the two facets of empowerment may give birth to multiple equilibria. In particular, a gender inequality trap, characterized a depressed level of investment in children, may emerge. Finally we discuss the most suitable policy intervention to escape from this kind of trap.

To do so, we propose a two-sex overlapping generations model in which individual utility is derived from private consumption and children's human capital achievement and women place a higher weight on human capital than men. Then, we consider the simplest framework capturing this basic fact : human capital formation depends on choices made both by parents (in the private sphere) and by policy makers (in the public sphere). Formally, children's human capital is produced by combining two substitutable inputs : public spending provided by the government and parents' child rearing time. Due to gender differences in preferences regarding children's human capital, the provision of these two inputs depends on the ability of women to influence decisions at the society and at the household level. We consider that the relative bargaining power of women *vs.* men might be different in the private sphere than in the public sphere. Below, we elaborate on the ways in which choices are made within these two spheres and how the two facets of women's bargaining power evolve over time.

In the private sphere, the time that parents devote to their children results from a collective decision-making process. Formally, this time is determined jointly by the two spouses to maximize a collective household utility function. The parameter measuring the relative weight of the husband (*vs.* wife's) utility in this collective function is interpreted as the intrahousehold bargaining power of men. Moreover, we model this intrahousehold bargaining power as endogenous by assuming, as is often the case in the literature (see, among others, de la Croix and Vander Donckt 2010, Iyigun and Walsh 2007, Baudin et al. 2015 and 2020 or Pretner and Strulik 2017), that it depends on the relative income of men compared to that of women. If the relative income of women increases, the wife's bargaining position improves. Finally, an individual's income depends on brains (the human capital endowment, which is equally shared between girls and boys) and brawn (a physical strength parameter that is higher for males than for females).

In the public sphere, political power is shared between different political groups with potentially conflicting interests. The two relevant groups for our purpose are males and females. Following Bisin and Verdier (2017), we assume that public policy is determined by a social planner that accounts for the preferences of the two groups and their relative political power. Formally, the planner chooses the amount of public spending to maximize a social welfare function – that is, a weighted average of the utility of males and females – taking as given the private decisions of the agents. The weight placed on the utility of males (*vs.* females) is interpreted as the relative political power – also called

institutional bargaining power – of men. The lack of commitment on the part of the social planner leads to suboptimal public policy. However, in line with Bisin and Verdier (2017), we assume that institutional changes serve as a commitment device. In other words, the institutional bargaining power of males adjusts over time to move the equilibrium closer to a hypothetical configuration in which the social planner would be able to commit to a tax rate. In this setting, female empowerment is viewed as a change in the institutional arrangements of society that benefits women, which will arise if it helps society achieve a less inefficient situation.

In our model, the two facets of empowerment interact and influence one another. On the one hand, an increase in women’s institutional power will induce a rise in public spending devoted to human capital formation. More human capital allows for a reduction in the relative importance of brawn in the productivity of labor such that the gender wage gap decreases. This generates an improvement in women’s bargaining position in the private sphere. On the other hand, when the empowerment of women in the private sphere is low relative to their empowerment in the public sphere, the government must over-invest in human capital to compensate for the small amount of time that parents devote to their children. In this configuration, if the government were able to commit to a level of public spending, it would choose a lower level and let the households adjust by investing more time in human capital formation. Hence, to close the gap between the public policy arising in equilibrium and the one that would have prevailed in the absence of a commitment problem, the institutional bargaining power of women must decrease such that public spending will decrease. A symmetric reasoning applies when the empowerment of women is greater in the private than in the public sphere such that, in that case, the institutional bargaining power of women must improve.

These mutual interplays between the evolution of women’s voice in society and in the family may induce the emergence of multiple equilibria. In particular, a *patriarchal* steady state in which decisions are dictated by males both in the private and in the public sphere may co-exist with another locally stable equilibrium in which institutional and intrahousehold bargaining power are more balanced between genders. Obviously, the *patriarchal* steady state is also characterized by a depressed amount of human capital and a large gender pay gap. The existence of multiple equilibria implies that two countries with different initial conditions – in terms of technology or institutional arrangements – in the distant past may ultimately have a substantially different balance of power between genders even if these discrepancies were eliminated later. This path-dependency result might be related to a recent set of studies that show that historical events may have persistent effects on several aspects of gender inequality and female empowerment (see Alesina et al. 2013, Xue 2018, Grosjean and Khattar 2019 or Teso 2019). In particular, we propose transmission channels allowing us to explain the persistence of an inegalitarian balance of power between genders even long after the original cause of gender inequality should have disappeared. Our results also allow us to shed new light on the impact of public policies that have been proposed to favor women’s empowerment

in developing countries. We particularly consider two types of policy. The first, directed towards the private sphere, aims at capturing the impact of targeting some public transfers at women. The second, directed towards the public sphere, consists of imposing quotas for women in policy-making positions. Our results offer a rationale for the mixed results concerning the effectiveness of these policies for empowering women. In particular, for a country trapped in the *patriarchal* equilibrium, these policies are ineffective if the country remains in the trap, while their impact can be substantial if it allows the economy to escape the trap. Moreover, we conclude that policies directed towards the private sphere and policies directed towards the public sphere exhibit complementarities and should be implemented conjointly.

Our article closely relates to the body of theoretical work that regards the bargaining power between men and women as endogenous (see Iyigun and Walsh 2007, Doepke and Tertilt 2009, de la Croix and Vander Donckt 2010, Bertocchi 2011, Fernandez 2014, Pretner and Strulik 2017). In most of this literature, this bargaining power is understood as intrahousehold bargaining power (in the private sphere, in our terminology). A notable exception is Bertocchi (2011), who considers empowerment as the extension of political rights of women (in the public sphere, in our terminology). Our paper is a first attempt to model the joint evolution of different facets of women's empowerment : intrahousehold and institutional empowerment. Since these two facets are clearly identified in the empirical literature and by policy makers, we believe that a theoretical analysis of how they interact fills an important gap in the literature. In particular, we show that those interactions might give rise to multiple equilibria, preventing some countries from escaping from a patriarchal trap. When addressing the engine of empowerment, the majority of the abovementioned articles assume that gender bargaining power is shaped by the relative earnings of men and women. We make a similar assumption concerning empowerment in the private sphere. Doepke and Tertilt (2009), Bertocchi (2011) and Fernandez (2014) consider another driving force for empowerment. In their papers, men initially have all the power and may decide to grant women rights when it is in their self interest to do so.⁵ Hence, in those articles, the level of empowerment tomorrow is chosen to maximize a welfare function in which the weight given to men and women utility is determined by those who have the power today. In a similar spirit, we assume that, in the public sphere, the institutions (*i.e.*, the balance of power between men and women) in one period determine the institutions for the next period to achieve a higher degree of social efficiency. Specifically, we adopt the framework proposed by Bisin and Verdier (2017) in which the balance of power adjusts over time to indirectly internalize the lack of commitment that plagues social choice problems. Importantly, this framework is sufficiently tractable to allow for modeling institutional empowerment as a continuous variable, just like intrahousehold empowerment.⁶ In contrast, Doepke and Tertilt (2009), Bertocchi (2011)

5. Geddes and Lueck (2002) also make this point without a formal model.

6. In their pathbreaking works Acemoglu and Robinson (2000 and 2006) propose alternative mechanisms to figure out institutional changes. In their model, the political group who holds the political power might choose to transfer this power to another group under the threat of revolution. We consider that the Bisin and Verdier (2017) framework

and Fernandez (2014) consider only two levels of power sharing : the *patriarchy regime*, in which men have all the decision power, and the *empowerment regime*, in which the power is equally shared between genders. Moreover, while in these papers the balance of power evolves in one direction (patriarchy to empowerment), it can also go in the opposite direction in our framework. This is a key feature that allows for the emergence of multiple equilibria.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 explores the dynamics and long-run equilibria, presents comparative statics results and discusses the effectiveness of selected public interventions intended to promote women’s empowerment. The main assumptions of the model are discussed in Section 4. Finally, Section 5 concludes the paper.

2 The Model

We propose an overlapping-generations model of a developing economy. Time is discrete (indexed by t), and the economy is populated by households. One household consists of two parents (a male and a female spouse) and two children (a boy and a girl).

2.1 Preferences and constraints

At date t , each spouse $i \in \{m, f\}$ derives utility from joint household consumption (c_t) and the children’s human capital (h_{t+1}) :

$$u_t^i = \gamma^i \ln c_t + (1 - \gamma^i) \ln h_{t+1} \tag{1}$$

The parameter γ^i accounts for the relative weight placed on consumption *vs.* the investment in children in the preferences of spouse i . We assume that women place more weight on children’s human capital than men :

Assumption 1 $\gamma^m > \gamma^f$

Many theoretical papers rely on the assumption that men and women have different preferences, with women being more oriented towards the well-being of their family, in particular that of their children, or the provision of public goods, than men (see, for instance, Doepke and Tertilt 2009, Bertocchi 2011 or Pretner and Strulik 2017).⁷ Empirical evidences also support Assumption 1 (see Pretner and Strulik (2017), Filipiak et al. (2017) and references therein).

is more appropriate to understand women’s political empowerment since *i.* in our view, the institutional bargaining power of women is fundamentally a continuous variable; *ii.* historical evidences show that this bargaining power has evolved gradually over time; and *iii.* female’s enfranchisement cannot be explained by the threat of social unrests. We elaborate on these arguments in Section 4.

7. Baudin and Hiller (2019) propose a theoretical explanation for the emergence and persistence of these gender differences in preferences.

Human capital depends on the time that parents devote to their children and on public investment (such as educational spending or public health investment targeted towards children). Moreover, in line with Glomm and Kaganovich (2003), Kimura and Yasui (2009) or Azarnert (2010), we assume that private and public inputs are substitutes.⁸ Formally, the human capital of generation $t + 1$ is given by :

$$h_{t+1} = a\tau_t + (1 - a)x_t \quad (2)$$

with $\tau_t \in [0, 1]$ being the tax levied by the government that is used to finance public spending devoted to children and $x_t \in [0, 1]$ being the parental time devoted to children. We assume that the only input for the private provision of human capital is this parental time (a similar assumption may be found in Galor and Weil 2000 or Tamura 2006). For the sake of simplicity, we also assume that child rearing time is equally shared between the two spouses.⁹ Finally, the parameter $a \in (0, 1)$ accounts for the relative weight of public spending *vs.* parental time in the children's human capital. Each adult member of the household is endowed with one unit of time, and the household faces the following budget constraint :

$$c_t = (1 - x_t)(1 - \tau_t)(w_t^f + w_t^m) \quad (3)$$

where w_t^f and w_t^m are the wage rates per unit of labor for men and women, respectively.

2.2 Women's empowerment

We consider two different dimensions of women's empowerment :

- i Intrahousehold bargaining power captures the capacity of women to influence her household's choices.
- ii Institutional power captures the capacity of women to have a voice in the political decision-making process at the society level.

These two dimensions both measure the relative say of women in economic decisions, but while the first dimension is limited to the private sphere, the second dimension concerns the public sphere. To more formally define these two dimensions of women's empowerment, let us explain how decisions are made within these two spheres.

8. Note that, the existence of a complementarity between private and public inputs in the production function of human capital would have strengthened our results by adding a mutually reinforcing link between the decisions taken in the private sphere and those taken in the public sphere.

