WOMEN'S EMPOWERMENT FROM PROPERTY TO POLITICAL AND LABOR RIGHTS

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Abstract.

Since the nineteenth century, many societies have transitioned from male-dominated institutions toward regimes in which rights are more evenly distributed across genders. Property, political, and labor rights now underpin modern gender equality. Yet, a central puzzle remains (Doepke and Tertilt, 2009): why would men, who initially monopolize authority, voluntarily expand women's rights?

We propose that such reforms occur when those in power face *credible threats* from the subordinated group. In our framework, an *increase in women's relative productivity* amplifies their bargaining power, making such threats more effective. Rights are thus extended not altruistically but *strategically*, as concessions to avert costly political or social instability.

We develop a dynamic model that endogenizes the evolution of women's rights as a *sequential process*—from property to political and ultimately to labor-market rights. The model identifies the strategic logic behind each stage and provides testable comparative statics on the timing and ordering of reforms.

Keywords: Property Rights, Political Rights, Labor Rights, Gender Equality, Women's Rights Revolution

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1. Introduction

Prior to the nineteenth century, women in common law countries such as the United Kingdom and the United States (excluding Louisiana) possessed virtually no independent social, economic, or legal rights. Extensive restrictions confined women: they could not own property, vote, or participate freely in the labor market. Understanding the historical evolution of women's rights is critical to explaining long-run economic development and institutional change. Becker (1981) attributes this entrenched gender hierarchy to comparative advantage—women's productivity in household production and men's in physical labor—which sustained a division of labor reinforcing women's confinement to domestic roles and limited rights. Men monopolized political and legal authority, including control over institutions governing women's rights. However, as women's rights expanded, decision-making power gradually became more equitable, undermining male dominance. This progression raises a fundamental puzzle emphasized by Doepke and Tertilt (2009) and Doepke et al. (2012): why would men, who stood to lose from such reforms, voluntarily support the extension of rights to women?

A key premise for addressing this question is that the Industrial Revolution transformed production from brawn-intensive to brain-intensive activities (see Galor and Weil, 1999; Rendall, 2013; Agte et al., 2024). This structural shift reduced the economic premium on physical strength and increased demand for human capital. Consequently, women's comparative advantage in market labor relative to men rose, catalyzing women's economic empowerment and initiating the gradual expansion of their rights. As the gender gap in comparative advantage narrowed, Bertocchi (2011) and Doepke et al. (2012) argue that the economic costs of restricting women's access to education and labor markets increased. This rising cost weakened male resistance to female autonomy, leading to a gradual erosion of institutional constraints on women during the latter half of the nineteenth century.

From an altruistic perspective, Doepke and Tertilt (2009) and Doepke et al. (2012) highlight a trade-off faced by men: as husbands, they may prefer to limit women's rights to preserve household authority, but as fathers, they have incentives to support greater rights and opportunities for their daughters. When paternal concerns outweigh spousal interests, this realignment of preferences helps drive institutional support for women's empowerment.

The expansion of women's rights was not a singular event but a gradual, multi-stage process unfolding through three pivotal phases—property rights, political rights, and labor rights—which collectively form the foundation of modern gender equality (see Doepke et al., 2012; Tertilt et al., 2022).

By the late nineteenth century, the United Kingdom abolished the legal doctrine of coverture through the *Married Women's Property Act 1882*, granting married women formal control over their property (Combs, 2005). Around the same period, most U.S. states eliminated coverture, ensuring married women gained some property ownership rights (Khan, 1996). Research shows women's property rights positively correlate with per capita wealth (Geddes and Lueck, 2002; Khan, 1996) and human capital demand (Doepke and Tertilt, 2009), while negatively correlating with fertility (Fernández, 2014). Theoretical models by Doepke and Tertilt (2009) and Fernández (2014) represent altruistic parental decisions where men weigh granting women economic autonomy as a binary choice to optimize familial outcomes.

In the early twentieth century, the United Kingdom extended political rights to women through the *Representation of the People Act* and the *Equal Franchise Act*. Studies highlight that increased female political participation reduces social conflict, enhances political stability, and fosters economic growth (Rodrik, 1999; Funk and Gathmann, 2015). Miller (2008) finds female suffrage contributed to lower child mortality, underscoring the societal impact of women's political empowerment. Building on earlier work, Doepke et al. (2012) develop a theoretical framework showing men may support a shift from patriarchal institutions to female empowerment when women's comparative advantage in market labor rises with growing human capital demand.

During World War I, women entered the labor force on an unprecedented scale, temporarily filling roles traditionally held by men. Nonetheless, gender-based employment discrimination persisted. The *Sex Disqualification (Removal) Act* of 1919 formally allowed women to enter professions such as law and banking, though protective labor legislation imposed ongoing constraints (Goldin, 1990). These barriers largely remained until the *Equal Pay Act* (1970) and the *Sex Discrimination Act* (1975), which mandated equal pay and outlawed gender-based employment discrimination. Empirical evidence documents a U-shaped relationship between female labor force participation and economic development, driven by structural transformation, rising education, and evolving norms (Goldin, 2024). Field et al. (2021) emphasize that increased control over property rights facilitates women's labor market participation. Theoretically, industrialization and technological progress enhanced women's comparative advantage in market production (Galor and Weil, 1999; Galor, 2010; Greenwood et al., 2005), while consumer goods innovations reduced household production costs, enabling greater female labor supply.

While the literature has made substantial progress, existing studies either treat women's rights as a unified phenomenon or focus on isolated stages of their evolution. Yet, no comprehensive theoretical framework captures the full sequential progression from property rights

to political rights and, ultimately, labor rights. Departing from the dominant altruistic-parents paradigm, we adopt a pragmatic and strategic perspective. Before the nineteenth century, women were regarded as subordinates, with men exercising near-total authority over legal, economic, and social institutions. Htun and Weldon (2018) show that both democratic and authoritarian regimes extend women's rights primarily as strategic concessions under pressure from mobilized women's movements. Building on Acemoglu and Robinson (2000), we argue that male elites grant political and economic rights when the existing order faces credible threats of upheaval. Our framework models the expansion of women's rights as the result of strategic bargaining between men and women, whose interests evolve over time. We trace the interdependent, staged development of property, political, and labor rights from a baseline of complete subordination to full legal and economic equality. This paper offers the first comprehensive theoretical framework endogenizing the entire trajectory of women's rights as a strategic, staged process.

2. The Model

Environment. Consider an infinite-horizon, overlapping-generations model with no population growth or bequests. Each agent lives for a single period, with the population evenly split between "females" and "males." Throughout the paper, the superscripts f and m denote female and male agents, respectively. All female agents are assumed to be identical and, similarly, all male agents are treated as identical.

In each period, production of the final good relies on two inputs: property X (which refers to the land and is fixed over time in our model) and effective labor $L_{i,t}$, where $i \in \{f, m\}$ denotes the type of agent. Following Galor (2005), output is given by the Cobb–Douglas production function:

$$Y_t = (L_{f,t} + L_{m,t})^{\alpha} X^{1-\alpha}, \tag{1}$$

where $0 < \alpha < 1$.

We define perfectly inelastic labor supply market by distinguishing between effective male and female labor along two dimensions: *relative productivity* and *relative labor force participation rate*. Our model begins in the preindustrial patriarchal era—prior to the nineteenth century—when economic production was predominantly brawn-intensive, giving men a natural advantage in labor productivity over women. To capture this, we normalize the male labor productivity to 1 and denote the female labor productivity with A_t, where $A_t \in (0, 1]$. As the Industrial Revolution progressed, production technologies shifted from brawn-intensive to brain-intensive, reducing the productivity gap between male and female labor. This technological shift corresponds to a gradual increase in A_t over time. We abstract from endogenizing the determinants of A_t and instead assume that it evolves exogenously at a

constant rate g, such that:

$$A_t = \min\{(1+g)^t A_0, 1\}, \quad \text{for } A_0 \in (0,1]. \tag{2}$$

A higher value of A_t implies a smaller gender productivity gap, with $A_t = 1$ indicating no difference in productivity between male and female labor.

Second, in the *relative labor force participation rate* dimension, we posit the presence of gender-based employment discrimination which reduces female effective labor supply by constraining their access to market opportunities. These constraints include occupational segregation, restrictions on hours worked, and constraints on working conditions—often disguised as protective legislation (see Goldin, 1990).[1] To capture this dimension, we normalize each male's effective labor supply to 1 and denote that of females by σ_t, where $\sigma_t \in [0,1]$. A value of $\sigma_t = 0$ corresponds to complete exclusion from the labor market—i.e., full restrictions on female employment—while $\sigma_t = 1$ represents full equality in employment opportunities, with no gender-based restrictions.

In addition, to simplify the model and facilitate analytical tractability, we abstract from labor force growth across generations. That is, we assume that the number of male and female workers, denoted by L_m and L_f, respectively, remains constant over time. Furthermore, without loss of generality, we assume an equal number of male and female workers, so that $L_m = L_f = \bar{L}$. This assumption builds on the earlier constant population assumption by further positing that the size and gender composition of the labor force remain fixed over time. While this simplification aids tractability, relaxing it would not affect our main results.

Given the gender-based differences in productivity and participation, the effective male labor supply in period t is $L^S_{m,t} = L_m$, while the effective female labor supply is $L^S_{f,t} = A_t \sigma_t L_f$. Assuming a competitive labor market, the marginal product of labor—i.e., the wage per unit of effective labor—is given by:

$$\omega_t = \alpha X^{1-\alpha}(L_{m,t} + L_{f,t})^{\alpha-1}.$$

Accordingly, the income earned by each male worker is:

$$\omega_{m,t} = \alpha X^{1-\alpha}(L_m + A_t \sigma_t L_f)^{\alpha-1}, \tag{3}$$

and the income earned by each female worker is:

$$\omega_{f,t} = A_t \sigma_t \alpha X^{1-\alpha}(L_m + A_t \sigma_t L_f)^{\alpha-1}. \tag{4}$$

[1] In the UK, one example of such protective legislation is the *Mines and Collieries Act 1842*, which stated: "*No Female shall be employed in or allowed to work under Ground in any Mine or Colliery.*" It was not until the enactment of the *Sex Disqualification (Removal) Act 1919* that women were permitted to enter professional occupations, such as law and accounting.

Finally, the total return to land in period t is given by:

$$R_t = (1-\alpha)Y_t. \tag{5}$$

Property, political, and labor rights. Next, we introduce the unified framework that endogenously captures the dynamic evolution of three fundamental and interrelated dimensions of women's rights: *property rights*, *political rights*, and *labor rights*. These rights evolve as a function of exogenous growth in female relative productivity, and their realization depends on a binary political status variable, $\theta_t \in \{m, f\}$, indicating whether political authority rests with men or women, with the opposite group in a subordinate position. Specifically, $\theta_t = m$ denotes male authority and female subordination, while $\theta_t = f$ reverses the roles. We formalize these three rights as the endogenous components defining the state space of women's rights at time t:

$$S_t = \big(\gamma_{f,t}^{\theta_t}, \phi_t^{\theta_t}, A_t\sigma_t \mid \theta_t\big).$$

Female *property rights* are captured by the share of land owned by women, $\gamma_{f,t}^{\theta_t} \in [0,1]$, with men owning the complement, $\gamma_{m,t}^{\theta_t} = 1 - \gamma_{f,t}^{\theta_t}$. Before the nineteenth century, land ownership was exclusively controlled by men, implying $\gamma_{f,0}^{\theta_t} = 0$. Importantly, we posit that land cannot be expropriated politically but may be transferred voluntarily from men to women. In Stage 1, we formalize property rights as an initial mechanism to consolidate male authority, which is gradually and endogenously transferred to women.

Political rights are expressed via the authority exploitation rate, $\phi_t^{\theta_t}$, representing the proportion of income that authorities extract from subordinates. This rate is endogenized through two key channels. The first is *state repression*, $\rho_t \in [0,1]$, reflecting institutionalized discrimination that establishes a baseline exploitation rate, such that $\frac{\partial \phi_t^{\theta_t}}{\partial \rho_t} > 0$ (Acemoglu, 2006).[2] Changes in ρ_t occur only when preferences align across genders (see Stage 1) or when concessions by authorities are accepted by subordinates (see Stage 3). The second channel arises from female political bargaining power, $\psi_t(\sigma_t) \in [0,1]$, which increases with female labor force participation σ_t, i.e., $\frac{\partial \psi_t}{\partial \sigma_t} > 0$ (Moghadam and Senftova, 2005; Iversen and Rosenbluth, 2008). When authority is held by men, i.e. $\theta = m$, women reduce baseline exploitation via bargaining:

$$\phi_t^m(\rho_t, \sigma_t) = \rho_t\big(1 - \psi_t(\sigma_t)\big), \tag{6}$$

[2]In Acemoglu (2006), this is referred to as *state capacity*, capturing the share of redistribution income that the ruling party can exploit from subordinates.

where ϕ_t^m lies in $[0,1]$, increasing with ρ_t but decreasing with σ_t.[3] Historically, such exploitation took legal form under coverture laws, which conferred men control over married women's income, facilitating mechanisms like dowries that functioned as marriage "prices" (Botticini and Siow, 2003; Edlund and Lagerlof, 2004; Lightfoot, 2016). Conversely, if women hold political authority, their bargaining power allows them to extract income from men:

$$\phi_t^f(\rho_t, \sigma_t) = \rho_t \psi_t(\sigma_t),$$

which increases with both ρ_t and σ_t and is often described as the "bride price" (Edlund and Lagerlof, 2004; Anderson, 2007; Anderson and Bidner, 2015). For analytical tractability, we specify $\psi_t(\sigma_t) = \mu\sigma_t$ for some $\mu \in (0,1]$ capturing the sensitivity of women's political bargaining power to female labor force participation.

Labor rights are represented by female bargaining power in the labor market. Comparing Equations 3 and 4, yields the female-to-male wage ratio, $A_t\sigma_t \in [0,1]$. This composite index captures female bargaining power in the labor market: greater labor bargaining power raises their earnings and narrows the gender wage gap. Improvements in female labor rights, as reflected in this index, require both relative productivity gains and a higher participation rate, and neither is sufficient alone.

The steady state occurs when $A_t = 1$, eliminating the gender productivity gap, such that women's productivity matches that of men. Although female productivity may exceed male levels in certain sectors or during transitory periods, we focus on the long-run, economy-wide dynamics. In this setting, the steady state $A_{ss} = 1$ represents the economy-wide institutional equilibrium reflecting the long-term trajectory of changes in women's rights. This simplification isolates the role of productivity convergence in driving institutional change and clarifies the broader mechanism of female empowerment.

If gender equality is the normative objective of the female democratic revolution, the steady-state equilibrium is characterized by equal property rights, $\gamma_{f,ss}^* = 0.5$, no exploitation, $\phi_{ss}^*(\rho_{ss}^*, \sigma_{ss}^*) = 0$ for all political statuses $\theta \in \{m, f\}$, and parity in labor income, $A_{ss}\sigma_{ss}^* = 1$.[4]

Credible Threat. For each agent $i \in \{f, m\}$, pre-exploitation income—denoted $y_{i,t}^{\theta_t}(\sigma_t)$—comprises labor income $\omega_{i,t}(\sigma_t)$, as defined in Equations 3 and 4, and a share $\gamma_{i,t}^{\theta_t}/L_i$ of total

[3] In the UK, the institutionalization of exploitation originated from *coverture*, a legal doctrine spanning the medieval to Victorian eras, under which the income of married women was administered by their husbands or male guardians. This framework legally empowered men to determine the portion of female income subject to exploitation, thereby ensuring asymmetric control over marital economic resources.

[4] For any endogenous variable X_t, we denote X_t^* as its equilibrium level in period t and X_{ss}^* as its steady-state value. For the exogenous variable A_t, we denote A_{ss} as its steady-state value, while its path is predetermined (see Equation 2).

land returns $R_t(\sigma_t)$. Thus, under authority θ_t, the pre-exploitation income of agent i at time t is given by:

$$y_{i,t}^{\theta_t}(\sigma_t) = \omega_{i,t}(\sigma_t) + \frac{\gamma_{i,t}^{\theta_t}}{L_i} R_t(\sigma_t).$$

Moreover, each agent has an identical utility function $U_{i,t}^{\theta_t}$, defined over their own consumption $C_{i,t}^{\theta_t}$. Consumption varies with the female labor supply and the level of state repression against women, and is constrained by the agent's post-exploitation income, denoted $\hat{y}_{i,t}^{\theta_t}(\rho_t, \sigma_t)$. Hence, the representative agent's problem is:[5]

$$\begin{aligned} \max_{\sigma_t^i, \rho_t^i} \quad & U_{i,t}^{\theta_t}(\rho_t, \sigma_t) = C_{i,t}^{\theta_t}(\rho_t, \sigma_t) \\ \text{s.t.} \quad & C_{i,t}^{\theta_t}(\rho_t, \sigma_t) \leq \hat{y}_{i,t}^{\theta_t}(\rho_t, \sigma_t), \\ & 0 \leq \rho_t \leq 1, \\ & 0 \leq \sigma_t \leq 1. \end{aligned}$$

We begin with a patriarchal model, $\theta_0 = m$, under the initial condition of zero female property rights, $\gamma_{f,0}^m = 0$. This setting allows for the accumulation of male income through the average redistribution of returns from exploitation of all women.

Male post-exploitation income is given by:

$$\hat{y}_{m,t}^m(\rho_t, \sigma_t) = y_{m,t}^m(\sigma_t) + \phi_t^m(\rho_t, \sigma_t)\, y_{f,t}^m(\sigma_t) \frac{L_f}{L_m}, \tag{7}$$

while female post-exploitation income is:

$$\hat{y}_{f,t}^m(\rho_t, \sigma_t) = (1 - \phi_t^m(\rho_t, \sigma_t))\, y_{f,t}^m(\sigma_t). \tag{8}$$

We begin with the assumption that the model operates under patriarchal authority, in which men hold all property rights. This authority, however, is not immutable. Adapting the regime-switching framework of Acemoglu and Robinson (2002) and **?** to a gendered setting, we partition the society into an elite and a subordinate group. The elite monopolizes political authority and appropriate rents from the subordinate group. When the subordinate group initiates a revolution to overthrow the regime, political authority transfers instantaneously and irreversibly to them, eliminating any role for the former elite and precluding transitional power-sharing. In our formulation, we impose the simplifying assumption that any female-led revolution always succeeds, with authority transferring to them instantaneously and reversing the direction of exploitation.

[5]In our model, for simplicity and without loss of generality, we assume that each agent's utility is equal to their post-exploitation income, i.e., $U_{i,t}^{\theta_t} = \hat{y}_{i,t}^{\theta_t}$. This assumption is without consequence for generality, as any monotonic transformation of utility would yield identical results. Throughout the analysis, an increase in agent i's income is thus directly associated with an increase in their utility.

Revolutions, though, entail economic costs: a fraction $\zeta \in [0,1]$ of total output is destroyed in the process. Accordingly, if a revolution occurs at time t, each female agent receives post-exploitation income given by:

$$\hat{y}^f_{f,t}(\rho_t, \sigma_t) = (1-\zeta)\left(y^f_{f,t}(\sigma_t) + \phi^f_t(\rho_t, \sigma_t)\, y^f_{m,t}(\sigma_t)\frac{L_m}{L_f}\right), \tag{9}$$

and each male agent receives:

$$\hat{y}^f_{m,t}(\rho_t, \sigma_t) = (1-\zeta)\left(1 - \phi^f_t(\rho_t, \sigma_t)\right) y^f_{m,t}(\sigma_t), \tag{10}$$

where ϕ^f_t is the women's exploitation rate of men's income.

By comparing Equations 7 and 10, it is clear that men always prefer to remain in authority, since their post-exploitation income under male authority is strictly higher than under female authority:

$$\hat{y}^m_{m,t} > \hat{y}^f_{m,t} \quad \forall \zeta \in \mathbb{R}_{\geq 0}.$$

Thus, the credibility of the revolutionary threat depends entirely on whether women are able to initiate a regime change. Such a threat is credible in period t if and only if

$$\hat{y}^f_{f,t} \geq \hat{y}^m_{f,t},$$

implying that the expected income under female authority is at least as high as under continued male dominance. This yields the following *credibility constraint:*

$$\zeta \leq \bar{\zeta}_t, \tag{11}$$

where $\bar{\zeta}_t$ denotes the credibility threshold, given by

$$\bar{\zeta}_t = \frac{\rho_t A_t\big(\alpha + \mu\sigma_t - 2\alpha\mu\sigma_t\big) + \rho_t\mu}{A_t\big(\alpha + \rho_t\mu\sigma_t - \alpha\rho_t\mu\sigma_t\big) + \rho_t\mu}. \tag{12}$$

In the baseline model, we assume that women pose a credible revolutionary threat in each period, enabling them to challenge male authority.[6] This implies that the credibility constraint (Equation 11) must hold in every period. The expression for the credibility threshold (Equation 12) shows that societies with lower relative productivity and female labor supply, combined with higher levels of state repression against subordinates, exhibit a higher credibility threshold ($\frac{\partial\bar{\zeta}_t}{\partial A_t} < 0$, $\frac{\partial\bar{\zeta}_t}{\partial\sigma_t} < 0$ and $\frac{\partial\bar{\zeta}_t}{\partial\rho_t} > 0$, see proof in Appendix A.1). Moreover, as we will show later, an exogenous increase in relative productivity induces an endogenous rise in female labor supply and a simultaneous decline in state repression. Consequently, the initial

[6]In Case Study 2 in Section 4, we relax this assumption to examine the implications of a non-credible revolutionary threat.

conditions (A_0, σ_0, ρ_0) correspond to the highest credibility threshold, which then declines monotonically as the revolution progresses.

As a result of the mechanism described above, $\bar{\zeta}_t$ is weakly decreasing over time. Consequently, it suffices for the credibility constraint (Equation 11) to hold in steady steady to ensure that it holds in all subsequent periods. This requires that the cost of revolution satisfy $\zeta < \bar{\bar{\zeta}}$, where[7]

$$\bar{\bar{\zeta}} = \frac{\rho^*_{ss}(\alpha + 2\mu - 2\alpha\mu)}{\alpha + 2\mu\rho^*_{ss} - \alpha\mu\rho^*_{ss}}.$$

Given that men initially hold authority over female autonomy, the presence of a credible revolutionary threat implies that women would challenge the regime if their demands were unmet. To maintain their authority, men are compelled to concede control over land and political rights as bargaining outcomes. This mechanism is consistent with Acemoglu (2006), who show that rights are redistributed only when the subordinate group presents a credible revolutionary threat. Building on these assumptions, we now formalize the timeline of the events.

Timing of events. In each period t, relative productivity A_t is realized. This determines whether women pose a credible revolutionary threat. If no credible threat arises, males retain authority (over female autonomy) and the period ends ($\theta^*_t = m$). If a credible threat does arise, the continuation of male authority depends on men's willingness to retain authority and the feasibility of concessions.

Men decide whether to preserve the stability of the regime by making institutional concessions. If they refuse, authority shifts immediately and permanently to women ($\theta^*_t = f$). If they concede, the process unfolds in following stages:

First-stage concession (property rights). If a feasible concession on property rights exists, it is implemented, denoted $\gamma^m_{f,t}$, and males retain authority ($\theta^*_t = m$). In this case, state repression adjusts only passively: if male and female preferences coincide, repression moves to the common preferred level; if preferences diverge, the prohibitively high cost of negotiation renders further adjustment infeasible, and repression remains at its prior level ($\rho^*_t = \rho^*_{t-1}$).

Second-stage concession (political rights). If a concession on property rights is infeasible, males proceed to make a concession on state repression. If this concession is feasible, they reduce repression to grant women political rights, thereby retaining authority ($\theta^*_t = m$). If it is also infeasible, neither concession can let women relinquish the revolution, and as a result, the authority shifts to women ($\theta^*_t = f$).

Given the concessions above, the ruling authority—whether male or female—determines the optimal level of female labor supply, σ^*_t. Finally, the institutional outcomes of the period

[7]In steady state, $A_t = A_{ss} = 1$ and $\rho_t = \rho^*_{ss}$. We solve for ρ^*_{ss} in Stage 2.

are realized: female property rights $\gamma_{f,t}^{m*}$, political rights ϕ_t^{m*}, and labor rights $\sigma_t^* A_t$ are formed.

The equilibrium path. We now characterize the equilibrium of the game, building directly on the timing described above. The equilibrium is a collection of policy rules (ρ_t^*, σ_t^*) for each period t that depend on the state variable, i.e., the relative productivity A_t, and on actions taken earlier within the same period. The equilibrium is thus described by strategy profiles $(\rho_t^*(A_t)), \sigma_t^*(A_t))$ that determine the evolution of women's rights over time. These strategies generate the period-specific state space of women's rights, defined as

$$S_t(\rho_t^*, \sigma_t^*) = \left(\gamma_{f,t}^{\theta_t}(\sigma_t^*),\ \phi_t^{\theta_t}(\rho_t^*, \sigma_t^*),\ A_t\sigma_t^* \mid \theta_t^*\right),$$

which encapsulates female property rights, political rights, and labor outcomes as functions of equilibrium policies.

The model evolves over time through three distinct stages, each stage characterizing the transition of a single dimension of women's rights to its steady state equilibrium level—first property rights, then political rights, and finally labor rights. We define the end of each stage and the beginning of the following stage as the period in which one dimension of women's rights reaches its steady-state level.

Stage 1: Property rights. Under the baseline assumptions described above, men initially hold authority over female autonomy but face a credible revolutionary threat capable of overturning the regime. To maintain political stability and preserve their authority, men first implement a sequential concession by granting female property rights. Specifically, they transfer a fraction $\gamma_{f,t}^m$ of land to women. If this initial concession is accepted, men retain control over female autonomy, denoted by $\theta_t = m$.

According to Equations 7 and 8, the post-exploitation income of each man is given by:[8]

$$\hat{y}_{m,t}^m(\rho_t, \sigma_t) = \omega_{m,t}(\sigma_t) + \gamma_{m,t}^m \frac{R_t(\sigma_t)}{L_m} + \phi_t^m(\rho_t, \sigma_t)\left(\omega_{f,t}(\sigma_t)\frac{L_f}{L_m}\right), \tag{13}$$

and the post-exploitation income of each woman is given by:

$$\hat{y}_{f,t}^m(\rho_t, \sigma_t) = \left(1 - \phi_t^m(\rho_t, \sigma_t)\right)\omega_{f,t}(\sigma_t) + \gamma_{f,t}^m \frac{R_t(\sigma_t)}{L_f}. \tag{14}$$

[8]Following Equation 7, the male post-exploitation income should, in principle, be

$$\hat{y}_{m,t}^m(\rho_t, \sigma_t) = \omega_{m,t} + \gamma_{m,t}^m \frac{R_t}{L_m} + \phi_t^m(\sigma_t)\left(\omega_{f,t}\frac{L_f}{L_m} + \gamma_{f,t}^m \frac{R_t}{L_m}\right),$$

reflecting a situation in which the land granted to women remains subject to male exploitation. However, as shown in Appendix A.2, this distorted form of empowerment does not affect the properties of the the steady-state outcome. For simplicity, we assume that men do not extract rents from the land granted to women.

If women reject the concession, the revolution succeeds, and authority shifts to women, such that $\theta_t = f$. According to Equations 9 and 10, the post-exploitation income of each woman is given by:[9]

$$\hat{y}^f_{f,t}(\rho_t, \sigma_t) = (1-\zeta)\left[\omega_{f,t}(\sigma_t) + \phi^f_t(\rho_t, \sigma_t)\left(\omega_{m,t}(\sigma_t) + \gamma^m_{m,t}\frac{R_t(\sigma_t)}{L_m}\right)\frac{L_m}{L_f}\right], \tag{15}$$

and the post-exploitation income of each man is given by:

$$\hat{y}^f_{m,t}(\rho_t, \sigma_t) = (1-\zeta)\left(1-\phi^f_t(\rho_t, \sigma_t)\right)\left(\omega_{m,t}(\sigma_t) + \frac{R_t(\sigma_t)}{L_m}\right). \tag{16}$$

The property concession is effective in preventing revolution if and only if, following the transfer of property rights, both male and female post-exploitation incomes under male authority are at least as high as they would be under female authority. Formally, there exists a value $\gamma^m_{f,t}$ such that, for any period t and for all $\rho_t, \sigma_t \in [0,1]$, the following conditions hold:

$$\hat{y}^m_{f,t} \geq \hat{y}^f_{f,t} \quad \text{and} \quad \hat{y}^m_{m,t} \geq \hat{y}^f_{m,t}.$$

If either condition fails—i.e., if either men or women prefer the outcome under female authority—the revolution proceeds, and authority shifts to women. By comparing Equations 14 and 15, we derive a threshold condition for female property rights: the concession is sufficient to prevent revolution only if the granted share exceeds a minimum threshold such that:[10]

$$\gamma^m_{f,t} \geq \underline{\gamma}^m_{f,t},$$

where the lower bound is given by

$$\underline{\gamma}^m_{f,t}(\rho_t, \sigma_t, A_t) = \frac{\sigma_t\left(A_t\rho_t(\alpha(1-2\mu\sigma_t)+\mu\sigma_t) + A_t\zeta(\alpha\rho_t\mu\sigma_t - \alpha - \rho_t\mu\sigma_t) + \rho_t\mu(1-\zeta)\right)}{(1-\alpha)(A_t\sigma_t+1)} > 0. \tag{17}$$

If men propose a share of female property rights below the minimum threshold $\underline{\gamma}_{f,t}$, the concession fails. In this case, women find that subverting the existing regime is beneficial, leading to a shift in authority over female autonomy from men to women.

From the perspective of men, the concession is only viable if the level of female property rights remains below the maximum they are willing to grant. By comparing Equations 13 and 16, the concession must satisfy:

$$\gamma^m_{f,t} \leq \bar{\gamma}_{f,t},$$

where the upper bound is defined as:

$$\bar{\gamma}^m_{f,t}(\rho_t, \sigma_t, A_t) = \frac{\rho_t\sigma_t\left(\alpha A_t(1-2\mu\sigma_t) + A_t\mu\sigma_t + \mu\right) + \zeta\left((1-\alpha)A_t\sigma_t + 1\right)(1-\rho_t\mu\sigma_t)}{(1-\alpha)(A_t\sigma_t+1)} > 0.$$

[9]When women hold authority, men no longer have an incentive to offer concessions, and thus $\gamma^f_{f,t} = 0$.
[10]See Appendix A.2 for all proofs related to female property rights.

We observe that the maximum level of property rights that men are willing to concede always weakly exceeds the minimum threshold required for women to forgo revolution, i.e. $\underline{\gamma}_{f,t} \leq \bar{\gamma}_{f,t}$. Therefore, in each period t, there exists a feasible range of property rights:

$$\gamma^m_{f,t} \in [\underline{\gamma}_{f,t}, \bar{\gamma}_{f,t}]$$

that ensures regime stability. Anticipating this, men authorities will set female property rights just above the threshold necessary to avoid revolution, thereby preserving control. Formally, the decision rule of property rights concession is given by:

$$\gamma^m_{f,t}(\rho_t, \sigma_t, A_t) = \underline{\gamma}_{f,t}(\rho_t, \sigma_t, A_t) + \varepsilon, \quad \text{where } \varepsilon \to 0^+. \tag{18}$$

The property rights concession is increasing in both repression and female labor force participation:

$$\frac{\partial \gamma^m_{f,t}}{\partial \rho_t} > 0 \quad \text{and} \quad \frac{\partial \gamma^m_{f,t}}{\partial \sigma_t} > 0.$$

This is because, following Equations 17 and 18, both higher state repression and higher female labor force participation increase women's returns under female authority by increasing the female exploitation rate. This, in turn, strengthens their incentive to revolt. As a result, men must concede a larger share of property rights to induce women to forgo the now more lucrative authority position. This further illustrates the implicit mechanism in the credibility threshold (Equation 12), where higher revolutionary costs weaken the credibility of the revolutionary threat and, ceteris paribus, lower the property rights conceded to women. Formally,

$$\frac{\partial \gamma^m_{f,t}}{\partial \zeta} < 0.$$

Intuitively, higher revolutionary costs imply that a successful revolution would destroy a larger share of output, thereby reducing women's post-exploitation income. As a result, only a smaller land concession is necessary to make women indifferent between maintaining male authority and pursuing a revolution, as the concession becomes sufficient to outweigh the potential gains from revolt.

Lemma 1. *Ceteris paribus, women receive lower property rights, $\gamma_{f,t}$, when*

(i) the level of state repression against women, ρ_t, is lower;
(ii) the female labor participation rate, σ_t, is lower;
(iii) the cost of revolution, ζ, is higher.