9. Note that, if we had distinguished the time spent by the father from the time spent by the mother, the latter would have been higher. This for two reasons. First, women give a higher weight to children human capital compared to men ($\gamma^m > \gamma^f$). Second, the opportunity cost of child rearing time is higher for men since, as developed in Section 2.4, men receive a higher wage. Hence, taking into account both male and female child rearing time, while complexifying the analysis, would have reinforced our results by exacerbating the gender earnings gap for a given level of human capital.

The private sphere. To model the decision-making process within the household, we adopt the collective approach proposed by Chiappori (1988, 1992). According to this approach, the household maximizes a collective utility function, which is a weighted average of the utilities of the two spouses, under income pooling. We denote by θ_t the relative weight associated with males' utility in the household utility function. This variable measures the degree of women's empowerment in the private sphere : When θ_t decreases, women gain influence in the household's decisions. The collective household utility function is written as :

$$H_t = \theta_t u_t^m + (1 - \theta_t) u_t^f \quad (4)$$

Using the expression for the individual utility function (1), the household utility function (4) can be rewritten as :

$$H_t = \Gamma_t \ln c_t + (1 - \Gamma_t) \ln h_{t+1} \quad (5)$$

with

$$\Gamma_t \equiv \gamma^f + \theta_t \Delta\gamma \quad \text{and} \quad \Delta\gamma \equiv \gamma^m - \gamma^f$$

The variable Γ_t accounts for the relative weight placed on consumption rather than children's human capital within the household. Under Assumption 1, $\Delta\gamma > 0$, meaning that Γ_t is increasing in θ_t . When the relative bargaining power of women declines, human capital becomes relatively less valued – compared to consumption – in the household's utility. Most of the existing literature models women's empowerment as a change in intrahousehold bargaining power θ_t (see de la Croix and Vander Donckt 2010, Iyigun and Walsh 2007, Doepke and Tertilt 2009, Rees and Riezman 2012, Baudin et al. 2015 and 2020 or Pretner and Strulik 2017). For the sake of clarity, in the following, we will refer to Γ_t as our measure of the relative power of men in the private sphere.

The public sphere. We model the political decision-making process in a reduced-form way by adopting the model proposed by Bisin and Verdier (2017). In this model, public policy is decided by a social planner (the policy maker or the government) to maximize a utilitarian social welfare function. Moreover, institutions are defined as the Pareto weights associated with the utility of each social group in this social welfare function.¹⁰ Two social groups are relevant for our purposes : men and women. The weight associated with men is denoted β_t , so $1 - \beta_t$ measures the institutional power of women. When β_t decreases, women exercise more voice in society, thereby having a larger

10. This view of institutions as mechanisms allowing to aggregate the preferences of distinct social groups and to implement social choices is in line with a large literature (North 1981, 1990 ; David 1994 ; Greif 2006). Moreover, in the spirit of Greif and Laitin (2004), Bisin and Verdier (2017) or Bisin et al. (2018), institutions are considered exogenous when decisions are made (see Section 2.3), even if those decisions will be the driver of endogenous institutional changes (see Section 3.2).

influence on public policy. Hence, the social welfare function is written as :

$$W_t = \beta_t u_t^m + (1 - \beta_t) u_t^f \quad (6)$$

Using the expression for the individual utility function (1), the social welfare function (6) is rewritten as :

$$W_t = \Psi_t \ln c_t + (1 - \Psi_t) \ln h_{t+1} \quad (7)$$

with

$$\Psi_t \equiv \gamma^f + \beta_t \Delta \gamma$$

The variable Ψ_t plays exactly the same role, at the society level, as Γ_t does at the household level. It is increasing in β_t , so when the institutional power of males increases, the weight placed on human capital in the social welfare function decreases. Then, in the following, we will refer to Ψ_t as our measure of the relative power of men in the public sphere.

2.3 The static equilibrium

As previously explained, consumption (c_t) and child rearing time (x_t) are chosen within the household, while public policy (τ_t) is decided by the social planner. Following Bisin and Verdier (2017), we assume that the planner cannot commit to a level of public spending. Hence, the tax rate is chosen without internalizing the effect on households' decisions. Under this assumption, the static equilibrium may be defined as the Nash equilibrium of a game played between the social planner and the representative household.

Definition 1 *The static equilibrium is defined as the pair $\{x_t^s, \tau_t^s\}$ such that :*

$$x_t^s \in \arg \max_{x_t} \{ \Gamma_t \ln(1 - x_t) + (1 - \Gamma_t) \ln(a\tau_t + (1 - a)x_t) \} \quad (8)$$

$$\tau_t^s \in \arg \max_{\tau_t} \{ \Psi_t \ln(1 - \tau_t) + (1 - \Psi_t) \ln(a\tau_t + (1 - a)x_t) \} \quad (9)$$

Equations (8) and (9) are obtained by plugging the expression for human capital (2) and the household budget constraint (3) into the household's utility function (5) and the social welfare function (7), respectively, using the fact that the policy maker regards x_t as given and the representative household regards τ_t as given. The first-order conditions associated with the maximization of the household utility function (8) and the social welfare function (9) lead to :

$$x_t = \max \left\{ 0, 1 - \Gamma_t \left[\frac{1 - a + a\tau_t}{1 - a} \right] \right\} \quad (10)$$

$$\tau_t = \max \left\{ 0, 1 - \Psi_t \left[\frac{a + (1 - a)x_t}{a} \right] \right\} \quad (11)$$

Equation (10) describes a negative relationship between child rearing time and the tax rate. This is driven by a simple substitution effect. The same kind of effect explains why x_t negatively affects τ_t in equation (11).¹¹

To avoid the special configurations in which a corner solution arises either for x_t or τ_t , let us assume a sufficiently balanced level of a such that the following condition applies :

Assumption 2 $a \in \left[\frac{\gamma^m(1-\gamma^f)}{1-\gamma^m\gamma^f}, \frac{1-\gamma^m}{1-\gamma^m\gamma^f} \right]$

Under Assumption 2 and combining the two best response functions (10) and (11), we obtain the following expressions for child rearing time and the tax rate in the static equilibrium :

$$x_t^s = 1 - \frac{\Gamma_t(1 - \Psi_t)}{(1 - a)(1 - \Psi_t\Gamma_t)} \equiv x^s(\Gamma_t, \Psi_t) \quad (12)$$

$$\tau_t^s = 1 - \frac{\Psi_t(1 - \Gamma_t)}{a(1 - \Psi_t\Gamma_t)} \equiv \tau^s(\Gamma_t, \Psi_t) \quad (13)$$

Through a direct effect, child rearing time is decreasing in Γ_t , while the tax rate is decreasing in Ψ_t . Then, through a substitution effect, child rearing time is increasing in Ψ_t , while the tax rate is increasing in Γ_t . The positive impact of women's institutional empowerment on government spending, in particular spending targeting children, is supported by several empirical findings (see Lott and Kenny 1999, Aidt et al. 2006, Miller 2008, Carruthers and Wanamaker 2015 or Kose et al. 2020 for evidence on now-developed countries and Clots-Figueras 2011 and 2012, Bhalotra and Clots-Figueras 2014 or Brollo and Troiano 2016 for evidence on developing countries). Empirical studies also confirm that a greater intrahousehold empowerment of wives changes household spending in a way benefiting children (see Hoddinot and Haddad 1995, Lundberg et al. 1997, Allendorf 2007, Schady and Rosero 2008, Rubalcava et al. 2009 or Calvi et al. 2018).

Plugging the values of x_t^s and τ_t^s into the production function of human capital (2) leads to the following value of h_{t+1} in the static equilibrium :

$$h_{t+1}^s = \frac{(1 - \Psi_t)(1 - \Gamma_t)}{1 - \Psi_t\Gamma_t} \equiv \rho^s(\Gamma_t, \Psi_t) \quad (14)$$

Children's human capital is decreasing in both Ψ_t and Γ_t . The empowerment of women, in either the public or private sphere, leads to an increase in the overall investments targeting children.

2.4 Production and wages

The consumption good is produced using two perfectly substitutable inputs : mental labor and physical labor. Each individual is endowed with an exogenous amount of physical labor while the

11. Note that, the choice of a log-utility greatly simplifies the derivation of these reaction functions. In particular, it allows to abstract from the interactions between the choices of τ_t and x_t arising from the budget constraint (3). Nevertheless, since an increase in x_t (resp. τ_t) reduces the marginal impact of a rise in τ_t (resp. x_t) on the household's budget, these budget constraint effects would have reinforced the substitution pattern between x_t and τ_t .

amount of mental labor provided by one individual is measured by her/his human capital endowment. Hence, the production function of the consumption good may be simply written as :

$$Y_t = \mu L_t^h + L_t^p \quad (15)$$

with L_t^h the amount of human capital and L_t^p the amount of physical labor used to produce the good and $\mu > 0$ a parameter measuring the relative productivity of human capital with respect to physical labor. Production factors are rewarded according to their marginal productivity such that the earnings of an individual i writes as :

$$w_t^i = \mu h_t^i + \ell_t^i \quad (16)$$

with h_t^i and ℓ_t^i the endowments of i in human capital and physical labor respectively. As already discussed, both women and men are endowed with $h_t^s = \rho^s(\Gamma_{t-1}, \Psi_{t-1})$ units of human capital. However, we assume that men have a greater endowment in physical labor than women.¹² This endowment is denoted $\chi > 0$ for males and is normalized to 0 for females, such that :

$$w_t^f = \mu \rho^s(\Gamma_{t-1}, \Psi_{t-1}) \quad (17)$$

$$w_t^m = \mu \rho^s(\Gamma_{t-1}, \Psi_{t-1}) + \chi \quad (18)$$

Due to this difference in physical labor endowment, men obtain a higher wage than women such that the wage ratio w_t^m/w_t^f is higher than one. Moreover, this ratio reduces as human capital accumulates. Indeed, a higher human capital allows to access to skill intensive occupations in which brain replaces brawn. Relatedly, Galor and Weil (1996), Kimura and Yasui (2010), Bertocchi (2011) or Sauré and Zoabi (2014) consider that physical capital and mental labor are complements while physical capital and physical labor are substitutes such that physical capital accumulation erodes the gender wage gap exactly as human capital accumulation does in our setting.¹³ This is important since, as developed in Section 3.1, the intrahousehold bargaining power of females and males depends on this wage ratio.

12. Galor and Weil (1996), Kimura and Yasui (2010), Bertocchi (2011), Hiller (2014) or Sauré and Zoabi (2014) make a similar assumption.

13. The existence of an exogenous gender gap that decreases with the accumulated level of human capital is a central feature of our model. The assumption of a gender difference in physical labor endowment is the most convenient way to obtain this feature. Alternatively, we could have assumed the presence of inegalitarian social norms or a discrimination against women the weight of which reduces with human capital.

3 The Dynamics

3.1 The evolution of intrahousehold empowerment

Following de la Croix and Vander Donckt (2010), Rees and Riezman (2012), Baudin et al. (2015 and 2020) and Prettnner and Strulik (2017), among others¹⁴, we assume that the balance of power within a household is determined by the relative income of the husband and the wife. A rationale for this assumption is that higher earnings allow a spouse to have a better outside option, which improves her/his bargaining position. Another argument lies in the fact that a spouse who contributes more to the household budget is likely to have greater legitimacy to make decisions about this budget. These arguments are captured in the following stylized way.