We now solve for the equilibrium $(\rho^*_t(A_t), \sigma^*_t(A_t))$ and characterize the corresponding state space of women's rights in each period $S_t(\rho^*_t, \sigma^*_t)$.[10]

Here, following the timeline above, at this stage, the equilibrium of repression ρ^*_t is determined through negotiations between men and women, with each side proposing its preferred

level $\rho_{i,t}$ for $i \in \{m, f\}$:

$$\rho_{m,t} = \arg\max_{\rho_t \in [0,1]} U^m_{m,t}(\rho_t, \sigma_t) \quad \text{and} \quad \rho_{f,t} = \arg\max_{\rho_t \in [0,1]} U^m_{f,t}(\rho_t, \sigma_t).$$

These preferences represent the repression level that maximizes their period-t payoff $U^m_{i,t}(\rho_t, \sigma_t)$, taking the female labor supply σ_t as given.

Following Lemma 1, in the presence of significant returns on land, both males and females have incentives to strategically feign weakness. The notion of the "weakness" is relative: for men, it corresponds to imposing less repression on women (i.e., a lower ρ_t); for women, it corresponds to experiencing greater repression by men (i.e., a higher ρ_t).[11] Men, seeking to minimize land concessions, prefer state repression targeted at women to be as low as possible—effectively, the absence of exploitation altogether, $\rho_{m,t} = 0$. From the credibility constraint (Equation 11), it follows that in the absence of repression, a credible revolutionary threat can arise only if the cost of revolution is zero, $\zeta = 0$. Substituting these conditions into the property rights decision (Equations 17 and 18) shows that men can retain political authority without conceding any land. In fact, when $\rho_t = 0$, post-exploitation income is invariant for both men and women, regardless of which group holds authority. Because land concessions derive from the surplus generated by exploitation, no concessions arise in the absence of exploitation. Consequently, men prefer zero exploitation as a means to retain the maximal share of land. Conversely, women may strategically tolerate highest levels of exploitation by men to amplify the degree of repression, thus securing a largest share of land property rights as compensation, i.e., $\rho_{f,t} = 1$. Following the timeline above, since men and women have different preferences over repression, $\rho_{f,t} \neq \rho_{m,t}$, negotiation fails, and the repression remains fixed at $\rho^*_t = \rho^*_{t-1}$ in every period of this stage. Applying this relation recursively yields $\rho^*_t = \rho^*_{t-1} = \rho^*_{t-2} = \cdots = \rho_0$. This implies that during Stage 1, negotiations over repression always fail and the level of repression remains fixed at its initial value.

Given $\rho^*_t = \rho_0$, women and men optimize their respective utility functions to select their preferred levels of female labor supply:

$$\sigma^*_{m,t} = \arg\max_{\sigma_t \in [0,1]} U^m_{m,t}(\rho^*_t, \sigma_t) \quad \text{and} \quad \sigma^*_{f,t} = \arg\max_{\sigma_t \in [0,1]} U^m_{f,t}(\rho^*_t, \sigma_t),$$

where $\sigma^*_{m,t}$ serves as an upper bound on female labor supply. If $\sigma^*_{m,t} < \sigma^*_{f,t}$, men enforce labor market restrictions to limit female labor supply to $\sigma^*_{m,t}$. Conversely, if $\sigma^*_{m,t} > \sigma^*_{f,t}$, this upper bound is non-binding since men cannot compel women to supply labor, and female

[11] Here, "weak" refers to the relatively less powerful group under a fixed level of state repression; either the authority or the subordinate may be weak. For men, low state repression implies a low exploitation rate from women; compared with a high exploitation rate, male authorities are then weak. An extreme case arises when state repression is zero: men derive no benefit from holding authority, making it the weakest possible form of authority. Conversely, high state repression entails a high exploitation rate from women; as repression increases, women as subordinates become increasingly weak.

labor supply remains at $\sigma^*_{f,t}$. Formally,

$$\sigma^*_t = \min\{\sigma^*_{m,t}, \sigma^*_{f,t}\}. \tag{19}$$

Within the current framework, women, face a strictly increasing relationship between their labor supply and utility. Higher female labor force participation increases labor income and enhances political bargaining power, which in turn reduces the exploitation rate and raises post-exploitation income. Consequently, women always prefer full labor supply, that is,

$$\sigma^*_{f,t}(A_t) = 1.$$

However, when holding authority, men face a trade-off in their preferences over the female labor supply. On the labor-income side, a higher female labor supply depresses male labor income. On the land side, greater female labor supply enlarges total land returns while reducing the male share of these returns. On the exploitation side, it increases female post-exploitation income while lowering the fraction subject to exploitation. This trade-off yields an interior optimum at $\sigma^*_{m,t}$. Consequently, although women always prefer full labor force participation, male authorities constrain participation by setting female labor supply at its lower bound:

$$\sigma^*_t = \min\{\sigma^*_{m,t}, 1\},$$

where

$$\sigma^*_{m,t}(A_t) = \frac{\alpha A_t - \alpha^2 A_t + \alpha^2 A_t \zeta + 2\rho_0\mu\zeta - 2\rho_0\mu + \alpha\rho_0\mu - \alpha\rho_0\mu\zeta + \sqrt{\Xi_t}}{2(1-\alpha^2)(1-\zeta)A_t\rho_0\mu}, \tag{20}$$

with

$$\Xi_t = 4(\alpha^2-1)\rho_0\mu(\zeta-1)\left(\alpha A_t\zeta + \rho_0\mu(\zeta-1)\right) + \left(\alpha A_t\left(\alpha(\zeta-1)+1\right) - (\alpha-2)\rho_0\mu(\zeta-1)\right)^2.$$

Equation 20 implies that female labor force participation occurs, $\sigma^*_{m,t} > 0$, only if

$$A_t \geq \underline{A}, \quad \text{where} \quad \underline{A} \equiv \frac{\rho_0\mu(1-\zeta)}{\alpha\zeta}.$$

In other words, the closed-form solution for $\sigma^*_{m,t}$ indicates that the relative productivity level A_t must exceed the threshold $\underline{A}$ for women to participate in the labor market. Counterintuitively, the threshold $\underline{A}$ suggests that, with an exogenous increase in female relative productivity, societies characterized by higher state repression or lower costs of revolution (i.e., a higher relative productivity threshold) experience a delayed transition to female empowerment. Formally, building on Lemma 1 , an increase in repression (or a decrease in

revolutionary costs) compels men to concede greater property rights to maintain authority. Strategically, men then restrict female labor supply to diminish the female political bargaining power, thereby mitigating the extent of property concessions.[12]

Lemma 2. *Ceteris paribus, women face lower labor market restrictions (i.e., higher labor force participation), σ_t^*, when:*

(i) female relative productivity, A_t, is higher;

(ii) the level of state repression against women, ρ_t, is lower;

(iii) the cost of revolution, ζ, is higher.

Toward the end of Stage 1, as male authorities concede progressively larger shares of land to sustain authority, the minimum transfer required to deter a female-led revolution eventually surpasses parity, i.e. 0.5. If the normative objective of the female democratic movement is gender equality (rather than matriarchal dominance), allocations granting women more than one half of property rights are ruled out. We encode this with the following *asymmetric empowerment constraint*:

$$\gamma_{f,t}^{m*}(A_t) \;=\; \min\Big\{\, \underline{\gamma}_{f,t}(\rho_t^*(A_t), \sigma_t^*(A_t))\,,\, 0.5 \,\Big\}. \tag{21}$$

Equivalently, this constraint imposes an upper bound on female labor force participation:

$$\sigma_t^*(A_t) \;=\; \min\Big\{\, \min\{\sigma_{m,t}^*, 1\}\,,\, \bar{\sigma}_t(A_t) \,\Big\},$$

where $\bar{\sigma}_t(A_t)$ is the value of σ_t^* that sets $\gamma_{f,t}^{m*} = 0.5$ for all $A_t \in [0,1]$, given by

$$\bar{\sigma}_t(A_t) \;\equiv\; \frac{2\alpha A_t\rho_0 + \alpha A_t - 2\alpha A_t\zeta - A_t + 2\rho_0\mu - 2\rho_0\mu\zeta + \sqrt{\Theta_t}}{4A_t\rho_0\mu\big(2\alpha + (1-\alpha)\zeta - 1\big)},$$

and

$$\Theta_t \;=\; \Big(\alpha A_t(-2\rho_0 + 2\zeta - 1) + A_t + 2\rho_0\mu(\zeta - 1)\Big)^2 - 8(\alpha - 1)A_t\rho_0\mu\big(-2\alpha + (\alpha - 1)\zeta + 1\big).$$

The asymmetric empowerment constraint formalizes the idea that male authority imposes an upper bound on female property rights given prevailing levels of state repression and female labor force participation. This constraint binds whenever $\underline{\gamma}_{f,t}(\rho_t^*, \sigma_t^*(A_t)) > 0.5$, implying that further increases in relative productivity or female labor force participation cannot immediately translate into greater property rights. In this regime, the economy operates at the boundary, $\sigma_t^*(A_t) = \bar{\sigma}_t(A_t)$.

Rather than solving directly for the threshold A_{S1} satisfying $\sigma_t^*(A_{S1}) = \bar{\sigma}(A_{S1})$, we exploit a sufficient test for entry into the next stage.[13] Since $\underline{\gamma}_{f,t}(\cdot)$ is strictly increasing in σ_t and σ_t^* is

[12] See an illustration of this mechanism in Figure B.1 in Appendix B.

[13] We define $S1$ as the endpoint of Stage 1, when land transfer by men alone fails to induce women to abandon revolution. Throughout the paper, Sn denotes the endpoint of stage n.

weakly increasing in A_t, evaluating the system at the steady state $A_{ss} = 1$ indicates whether the maximal attainable level of property rights would exceed equality. If $\sigma^*(1) > \bar{\sigma}(1)$, then

$$\gamma_f\big(\sigma^*(1)\big) > \gamma_f\big(\bar{\sigma}(1)\big) = 0.5,$$

showing that the upper bound on $\underline{\gamma}_{f,t}$ exceeds 0.5. The continuity and monotonicity of both $\underline{\gamma}_{f,t}(\sigma_t)$ and $\sigma_t^*(A_t)$ then guarantee the existence of an intermediate threshold $A_{S1} < 1$ such that

$$\underline{\gamma}_{f,t}\big(\sigma^*(A_{S1})\big) = 0.5, \quad \text{and} \quad \sigma^*(A_{S1}) = \bar{\sigma}(A_{S1}).$$

This threshold A_{S1} represents the point at which the economy transitions from Stage 1 to Stage 2. Beyond this threshold, male concessions on property rights are capped by the asymmetric empowerment constraint, and further increases in relative productivity cannot translate into further land concessions, which would be needed to prevent a revolution. To preserve political authority, men must now implement a second-stage concession by extending political rights. This marks the terminus of Stage 1 and provides the natural transition to Stage 2.

In contrast, if $\sigma_t^*(1) < \bar{\sigma}_t(1)$, then

$$\underline{\gamma}_{f,t}\big(\sigma_t(1)\big) < \gamma_f\big(\bar{\sigma}(1)\big) = 0.5,$$

implying that, in all periods, female property rights remain below parity. The asymmetric empowerment constraint no longer binds $\gamma_t^* = \underline{\gamma}_{f,t} < 0.5 \ \forall t$, allowing men to deter a female revolution solely through concession over property rights. As a result, women remain stagnate in the property rights trap, unable to advance to the next stage, implying that full property rights are never achieved in the steady state. We analyze this scenario further in Case Study 4 in Section 4.

At the end of Stage 1,the state space of women's rights can be characterized by:

$$S_{S1}(\rho_0, \sigma^*) = \big(\gamma_{f,ss}^{m^*} = 0.5,\ \phi_{S1}^{m^*}(\rho_0, \sigma_{S1}^*(A_{S1})),\ A_{S1}\sigma_{S1}^*(A_{S1}) \,\big|\, \theta_{S1} = m\big),$$

where women have equal property rights but lack full political rights, as $\phi_{S1}^*(\rho_0, \sigma_{S1}^*) = \rho_0\big(1 - \mu\sigma_{S1}^*\big) > 0$, where ρ_0 denotes the initial condition for the repression parameter. During Stage 1, negotiations over repression fail and the level of repression remains fixed at its initial value. Consequently, exploitation of women persists throughout the stage, as reflected in $\phi_{S1}^{m*} > 0$. Women also do not enjoy full labor rights, as both A_{S1} and σ_{S1}^* are less than 1, implying $A_{S1}\sigma_{S1}^* < 1$. This configuration marks the upper bound of empowerment achievable under Stage 1 institutions, setting the stage for the subsequent political concessions that define Stage 2.

Stage 2: Political rights. Continuing with the scenario where land concession is insufficient to induce women to relinquish the revolution, we now turn to the concession of political rights. Following the state space S_{S1}, when men hold authority, male and female post-exploitation incomes, respectively, are

$$\hat{y}^m_{m,t}(\rho_t, \sigma_t) = \omega_{m,t}(\sigma_t) + 0.5\frac{R_t(\sigma_t)}{L_m} + \phi^m_t(\rho_t, \sigma_t)\left(\omega_{f,t}(\sigma_t)\frac{L_f}{L_m}\right), \tag{22}$$

and

$$\hat{y}^m_{f,t}(\rho_t, \sigma_t) = (1 - \phi^m_t(\rho_t, \sigma_t))\,\omega_{f,t}(\sigma_t) + 0.5\frac{R_t(\sigma_t)}{L_f}. \tag{23}$$

When women hold authority, male and female post-exploitation incomes, respectively, are

$$\hat{y}^f_{m,t}(\rho_t, \sigma_t) = (1 - \zeta)\left(1 - \phi^f_t(\rho_t, \sigma_t)\right)\omega_{m,t}(\sigma_t) + 0.5\frac{R_t(\sigma_t)}{L_m}, \tag{24}$$

and

$$\hat{y}^f_{f,t}(\rho_t, \sigma_t) = (1 - \zeta)\left(\omega_{f,t}(\sigma_t) + 0.5\frac{R_t(\sigma_t)}{L_f} + \phi^f_t(\rho_t, \sigma_t)\omega_{m,t}(\sigma_t)\frac{L_m}{L_f}\right). \tag{25}$$

By comparing male post-exploitation income under male versus female authority (Equations 22 and 24), it follows that for any repression level $\rho_t \in \mathbb{R}_{\geq 0}$ men strictly prefer to retain authority, $\hat{y}^m_{m,t}(\rho_t) > \hat{y}^f_{m,t}(\rho_t)$. Facing a credible revolutionary threat, men therefore have an incentive to concede on state repression and are willing to accommodate any non-negative level of repression provided they retain authority—i.e., their acceptance set is $\{\rho_t \geq 0\}$. Women, in contrast, forgo revolution only if repression is sufficiently low so that $\hat{y}^m_{f,t}(\rho_t) > \hat{y}^f_{f,t}(\rho_t)$. This participation constraint implies

$$0 \leq \rho^*_t \leq \bar{\rho}_t,$$

where

$$\bar{\rho}_t \equiv \frac{\zeta\big(\alpha(A_t\sigma_t - 1) + A_t\sigma_t + 1\big)}{2\alpha\sigma_t\big(A_t(1 - \mu\sigma_t) + \mu(1 - \zeta)\big)}. \tag{26}$$

In Stage 1, heterogeneity in male and female preferences over repression kept repression fixed at its initial level ρ_0; regime stability was maintained instead through property-rights concessions (i.e., land redistribution) to women. In Stage 2, although the preference misalignment persists, land concessions have already reached parity, eliminating further scope for redistribution along that margin. Consequently, the remaining concession margin is political rights via reductions in repression: men choose $\rho^*_t = \bar{\rho}_t$, which delivers a Pareto improvement relative to the pre-concession benchmark (the counterfactual in which, absent any concession by men, women seize authority).

To obtain a tractable closed-form characterization of the Stage 2 equilibrium, we introduce a one-period lag in the repression decision rule. Specifically, we assume that the repression

level chosen in period $t-1$ is implemented only in period t, reflecting institutional and bureaucratic delays in altering repressive policies. Under this timing, the repression is setting by[14]

$$\rho_t^* = \bar{\rho}_{t-1}, \tag{27}$$

so that the repression level implemented in period t is predetermined at the start of that period and equals the threshold chosen in the previous period.

Following the Equation above, higher female labor force participation and lower revolutionary costs increase women's incentives to assume authority, as they increase the potential post-exploitation income, $\hat{y}_{f,t}^f$. In response, men strategically reduce state repression to stabilize the existing male-dominated regime by both curbing women's incentives to seize power and narrowing the income gap between women as authorities and as subordinates.