When the two spouses have the same income ($w_t^m = w_t^f$), the decision power is equally shared ($\theta_t = 1/2$). Otherwise, the husband (resp. the wife) obtains more power as w_t^m/w_t^f increases (resp. decreases). We choose the following convenient formulation that is close to that adopted in Prettnner and Strulik (2017) or Strulik (2019) .¹⁵

$$\theta_t = \min \left\{ \frac{1}{2} \left(\frac{w_t^m}{w_t^f} \right), 1 \right\} \quad (19)$$

Putting the expressions (17) and (18) of w_t^f and w_t^m into (19) and then into the expression of Γ_t , it yields :

$$\Gamma_{t+1} = \min\{g(\Gamma_t; \Psi_t), \gamma^m\} \quad (20)$$

with

$$g(\Gamma_t; \Psi_t) \equiv \frac{1}{2} \left[\gamma^m + \gamma^f + \frac{\chi(\gamma^m - \gamma^f)(1 - \Psi_t \Gamma_t)}{\mu(1 - \Psi_t)(1 - \Gamma_t)} \right] \quad (21)$$

This equation describes how the intrahousehold empowerment parameter (Γ_t) evolves over time for a given value of the institutional empowerment parameter (Ψ_t). According to equations (20) and (21), Γ_{t+1} is increasing in Γ_t . Indeed, at date t , if women have less bargaining power within the household, the private provision of human capital is dampened such that h_{t+1} is low. Then, at the next date, the gender wage gap will be enhanced, and the intrahousehold bargaining position of women will be reduced. To ensure that (for any value of Ψ_t) the dynamical equation (20) exhibits a unique steady state, we assume that the parameter μ is large enough¹⁶ :

14. See also Attanasio and Lechene (2002) for empirical evidence.

15. By (17) and (18), $w_t^m > w_t^f$ such that θ_t is always higher than 1/2. Moreover, the effects of an increase in w_t^m and an increase in w_t^f are not symmetric. In particular, when w_t^m becomes too large with respect to w_t^f , males have all the bargaining power ($\theta_t = 1$). This is an important feature for the emergence of patriarchal traps.

16. Formally, Assumption 3 ensures that, for all $\Gamma_t \in [\gamma^f, \gamma^m]$, the slope of $g(\Gamma_t; \gamma^m)$ is lower than one. If this assumption was not satisfied, Γ_{t+1} would have been very sensitive to the value of Γ_t so that the dynamics of Γ_t (for a given value of Ψ_t) could have exhibited multiple locally stable steady-states . We have decided to abstract from this extreme situation and to focus on configurations in which multiple equilibria arise from the mutual interplay between the empowerment in the two spheres, which is the central focus of this work.

Assumption 3 $\mu \geq \frac{\chi(\gamma^m - \gamma^f)}{2(1 - \gamma^m)^2} \equiv \hat{\mu}$

Moreover, we denote by $\tilde{\mu}$ the value of μ such that $g(\gamma^m, \gamma^m) = \gamma^m$:

$$\tilde{\mu} \equiv \frac{(1 + \gamma^m)\chi}{1 - \gamma^m}$$

and we define $\hat{\gamma}^m$ and $\tilde{\gamma}^m$ as the unique value of γ^m – belonging to $(\gamma^f, 1)$ – such that, respectively, $\tilde{\mu} = 2\hat{\mu}$ and $\tilde{\mu} = \hat{\mu}$. Finally, to lighten the analysis by focusing on the configurations which are the most relevant for our purpose, we assume that :

Assumption 4 $\gamma^m \in (\hat{\gamma}^m, \tilde{\gamma}^m)$

In particular, Assumption 4 allows to abstract from the case in which, whatever the value of Ψ_t , in the long-run men have all the power (Γ_t always converges towards γ^m).¹⁷ Under this assumption $\hat{\mu} < \tilde{\mu} < 2\hat{\mu}$. Then, we can claim that

Lemma 1 *Under Assumptions 1-4, and fixing $\Psi_t = \Psi \in [\gamma^f, \gamma^m]$:*

- 1) *for $\mu \in [\hat{\mu}, \tilde{\mu}]$: there exists a $\tilde{\Psi} \in (\gamma^f, \gamma^m)$ such that if $\Psi < \tilde{\Psi}$, Γ_t converges towards an interior steady state denoted $\Gamma^*(\Psi)$, while if $\Psi \geq \tilde{\Psi}$, Γ_t converges towards γ^m ;*
- 2) *for $\mu \geq \tilde{\mu}$: for all possible values of Ψ_t , Γ_t converges towards an interior steady state denoted $\Gamma^*(\Psi)$;*

where $\Gamma^*(\Psi)$ is the value of the Γ_t solution of equation $\Gamma_t = g(\Gamma_t, \Psi)$ and is increasing in Ψ .

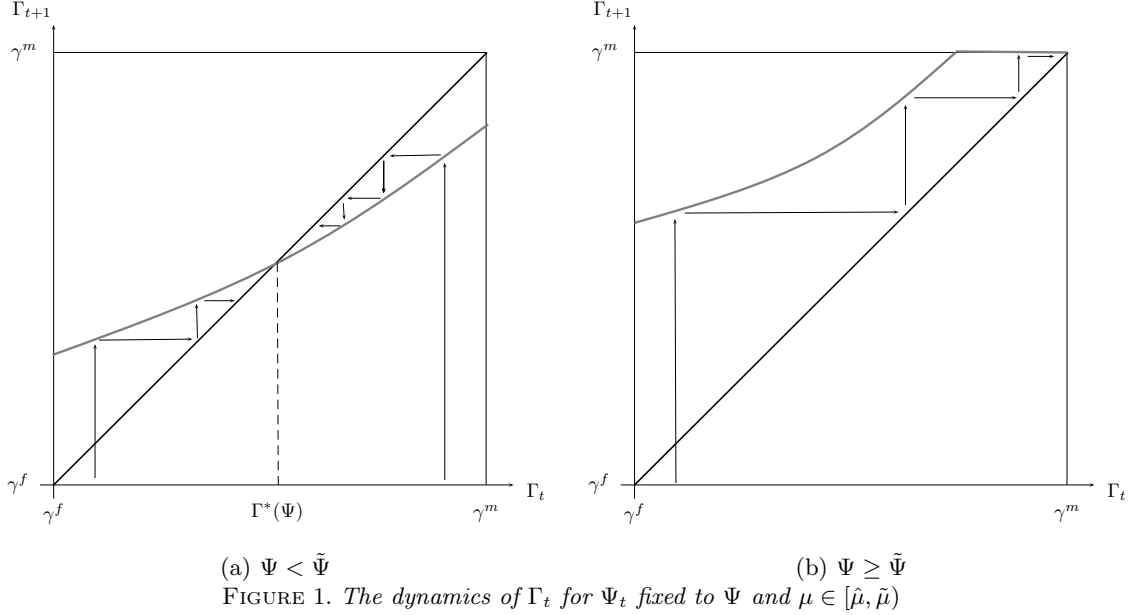
Proof. See Appendix A ■

In Figure 1, we depict the dynamics of Γ_t for a given value of Ψ_t (denoted Ψ) and for $\mu \in [\hat{\mu}, \tilde{\mu}]$. Whatever its initial value, Γ_t converges towards a unique globally stable steady state that could belong to the interval (γ^f, γ^m) if Ψ is sufficiently low or equals γ^m if Ψ is too large. In the latter case, males have full control over the household's decisions. As mentioned in Lemma 1, the value of Γ_t reached in the long run is increasing in Ψ . Indeed, all other things being equal, a higher value of Ψ translates to a lower level of human capital since public spending is reduced. In turn, it widens the gender wage gap and enhances the intrahousehold bargaining position of males.

3.2 The evolution of institutional empowerment

As previously explained, the lack of commitment on the part of the policy maker leads to a sub-optimal equilibrium. Following Bisin and Verdier (2017), we assume that, at a given point in time, current institutions choose the power sharing for the next date to correct these imperfections in the political process. In short, institutional evolutions act as a commitment device. For instance,

17. Assumption 4 is also a sufficient condition to get some parameter configurations for which the mutual interplay between the empowerment in both spheres leads to multiple equilibria (see Section 3.3).



if the lack of commitment leads to an under-provision of human capital, current institutions are willing to transfer more political power to women to reach a situation closer to what is considered optimal by these current institutions.¹⁸

Formally, at date t , future institutional powers (Ψ_{t+1}) are designed to maximize the social welfare function evaluated by the current institutions (*i.e.*, using the institutional powers as of date t). Hence, Ψ_{t+1} will be the solution of the following maximization problem :

$$\Psi_{t+1} \in \arg \max_{\Psi} \{ \Psi_t \ln c^s(\Gamma_{t+1}^e, \Psi) + (1 - \Psi_t) \ln \rho^s(\Gamma_{t+1}^e, \Psi) \} \quad (22)$$

with Γ_{t+1}^e being the expectation, from the perspective of date t , of the value of the private sphere empowerment index that would prevail in $t + 1$.¹⁹ According to (22), Ψ_{t+1} is chosen such that the static equilibrium on date $t + 1$ corresponds to the equilibrium that would have prevailed had the policy maker been able to commit to her choices.²⁰ Using expressions (3), (12) and (13), the

18. Note that, Bisin and Verdier (2017) depart from other institutional evolutions models (e.g. Acemoglu and Robinson 2000) by assuming that political power is not embedded in one single political group. Instead, the different political groups – in our case, females and males – share the power and institutions determine the political weight of each group in the decision making process. Hence, institutional changes make winners and losers. For instance, men (resp. women) are worst off (resp. better off) following a decrease in Ψ_t . Nevertheless, institutional changes may occur even in the absence of any threat of social unrest. Indeed, from the point of view of current institutions (*i.e.* Ψ_t being given), the equilibrium that will prevail under the future weights (Ψ_{t+1}) weakly dominates the equilibrium of the date t . In Section 4 we discuss in more details why the Bisin and Verdier (2017) model is well suitable to describe the process of women’s political empowerment.

19. According to expression (22), institutional changes are myopic in the sense that institutional powers are designed for the next date without taking into account the fact that they will be re-designed afterward (see Bisin and Verdier 2017 for a discussion).

20. In Appendix we show that the solution of the maximization problem (22) corresponds to the value of Ψ_{t+1} such

maximization problem (22) may be rewritten as :

$$\Psi_{t+1} \in \arg \max_{\Psi} \{ \ln(1 - \Psi) + \Psi_t \ln \Psi - (1 + \Psi_t) \ln(1 - \Gamma_{t+1}^e \Psi) \} \quad (23)$$

The first order condition associated with the above maximization problem is :

$$\frac{-1}{1 - \Psi_{t+1}} + \frac{\Psi_t}{\Psi_{t+1}} + \frac{\Gamma_{t+1}^e (1 + \Psi_t)}{1 - \Gamma_{t+1}^e \Psi_{t+1}} = 0$$

after simple algebra, this equation reduces to

$$\Psi_{t+1} = \frac{\Psi_t}{1 + \Psi_t - \Gamma_{t+1}^e} \quad (24)$$

The following Lemma describes the dynamics behavior of Ψ_t for a fixed value of Γ_{t+1}^e .

Lemma 2 *Under Assumptions 1 and 2 and fixing $\Gamma_{t+1}^e = \Gamma \in [\gamma^f, \gamma^m]$, Ψ_t converges towards Γ .*

Proof. See Appendix C ■

According to this result, public sphere empowerment converges towards the anticipated private sphere empowerment. In Figure 2, we illustrate Lemma 2 by depicting the dynamics of Ψ_t for a given value of $\Gamma_{t+1}^e = \Gamma \in [\gamma^f, \gamma^m]$.