Lemma 3. *Ceteris paribus, state repression, ρ_t^*, decreases when:*

(i) female labor force participation, σ_t, is higher;

(ii) female revolutionary costs, ζ, are lower;

Given the endogenous predetermined state repression level ρ_t^* and the exogenous relative productivity A_t, the two groups solve for the equilibrium of female labor force participation,

$$\sigma_t^* = \frac{\sqrt{\Omega_t} + 2\alpha A_t \bar{\rho}_{t-1} - \alpha A_t + A_t - 4\bar{\rho}_{t-1}\mu}{4(\alpha+1)A_t\bar{\rho}_{t-1}\mu}, \tag{28}$$

where

$$\Omega_t = \big(\alpha A_t(2\bar{\rho}_{t-1}-1) + A_t - 4\bar{\rho}_{t-1}\mu\big)^2 + 8(\alpha+1)A_t\bar{\rho}_{t-1}\mu\big(\alpha + 2\bar{\rho}_{t-1} - 1\big).$$

In particular, the direct effect of relative productivity on state repression is negligible, so most variation in repression arises indirectly through its effect on female labor force participation. Equation 28 formalizes this mechanism: exogenous increases in relative female productivity raise female labor force participation, $\frac{\partial \sigma_t}{\partial A_t} > 0$, which in turn reduces state repression (Lemma 3(i)) and lowers the male exploitation rate, thereby increasing the equilibrium allocation of political authority to women.

Building on this mechanism, our analysis shows an exogenous increase in relative productivity A_t raises female labor force participation σ_t, and reduces state repression ρ_t, thereby driving female political rights toward their equilibrium level.

Eventually, at the end of this stage, the restrictions of the female labor market are fully eliminated and the female labor force participation is able to reach the steady state $\sigma_{ss}^* = 1$

[14] See Appendix A.3 for all proofs related to female political rights.

when relative productivity reaches the threshold:

$$\bar{A} \equiv \frac{\alpha + \rho^*_{ss}(2-4\mu) - 1}{2\alpha\rho^*_{ss}(\mu-1) + \alpha + 2\rho^*_{ss}\mu - 1} < 1, \tag{29}$$

and the state repression reaches its steady state value

$$\rho^*_{ss} = \frac{\zeta\big(\alpha(\bar{A}-1) + \bar{A} + 1\big)}{2\alpha\big(\bar{A}(1-\mu) + \mu(1-\zeta)\big)}.$$

This implies that female political rights also reach their steady state value

$$\phi^{m*}_{ss} = \rho^*_{ss}(1-\mu\sigma^*_{ss}) = \frac{\zeta\big(\alpha(\bar{A}-1) + \bar{A} + 1\big)(1-\mu)}{2\alpha\big(\bar{A}(1-\mu) + \mu(1-\zeta)\big)}$$

It follows that, although female political rights improve over time, they remain incomplete in equilibrium. Whenever the cost of revolution, ζ, is positive, state repression—and consequently male exploitation—persists. In the special case of zero revolutionary costs, which would correspond to a first-best outcome, complete elimination of state repression and exploitation would be attainable. We will show this scenario and its implications for policy in Case Study 1 in Section 4. As long as $\zeta > 0$, however, this benchmark remains unreachable.

Similarly, although formal labor market entry restrictions are fully removed, with $\sigma^*_t = 1$, complete labor rights have not yet been realized. The effective labor share, $\sigma_t A_t$, remains below 1 at the end of this stage, as the relative productivity has only reached $A_t = \bar{A} < 1$.

At the end of Stage 2, the state space of women's rights can be characterized as:

$$S_{S2}(\rho^*_{ss}, \sigma^*_{ss}) = \big(\gamma^{m^*}_{f,ss} = 0.5,\ \phi^{m*}_{ss} = \frac{\zeta\big(\alpha(\bar{A}-1) + \bar{A} + 1\big)(1-\mu)}{2\alpha\big(\bar{A}(1-\mu) + \mu(1-\zeta)\big)},\ A_{S2}\cdot\sigma^*_{ss} = \bar{A}\cdot 1 \,\big|\, \theta_{ss} = m\big).$$

Stage 3: Labor rights. At the outset of this final stage, women's property rights have already reached parity, and political rights have converged to their equilibrium levels, reflecting the persistent, positive costs of revolution that prevent attainment of the first-best outcome of no income exploitation. Labor force participation has already reached its maximum level, $\sigma^*_t = 1$, so that formal labor market entry restrictions are eliminated. However, complete labor rights have not yet been realized, since the effective labor share, $\sigma_t A_t$, remains below one. Consequently, the evolution of labor rights in this stage is driven exclusively by exogenous increases in female relative productivity, A_t, with the dynamic trajectory of women's rights fully determined by the path of relative productivity.

Consequently, at the end of Stage 3, the state space of women's rights can be characterized by:

$$S_{S3}(\rho^*_{ss}, \sigma^*_{ss}) = \left(\gamma^{m^*}_{f,ss} = 0.5, \phi^{m*}_{ss} = \frac{\zeta\big(\alpha(\bar{A}-1) + \bar{A} + 1\big)(1-\mu)}{2\alpha\big(\bar{A}(1-\mu) + \mu(1-\zeta)\big)}, A_{ss}\sigma^*_{ss} = 1 \mid \theta_{ss} = m\right).$$

Lemma 4. *Improvements in modern women's labor rights are driven primarily by increases in female relative productivity A_t. True equality in labor rights, such as equal pay, is achieved only when women attain productivity parity with men, that is, when $A_t = 1$.*

The evolution of women's rights in the model is driven by changes in relative female productivity A_t. Whether the economy ultimately reaches true equality, however, depends on the value of the revolutionary cost parameter ζ. When $\zeta > 0$, as in the benchmark specification, full equality cannot be achieved even when $A_t = 1$, since some degree of repression and exploitation persists in steady state. Only in the limiting case $\zeta = 0$, which we explore in Case Study 1 in Section 4, does the model deliver complete equality, with no wedge remaining once productivity parity is reached.

Simulation of the three-stage dynamics. To illustrate the evolution of women's rights across the three stages, we simulate the model using the parameterization shown in Table 1. Figure 1 shows this dynamic process, with the horizontal axis representing time and the vertical axis representing the status of women's rights. The blue dashed line marks equal property rights ($\gamma_f = 0.5$), the red dashed line marks full female political rights ($\phi = 0$), and the yellow dashed line marks equal labor rights ($\sigma \cdot A = 1$). Solid lines of the corresponding colors depict the simulated dynamic trajectories.

The vertical dashed lines in Figure 1 indicate the start and end of each stage of women's rights evolution. Stage 1 begins once relative female productivity surpasses the threshold $A_t = \underline{A}$, which marks the onset of labor market entry and the initial evolution of women's rights. We define the end of each stage and the beginning of the following stage as the period in which one dimension of women's rights reaches its steady-state level.

In the initial stage, Stage 1, growth in relative productivity increases the female labor force participation, which in turn progressively advances property, political, and labor rights. Property rights are the first dimension to reach parity, granting women equal ownership. Political rights increase gradually through the bargaining-power channel and, simultaneously, higher labor force participation and rising relative productivity jointly accelerate the growth of women's labor rights. Both expand during this stage, but remain below their steady state values.

At this point, the economy enters Stage 2, with relative productivity continuing to increase exogenously. Female labor force participation remains at the forefront of rights expansion. The combination of higher participation and productivity continues to strengthen labor rights, while reductions in state repression—mediated by the indirect repression channel—lower male exploitation and further enhance political rights. At the end of this stage, relative productivity reaches $A_t = \bar{A}$, labor market entry restrictions are eliminated ($\sigma_t^* = 1$), the

Parameter	Interpretation	Value
α	Labor share in production	0.7
μ	Sensitivity of women's political bargaining power to female labor force participation	0.15
ρ_0	Initial state repression against women	0.45

TABLE 1. Parameters and initial conditions

repression channel converges to ρ^*_{ss}, and political rights reach their steady-state level. It is worth noting that the coincidence of $A_t = \bar{A}$ and $\rho^*_t = \rho^*_{ss}$ reflects a one-period lag with respect to the liberalization of labor market entry, consistent with the assumption in Equation 27: when $\sigma^*_{t-1} = 1$, the effect is only manifested in ρ^*_t in the subsequent period, $\rho^*_t = \bar{\rho}_t(\sigma^*_{t-1})$. As shown in Figure 3, labor rights and relative productivity therefore shift onto the same trajectory one period earlier than the attainment of $A_t = \bar{A}$. Whether women achieve full political rights in this environment depends on the size of revolutionary costs: when costs are strictly positive, women remain subject to exploitation, whereas in the zero-cost case, first-best political equality would be attainable (see Case Study 1 in Section 4).

In the final stage, Stage 3, with property and political rights already at their steady states and labor force participation fully realized ($\sigma^*_t = 1$), further exogenous growth in relative productivity directly expands effective labor rights. Labor rights continue to increase until $A_t = 1$, at which point the effective labor share $\sigma_t A_t$ reaches unity, completing the empowerment process.

Overall, Figure 1 illustrates the dynamic evolution of women's rights across the three stages of the model, highlighting how property, political, and labor rights are sequentially expanded and eventually converge to their respective steady-state levels. The figure shows that property rights reach parity first, followed by political rights, which are constrained by positive revolutionary costs, and finally labor rights, which continue to grow with exogenous increases in relative female productivity until full labor market equality is attained. This simulation provides a visual representation of the mechanisms described in the theoretical model and set the stage for the subsequent empirical analysis, which evaluates the extent to which these predicted dynamics are observed in real-world data.

3. Empirical Validation

We undertake an empirical validation of our model by focusing on the United States, operating under the assumption of negligible revolution costs, to assess its ability to predict the evolution of female labor and property rights. This assumption is justified by the steady-state of political rights in which the abolition of women's historical subordination to men

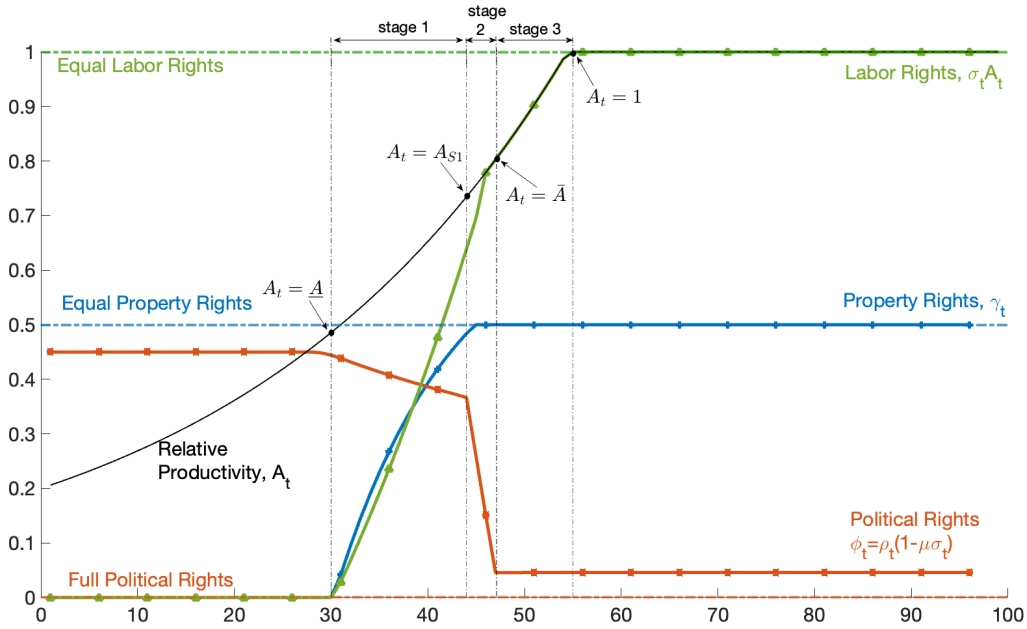


FIGURE 1. Dynamic trajectories of women's rights. Note: "Stage 1" refers to concession on property rights; "Stage 2" refers to concession on political rights; "Stage 3" refers to empowering labor rights. Blue solid line: path of women's property rights; blue dashed line: equal property rights ($\gamma_{f,t} = 0.5$). Red solid line: path of female political rights; red dashed line: full female political rights ($\phi_t = 0$). Green solid line: path of women's labor rights; green dashed line: equal labor rights ($\sigma_t A_t = 1$).

only occurs when such costs are arbitrarily close to zero. Specifically, we evaluate the model's capacity to replicate observed historical patterns of female empowerment by comparing its theoretical predictions with extensive longitudinal data.

In our framework, female labor rights are proxied by the relative earnings gap between female and male workers, operationalized through the U.S. female-to-male earnings ratio from 1815 to 1987, sourced from the contribution to *Historical Statistics of the United States: Millennial Edition* by Margo (2006). Female property rights are measured as the female share of total (male plus female) property rights using data from the V-Dem Institute. The model's exogenous input for female relative productivity is approximated by the female-to-male higher education enrollment ratio, drawn from the contribution to *Historical Statistics of the United States: Millennial Edition* by Goldin (2006). To the best of our knowledge, these series constitute the only relevant data that can be traced back to the 18th century in the United States.

Using these inputs, we run simulations combined with a maximum correlation lag analysis to assess the model's predictive performance. Our results show that the model predicts

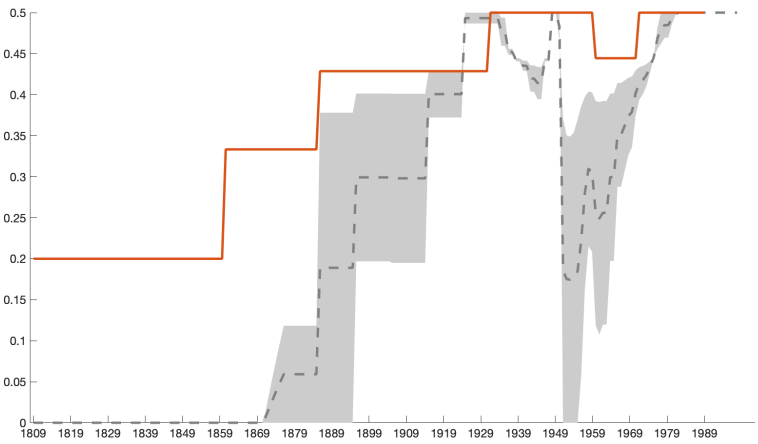
changes in female labor rights and property rights with lead times of twelve and nine years, respectively (details are provided in the Appendix C). Figure 2a presents the model's predicted range for female property rights—displayed as a shaded area—lagged by nine years. The black dashed line corresponds to the model's average prediction, while the red solid line depicts the observed data. Similarly, Figure 2b shows the twelve-year lagged predictions for female labor rights, following the same line conventions. Quantitatively, the model explains approximately 88% of the variation in female property rights and 71% in female labor rights, with both results statistically significant at conventional levels (see Table 2).

The fact that the model's predictions align most closely with the observed data when shifted forward by nine years for property rights and twelve years for labor rights suggests that the mechanisms driving rights expansion in practice operate with substantial delays. Several factors could contribute to this lag. First, institutional change—particularly in formal rights—often requires legislative processes, judicial interpretation, or constitutional amendments, all of which can introduce multi-year implementation delays even after economic conditions become favorable. Second, shifts in social norms and political coalitions that support gender equality may follow, rather than coincide with, changes in economic productivity, further lengthening the timeline between economic capacity and realized rights. Finally, measurement issues may play a role: our proxy for relative female productivity relies on higher education enrollment, which captures long-term human capital investment rather than immediate labor market productivity, potentially displacing the timing of predicted changes relative to observed rights. Together, these structural, political, and measurement-related factors can plausibly explain why the model's predictions track the data most closely only after a nearly decade-long lag.