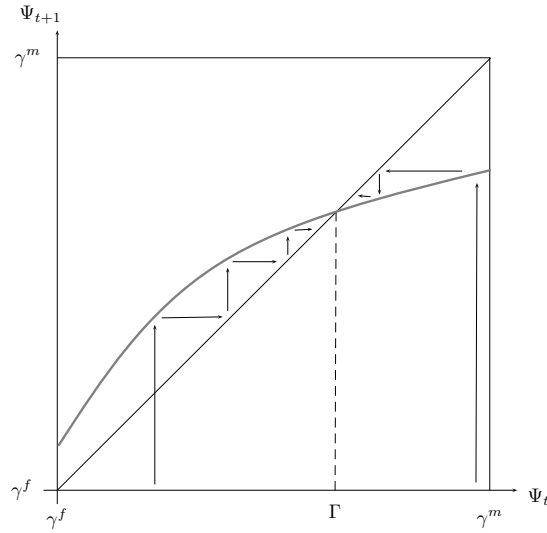


FIGURE 2. *The dynamics of Ψ_t for Γ_{t+1}^e fixed to Γ*

In order to understand the convergence pattern described in Figure 2 let us, for instance, consider the case where $\Psi_t > \Gamma$. In that case, the social planner put a smaller weight on human capital than that $\tau^s(\Gamma_{t+1}^e, \Psi_{t+1}) = \tau^c(\Gamma_{t+1}^e, \Psi_t)$ where $\tau^c(\Gamma_t, \Psi_t)$ is the level of public spending that would have been chosen at date t in the hypothetical situation in which the commitment problem is settled. This result is proven by Bisin and Verdier (2017) in a more general setting.

households. Then, from the planner's point of view, households invest too much in x_t . Thus, if the planner could commit to the public policy, it would have chosen a higher τ_t in order to induce the households to reduce their private provision of human capital.²¹ In order to address this inefficiency, public institutions delegate more power to women. Since women value more human capital than men, this transfer of power will indeed rise public spending. Then, the power of women in the public sphere becomes closer to their power in the private sphere : $\Psi_{t+1} \in (\Gamma, \Psi_t)$. Same arguments apply again in $t + 1$ such that Ψ_t gradually converges towards Γ (as illustrated on Figure 2). Obviously, similar arguments hold true when starting from $\Psi_t < \Gamma$.

To sum up, Ψ_t progressively adjusts to the expected value of the index of empowerment in the private sphere (Γ_{t+1}^e). In the following, we will assume perfect foresight such that Γ_{t+1}^e must be consistent with the value of Γ_{t+1} that will be realized at date $t + 1$. Under this assumption, the *perfect foresight dynamics* of Ψ_t can be rewritten as

$$\Psi_{t+1} = \frac{\Psi_t}{1 + \Psi_t - \Gamma_{t+1}} \quad (25)$$

with Γ_{t+1} given by (20).

3.3 The dynamics of women's empowerment

The joint evolution of intrahousehold and institutional empowerment. As developed in Sections 3.1 and 3.2, there exists a mutual interplay between the evolution of women's bargaining power in the private and public spheres. The joint evolution of (Γ_t, Ψ_t) is described by the two-dimensional first-order dynamical system given by equations (20) and (25). According to Lemma 1, the stationary value of men's bargaining power in the private sphere (Γ_t) is positively related to their institutional power in the public sphere (Ψ_t). In turn, according to Lemma 2, Ψ_t converges towards Γ_{t+1} . These complementarities between the two facets of empowerment may give rise to multiple equilibria. Indeed, a low institutional power for women may impede the development of public policies allowing for their emancipation in the private sphere (see Section 3.1). In turn, limited intrahousehold bargaining power for women will prevent their enfranchisement in the public sphere (see Section 3.2).

In the following proposition, we state that several steady states can indeed co-exist, and we specify the configurations in which this is the case.

Proposition 1 *Under Assumptions 1-4, there exists a $\mu' \in (\hat{\mu}, \tilde{\mu})$ such that :*

21. We show in Appendix B that the optimal level of the tax when the planner is able to commit on the public policy (τ_t^c) is indeed higher than τ_t^s when $\Psi_t > \Gamma$. Since x_t and τ_t are substitutable, the level of x_t that corresponds to the equilibrium with commitment (x_t^c) is lower than x_t^s . However, this lower level of x_t is not sustainable at the (non-cooperative) equilibrium. Indeed, the public powers have an incentive to deviate and to choose a lower τ_t in order to raise consumption. Then, the households will react by raising x_t , leading public powers to increase τ_t again. This process stops when the static equilibrium (x_t^s, τ_t^s) has been reached.

- i* If $\mu \geq \tilde{\mu} : (\Gamma_t, \Psi_t)$ converges towards a unique interior steady state (Γ^*, Ψ^*) with $\Psi^* = \Gamma^*$.
 - ii* If $\mu \in [\mu', \tilde{\mu}) : (\Gamma_t, \Psi_t)$ may either converge towards the interior steady state (Γ^*, Ψ^*) with $\Psi^* = \Gamma^*$ or towards the patriarchal steady state (γ^m, γ^m) .
 - iii* If $\mu \in [\hat{\mu}, \mu') : (\Gamma_t, \Psi_t)$ converges towards the patriarchal steady state (γ^m, γ^m) ,
- where $\Gamma^* \in \left(\frac{\gamma^f + \gamma^m}{2}, \gamma^m\right)$ is the value of Γ_t solution of equation $\Gamma^*(\Gamma_t) = \Gamma_t$.

Proof. See Appendix D ■

The results of Proposition 1 could be intuitively represented by drawing the phase diagram associated with the joint dynamics of Γ_t and Ψ_t . This diagram is given in Figure 3 for each of the configurations listed in Proposition 1. In this figure, $\Gamma\Gamma$ is the stationary locus of Γ_t , defined as the set of pairs (Γ_{t+1}, Ψ_t) such that Γ_t is constant : $\Gamma\Gamma \equiv \{(\Gamma_{t+1}, \Psi_t) \in [\gamma^f, \gamma^m]^2 : \Gamma_{t+1} = \Gamma_t\}$, and $\Psi\Psi$ is the stationary locus of Ψ_t : $\Psi\Psi \equiv \{(\Gamma_{t+1}, \Psi_t) \in [\gamma^f, \gamma^m]^2 : \Psi_{t+1} = \Psi_t\}$. The steady-state equilibria of the joint dynamics of (Γ_t, Ψ_t) are given by the crossing points between the $\Gamma\Gamma$ locus and the $\Psi\Psi$ locus. Finally, the motion arrows indicate how Ψ_t and Γ_t evolve off the stationary loci. The shape of the $\Gamma\Gamma$ and $\Psi\Psi$ loci can be easily derived from the analysis developed in sections 3.1 and 3.2. From Section 3.1 we deduce that the $\Gamma\Gamma$ locus is given by the value of Γ_{t+1} solution of $\Gamma_{t+1} = \min\{g(\Gamma_{t+1}; \Psi_t), \gamma^m\}$, *i.e.* $\Gamma_{t+1} = \min\{\Gamma^*(\Psi_t), \gamma^m\}$. As already discussed, this describes a positive relationship between Γ_{t+1} and Ψ_t . In section 3.2 we have shown that Ψ_t converges towards Γ_{t+1} . Hence, under perfect foresight, the stationary locus of Ψ_t is simply the 45° line in the plan (Γ_{t+1}, Ψ_t) .

Let us also remark that, parametric conditions (in particular, the value of μ with respect to other parameters) crucially affect the dynamics of women's empowerment (see Proposition 1). The impact of μ (and other parameters) fully goes through its effect on the $\Gamma\Gamma$ locus (the $\Psi\Psi$ locus is independent of the fundamentals). Indeed, an increase in the productivity of human capital, compared to men's physical labor endowment, improves the bargaining position of women within the household. Thus, as discussed in Section 3.1, for a given Ψ_t , the stationary value of Γ_t is decreasing in μ and, symmetrically, increasing in χ . This explains why, on the phase diagram, the $\Gamma\Gamma$ locus is shifted towards the left as μ increases. Hence, when μ is low, the $\Gamma\Gamma$ locus is always below the 45° line and the unique steady-state is (γ^m, γ^m) ; for intermediate values of μ the $\Gamma\Gamma$ locus cross the 45° line twice, giving birth to multiple equilibria²²; and when μ is large the $\Gamma\Gamma$ locus cross the 45° only once and this crossing point corresponds to the unique interior steady state. These three different configurations are discussed in more details below.

When μ is very low (lower than μ'), the productivity of human capital is quite depressed with respect to χ , so that, whatever the prevailing value of Ψ_t , the gender wage gap is large and Γ_t

22. Note that, as briefly mentioned in footnote 17, Assumption 4 is a sufficient condition for the existence of parameters configurations such that multiple equilibria arise. Indeed, Assumption 4 implies that $\tilde{\mu} < 2\hat{\mu}$ while $\mu < 2\hat{\mu}$ ensures that the slope of the $\Gamma\Gamma$ locus at the point (γ^m, γ^m) is lower than one. Hence, under Assumption 4, for all values of μ lower than $\tilde{\mu}$, the $\Gamma\Gamma$ locus can cross the $\Psi\Psi$ locus twice (as illustrated in Figure 3(b)).

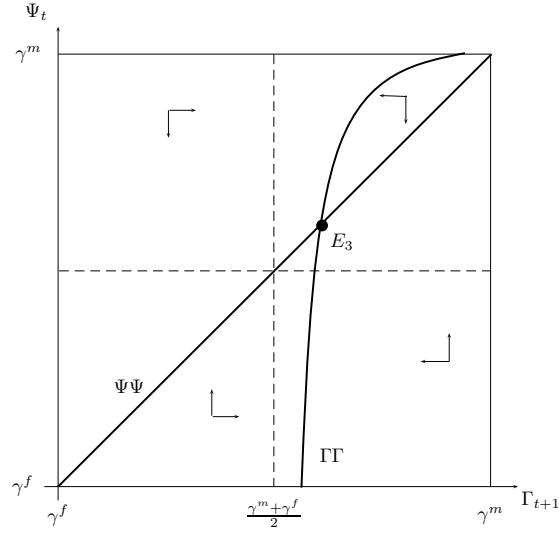
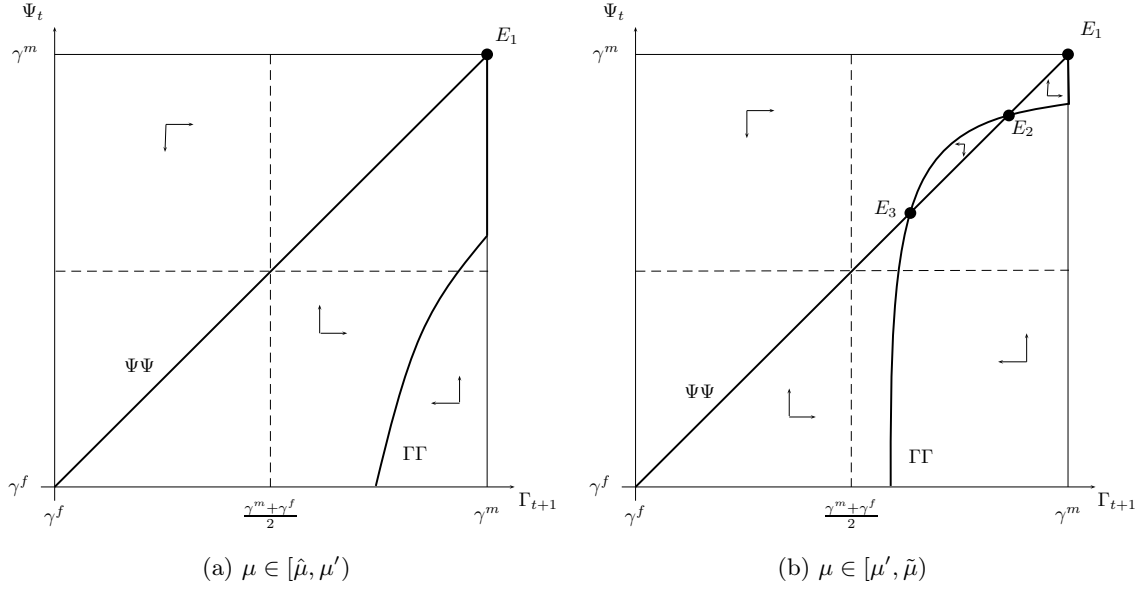