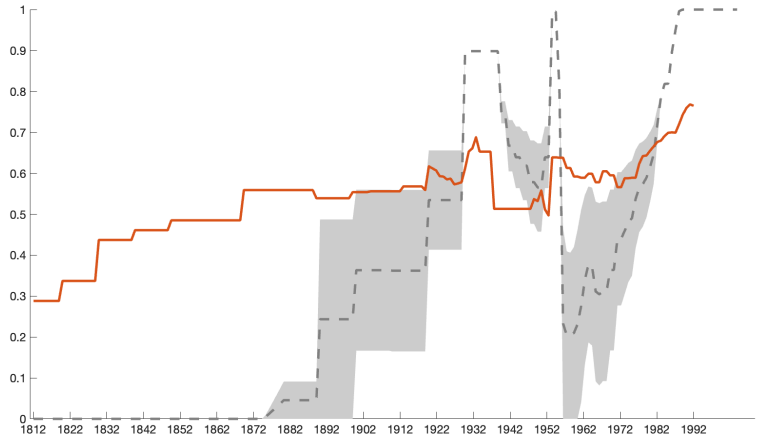
Moreover, our model predicts that empowering female labor and property rights starts around the 1870s, while the actual data shows that these rights existed earlier, although limitedly (as shown in Figures 2a and 2b). We attribute this discrepancy to our reliance on higher education enrollment as the sole measure of relative female productivity (A_t), implicitly capturing only brain-intensive productivity and omitting brawn-intensive productivity. Before the Second Industrial Revolution, industries such as family farming and textiles relied heavily on physical labor (brawn-intensive), implying that our measure underestimates

Variable	Correlation	p-value
Property rights	0.88	2.89e-62
Labor rights	0.71	1.82e-29

TABLE 2. Pearson correlation coefficients and p-values comparing model-predicted and observed measures of property and labor rights



(A) Property rights. Source: Relative productivity A_t from Goldin (2006).



(B) Labor rights. Source: Labor rights data from Margo (2006).

FIGURE 2. The solid orange line are the observed property and labor rights, respectively in Panel A and B. The dashed gray line is the mean model prediction along with the shaded band that represents the lower and upper bounds of the simulated outcomes corresponding to variation in the parameter μ within 0.1 and 0.2.

female productivity during these years. Thus, incorporating these missing productivity dimensions should yield earlier predictions aligned more closely with historical observations. Despite this limitation, we maintain the current measure due to the gradual dominance of brain-intensive productivity following industrialization.

Furthermore, the model's predictions for female labor rights tend to exceed observed values during periods of economic and social upheaval, notably in the 1930s and 1960s. We interpret this as reflecting the model's emphasis on long-term trends, without accounting for business cycle fluctuations and major historical disruptions, such as the Great Depression or

the Cuban Missile Crisis. During such crises, women's labor rights were disproportionately curtailed, particularly in the absence of full political rights, exemplified by marriage bars during the Great Depression that restricted married women's employment in professional sectors, including government and education.

Meanwhile, predicted female property rights exhibit greater volatility than observed data, especially during the 1960s. This may be explained by the inherently rigid nature of property rights as formal legal entitlements, which are less flexible than labor market adjustments, such as wage gaps. Once legally established, property rights entail substantial legal and social costs if reversed. This institutional rigidity contributes to their empirical stability and gradual progression; when declines occur, they tend to be minor and short-lived, as illustrated in Figure 2a.

Overall, this empirical validation exercise shows that the model captures the long-run dynamics of female labor and property rights with substantial accuracy, explaining a large share of the observed historical variation. Discrepancies in early periods and during times of economic or geopolitical turbulence highlight the importance of refining the productivity measure and incorporating mechanisms to account for business cycle fluctuations. Nevertheless, the strong explanatory power over more than a century of U.S. data suggests that the model offers a credible framework for analyzing the sequencing of rights expansions and their underlying economic drivers.

Next, to draw out actionable insights, we connect the theoretical mechanisms to real-world institutional failures and policy challenges. In particular, we examine scenarios in which social or economic arrangements persist in suboptimal equilibria—often characterized by restricted rights for women, inefficient labor allocations, and entrenched inequality.

4. Policy Implications

We examine four real-world case studies that highlight how societies experience stalled progress, backsliding, or persistent gaps in women's rights. For each, we link observed institutional or policy contexts to corresponding mechanisms and equilibrium outcomes within our model. Some cases involve active policy interventions, while others reflect situations where such measures are absent. Drawing on the model's insights, we illustrate how targeted interventions can facilitate transitions toward a more inclusive equilibrium, particularly for societies yet to adopt these reforms.

This structured approach clarifies how the model can serve as a tool for understanding institutional inertia and designing pathways toward reform. By grounding the policy implications in concrete scenarios, we emphasize the model's practical relevance while preserving

its analytical rigor.

Case Study 1: Female empowerment with zero revolutionary costs. In our model so far, we have assumed that women's revolutionary costs are strictly positive but sufficiently low to satisfy the credibility constraint (Equation 11). However, under these conditions, the economy will remain trapped in a suboptimal equilibrium characterized by unequal political rights and male exploitation of women's income (see Figure 1). In practice, revolutionary costs are rarely zero, and absent government intervention, societies often persist in such inefficient equilibrium.

To escape this equilibrium and facilitate political inclusion, policymakers have implemented measures that effectively reduce these costs. Examples include quota systems such as *Quote Rosa*, or Pink Quota, in Italy and Argentina, which reserve a share of parliamentary seats and corporate boards for women, and the *Zipper system*, which guarantees alternating placement of male and female candidates on party lists, as in Sweden, or that the first and second positions cannot be held by candidates of the same gender, as in Belgium. Such interventions lower the barriers to political representation, moving society away from an equilibrium with unequal political rights and male exploitation of women's income.

In our model, these interventions are captured by a permanent reduction in the revolutionary cost parameter ζ. As ζ drops to zero, political rights are immediately granted: women acquire full political rights, and the exploitation rate falls to zero (see Figure 3). This outcome arises because the feasible upper bound on state repression collapses to $\bar{\rho}_t = 0$ (Equation 26), leaving the single feasible repression level $\rho_t^* = 0$, which drives the abrupt political concession.

If women accept this concession, then men remain in authority and their optimal response is to set female labor supply to zero, $\sigma_t^* = 0$.This choice reflects a trade-off: increasing female labor depresses male labor income but raises land rents. Once women have equal land rights, at the end of Stage 1, the land-rent gain no longer offsets the labor-income loss, making zero female labor supply optimal for men.

Under perfect information, women anticipate this outcome and reject continued male authority. They overthrow male authority and establish female autonomy. Anticipating this inevitability, men maintain repression at zero to minimize the reversal of exploitation—from male exploitation of women's income under dowry (ϕ^m) to potential female exploitation of men's income under bride price (ϕ^f).

The model thus formalizes the channel through which interventions like *Quote Rosa* and the *Zipper system* can help shift a society from a suboptimal equilibrium with unequal political rights and male exploitation of women's income to the first-best outcome with full

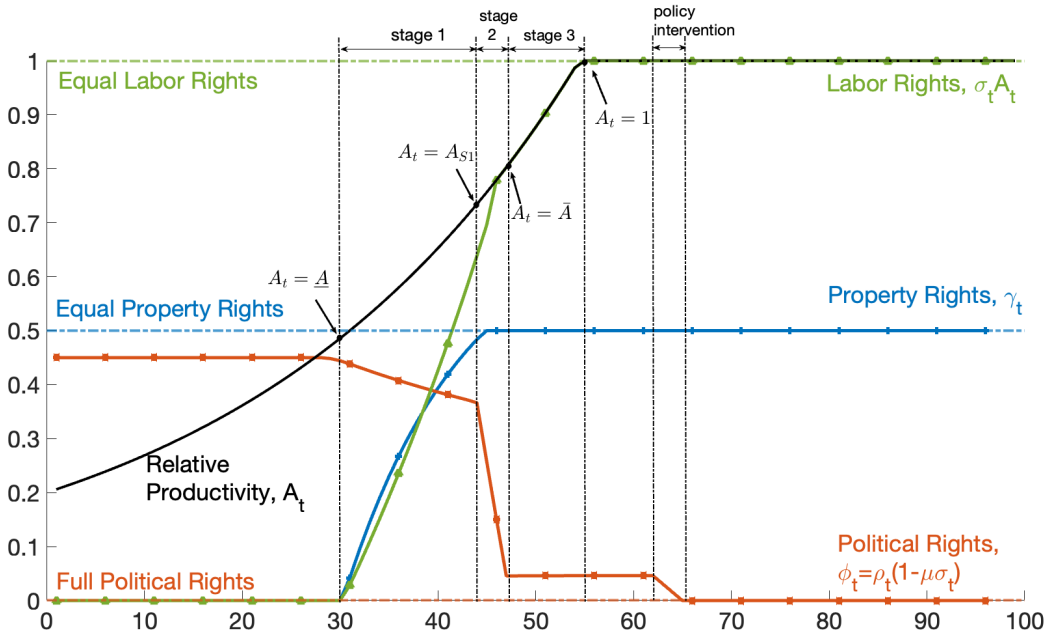


FIGURE 3. Dynamic trajectories of women's rights following a zero revolutionary cost policy intervention. Note: Blue solid line: path of women's property rights; blue dashed line: equal property rights ($\gamma_{f,t} = 0.5$). Red solid line: path of female political rights; red dashed line: full female political rights ($\phi_t = 0$). Green solid line: path of women's labor rights; green dashed line: equal labor rights ($\sigma_t A_t = 1$).

equality and no exploitation. By lowering ζ to zero, repression falls permanently to zero ($\rho = 0$), men's exploitation of women's income also fall to zero ($\phi^m = 0$), authority is transferred to women ($\theta = f$), and retaliation does not occur, meaning that women will not exploit men's income ($\phi^f = 0$). For societies that have yet to adopt such measures, our model provides theoretical support for these policies as pathways toward the first-best steady state of gender equality and economic efficiency. The steady state of women's rights in this case of zero revolutionary costs can be characterized by:

$$S(\rho^*_{ss}, \sigma^*_{ss}) = \left(\gamma^{f^*}_{f,ss} = 0.5,\ \phi^f_{ss} = 0,\ \sigma^*_{ss} A_{ss} = 1 \,\middle|\, \theta_{ss} = f\right).$$

Case Study 2: Prohibitively high revolutionary costs and entrenched male authority. We now consider the contrasting scenario in which revolutionary costs for women are prohibitively high so that the credibility constraint (Equation 11) is never satisfied and the threat of revolution is not credible, that is $\zeta \geq \bar{\zeta}_0$, where

$$\bar{\zeta}_0 = \frac{\rho_0 \alpha A_0 + \rho_0 \mu}{\alpha A_0 + \rho_0 \mu}.$$

In this environment, male authority over female autonomy persists indefinitely ($\theta_t = m$), without making any concessions, and men retain full ownership of land in all periods. Following Equations 7 and 8, now the post-exploitation income at time t are

$$y^m_{m,t}(\rho_t, \sigma_t) = \omega_{m,t}(\sigma_t) + \frac{R_t(\sigma_t)}{L_m} + \rho_t(1 - \mu\sigma_t)\,\omega_{f,t}(\sigma_t)\frac{L_f}{L_m},$$

and

$$y^m_{f,t}(\rho_t, \sigma_t) = (1 - \rho_t(1 - \mu\sigma_t))\,\omega_{f,t}(\sigma_t).$$

In the absence of a credible revolutionary threat, the timing of institutional and economic decisions no longer involves any concessions. The within-period sequence therefore deviates from the baseline model and unfolds as follows: First, the exogenous growth in female relative productivity is captured by A_t. Females lack incentives to revolt, and male authority over female autonomy remains fixed at $\theta_t = m$. Repression ρ_t can adjust if male and female preferences over its level coincide; otherwise it remains unchanged, $\rho_t = \rho_{t-1}$. Subsequently, the male authorities set the level of female labor supply σ^*_t. Finally, the institutional outcomes of the period are realized: female property rights $\gamma^{m*}_{f,t}$, political rights ϕ^{m*}_t, and labor rights $\sigma^*_t A_t$ are formed accordingly.

Without land concessions, neither side engages in the strategic weakness behavior as described in Stage 1. Instead, both reveal their true preferences. Intuitively men strictly prefer $\rho_{m,t} = 1$, because high repression increases the scope for the exploitation of female income and thus increases male income and utility. In contrast, women strictly prefer $\rho_{f,t} = 0$, as repression reduces their own incomes and utility. When these preferences are opposed, negotiations over repression fail (as $\rho_{f,t} \neq \rho_{m,t}$) and the prevailing social norm persists: $\rho^*_t = \rho_{t-1} = \rho_0$.

Given the prevailing repression level ρ^*_t, each gender chooses a preferred female labor supply by solving

$$\sigma_{i,t} = \arg\max_{\sigma_t \in [0,1]} U^m_{i,t}(\rho^*_t, \sigma_t).$$

Women always strictly prefer full labor participation, $\sigma_{f,t}(A_t) = 1$. Men, as authorities, face a trade-off over the choice of $\sigma_{m,t}$. On the one hand, a higher female labor supply increases male post-exploitation income by raising returns to land and by increasing female post-exploitation income (which may be partially appropriated). On the other hand, a higher σ_t depresses male labor income through an increase in the overall labor supply and strengthens female bargaining power, thus reducing the feasible exploitation rate. This trade-off generates an interior optimum $\sigma_{m,t}$.

As a result, although women prefer full labor force participation, male authorities impose restrictions and set

$$\sigma_t^* = \min\{\sigma_{m,t}^*, 1\}.$$

The male-preferred female labor supply admits the closed form:

$$\sigma_{m,t}^*(A_t) = \frac{\sqrt{4(\alpha+1)A_t\rho_t^{*2}\mu + \left(\alpha A_t(\rho_t^* - 1) + A_t - 2\rho_t^*\mu\right)^2} + \alpha A_t\rho_t^* - \alpha A_t + A_t - 2\rho_t^*\mu}{2(\alpha+1)A_t\rho_t^*\mu}.$$

If Equation 19 ceases to bind, however, the incentives can change markedly. This situation is observed in some agricultural economies (for example, Niger, Mali, and Tanzania), where male authorities over female autonomy remain unchallenged and have little incentive to share land rights as a tool of political stabilization. In these contexts, an increase in female participation can raise rents sufficiently to outweigh declines in male labor income (i.e. $\partial\omega_{m,t}/\partial\sigma_t > 0$, $\partial(R_t/L_m)/\partial\sigma_t < 0$, and $\partial\omega_{m,t}/\partial\sigma_t + \partial(R_t/L_m)/\partial\sigma_t > 0$), while the marginal reduction in the exploitation rate is dominated by the expansion of female pre-exploitation labor income (i.e. $\partial\phi_t^m/\partial\sigma_t < 0$, $\partial(\omega_{f,t}L_f/L_m)/\partial\sigma_t > 0$, and $\partial(\phi_t^m \cdot \omega_{f,t}L_f/L_m)/\partial\sigma_t > 0$). Consequently, increasing the female labor supply can generate net gains for male utility, $\partial y_{m,t}^m/\partial\sigma_t > 0$.

Under severe democratic backsliding—which raises the cost of revolution to prohibitively high levels—males may coerce greater female participation in informal and precarious work, such as cultivation, causing Equation 19 to cease to be binding. In such cases $\sigma_t^* = \sigma_{m,t}^*$ and it is possible for σ_t^* to exceed 1, with female labor supply exceeding the male labor supply, as women are compelled into additional work.

When female relative productivity stabilizes at $A_{ss} = 1$, the economy converges to a (female-relative) static steady state characterized by

$$\sigma^* = \frac{\sqrt{4(\alpha+1)\rho_0{}^2\mu + \big(\alpha(\rho_0 - 1) + 1 - 2\rho_0\mu\big)^2} + \alpha\rho_0 - \alpha + 1 - 2\rho_0\mu}{2(\alpha+1)\rho_0\mu}.$$

The steady state of women's rights in this case of prohibitively high revolutionary costs can be characterized by:

$$S(\rho_{ss}^*, \sigma_{ss}^*) = \big(\gamma_{f,ss}^{m^*} = 0,\ \phi_{ss}^m = \rho_0(1 - \mu\sigma_{ss}^*),\ \sigma_{ss}^* A_{ss} = \sigma_{ss}^* \cdot 1 \,\big|\, \theta_{ss} = m\big).$$

Although female labor participation is higher (or even exceeds male participation under coercion), these outcomes do not imply full labor rights. In many agrarian or household-based economies, such as in parts of Sub-Saharan Africa, a substantial share of female income is embedded in household production (e.g., traditional agricultural or handicraft sectors) and is directly appropriated or partially expropriated by men. This mechanism helps explain why, in such economies, female employment rates or working hours can match or surpass

those of men, yet women retain little control over land and remain subject to significant exploitation. Persistent social norms and weak institutions sustain high revolutionary costs, thereby undermining the credibility of any threat women might pose to incumbent male authorities.

This suggests that increasing female labor participation alone does not guarantee empowerment when revolutionary costs remain prohibitively high. Policies that aim simply to raise female labor supply—without addressing the institutional levers that determine appropriation, property rights, and the credibility of collective action, risk reinforcing suboptimal equilibria. To move these economies toward more inclusive and efficient outcomes, the model indicates the need to reduce the structural determinants of ζ and to strengthen the institutional constraints on appropriation. In practice, this entails measures such as securing and enforcing female property rights, bolstering judicial and administrative capacity to protect legal entitlements, supporting collective organizations that lower coordination costs for women, and reinforcing monitoring and accountability mechanisms (domestic or international) that raise the political cost of repression and rollback. Only by lowering the effective cost of collective action and increasing the enforceability of rights can societies escape the trapped equilibria documented here.