FIGURE 3. *The phase diagram*

converges towards γ^m . Then, Ψ_t progressively adjusts and also converges towards γ^m . In the long run, all the power, in both the private and public spheres, is in the hands of males (the economy belongs to the patriarchal equilibrium E_1 in Figure 3(A)). In contrast, when μ is very high (higher than $\tilde{\mu}$), the gender wage gap is relatively narrow even for large values of Ψ_t . As a consequence, in the long run, the bargaining power within the family remains relatively balanced ($\Gamma_t < \gamma^m$), even if males have all institutional power. Hence, the economy must evolve towards an interior steady state in which, in both spheres, the power is somehow shared between men and women (equilibrium

E_3 in Figure 3(C)).²³ In this configuration, an economy in which, initially, women have a limited voice – both at the society and the family level – will experience a progressive empowerment in both spheres and a rise in human capital. This is consistent with the trajectory experienced by some developed countries. For instance, Doepke et al. (2012) or Moehling and Thomasson (2000) report that, in the US, there has been a gradual movement towards more political power for women during the first half of the twentieth century. Goldin (1990) documents a concomitant increase in the female to male earning ratio, which is the main determinant of women’s household bargaining power in our model.

Let us now focus on the intermediate configuration : $\mu \in [\mu', \tilde{\mu})$. As depicted in Figure 3(B), in that configuration, two locally stable steady states co-exist. If, initially, the bargaining power of men is high in both the private and public spheres – (Γ_t, Ψ_t) is close to the upper-right corner – investments in human capital are markedly reduced and the gender wage gap is large. Hence, Γ_t tends to increase, inducing further reductions in private spending devoted to human capital and widening the gender wage gap. Then, this increase is reinforced by the rise in the institutional power of males (Ψ_t). Finally, the economy ends up in the patriarchal equilibrium E_1 in which men own all the bargaining power in both the private and the public sphere. For lower initial values of Γ_t and/or Ψ_t , the initial gender wage gap is sufficiently low to allow for a decrease in Γ_t that is reinforced by a reduction in Ψ_t . In that case, the economy ends up in the interior equilibrium E_3 . Note that, in this intermediate configuration, the unstable equilibrium is shifted up to the right when μ increase. More broadly, a rise in μ , or symmetrically a fall in χ , by reducing the gender wage gap, narrows the basin of attraction of the patriarchal equilibrium while widening the basin of attraction of the interior equilibrium.²⁴

The emergence of multiple equilibria is intimately linked to the process of mutual reinforcement between the evolution of Γ_t and Ψ_t . Indeed, as shown in Sections 3.1 and 3.2, when the dynamics of these two variables are considered separately, each of them converges towards one unique and globally stable steady state. Let us also remark that the two locally stable steady states (E_1 and E_3) can obviously be ranked in terms of the level of empowerment for women but also in terms of human capital (and income) and in terms of gender inequality. Indeed, h_{t+1}^s is decreasing in both Ψ_t and Γ_t such that the level of human capital in the economy is higher at the interior steady state E_3 than in the patriarchal equilibrium E_1 . Moreover, the gender wage gap w_t^m/w_t^f is decreasing in the level of human capital such that the interior steady state E_3 is less inegalitarian than the patriarchal steady state E_1 . Hence, our model allows us to shed light on a new kind of gender inequality trap (World Bank 2006), which we refer to as a *patriarchal trap*. These features, up to the fact that a more balanced bargaining power among genders may be desirable for its own sake, offer a rationale

23. Nevertheless, due to the existence of an exogenous wage premium for men, full equality cannot be achieved in the long run : At point E_3 , we have $\Gamma_t = \Psi_t > (\gamma^m + \gamma^f)/2$.

24. Indeed, as already underlined, the $\Gamma\Psi$ locus is displaced towards the left as μ increases.

for policy interventions helping to escape the patriarchal trap.

Comparative statics and path dependency. As argued in Proposition 1, a change in the technological parameters drastically affects the long-run situation reached by the economy. The effects of such a change are summarized on the following bifurcation diagram (Figure 4).²⁵

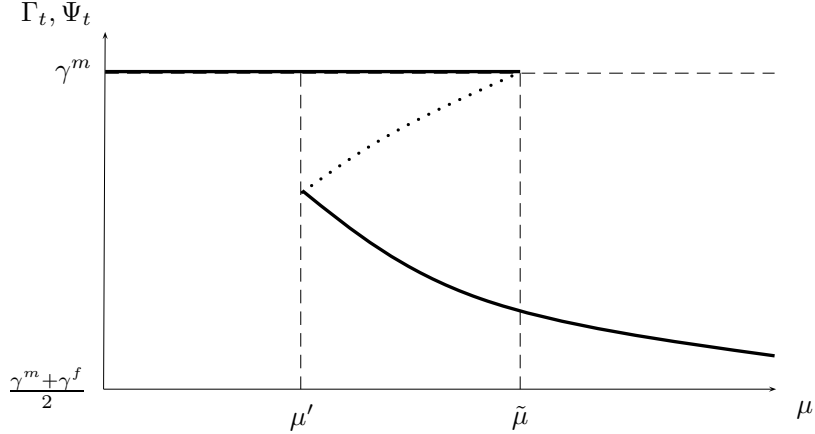


FIGURE 4. *Steady states as a function of μ*

When $\mu < \mu'$, (Γ_t, Ψ_t) converges towards the patriarchal steady state (γ^m, γ^m) . Once μ reaches μ' , two additional steady states appear. The lower one – E_3 in Figure 3(B) – is stable, and the second one – E_2 in Figure 3(B) – is unstable. When $\mu \in (\mu', \tilde{\mu})$, as μ increases, the basin of attraction of the patriarchal equilibrium shrinks (the dotted line is upward sloping), while women’s bargaining power increases in the interior equilibrium (the solid line is downward sloping). Finally, when $\mu > \tilde{\mu}$, (Γ_t, Ψ_t) always converges towards the interior steady state in which women’s empowerment is enhanced as μ rises.

Hence, a rise in the productivity of human capital increases the likelihood for an economy to converge towards the interior equilibrium. In that sense, economic development has the potential to initiate the virtuous circle of empowerment that will, in turn, promote development by generating an increase in human capital investments. A larger μ also improves the bargaining position of women in both spheres at the interior equilibrium. An increase in χ will have the exact opposite effect. Indeed, by rising the men’s physical labor endowment, it enlarges the gender wage gap. This induces a reduction of women’s bargaining power in the private sphere and in the public sphere (as Ψ_t adjust to the expected value of Γ_t).

As shown on Figure 4, the level of women’s empowerment depends on both initial conditions (since multiple equilibria may co-exist) and parametric conditions (the value of μ and χ). Because of

²⁵. In Figure 4, the locally stable steady states are depicted by solid lines while the unstable steady state is depicted by a dotted line.

this, path dependence phenomena (*i.e.*, situations in which exogenous discrepancies in the distant past may be magnified by endogenous changes) may arise. To see this, let us consider two economies that initially differ according to their value of χ . This could be, for instance, attributed to technological differences, with one of the two countries being characterized by technologies relying more on physical strength such that the gender gap in productivity is higher in this country. It could be the case that for the country with the higher χ (say Country 1), (γ^m, γ^m) is the unique globally stable steady state, while for the other country (say Country 2), the inequalitarian steady state co-exists with an interior steady state. If, in Country 2, the balance of power between men and women is not too unequal, it would converge towards the interior equilibrium. Then, even if, later in time, the technology relying on physical strength becomes obsolete and Country 1 adopts exactly the same technology as Country 2 (the parameter χ becomes the same in the two countries), Country 1 will remain trapped in a situation in which males hold all the power; in contrast, in Country 2, women will be, to some extent, empowered. This path dependency property may be related to the empirical findings obtained by Alesina et al. (2013) or Xue (2018).²⁶ In particular, Alesina et al. (2013) conclude that countries characterized by agricultural forms that rely heavily on physical strength (such as plow cultivation) at low development stages are more likely to exhibit low female participation in politics at present. Our model proposes new mechanisms related to the interplay between empowerment in the public and in the private sphere to account for the persistence of those gender inequality traps.²⁷

The long-lasting effects of temporary shocks. The presence of multiple equilibria also implies that temporary shocks on the state variables (Γ_t and Ψ_t) might have long-lasting impact on women’s empowerment. To illustrate this, we have depicted (for a second time) the phase diagram corresponding to the intermediate case in which $\mu \in [\mu', \tilde{\mu})$ and we have drawn on it the unstable paths (in grey) that converge towards E_2 (see Figure 5). These paths share the state space into the basin of attraction of the patriarchal trap (above the paths) and the interior equilibrium (below the paths). Figure 5 allows us to discuss the effectiveness of policy intervention aiming at empowering women. Two broad types of reforms have been proposed and sometimes implemented in developing countries.

The first type of reform, related to the private sphere, consists of targeting some public transfers to women.²⁸ The impact of such a policy may be captured by a negative shock on the value of Γ_{t+1} .

26. See also the enlightening survey by Giuliano (2018).

27. Hiller (2014), Hiller and Baudin (2016) and Baudin and Hiller (2019) propose alternative mechanisms based on the cultural transmission of inequalitarian gender norms and preferences that could also explain the emergence of gender inequality traps.