However, when $\bar{\bar{\zeta}} < \zeta < \bar{\zeta}_0$, the evolution of women's rights follows a distinctive pattern. At first, women can issue credible threats, and the exogenous rise of A_t generates dynamics consistent with our baseline model: on the one hand, female labor force participation expands, property rights improve, and exploitation declines; on the other hand, the scope for credibility gradually narrows. The threshold $\bar{\zeta}_t$ steadily diminishes until ζ reaches $\bar{\zeta}_t$, at which point credibility collapses abruptly. The initial gains—land rights, political rights, and related advances—revert sharply, and the subsequent trajectory aligns with the logic of prohibitively high revolutionary costs and entrenched male authority. This dynamic process helps explain the Arab Spring cases of Egypt, Libya, and Yemen: women's rights experienced a brief expansion under credible threats, but once credibility was exhausted, they receded rapidly, and the society converged to a steady state governed by non-credible threats.

Case Study 3: Order matters! Doepke et al. (2012) and Tertilt et al. (2022) provide historical evidence from the United Kingdom and the United States indicating that gains in female property rights preceded advances in political rights. Motivated by this empirical regularity, we turn to evaluating the sequential ordering of the three stages in our theoretical model.

Our model provides a theoretical rationale for why the sequencing of rights concessions—beginning with property rights, followed by political rights, and concluding with labor rights—is critical for attaining optimal societal outcomes. Departures from this sequence

disrupt the transition dynamics, entrenching inequality, and generating persistent social inefficiencies.

From Section 2, when repression against women persists ($\rho_t \in \mathbb{R}_{>0}$), men earn strictly higher payoffs by remaining in power ($\hat{y}^m_{m,t} > \hat{y}^f_{m,t}$). If the first step in responding to a credible revolutionary threat is to adjust repression, men optimally choose a level ρ^*_t that makes women indifferent between male and female authority, i.e., there exists ρ^*_t such that for all $\sigma_t \in [0,1]$:

$$\hat{y}^f_{f,t}(\rho^*_t, \sigma_t) = \hat{y}^m_{f,t}(\rho^*_t, \sigma_t).$$

Using Equations 8 and 9, the repression level satisfying this condition is

$$\rho^*_t(\sigma_t, A_t) = \frac{\zeta \alpha A_t}{A_t\left[\alpha(1-\mu\sigma_t) + \mu\sigma_t(1-\alpha)(1-\zeta)\right] + \mu(1-\zeta)}. \tag{30}$$

When the cost of revolution is positive, $\zeta \in (0,1]$, Equation 30 yields a strictly positive equilibrium repression level for all feasible σ_t and A_t:

$$\rho^*_t > 0 \quad \forall t, \quad \forall \sigma_t, A_t \in [0,1].$$

In this equilibrium, concessions in political rights—implemented via reductions in repression—are sufficient to neutralize the revolutionary threat while preserving male control over property. Consequently, women remain locked in a *political rights trap*, unable to advance to bargaining over land property rights ($\gamma^*_{f,t} = 0$ for all t).

Moreover, Equation 30 also shows that higher revolutionary costs weaken women's threat potential, reduce male incentives to lower repression, and—ceteris paribus—further restrict women's political rights:

$$\frac{\partial \rho^*_t}{\partial \zeta} > 0.$$

This result formalizes why, in the early stages of rights bargaining under a credible revolutionary threat, property rights concessions cannot emerge before political concessions.

This political-first concession pattern is observable in several patrilineal societies in the South Pacific, where land rents form the principal basis of sovereign authority. Faced with the prospect of revolution, male authorities have a strict preference for stabilizing control by granting limited, often symbolic, political concessions rather than ceding direct, tangible land rights. Empirically, this tendency is reflected in instances where states ratify the *Convention on the Elimination of All Forms of Discrimination Against Women* (CEDAW) while adoption or effective implementation of its Optional Protocol has lagged.[15] The mechanism in the model is transparent: by Equation 30, a reduction in repression can be sufficient to

[15]Table D.2 in Appendix D documents selected cases.

equalize women's and men's expected payoffs and thus neutralize the revolutionary threat without altering the underlying property allocation.

As a consequence, women in these settings are caught in a political-rights trap and cannot credibly advance the next-stage bargaining over land redistribution. This dynamic helps explain why international actors (e.g., UN Women, the Department of Foreign Affairs and Trade, the World Bank) have prioritized research and policy interventions on female land rights, yet often observe muted effects: symbolic political concessions reduce the immediate pressure for deeper, redistributive reform, creating strategic resistance to changes that would alter rent-bearing property relations.

Case Study 4: Trapped in Stage 1. This scenario explores how the evolution of women's rights can stall even as female relative productivity rises to parity. The mechanism centers on the asymmetric empowerment constraint (Equation 21), which in the model encodes the normative objective of the female democratic movement: allocations granting women more than one half of property rights are ruled out, reflecting a commitment to gender equality rather than matriarchal dominance.

Formally, this constraint binds whenever $\underline{\gamma}_{f,t}(\rho_t^*, \sigma_t^*(A_t)) > 0.5$, implying that further increases in relative productivity cannot immediately translate into greater property rights. The economy operates at the boundary, $\sigma_t^*(A_t) = \bar{\sigma}_t(A_t)$ and, since eland concession are now insufficient to induce women to relinquish the revolution, men must turn to the concession of political rights.

In this case study, we explore the evolution of rights when the asymmetric empowerment constraint does not bind, i.e., when $\sigma_t(1) < \bar{\sigma}_t(1)$. This implies that

$$\underline{\gamma}_{f,t}\big(\sigma_t(1)\big) < \gamma_f\big(\bar{\sigma}(1)\big) = 0.5,$$

meaning that, in all periods, female property rights remain below parity. This happens because, in this regime, increases in female relative productivity A_t can still be translated into further land concessions. Although women achieve partial empowerment, property rights concession remains sufficient to ensure male authority persisting over female autonomy and full equality in property rights is never reached.

Consequently, reforms in women's rights stagnate at the stage of property rights empowerment. Figure 4 illustrates this process, with the horizontal axis representing time and the vertical axis representing the status of women's rights. In this equilibrium, increases in female relative productivity translate into incremental property rights gains, but full parity is never reached, reflecting the combined effects of the asymmetric empowerment constraint and the gradual nature of concessions.

Our analysis suggests that the timing of entry into the empowerment stage plays a crucial role in determining the eventual level of female labor rights. Societies that enter this stage earlier—characterized by relatively high revolutionary costs (ζ still below $\bar{\bar{\zeta}}$) and low initial repression (ρ_0)—tend to achieve higher steady-state labor rights for women (see proof in Appendix A.2.5). Figures 4a and 4b illustrate late and early entrants, respectively. In both cases, women do not attain full property rights; however, earlier entry into empowerment (Figure 4b) results in stronger labor rights overall.

In exceptional cases, where empowerment occurs *early enough* such that $(\zeta, \rho_0) \in \mathcal{A}$, defined as

$$\mathcal{A} := \left\{ (\zeta, \rho_0) \in [0, \bar{\zeta}_1) \times (0,1) \mid \tilde{A}(\zeta, \rho_0) \leq 1 \right\},$$

women can achieve what the model defines as "full" labor rights.[16] Importantly, even under this scenario, the status of "full" labor rights remains largely nominal: women may still be subject to direct or indirect forms of exploitation, such as dowry practices in countries like India and Bangladesh, highlighting the distinction between formal labor rights and full equality.

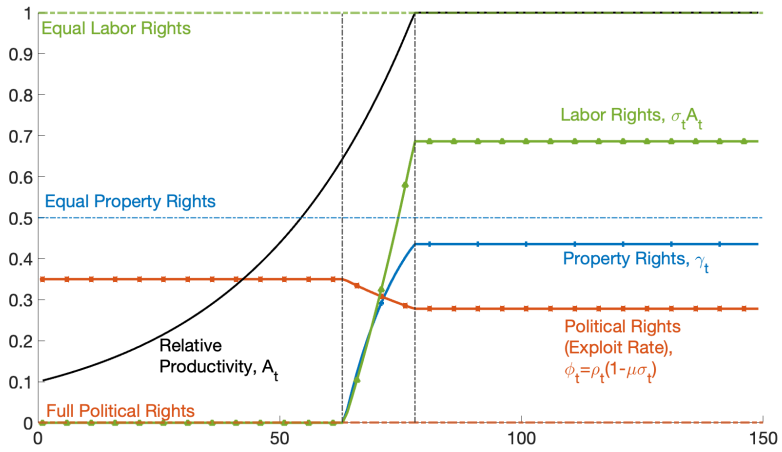
5. Conclusion

To the best of our knowledge, this paper offers the first theoretical framework that disentangles the evolution of women's rights into three distinct stages: property rights, political rights, and labor rights. Our model highlights the critical role of revolution costs, showing that low costs enable successful women's rights revolutions, while excessively high costs prevent women from posing credible threats to male authority, thereby limiting their bargaining power to achieve greater rights.

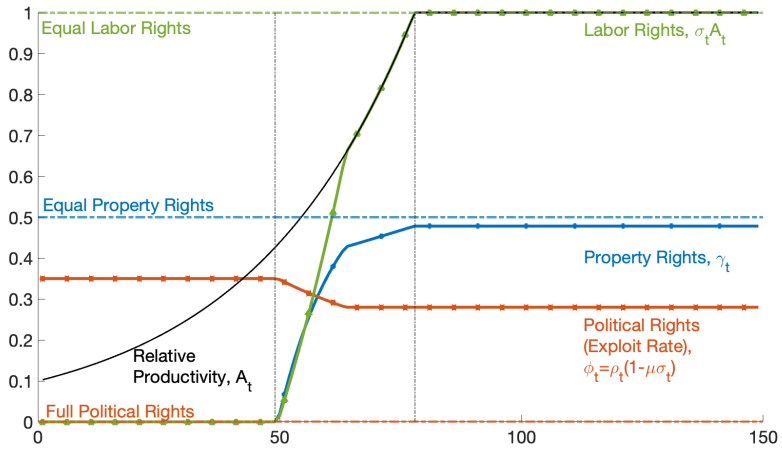
The model also explains why, in most common law systems, successful women's rights revolutions typically prioritize property rights reforms over political or labor rights. Reversing this sequence results in a "political rights trap", where progress towards property rights reform is blocked. Initially, men strategically redistribute property rights to temporarily consolidate political power: this exchange marks the true beginning of women's liberation. Gains in labor rights without accompanying political rights are largely illusory, reflecting the continued exploitation of women's labor income rather than genuine empowerment.

In the modern era, improvements in women's labor rights are primarily driven by increases in women's relative productivity compared to men. Therefore, fully eliminating labor market discrimination requires narrowing the productivity gap between men and women.

[16]Here, *early enough* means that ζ is sufficiently large and ρ_0 sufficiently small. The function $\tilde{A}$ denotes the threshold level of female relative productivity at which all restrictions on female participation in the labor force are fully lifted. See Appendix A.2.5 for the formal derivation and the explicit expression of $\tilde{A}$.



(A) Limited political and labor rights



(B) Full labor rights but limited political rights

FIGURE 4. Stagnation in property rights trap. Note: Blue solid line: path of women's property rights; blue dashed line: equal property rights ($\gamma_{f,t} = 0.5$). Red solid line: path of female political rights; red dashed line: full female political rights ($\phi_t = 0$). Green solid line: path of women's labor rights; green dashed line: equal labor rights ($\sigma_t A_t = 1$).

Finally, our empirical predictions strongly support the model's validity, demonstrating its ability to explain observed patterns in the historical evolution of women's rights. This framework thus provides a unified and robust foundation for understanding the strategic and staged nature of women's rights development.

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Appendix A. Proofs

A.1. **Credible Threat.** Women revolt if and only if their post-exploitation income under female authority exceeds that under male authority, yielding the credibility constraints (Equation 11):

$$\begin{aligned} &\hat{y}^m_{f,t} \leq \hat{y}^f_{f,t} \\ \Leftrightarrow \zeta \leq \bar{\zeta}_t &= \frac{\rho_t A_t(-2\alpha\mu\sigma_t + \alpha + \mu\sigma_t) + \rho_t\mu}{A_t(-\alpha\rho_t\mu\sigma_t + \alpha + \rho_t\mu\sigma_t) + \rho_t\mu}. \end{aligned} \tag{A.1}$$

Here, $\bar{\zeta}_t$ is negatively correlated with both A_t and σ_t, since

$$\frac{\partial\bar{\zeta}_t}{\partial A_t} = -\frac{\alpha\rho_t\mu(1-\rho_t(1-\mu\sigma_t))}{(A_t(-\alpha\rho_t\mu\sigma_t + \alpha + \rho_t\mu\sigma_t) + \rho_t\mu)^2} < 0,$$

and

$$\frac{\partial\bar{\zeta}_t}{\partial\sigma_t} = \frac{\alpha A_t\rho_t\mu(\alpha A_t\rho_t - A_t\rho_t + A_t - 2\alpha A_t - \rho_t\mu)}{(A_t(-\alpha\rho_t\mu\sigma_t + \alpha + \rho_t\mu\sigma_t) + \rho_t\mu)^2} < 0$$

under the assumption that the labor-income share α is greater than 0.5. Meanwhile, ζ_t is positive correlated with ρ_t, since

$$\frac{\partial\bar{\zeta}_t}{\partial\rho_t} = \frac{\alpha A_t(\alpha A_t - \alpha A_t\mu\sigma_t + A_t\mu\sigma_t - \alpha A_t\mu\sigma_t + \mu)}{(A_t(-\alpha\rho_t\mu\sigma_t + \alpha + \rho_t\mu\sigma_t) + \rho_t\mu)^2} > 0.$$

A.2. **Stage 1: Property Rights.** If the credibility constraint (Equation 11) holds in all periods.

A.2.1. *Proof of the decision rule of property rights.* The lower bound of property rights is the threshold, $\underline{\gamma}_{f,t}$, at which females are indifferent, in terms of post-exploitation income, between male and female authority:

$$\begin{aligned} &\hat{y}^m_{f,t} = \hat{y}^f_{f,t} \\ \Leftrightarrow \underline{\gamma}^m_{f,t}(\rho_t,\sigma_t) &= \frac{\sigma_t(A_t\rho_t(\alpha(1-2\mu\sigma_t) + \mu\sigma_t) + A_t\zeta(\alpha\rho_t\mu\sigma_t - \alpha - \rho_t\mu\sigma_t) + \rho_t\mu(1-\zeta))}{(1-\alpha)(A_t\sigma_t + 1)} > 0. \end{aligned} \tag{A.2}$$

We show that this lower bound is a positive value, by substituting the credible threshold (the highest value of the feasible revolutionary cost $\bar{\zeta}_t$), into Equation A.2, yielding $\underline{\gamma}^m_{f,t_{min}} = 0$. Thus, $\underline{\gamma}_{f,t} > 0\ \forall\rho_t,\sigma_t \in [0,1]$.