28. Most conditional cash transfer programs (which consist of offering public benefits to poor households, conditional upon the investment, by the receivers, in the human capital of their children), such as PROGRESA/Oportunidades in Mexico, direct the transfer to women, not men. This design has been adopted for many reasons, for instance, on the grounds that, as already discussed, evidence suggests that women will be more prone to spend money on children than men. Nevertheless, the indirect benefits associated with enhanced bargaining power for women have also been

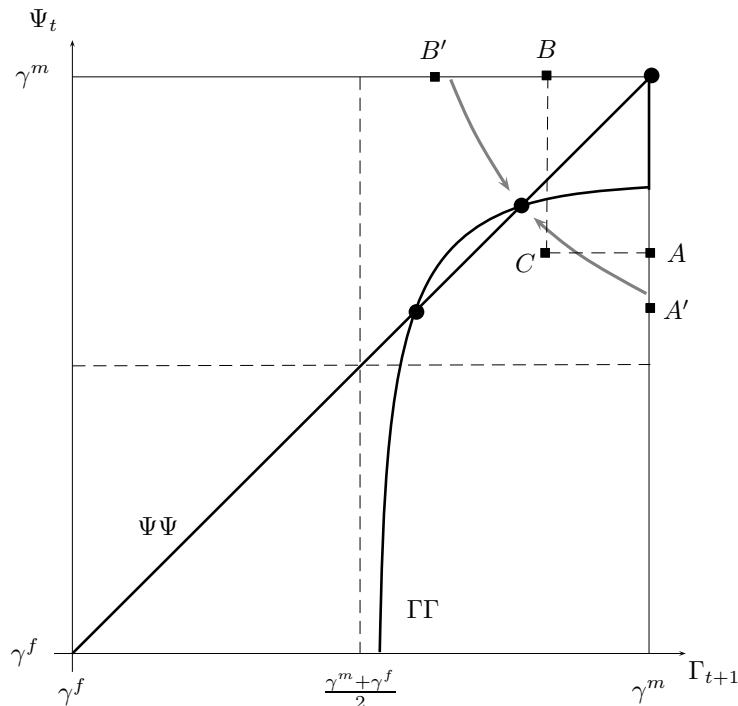


FIGURE 5. Multiple equilibria and the long-lasting impact of temporary shocks

Let us consider the impact of such a shock in an economy trapped in the patriarchal equilibrium. As illustrated in Figure 5, if the change in Γ_{t+1} is not large enough (for instance if the economy reaches the point A of the state space), the economy remains in the basin of attraction of the patriarchal trap and public transfers have essentially innocuous effect on female empowerment. On the contrary, a sufficiently large shock (such that the economy reaches the point A') allows the economy to enter in the basin of attraction of the interior equilibrium such that things change drastically. These contrasting results concerning the impact of an exogenous shock to women's empowerment in the private sphere echo the mixed cross-country evidence for the impact of targeted transfers or credit policies on empowerment and gender equality in developing countries (see, for instance, Kabeer 2001, Mabsout and van Stereven 2010 and the discussion in Prettnner and Strulik 2017). This comparative statics exercise also contributes to the debates around the long-run impacts of a temporary cash transfer policy (see Molina Millán et al. 2019). In particular, the virtuous cycle of empowerment offers a new channel through which the impact of cash transfer programs on women's empowerment and household behavior may be sustained even after transfers end. Indeed, a temporary shock might be sufficient to trigger a convergence towards the locally stable interior equilibrium.

The second type of reform, related to the public sphere, consists of ensuring a minimal political

proposed to justify targeting towards women (see Fiszbein and Schady 2009). Microcredit targeted towards female entrepreneurs is also considered a means to promote female empowerment (the findings by Hashemi et al. 1996 or Angellucci et al. 2015 support this view).

representation of women. The impact of such a policy may be captured by a negative shock on the value of Ψ_t . Again, the effectiveness of such an affirmative action policy depends on the size of the shock. For an economy subject to the inegalitarian trap, a reform which is not ambitious enough (such that the economy reaches the point B), while allowing for better representation of women’s interests in the political decision-making process, may fail to trigger female empowerment in other dimensions. However, such quota policies, even when temporary, can have a major impact on women’s empowerment if they are sufficiently ambitious to allow the economy to escape the inegalitarian trap. This is the case, for instance, if the policy brings the economy to the point B' .²⁹

Figure 5 also illustrates the fact that the most effective way to get our from the trap might be to combine the two types of policy. Indeed, the combination of a conditional cash transfer policy – that would have bring the economy to the point A – with a quotas policy – that would have bring the economy to the point B – allows the economy to converge towards the interior equilibrium. The result according to which affirmative action policies intended to empower women in the public sphere could be more effective when combined with cash transfer programs intended to empower women within the household (and vice versa) echoes the empirical findings of Mabsout and van Stereven (2010), according to which policies intended to improve women’s bargaining power within the family may be unproductive when women’s institutional empowerment is too low.

Finally, Figure 5 allows to consider the role played by initial conditions in other dimensions of women’s empowerment. For instance, men have structurally more intrahousehold decision power in a patrilineal society than in a matrilineal societies (see Andersen et al. 2013 or Shu et al. 2013). In the model, this effect could be captured by a lower initial value of Γ_t in matrilineal society such that those societies are more likely to converge towards the interior equilibrium. This is consistent with the fact that the political participation of women is higher in matrilineal societies (see Gottlieb and Robinson 2019 or Brulé and Gaikwad 2020). Another example is the role played by sex ratios. Indeed, a sex ratio more biased towards males improves the bargaining position of women. In the model, this may also be captured by a lower Γ_t that facilitates the convergence towards the interior equilibrium. This result may be related to the empirical findings by Grosjean and Khattar (2019) or Teso (2019) who conclude to a long-lasting positive impact of male biased sex ratios on women’s status.

4 Discussion of the set-up

In this section we discuss two crucial aspects of our model. The first is why do we choose the Bisin and Verdier (2017) framework to model the process of women’s political empowerment? The

29. See Beath et al. (2013) or van der Windt et al. (2018). The latter explains the failure of the introduction of gender quotas to empower women in Congo by the limited length and scope of the program. More broadly, and in consistency with our theoretical results, the authors conclude about gender quotas policies that “*The evidence for gender parity provisions comes from cases where considerable power is given for women to extended periods*”.

second is why do we focus on public investment in human capital instead of other public policies ?

The process of women’s political empowerment. Our model of institutional transformations is borrowed from Bisin and Verdier (2017). However, there exist alternative ways to figure out institutional changes. In particular, in their now standard model, Acemoglu and Robinson (2000 and 2006) consider that the political group having the power to control social choice³⁰ may choose to transfer the power to another group under the threat of revolution or social unrests. We see several reasons to think that the model proposed by Bisin and Verdier (2017) is more appropriate to deal with the specific issue of women’s political empowerment.

First, in our view, the institutional power of women is multidimensional. It does not only encompass voting rights but also all other dimensions that could allow women to influence the political decision process as freedom of expression, possibility of political activism through collective organizations, access to political positions and the like. Hence, women’s institutional empowerment cannot be limited to a yes (equal political rights between men and women) or no (political patriarchy) and is better represented by a continuous variable.³¹

Second, historical evidences suggest that, even if we restrict our attention to voting rights, the evolution of women political power is a gradual process.³² In the US, some states started to grant voting rights to women in the first half of 1800s but not to all women and not for all elections. For instance, Kentucky granted widows and single white women with property rights the right to vote in school election in 1838. In the course of the XIXth century, more and more states had given partial suffrage – granting voting right to municipal or school elections – to white women. Full suffrage has been won for all white women after the ratification of the nineteenth amendment in 1919. However, it was only in 1965, with the passage of the Voting Rights Act, that all women – both black and white – could be said to have, in practice, the same voting rights than men.³³ For the case of England, Doepke et al. (2012) provide the following timeline. Municipal suffrage was granted to single women and widows in 1869 and county suffrage in 1888. In 1894, both married and single women won the right to elect and to be elected to parish and district councils. In 1907, the right is given to women to be elected as mayors, aldermen, and county and town councilors. In 1918, they are allowed to stand in parliament. In 1929, the Equal Franchise Act gave women equal voting rights with men. Again, this review is focused on the evolution of women suffrage and omit

30. In Acemoglu and Robinson (2000 and 2006) institutions define which political group holds the power.

31. This multidimensional view of women’s political power is in line with the different indexes measuring women’s institutional empowerment. For instance, the *V-DEM women political empowerment indice* aggregates several indexes measuring, for instance, the freedom of discussion for women, the women’s participation in civil society organizations or the political participation of women (Sundström et al. 2007).

32. Historical evidences provided below are borrowed to Moehling and Thomasson (2000) for the US and Doepke et al. (2012) for the UK.

33. Moehling and Thomasson (2000) also report some episodes in which women’s voting rights narrowed. The Bisin and Verdier (2017) framework allows the balance of power to go in both directions and then to encompass these episodes.

other dimensions of women’s political empowerment. Institutional empowerment would be an even more gradual process if we had also considered those other dimensions.

Third, contrary to other kinds of institutional changes (see Acemoglu and Robinson 2000 and 2006), the threat of revolution cannot be considered as an engine for women’s political empowerment. Indeed, although suffragette movement may have facilitated or accelerated the extension of the franchise to women in the US, political power has not been granted to women under the threat of female unrest.³⁴ Moehling and Thomasson (2020) propose an enlightening discussion on the reasons behind women’s enfranchisement in the US. One stated explanation is that groups in power (men at the beginning of 1800s) extended voting rights in order to promote their preferred policies. For instance, school suffrage has been granted to women with the idea that, as mother, they are likely to support public education. Empirical evidences suggest that female voter enfranchisement has indeed had a positive impact on educational spending (see Carruthers et al. 2015 or Kose et al. 2020). The idea according to which men, who initially hold the power, may decide to grant women rights when it is in their self interest to do so, is at the hearth of another strand of the literature on women empowerment that focuses on economic rights – or empowerment in the private sphere in our words – rather than political rights (Doepke and Tertilt 2009 or Fernandez 2014). The Bisin and Verdier (2017) set-up allows us to capture this kind of motives in a parsimonious way.

Human capital investment and other public policies. Public investment in human capital (τ_t) must be understood in a broad sense. It encompasses all kinds of public interventions targeted towards children and that contribute to increase their skills once adult. This includes public investments in education but also public provision of childhood health services.³⁵ Different pieces of evidence suggest that women’s political empowerment might have a particular influence on this kind of public investment. First, and as already discussed, several studies show that, within the household, when women get a higher control on decisions, they tend to allocate more resources on children (Hoddinot and Haddad 1995, Lundberg et al. 1997, Attanasio and Lechene 2002, Allendorf 2007, Schady and Rosero 2008, Rublacava et al. 2009 and Calvi et al. 2018). Extrapolating these results to the public sphere lead to think that women’s institutional enfranchisement might translate into higher public spending devoted to children. Recent empirical studies conclude that an increase in females’ political power indeed induces an increase in public investment in education (Aidt et al. 2006, Clots-Figueras 2011 and 2012, Carruthers and Wanamaker 2015, Kose et al. 2020) and public provision of childhood health services (Aidt et al. 2006, Miller 2008, Bhalotra and Clots-Figueras

34. For this reason, and because the extension of voting rights to women cannot be explained by redistributive motives, Acemoglu and Robinson (2000) recognize that their model is not the more appropriate setting to figure out the extension of political rights to women.

35. Early life health may indeed have a long-lasting impact on educational achievement, cognitive functions and productivity (Schultz 1999, Case and Paxson 2008 or Bharadwaj et al. 2013).

2014, Brollo and Troiano 2016).³⁶ Based on these evidences we have focused our attention on public spending targeted towards human capital acquisition. One additional advantage is that children’s human capital is directly affected by both public spending and private (parental) efforts. Hence, it allows us to capture in a simple way the existing interactions between the public and the private spheres.

Nevertheless, we are aware that human capital investment does not constitute the unique public intervention that might be influenced by women’s political empowerment. More broadly, it may influence public policies related to issues that directly and particularly affect women as maternity and child care laws, abortion laws, inheritance laws or investments in infrastructures like drinking water facilities (see Clots-Figueras 2011, Dufflo 2012 or Hessami and Lopes da Fonseca 2020 and references therein). As this is the case for the publicly provided human capital, this kind of public policy might have an impact on empowerment in the private sphere. For instance, a more generous child care assistance could allow women to spend more time on the labor market and then to increase their relative earnings and, ultimately, their bargaining power within the household. Similarly, in developing countries, women are overwhelmingly in charge of the management of household water supply such that a better access to drinking water might allow them to spend her time on other tasks.³⁷ Hence, we can consider these public policies as complementary channels that would reinforce the impact of women’s institutional empowerment on empowerment in the private sphere.

This being said, one important difference between public investments in human capital and public interventions discussed in the previous paragraph is that the primary purpose of the former is to improve children’s welfare while the latter might directly aim at improving women’s status at home. In the current version of the article, the impact of the public policy on empowerment in the private sphere is not internalized by the agents. The model may be extended to make empowerment within the household the main purpose of the policy. For instance, we could have assumed that *i.* at the beginning of the period t , the social planner has to decide over a public policy that directly influences θ_t ; and *ii.* the intrahousehold bargaining power θ_t enters directly in the utility function of females. In this setting, women’s bargaining power in the private sphere (Γ_t) would be positively related to women’s bargaining power in the public sphere (Ψ_t). However, since Ψ_{t+1} is positively related to the expected value of Γ_{t+1} (see Section 3.2) this might give birth to multiple coordination equilibria. For instance, if institutions of the date t anticipate a high bargaining power within the household in $t + 1$, they will choose a large value for Ψ_{t+1} such that their initial expectation on the value of Γ_{t+1} will be self-fulfilled. But, a low level of empowerment for the next date might also constitute a self-fulfilling prophecy. Our modeling strategy allows us to abstract from these

36. Note that, this finding holds true in studies related to both the historical experience of now-developed countries (Aidt et al. 2006, Miller 2008, Carruthers and Wanamaker 2015, Kose et al. 2020) and the current experience of developing countries (Clots-Figueras 2011 and 2012, Bhalotra and Clots-Figueras 2014, Brollo and Troiano 2016).

37. In a similar spirit, a liberalization of abortion laws or the adoption of more equal inheritance rights might improve the bargaining position of women within the household.

coordination issues that, while interesting, are beyond the scope of the current article.

5 Conclusion

In the existing literature, the different dimensions of women’s empowerment are considered in isolation. In this paper, we argue that this should not be the case, and we propose a simple theoretical framework in which women’s decision power is endogenous, in both the private and public spheres. We conclude that the mutual interplay between these two facets of empowerment may lead to a patriarchal trap in which males have the decision power in both spheres, the gender wage gap is large and the level of human capital depressed. However, well-targeted economic policies may help those countries escape from such a trap. In particular, we stress that public interventions intended to improve the bargaining position of women within the household and those targeting the political empowerment of women should be considered complementary.

While an emergent empirical literature emphasizes the role played by the interactions between different facets of women’s decision power as an impediment to women’s empowerment (see Mabsout and van Stereven 2010, Gottlieb and Robinson 2019 or Brulé and Gaikwad 2020), the implications in terms of public intervention have been largely ignored thus far. To that extent, some of the predictions of our model deserve to be empirically investigated. In particular, when a public policy intended to empower women in one sphere (e.g., conditional cash transfers or quotas) is evaluated, women’s bargaining position in other spheres should be more systemically taken into account. Moreover, we advocate policy experiments that combine instruments promoting women’s decision power both in the family and in politics.

Finally, the framework we propose is sufficiently tractable to be extended in several dimensions. For instance, human capital accumulation could be easily introduced to determine the interplay between the development process and the different facets of empowerment. Such an introduction is likely to reinforce our results since patriarchy tends to impede development, while low development may sustain patriarchy (see Doepke and Tertilt 2009). In the current version of the model, patriarchal traps emerge even in the absence of feedback effects between empowerment and the human capital accumulation process. Another dimension deserving more attention is the impact of gender empowerment on the gender gap in human capital. In the current version of the model, boys and girls receive, by assumption, the same amount of human capital. In fact, in developing countries, boys often receive more education than girls. One simple way to introduce this aspect in our model would be to assume that, compared to fathers, mothers put a greater weight on girls’ human capital (see Prettner and Strulik 2016). Again, it is likely to reinforce our mechanisms since, under this assumption, the empowerment of women would result in a reduction of the gender gap in human capital that would improve the future bargaining power of women.

Appendices

A Proof of Lemma 1

By differentiating the expression (21) with respect to Γ_t and then Ψ_t we get that :

$$\frac{\partial g(\Gamma_t; \Psi_t)}{\partial \Gamma_t} = \frac{\chi(\gamma^m - \gamma^f)}{2\mu(1 - \Gamma_t)^2} > 0 \quad \text{and} \quad \frac{\partial g(\Gamma_t; \Psi_t)}{\partial \Psi_t} = \frac{\chi(\gamma^m - \gamma^f)}{2\mu(1 - \Psi_t)^2} > 0$$

Hence, $g(\Gamma_t; \Psi_t)$ is increasing and convex in Γ_t while an increase in Ψ_t shifts the function $g(\Gamma_t; \Psi_t)$ upwards. Moreover, it is easy to verify that $g(\gamma^f; \gamma^f) > \gamma^f$ and that Assumption 3 ensures that the slope of $g(\Gamma_t; \Psi_t)$ with respect to Γ_t when $\Gamma_t = \gamma^m$ is lower than one for all $\Psi_t \in [\gamma^f, \gamma^m]$. Moreover, the threshold $\tilde{\mu}$ is defined s.t. $g(\gamma^m; \gamma^m) > \gamma^m$ iff $\mu < \tilde{\mu}$. Given the expressions of $\hat{\mu}$ and $\tilde{\mu}$, $\tilde{\mu} > \hat{\mu}$ iff

$$\gamma^m > \frac{\gamma^m - \gamma^f}{2(1 - \gamma^m)} - 1 \quad (\text{A.1})$$

Since the RHS equals -1 when $\gamma^m = \gamma^f$ and tends towards $+\infty$ as γ^m approaches to 1, there is a unique value of γ (denoted $\tilde{\gamma}^m$) such that when $\gamma^m < \tilde{\gamma}^m$, $\tilde{\mu} > \hat{\mu}$. From the same kind of arguments we deduce that there exists a unique value of γ (denoted $\hat{\gamma}^m$) such that when $\gamma^m > \hat{\gamma}^m$, $\tilde{\mu} < 2\hat{\mu}$. Moreover, since $2\hat{\mu} > \hat{\mu}$, $\tilde{\gamma}^m$ must be higher than $\hat{\gamma}^m$. Finally, $g(\gamma^f; \gamma^f) < \gamma^m$ iff $\mu > \frac{(1+\gamma^f)\chi}{1-\gamma^f} \equiv \bar{\mu}$ and we can verify that, at the point $\gamma^m = \hat{\gamma}^m$, $\bar{\mu} < \hat{\mu}$. Hence, since $\hat{\mu}$ is increasing in γ^m while $\bar{\mu}$ is independent of γ^m , $\bar{\mu} < \hat{\mu}$ for all $\gamma^m > \hat{\gamma}^m$.

To sum up, Assumption 4 ensures that $\bar{\mu} < \hat{\mu} < \tilde{\mu} < 2\hat{\mu}$ such that we have :

- i for $\mu \in [\hat{\mu}, \tilde{\mu})$: $g(\gamma^m; \gamma^m) > \gamma^m > g(\gamma^f; \gamma^f)$ meaning that there exists a unique value of Ψ_t (denoted $\tilde{\Psi}$) such that $g(\gamma^m; \tilde{\Psi}) = \gamma^m$. Hence, if $\Psi_t < \tilde{\Psi}$, $g(\Gamma_t; \Psi_t)$ crosses the 45° line only once between γ^f and γ^m and Γ_t converges towards an interior steady state³⁸; while, if $\Psi_t \geq \tilde{\Psi}$, $g(\Gamma_t; \Psi_t) > \Gamma_t$ and Γ_t converges towards γ^m ;
- ii for $\mu \geq \tilde{\mu}$: $g(\gamma^f; \gamma^f) < g(\gamma^m; \gamma^m) < \gamma^m$ meaning that for all possible values of Ψ_t , $g(\Gamma_t; \Psi_t)$ crosses the 45° line only once between γ^f and γ^m and Γ_t converges towards an interior steady state.

B Equilibrium with commitment and institutional dynamics

The *equilibrium with commitment* may be defined as a situation reached when the policy maker is able to commit on a particular value of the public policy (τ_t). More, formally :

38. This interior steady state is denoted $\Gamma^*(\Psi_t)$. Since $g(\Gamma_t; \Psi_t)$ is upward shifted when Ψ_t rises, $\Gamma^*(\Psi_t)$ is increasing in Ψ_t .

Definition 2 *The equilibrium with commitment is defined as the pair $\{x_t^c, \tau_t^c\}$ such that :*

$$\tau_t^c \in \arg \max_{\tau_t} \{ \Psi_t \ln((1 - \tau_t)(1 - x^*(\tau_t))) + (1 - \Psi_t) \ln(a\tau_t + (1 - a)x^*(\tau_t)) \} \quad (\text{B.1})$$

$$s.t. \quad x^*(\tau_t) \in \arg \max_{x_t} \{ \Gamma_t \ln(1 - \tau_t) + (1 - \Gamma_t) \ln(a\tau_t + (1 - a)x_t) \} \quad (\text{B.2})$$

and $x_t^c = x^*(\tau_t^c)$.

Having this definition in mind we can show the following result :³⁹

Lemma 3 *The solution of the maximization problem (22) corresponds to the value of Ψ_{t+1} such that :*

$$\tau^s(\Gamma_{t+1}^e, \Psi_{t+1}) = \tau^c(\Gamma_{t+1}^e, \Psi_t) \quad (\text{B.3})$$

Proof. To solve for the equilibrium with commitment, we plug the best response function of the household (10) into the social welfare function. Say differently, we replace, in the maximization problem (B.1), $x^*(\tau_t)$ by the expression of x_t given by (10). Hence, the problem of the social planner might be rewritten as :

$$\tau_t^c \in \arg \max_{\tau_t} \{ \Psi_t \ln(1 - \tau_t) + \ln(1 - a + a\tau_t) \} \quad (\text{B.4})$$

so that

$$\tau_t^c = 1 - \frac{\Psi_t}{a(1 + \Psi_t)} \equiv \tau^c(\Gamma_{t+1}^e, \Psi_t) \quad (\text{B.5})$$

Using expression (13) we deduce that the value of Ψ_{t+1} solving the equation $\tau^s(\Gamma_{t+1}^e, \Psi_{t+1}) = \tau^c(\Gamma_{t+1}^e, \Psi_t)$ is :

$$\Psi_{t+1} = \frac{\Psi_t}{1 + \Psi_t - \Gamma_{t+1}^e}$$

It exactly corresponds to the value of Ψ that solves the problem (22) as shown in Section 3.2. ■

Equation (B.3) may be interpreted as follows. Institutions today anticipate that the intrahousehold bargaining power tomorrow will be Γ_{t+1}^e . Hence, they anticipate that the “optimal” policy, from their perspective, will be $\tau^c(\Gamma_{t+1}^e, \Psi_t)$. Finally, they also anticipate that if institutions do not change, this level will not be reached due to the commitment problem. Hence, current institutions re-design political power (*i.e.*, choose Ψ_{t+1}) such that the policy that will prevail tomorrow in equilibrium ($\tau^s(\Gamma_{t+1}^e, \Psi_{t+1})$) corresponds to the “optimal” policy ($\tau^c(\Gamma_{t+1}^e, \Psi_t)$).