While upper bound of property rights is the threshold, $\bar{\gamma}^m_{f,t}$, at which male are indifferent between male and female authority:

$$\begin{aligned} &\hat{y}^m_{m,t} = \hat{y}^f_{m,t} \\ \bar{\gamma}^m_{f,t}(\rho_t,\sigma_t) &= \frac{\rho\sigma_t(\alpha A_t(1-2\mu\sigma_t) + A_t\mu\sigma_t + \mu) + \zeta((1-\alpha)A_t\sigma_t + 1)(1-\rho\mu\sigma_t)}{(1-\alpha)(A_t\sigma_t + 1)} > 0. \end{aligned} \tag{A.3}$$

Notice that, this upper bound, $\bar{\gamma}^m_{f,t}$, is always greater than the lower bound $\underline{\gamma}^m_{f,t}$,

$$\bar{\gamma}^m_{f,t}(\rho_t, \sigma_t) - \underline{\gamma}^m_{f,t}(\rho_t, \sigma_t) = \frac{\zeta}{1-\alpha} \geq 0,$$

which indicates that it is feasible to preserve authority by transferring property rights, and men need only cede the minimal level required to satisfy the condition, $\underline{\gamma}^m_{f,t}$. Therefore, the female property rights decision rule is,

$$\gamma^*_t = \underline{\gamma}_{f,t} \tag{A.4}$$

A.2.2. *Proof of Lemma 1.* Following the property rights' decision rule above, we derive that

$$\frac{\partial \gamma^*_t}{\partial \zeta} = -\frac{\sigma_t(A_t(\alpha + \rho_t\mu\sigma_t - \alpha\rho_t\mu\sigma_t) + \rho_t\mu)}{(1-\alpha)(A_t\sigma_t + 1)} < 0$$

$$\frac{\partial \gamma^*_t}{\partial \rho_t} = \frac{\sigma_t(A_t(\alpha(1-\mu\sigma_t) + \mu\sigma_t(1-\alpha)(1-\zeta)) + \mu(1-\zeta))}{(1-\alpha)(A_t\sigma_t + 1)} > 0$$

$$\frac{\partial \gamma^*_t}{\partial \sigma_t} = \frac{A_t^2\rho_t\mu\sigma^2(2\alpha + \zeta(1-\alpha) - 1) + A_t\rho_t(\alpha(4\mu\sigma - 1) - 2\mu\sigma) + A_t\zeta(\alpha + 2\rho_t\mu\sigma(1-\alpha)) + \rho_t\mu(\zeta - 1)}{(\alpha-1)(A_t\sigma + 1)^2} > 0$$

when $\zeta < \frac{\alpha\rho_t(-6\mu+1)+4\rho_t\mu}{-3\alpha\rho_t\mu+\alpha+4\rho_t\mu}$ and $4\mu + \alpha(1-6\mu) > 0$

A.2.3. *Equilibrium under property rights concession.* We solve the equilibrium (ρ^*_t, σ^*_t) sequentially. As the first step, females and males decide the social norm ρ_t following their own preference, such that at this stage, a representative female problem is,

$$\max_{\rho_t} U^m_{f,t}(\rho_t, \sigma_t) = C^m_{f,t}(\rho_t, \sigma_t),$$
$$s.t. C^m_{f,t}(\rho_t, \sigma_t) \leq \hat{y}^m_{f,t}(\rho_t, \sigma_t),$$
$$0 \leq \rho_t \leq 1.$$

Substituting the decision rule of property rights (Equation 17) into $\hat{y}^m_{f,t}$ (Equation 14),

$$\hat{y}^m_{f,t} = (1-\zeta)\sigma_t X^{1-\alpha}(A_t L\sigma_t + L)^{\alpha-1}(\alpha A_t(1-\rho_t\mu\sigma_t) + A_t\rho_t\mu\sigma_t + \rho_t\mu).$$

Given the utility function $U^m_{f,t} = C^m_{f,t}$ and the constraint $C^m_{f,t} \leq \hat{y}^m_{f,t}$, the individual maximizes utility by choosing the highest feasible level of consumption. As a result, the optimal choice is $C^m_{f,t} = \hat{y}^m_{f,t}$, and thus utility at the optimum becomes $U^m_{f,t} = \hat{y}^m_{f,t}$. Therefore, $\rho_{f,t} = \arg\max_{\rho_t \in [0,1]} U^m_{f,t}(\rho_t, \sigma_t) = \arg\max_{\rho_t \in [0,1]} y^m_{f,t}(\rho_t, \sigma_t)$. By taking the first-order condition (F.O.C.), female post-exploitation income is strictly positive to ρ_t:

$$\frac{\partial \hat{y}^m_{f,t}}{\partial \rho_t} = \mu(1-\zeta)\sigma_t X^{1-\alpha}((1-\alpha)A_t\sigma_t + 1)(A_t L\sigma_t + L)^{\alpha-1} > 0,$$

therefore, females prefer the ρ_t as high as possible, $\rho_{f,t} = 1$.

Simultaneously, at this step, a representative male problem is,

$$\max_{\rho_t} U^m_{m,t}(\rho_t, \sigma_t) = C^m_{m,t}(\rho_t, \sigma_t),$$
$$s.t. C^m_{m,t}(\rho_t, \sigma_t) \leq \hat{y}^m_{m,t}(\rho_t, \sigma_t),$$
$$0 \leq \rho_t \leq 1.$$

Substituting the decision rule of property rights into $\hat{y}^m_{m,t}$ (Equation 13),

$$\hat{y}^m_{m,t} = X^{1-\alpha}(A_t L\sigma_t + L)^{\alpha-1}(A_t\sigma_t(-\alpha(\zeta-1)(\rho_t\mu\sigma_t - 1) + \rho_t\mu(\zeta-1)\sigma_t + 1) + \rho_t\mu(\zeta-1)\sigma_t + 1).$$

By taking the first-order condition (F.O.C.), male post-exploitation income is strictly negative to ρ_t:

$$\frac{\partial \hat{y}^m_{m,t}}{\partial \rho_t} = -\left(\mu(1-\zeta)\sigma_t X^{1-\alpha}((1-\alpha)A_t\sigma_t + 1)(A_t L\sigma_t + L)^{\alpha-1}\right) < 0,$$

therefore, males prefer the ρ_t as low as possible, $\rho_{m,t} = 0$. As a result, divergence preferred level lead the negotiation cease to hold, $\rho_{m,t} \neq \rho_{f,t}$, $\rho^*_t = \rho_0$.

Given ρ^*_t, now, females and males optimize their respective utility functions to select their preferred levels of female participation rate, such that,

$$\max_{\sigma_t} U^m_{f,t}(\rho_0, \sigma_t) = C^m_{f,t}(\rho_0, \sigma_t),$$
$$s.t. C^m_{f,t}(\rho_0, \sigma_t) \leq \hat{y}^m_{f,t}(\rho_0, \sigma_t),$$
$$0 \leq \sigma_t \leq 1,$$

and

$$\max_{\sigma_t} U^m_{m,t}(\rho_0, \sigma_t) = C^m_{m,t}(\rho_0, \sigma_t),$$
$$s.t. C^m_{m,t}(\rho_0, \sigma_t) \leq \hat{y}^m_{m,t}(\rho_0, \sigma_t),$$
$$0 \leq \sigma_t \leq 1.$$

By taking the F.O.C., we derive the following:

$$\frac{\partial \hat{y}^m_{f,t}}{\partial \sigma_t} = \frac{(\zeta-1)X^{1-\alpha}(A_t L\sigma + L)^{\alpha}\left(A_t^2\sigma\left(\alpha^2(\rho_0\mu\sigma - 1) - \rho_0\mu\sigma\right) + A_t(\alpha(\rho_0\mu\sigma - 1) - 2\rho_0\mu\sigma) - \rho_0\mu\right)}{L(A_t\sigma + 1)^2} > 0,$$

which suggests that $\sigma_{f,t} = 1$. Meanwhile,

$$\frac{\partial \hat{y}^m_{m,t}}{\partial \sigma_t} = -\frac{X^{1-\alpha}(A_t L\sigma + L)^{\alpha}\left(A_t^2\sigma\left(-\alpha + \alpha^2(\zeta-1)(\rho_0\mu\sigma - 1) - \rho_0\mu(\zeta-1)\sigma\right) + A_t(-(\alpha-2)\rho_0\mu\sigma + \alpha\zeta(\rho_0\right.}{L(A_t\sigma + 1)^2}$$

By solving $\frac{\partial \hat{y}^m_{m,t}}{\partial \sigma_t} = 0$,

$$\sigma_{m,t}(A_t) = \frac{\alpha A_t - \alpha^2 A_t + \alpha^2 A_t \zeta + 2\rho_0 \mu\zeta - 2\rho_0\mu + \alpha\rho_0\mu - \alpha\rho_0\mu\zeta + \sqrt{\Xi_t}}{2(1-\alpha^2)(1-\zeta)A_t\rho_0\mu},$$

where

$$\Xi_t = 4(\alpha^2-1)\rho_0\mu(\zeta-1)\left(\alpha A_t\zeta + \rho_0\mu(\zeta-1)\right) + \left(\alpha A_t\left(\alpha(\zeta-1)+1\right) - (\alpha-2)\rho_0\mu(\zeta-1)\right)^2.$$

A.2.4. *Proof of Lemma 2.* Following Equation 20,

$$\frac{\partial \sigma_{m,t}}{\partial A_t} = \frac{\alpha M_t + (2-\alpha)\Xi_t}{2\left(1-\alpha^2\right)A_t^2\Xi_t} > 0$$

where $M_t = \left((\alpha^2+2\alpha-2)\zeta + \alpha^2 - 3\alpha + 2\right)A_t + (4-5\alpha)(1-\zeta)\mu\rho_t > 0$, and

$$\frac{\partial \sigma_{m,t}}{\partial \rho_t^*} = -\frac{\alpha A_t - \alpha^2 A_t + \alpha^2 A_t\zeta + \frac{\alpha(1-\zeta)\mu\rho_t M_t}{\Xi_t} + \Xi_t}{2\left(1-\alpha^2\right)A_t{\rho_t^*}^2\mu(1-\zeta)} < 0,$$

$$\frac{\partial \sigma_{m,t}}{\partial \zeta} = \frac{\alpha\left(-\alpha^2 A_t + \alpha A_t + \alpha^2 A_t\zeta + 2\alpha^2\rho_t\mu\zeta - 2\alpha^2\rho_t\mu + \alpha\rho_t\mu - \alpha\rho_t\mu\zeta + \sqrt{\Xi_t}\right)}{2\left(1-\alpha^2\right)\rho_t\mu(\zeta-1)^2\sqrt{\Xi_t}} > 0.$$

A.2.5. *Proceeding to Stage 2.* As discussed in the main text (Stage 1), the reform dynamics under *Stage 1* depend crucially on the relationship between $\sigma_t^*(A_t)$ and $\bar{\sigma}_t(A_t)$ at $A_t = 1$ (the steady state).

If $\sigma_t^*(1) > \bar{\sigma}_t(1)$: the property rights level required to prevent a revolutionary reversion exceeds the equality benchmark, $\gamma^*_{f,ss} > 0.5$ at the steady state. That is, a *property-rights-only* reform path would require more than equality to sustain, which contradicts Equation 21. Hence, property rights concessions alone are insufficient.

By the continuity and monotonicity of the function $\underline{\gamma}_{f,t}(A_t)$, there must exist a unique threshold $A_{S1} \in (0,1)$ such that

$$\gamma(A_{S1}) = 0.5.$$

For $A_t < A_{S1}$, $\underline{\gamma}_{f,t}(A_t) < 0.5$ (solid blue line in Figure A.1), whereas for $A > A_{S1}$, $\underline{\gamma}_{f,t}(A_t) > 0.5$ (dashed line). Therefore, A_{S1} constitutes the turning point at which male initiate second-stage concession.

If $\sigma_t^*(1) < \bar{\sigma}_t(1)$: the property rights required to avoid revolution are below the equality benchmark. Stage 1 concessions are sufficient to prevent revolution, even though women do not obtain full property rights or political rights in the steady state. Nevertheless, full labor rights may still be achieved if:

$$\sigma_{m,t}(A_t) > 1.$$

Under the female participation constraint, this implies $\sigma_t^* = 1$, and hence in steady state, women attatin the full labor rights,

$$\sigma_{ss}^* \cdot A_{ss} = 1.$$

Given the monotonicity of $\sigma_{m,t}(A_t)$ in A, if there exists $\tilde{A} \in [0,1]$ such that:

$$\sigma_{m,t}(\tilde{A}) = 1,$$

then for any $A_t > \tilde{A}$:

$$\sigma_{m,t}(A_t)) > \sigma_m(\tilde{A}) = 1.$$

Here, the threshold $\tilde{A}$ depends on the parameters (ζ, ρ_0) and is given by:

$$\tilde{A}(\zeta,\rho_0) = \frac{\alpha\rho_0\mu - 2\rho_0\mu - \sqrt{4\rho_0\mu(\zeta-1)\left[-\alpha+\alpha^2(\zeta-1)(\rho_0\mu-1)-\rho_0\mu(\zeta-1)\right]+\left[(\alpha-2)\rho_0\mu+\zeta\left(-\alpha\rho_0\mu\right.\right.}}{-2\alpha+2\alpha^2(\zeta-1)(\rho_0\mu-1)-2\rho_0\mu(\zeta-1)}$$

Hence, if $\tilde{A}(\zeta,\rho_0) > 1$, although women's rights fail to proceed to stage 2, women nevertheless secure full labor rights. If $\tilde{A}(\zeta,\rho_0) < 1$, full labor rights cannot be attained.

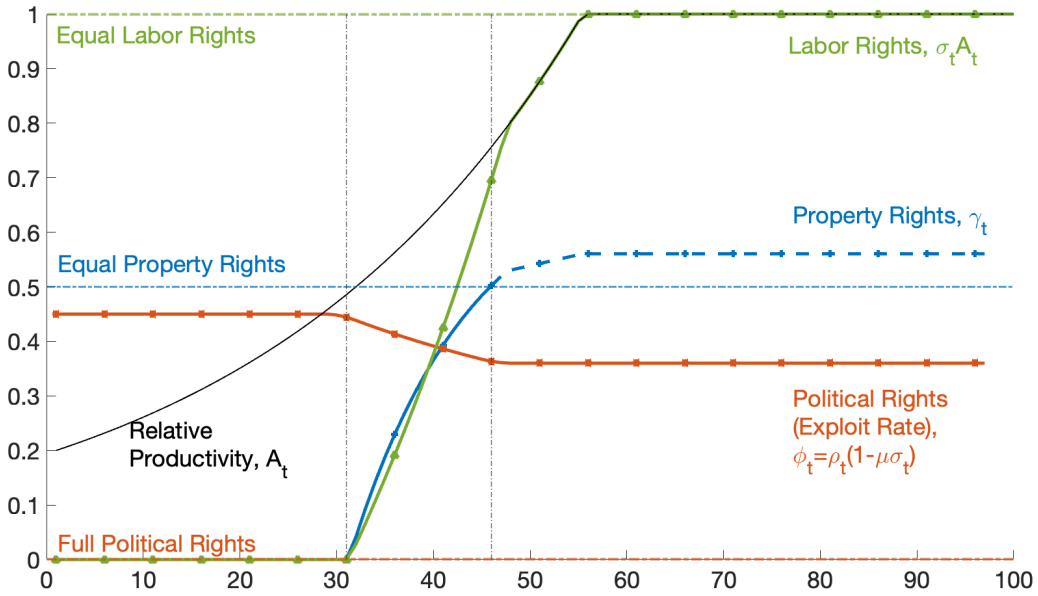


FIGURE A.1. Escape from Property Rights Trap

A.3. **Stage 2: Political Rights.**

A.3.1. *Proof for Lemma 3.*

$$\frac{\partial \rho_t^*}{\partial \zeta} = -\frac{(\alpha(A_t\sigma_t - 1) + A_t\sigma_t + 1)(A_t(\mu\sigma_t - 1) - \mu)}{2\alpha\sigma_t(A_t(\mu\sigma_t - 1) + \mu(\zeta - 1))^2} > 0$$

$$\frac{\partial \rho_t^*}{\partial \sigma_t} = -\frac{\zeta\left((\alpha+1)\left(-A_t^2\right)\mu\sigma_t^2 + (\alpha-1)A_t(2\mu\sigma_t - 1) + (\alpha-1)\mu(\zeta-1)\right)}{2\alpha\sigma_t^2(A_t(\mu\sigma_t-1)+\mu(\zeta-1))^2} < 0$$

$$\frac{\partial \sigma_t^*}{\partial A_t} = \frac{\sqrt{A_t^2(-2\alpha\rho_0+\alpha-1)^2 + 8A_t\rho_0\mu\left(\alpha^2+\alpha+2\rho_0-2\right)+16\rho_0^2\mu^2} + A_t\left(2-\alpha^2-\alpha-2\rho_0\right) - 4\rho_0\mu}{(\alpha+1)A_t^2\sqrt{(\alpha A_t(2\rho_0-1)+A_t-4\rho_0\mu)^2+8(\alpha+1)A_t\rho_0\mu(\alpha+2\rho_0-1)}} > 0$$

Since A_t is positively correlated with σ_t^* and σ_t^* is negatively correlated with ρ_t^*, A_t is negative correlated to ρ_t^*, which implies that as relative productivity exogenously increases over time, the state repression decreases correspondingly at this stage.

A.3.2. *Equilibrium in Stage 2.* Following Equation 28, we derive $\sigma_t^* = 1$ that requires

$$A_t = \frac{\alpha + \rho_{t-1}^*(2-4\mu) - 1}{2\alpha\rho_{t-1}^*(\mu-1)+\alpha+2\rho_{t-1}^*\mu-1}.$$

Here, $\frac{\alpha+\rho_{t-1}^*(2-4\mu)-1}{2\alpha\rho_{t-1}^*(\mu-1)+\alpha+2\rho_{t-1}^*\mu-1} < 1$ when $2\mu < \alpha$, which is always true since our model setting μ as a very small number to satisfy $4\mu + \alpha(1-6\mu) > 0$ (see Appendix A.2.2). We denote the special value of A_t that brings relative productivity to its steady state as $\bar{A}_t$.

Moreover, following Equations 27 and 26, we notice that once $\sigma_t = 1$, ρ_t reaches also reach its steady state at

$$\rho_{ss}^* = \frac{\zeta\big(\alpha(\bar{A}-1)+\bar{A}+1\big)}{2\alpha\big(\bar{A}(1-\mu)+\mu(1-\zeta)\big)}.$$

A.4. **Proof of equilibrium dynamics without the threat of revolution.** We solve the equilibrium (ρ_t^*, σ_t^*) sequentially. As the first step, females and males decide the social norm ρ_t following their own preference, such that at this stage, a representative female problem is,

$$\max_{\rho_t} U_{f,t}^m(\rho_t,\sigma_t) = C_{f,t}^m(\rho_t,\sigma_t),$$
$$s.t. C_{f,t}^m(\rho_t,\sigma_t) \le \hat{y}_{f,t}^m(\rho_t,\sigma_t),$$
$$0 \le \rho_t \le 1,$$

where $y_{f,t}^m(\rho_t,\sigma_t) = (1-\rho_t(1-\mu\sigma_t))A_t\sigma_t\alpha X^{1-\alpha}(L_m + A_t\sigma_t L_f)^{\alpha-1}$. Given the utility function $U_{f,t}^m = C_{f,t}^m$ and the constraint $C_{f,t}^m \le \hat{y}_{f,t}^m$, the individual maximizes utility by choosing the highest feasible level of consumption. As a result, the optimal choice is $C_{f,t}^m = \hat{y}_{f,t}^m$, and thus utility at the optimum becomes $U_{f,t}^m = \hat{y}_{f,t}^m$. Therefore, $\rho_{f,t} = \arg\max_{\rho_t\in[0,1]} U_{f,t}^m(\rho_t,\sigma_t) = \arg\max_{\rho_t\in[0,1]} y_{f,t}^m(\rho_t,\sigma_t)$. By taking the first-order condition (F.O.C.),

$$\frac{\partial \hat{y}_{f,t}^m}{\partial \rho_t} = -(1-\mu\sigma_t)A_t\sigma_t\alpha X^{1-\alpha}(L_m + A_t\sigma_t L_f)^{\alpha-1} = -(1-\psi_t)\omega_{f,t} < 0,$$

demonstrating that female post-exploitation is negative correlated to ρ_t, hence,

$$\rho_{f,t} = 0. \tag{A.5}$$

Simultaneously, at this step, a representative male problem is,

$$\max_{\rho_t} U^m_{m,t}(\rho_t, \sigma_t) = C^m_{m,t}(\rho_t, \sigma_t),$$
$$s.t. C^m_{m,t}(\rho_t, \sigma_t) \leq \hat{y}^m_{m,t}(\rho_t, \sigma_t),$$
$$0 \leq \rho_t \leq 1,$$

where $y^m_{m,t}(\rho_t, \sigma_t) = \alpha X^{1-\alpha}(L_m + A_t\sigma_t L_f)^{\alpha-1} + \frac{(1-\alpha)(L_{m,t}+L_{f,t})^\alpha}{L_m} + \rho_t(1-\mu\sigma_t)A_t\sigma_t\alpha X^{1-\alpha}(L_m + A_t\sigma_t L_f)^{\alpha-1}\frac{L_f}{L_m}$. Similarly, we solve $\rho_{m,t}$ by taking the F.O.C. with respect to ρ_t,

$$\frac{\partial y^m_{f,t}}{\partial \rho_t} = (1-\mu\sigma_t)A_t\sigma_t\alpha X^{1-\alpha}(L_m + A_t\sigma_t L_f)^{\alpha-1}\frac{L_f}{L_m} = (1-\psi_t)\omega_{f,t} > 0,$$

demonstrating that male post-exploitation is positive correlated to $\rho_{m,t}$, hence,

$$\rho_{m,t} = 1. \tag{A.6}$$

Combining Equations A.5 and A.6, the divergent optimal solutions in ρ_t lead to a breakdown in the negotiation and $\rho^*_t = \rho_0$.

Given ρ^*_t, now, for the second step, females and males optimize their respective utility functions to select their preferred levels of female labor supply, such that,

$$\max_{\sigma_t} U^m_{f,t}(\rho_0, \sigma_t) = C^m_{f,t}(\rho_0, \sigma_t),$$
$$s.t. C^m_{f,t}(\rho_0, \sigma_t) \leq \hat{y}^m_{f,t}(\rho_0, \sigma_t),$$
$$0 \leq \sigma_t \leq 1,$$

and

$$\max_{\sigma_t} U^m_{m,t}(\rho_0, \sigma_t) = C^m_{m,t}(\rho_0, \sigma_t),$$
$$s.t. C^m_{m,t}(\rho_0, \sigma_t) \leq \hat{y}^m_{m,t}(\rho_0, \sigma_t),$$
$$0 \leq \sigma_t \leq 1.$$

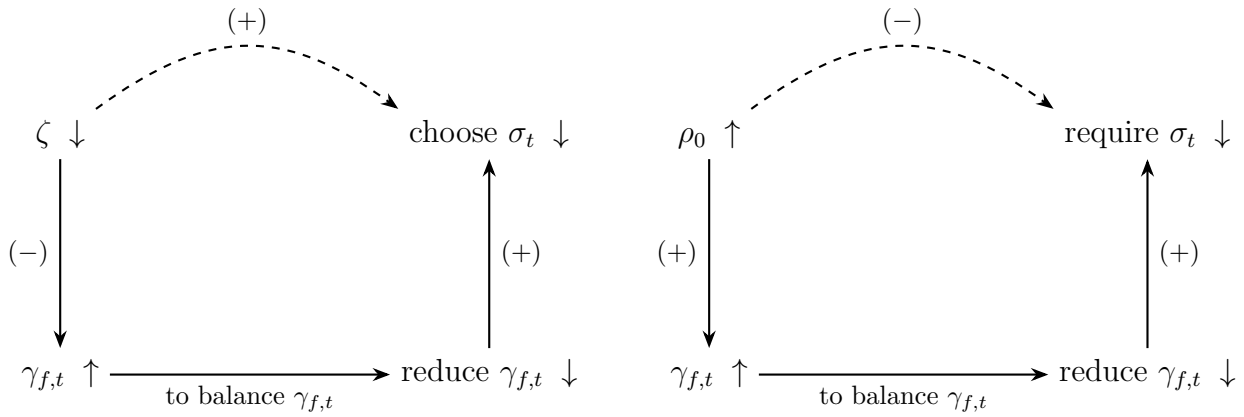
Take the F.O.C. $\frac{\partial y_{m,t}}{\partial \sigma_t} == 0$,

$$\sigma^*_t = \frac{\sqrt{4(\alpha+1)A_t\rho^2\mu + (\alpha A_t(\rho-1) + A_t - 2\rho\mu)^2} + \alpha A_t\rho - \alpha A_t + A_t - 2\rho\mu}{2(\alpha+1)A_t\rho\mu} \tag{A.7}$$

$$\frac{\partial \sigma^*}{\partial A_t} = \frac{\sqrt{4(\alpha+1)A_t\rho^2\mu + (\alpha A_t(\rho-1) + A_t - 2\rho\mu)^2} + \alpha A_t\rho - \alpha A_t + A_t - 2\rho\mu}{2(\alpha+1)A_t\rho\mu} > 0$$

Hence, even without threat of revolution, as the A_t increasing over time, σ_t increases accordingly, which in turn enhances female labor rights $A_t\sigma_t$.

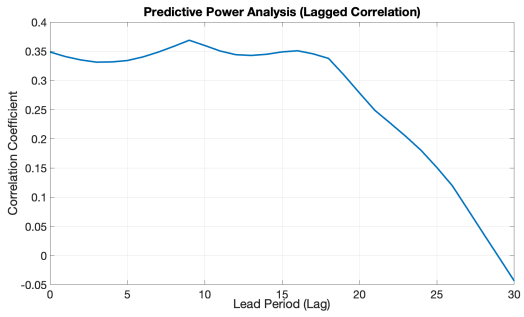
Appendix B. Mechanism



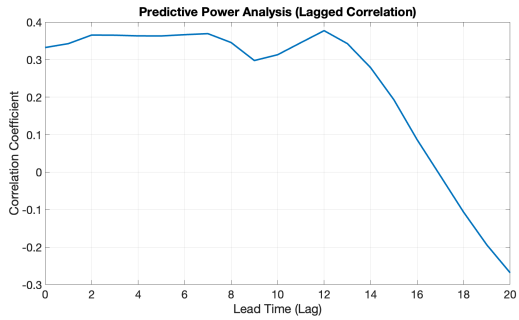
(A) Mechanism of $\zeta - \sigma_t$ relationship (B) Mechanism of $\rho_0 - \sigma_t$ relationship

FIGURE B.1. Mechanism linking ζ, ρ_0 to σ_t

Appendix C. Empirical validation



(A) Lagged correlation: female property rights



(B) Lagged correlation: female labor rights

Figure C.1. Lagged correlation

Lag	Correlation	p-value
0	0.34875	5.84e-07
1	0.34087	1.1529e-06
2	0.33512	1.8986e-06
3	0.33135	2.671e-06
4	0.33173	2.7588e-06
5	0.33412	2.4619e-06
6	0.34025	1.6648e-06
7	0.34861	9.4532e-07
8	0.35842	4.7339e-07
9*	0.36888	2.2085e-07
10	0.35990	4.8618e-07
11	0.35042	1.0799e-06
12	0.34416	1.8389e-06
13	0.34283	2.1634e-06
14	0.34484	1.9961e-06
15	0.34890	1.5859e-06
16	0.35088	1.4682e-06
17	0.34558	2.3072e-06
18	0.33776	4.2744e-06
19	0.30917	2.9788e-05
20	0.27853	0.00018972

Table C.1. Lagged correlation coefficients and significance (p-value) for female property and labor rights

Lag	Correlation	p-value
0	0.33214	0.0002874
1	0.34257	0.00019079
2	0.36544	6.8883e-05
3	0.36505	7.5762e-05
4	0.36325	8.9125e-05
5	0.36305	9.6948e-05
6	0.36641	8.9075e-05
7	0.36921	8.4197e-05
8	0.34548	0.00026778
9	0.29754	0.0019516
10	0.31295	0.0011521
11	0.34520	0.00033219
12*	0.37712	8.6154e-05
13	0.34263	0.00042334
14	0.27846	0.0048077
15	0.19299	0.054387
16	0.08646	0.39481
17	-0.00995	0.92253
18	-0.10683	0.29762
19	-0.19418	0.058002
20	-0.26832	0.0085616

TABLE C.2. Lagged correlation coefficients and significance (p-value): female labor rights

Appendix D. Policy interventions

Case study 2. Vulnerable female employment.

Figure D.1 illustrates the impact of Directive 2019/1158, a policy designed to mitigate the child penalty faced by female in the European Union (EU) through an introduction of father's quota, on the gender wage gap, using an event-study approach.[17] We define the policy announcement year (2019) as the event year (year 0) and estimate gender wage gap variations relative to this baseline. Our analysis reveals that this directive significantly reduced gender wage disparities. On average, the gender wage gap narrowed by 5.44 percentage points over four years post-implementation. Specifically, the effect was -5.39 percentage points $(95\% CI : [-10.41, -0.37])$ in the first year, peaked at -5.61 percentage points $(95\% CI : [-10.63, -0.59])$ in the second year, and persisted thereafter.

This event study emphasizes that although gender differences in relative productivity are often presumed to be "natural" attributed to female pre-natal and post-natal caregiving responsibilities, and male relative productivity is fixed at one in our model, policy interventions can alter the substantive meaning of this baseline. Specifically, such interventions reduce female traditional involvement in household production, while increasing male engagement in non-market activities, thereby structurally diminishing male relative productivity in the labor market. This dilution of the baseline male relative productivity means that even if female household production duties remain unchanged (i.e., the child penalty persists), female relative productivity still improves. In turn, this improvement indirectly promotes gender equality in labor-market outcomes and facilitates female full labor rights.

[17] Directive (EU) 2019/1158 introduced a mandatory, individual, and non-transferable parental leave quota of at least two months per parent across all EU member states.

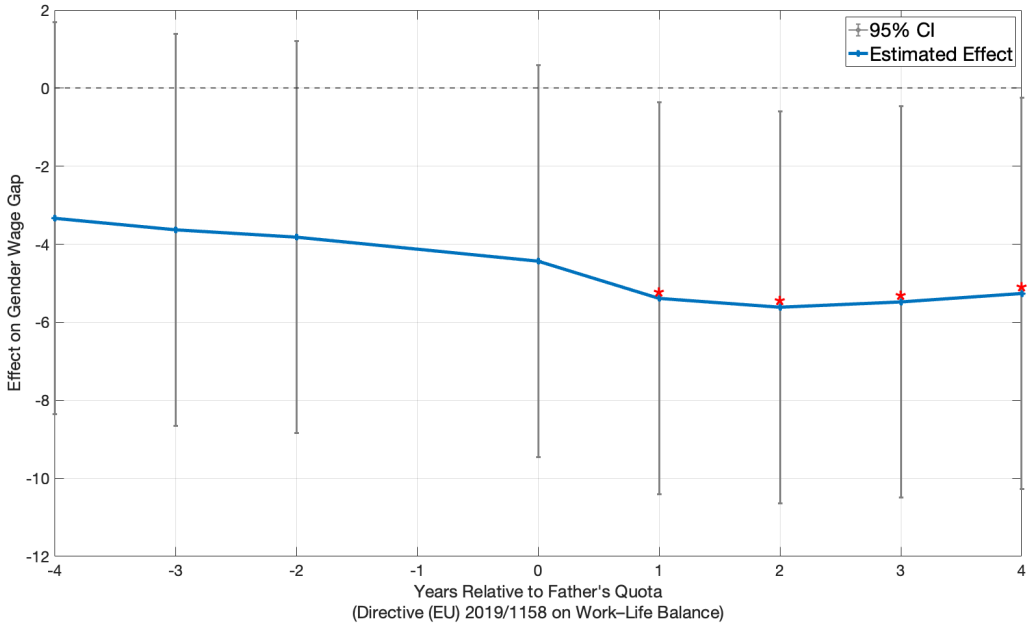


FIGURE D.1. Event study: increasing female relative productivity. Note: Figure shows the impact of the Directive 2019/1158 on the gender wage gap. The horizontal axis denotes event time (years relative to directive implementation), and the vertical axis plots estimated effects in percentage points. Vertical bars represent 95% confidence intervals. Red stars indicate statistically significant based on the 95% confidence interval.

Year	**Effect**	**Year**	**Effect**
-4	-3.33	1	-5.39**
	[-8.35,1.68]		[-10.41,-0.37]
-3	-3.63	2	-5.6137**
	[-8.64,1.39]		[-10.63,-0.59]
-2	-3.82	3	-5.48**
	[-8.84,1.20]		[-10.50,-0.46]
0	-4.43*	4	-5.26**
	[-9.45,0.59]		[-10.28,-0.24]

TABLE D.1. Event study (Relative to Year $t = -1$). Note: We show the point estimate of the outcome along with the lower and upper bounds of the 95% confidence interval. '*' and '**' indicate significance levels at the 10 and 5 percent respectively.

Case study 3. Patrilineal societies in the South Pacific

Country	CEDAW Status	Optional Protocol Status
Fiji	Ratified (1995)	Not Ratified
Papua New Guinea	Ratified (1995)	Not Ratified
Vanuatu	Ratified (1995)	Ratified (2007)
Samoa	Ratified (1992)	Not Ratified
Tuvalu	Ratified (1999)	Not Ratified
Solomon Islands	Ratified (2002)	Ratified (2002)
Kiribati	Ratified (2004)	Not Ratified
Nauru	Ratified (2011)	Not Ratified
Tonga	Not Ratified	Not Ratified

TABLE D.2. CEDAW and Optional Protocol Ratification in South Pacific Countries. Note: Data sourced from the United Nations Treaty Collection. "CEDAW" refers to the Convention on the elimination of all forms of discrimination against women. The "Optional Protocol" allows individual complaints and inquiry procedures.