In Figure 6, we have drawn the level of public spending at both the static equilibrium and the equilibrium with commitment for a given value of $\Gamma_{t+1}^e = \Gamma \in [\gamma^f, \gamma^m] : \tau^s(\Gamma, \Psi_t)$ and $\tau^c(\Gamma, \Psi_t)$.⁴⁰ This allows us to describe the institutional dynamics as stated by equation (B.3) : The horizontal arrows correspond to the adjustment of Ψ_t between two consecutive dates, and the vertical arrows

39. Bisin and Verdier (2017) provides a proof of the following statement in a general setting

40. To derive Figure 6, it is sufficient to note that, according to expressions (13) and (B.5), $\tau^s(\Gamma, \Psi_t)$ is decreasing and concave in Ψ_t , $\tau^c(\Gamma, \Psi_t)$ is decreasing and convex in Ψ_t and equation $\tau^s(\Gamma, \Psi_t) = \tau^c(\Gamma, \Psi_t)$ admits one unique solution on $[\gamma^f, \gamma^m] : \Psi_t = \Gamma$.

correspond to the associated change in the equilibrium public policy ($\tau^s(\Gamma, \Psi_t)$). As shown in this figure, the value of Ψ_t adjusts over time to ensure that the equilibrium value of the economic policy anticipated for tomorrow ($\tau^s(\Gamma, \Psi_{t+1})$) corresponds to the public policy that would have been chosen in equilibrium with commitment by the current institutions ($\tau^c(\Gamma, \Psi_t)$).

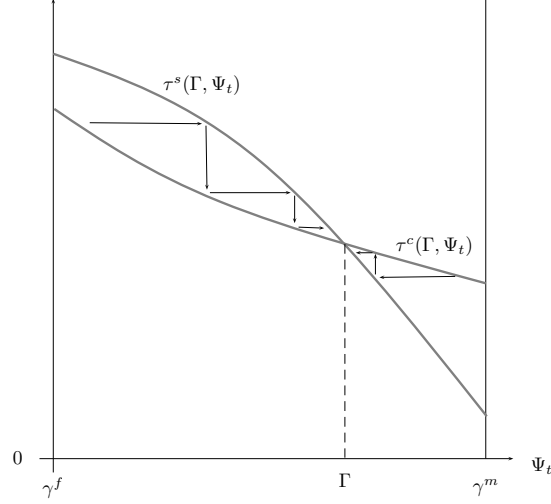


FIGURE 6. *The dynamics of Ψ_t for Γ_{t+1}^e fixed to Γ*

C Proof of Lemma 2

According to equation (B.3) and for a fixed value of Γ_{t+1}^e (denoted Γ), the dynamics of Ψ_t is described by the following equation :

$$\Psi_{t+1} = \frac{\Psi_t}{1 + \Psi_t - \Gamma} \equiv h(\Psi_t) \quad (\text{C.1})$$

with

$$h'(\Psi_t) = \frac{1 - \Gamma}{(1 + \Psi_t - \Gamma)^2} > 0 \quad \text{and} \quad h''(\Psi_t) = \frac{-2(1 - \Gamma)}{(1 + \Psi_t - \Gamma)^3} < 0$$

Hence, $h(\Psi_t)$ is increasing and concave. Moreover, $h(\gamma^f) = \frac{\gamma^f}{1 + \gamma^f - \Gamma} \geq \gamma^f$ (since $\Gamma \geq \gamma^f$), $h(\gamma^m) = \frac{\gamma^m}{1 + \gamma^m - \Gamma} \leq \gamma^m$ (since $\Gamma \leq \gamma^m$) and $h(\Psi_t) = 0$ iff $\Psi_t = \Gamma$. Thus, $h(\Psi_t)$ crosses the 45° line only once in Γ and Ψ_t converges towards Γ .

D Proof of Proposition 1

The steady states of the joint dynamics of Γ_t and Ψ_t are defined as the crossing points of $\Gamma\Gamma$, the stationary locus of Γ_t , and $\Psi\Psi$, the stationary locus of Ψ_t . Hence, as a first step, we will successively

analyze the shape and the properties of these $\Gamma\Gamma$ and the $\Psi\Psi$ loci. For matters of convenience and since the $\Gamma\Gamma$ locus is defined such that $\Gamma_{t+1} = \Gamma_t$, the two loci will be drawn in the plan (Γ_{t+1}, Ψ_t) . Then, we will be in position to complete the proof of the proposition.

The $\Gamma\Gamma$ locus. From equation (20) we know that the $\Gamma\Gamma$ locus is either γ^m or the value of Γ_t solution of the equation $g(\Gamma_t; \Psi_t) = \Gamma_t$. Moreover, since the $\Gamma\Gamma$ locus is such that $\Gamma_{t+1} = \Gamma_t$, the latter equation can be re-expressed as $g(\Gamma_{t+1}; \Psi_t) = \Gamma_{t+1}$. The differentiation of this equality yields

$$d\Gamma_{t+1} = g'_{\Psi} d\Psi_t + g'_{\Gamma} d\Gamma_{t+1} \quad \Leftrightarrow \quad \frac{d\Psi_t}{d\Gamma_{t+1}} = \frac{1 - g'_{\Gamma}}{g'_{\Psi}} \geq 0 \quad (\text{D.1})$$

where the inequality comes from the fact that $g'_{\Psi}(\Gamma_{t+1}; \Psi_t) > 0$ and $g'_{\Gamma}(\Gamma_{t+1}; \Psi_t) \leq 1$ under Assumption 3. Moreover, the derivative of the equation (D.1) with respect to Γ_{t+1} yields :

$$\frac{\partial}{\partial \Gamma_{t+1}} \left(\frac{d\Psi_t}{d\Gamma_{t+1}} \right) = \frac{-g''_{\Gamma\Gamma} g'_{\Psi} - g''_{\Psi\Gamma} (1 - g'_{\Gamma})}{(g'_{\Psi})^2} < 0 \quad (\text{D.2})$$

where the inequality comes from the fact that $g''_{\Psi\Gamma} = 0$ while $g''_{\Gamma\Gamma} > 0$ and $g'_{\Psi} > 0$ (see Appendix A).

Hence, in the plan $(\Gamma_{t+1}, \Psi_t) \in [\gamma^f, \gamma^m]^2$, the $\Gamma\Gamma$ locus is increasing and concave. Using equation (D.1) and the expressions of g'_{Ψ} and g'_{Γ} provided in Appendix A, we also conclude that the slope of the $\Gamma\Gamma$ locus at the point $(\Gamma_{t+1}, \Psi_t) = (\gamma^m, \gamma^m)$ is lower than one if and only if $\mu < 2\hat{\mu}$. Finally, $\hat{\gamma}^m$ is defined as the value of γ^m such that $2\hat{\mu} = \tilde{\mu}$ and Assumption 4 ensures that $2\hat{\mu} > \tilde{\mu} > \hat{\mu}$. Thus, the $\Gamma\Gamma$ locus may be expressed as :

$$\Gamma\Gamma \equiv \left\{ (\Gamma_{t+1}, \Psi_t) \in [\gamma^f, \gamma^m]^2 : \Psi_t = \min\{f_{\Gamma\Gamma}(\Gamma_{t+1}), \gamma^m\} \right\} \quad (\text{D.3})$$

with $f_{\Gamma\Gamma}(\Gamma_{t+1})$ increasing and concave in Γ_{t+1} . Moreover, since $g(\gamma^f, \gamma^f) > (\gamma^m + \gamma^f)/2$ and $g(\Gamma_{t+1}; \Psi_t)$ is increasing in both Ψ_t and Γ_{t+1} , the value of Γ_{t+1} such that $f_{\Gamma\Gamma}(\Gamma_{t+1}) = \gamma^f$ is larger than $(\gamma^m + \gamma^f)/2$. In addition, $f_{\Gamma\Gamma}(\Gamma_{t+1})$ is upward shifted as μ increases⁴¹ with

$$f_{\Gamma\Gamma}(\gamma^m) \begin{cases} > \\ = \\ < \end{cases} \gamma^m \quad \Leftrightarrow \quad \mu \begin{cases} > \\ = \\ < \end{cases} \tilde{\mu}$$

Finally, since $\tilde{\mu} < 2\hat{\mu}$, when μ is close to $\tilde{\mu}$ the slope of $f_{\Gamma\Gamma}(\Gamma_t)$ is lower than one. All these properties of $f_{\Gamma\Gamma}(\Gamma_t)$ are depicted on Figure 7.

From these properties we conclude that when μ is low, the $\Gamma\Gamma$ locus is always below the 45° line. When μ is lower but become sufficiently close to $\tilde{\mu}$, the $\Gamma\Gamma$ locus crosses the 45° line twice (first

41. To see this, let us observe that the differentiation of $\Gamma_{t+1} = g(\Gamma_{t+1}; \Psi_t)$ with respect to μ and Ψ_t yields $\frac{d\Psi_t}{d\mu} = -\frac{\partial g}{\partial \mu} / g'_{\Psi}$ which is positive since $\frac{\partial g}{\partial \mu} < 0$ and $g'_{\Psi} > 0$.

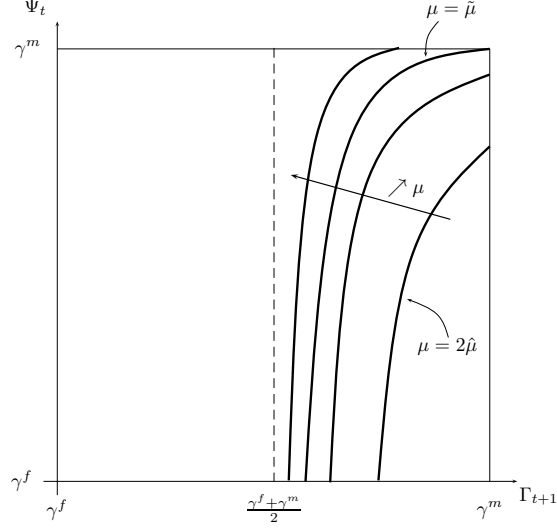


FIGURE 7. Properties of $f_{\Gamma\Gamma}(\Gamma_{t+1})$

from below and then from above). Finally, when $\mu > \tilde{\mu}$, the $\Gamma\Gamma$ locus crosses the 45° line (from below) only once.⁴²

The $\Psi\Psi$ locus. From equation (25) we know that the $\Psi\Psi$ locus may be expressed as

$$\Psi\Psi \equiv \left\{ (\Gamma_{t+1}, \Psi_t) \in [\gamma^f, \gamma^m]^2 : \Psi_t = \Gamma_{t+1} \right\} \quad (\text{D.4})$$

Hence, in the plan (Γ_{t+1}, Ψ_t) , the $\Psi\Psi$ locus corresponds to the 45° line.

Completion of the proof of Proposition 1. It directly follows from the properties of the function $f_{\Gamma\Gamma}(\Gamma_{t+1})$ that :

- When $\mu > \tilde{\mu}$, the $\Gamma\Gamma$ and the $\Psi\Psi$ loci cross only once. We deduce from Lemma 1 and 2 that the corresponding steady-state is globally stable. Moreover, this steady state (Γ^*, Ψ^*) is such that $\Gamma^* = \Psi^* > (\gamma^m + \gamma^f)/2$.
- When μ is slightly lower than $\tilde{\mu}$, the $\Gamma\Gamma$ and the $\Psi\Psi$ loci cross three times. Two of the corresponding steady states are interiors and the third is (γ^m, γ^m) . We deduce from Lemma 1 and 2 that the two extreme steady states are locally stable while the intermediate steady state is unstable. Finally, the interior and locally stable steady state (Γ^*, Ψ^*) is such that $\Gamma^* = \Psi^* > (\gamma^m + \gamma^f)/2$.
- When μ is sufficiently low, the $\Gamma\Gamma$ and the $\Psi\Psi$ loci cross only once in (γ^m, γ^m) . We deduce from Lemma 1 and 2 that the corresponding steady-state is globally stable.

^{42.} μ' is defined as the value of μ such that the $\Gamma\Gamma$ locus is tangent to the 45° line in one point on the interval $\Gamma_t \in [\gamma^f, \gamma^m]$.

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