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# Gender inequality, corruption, and economic development

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## Abstract

We investigate the effect of bureaucratic corruption on economic development when women are discriminated against in the labor market. The analysis is based on a dynamic general equilibrium model in which capital accumulation drives economic development. The government appoints bureaucrats to administer public policy. Corruption arises due to the opportunity for bureaucrats to embezzle public funds. In the event of detection and dismissal, the private sector serves as the bureaucrats' outside option. Our main results can be summarized as follows: first, when the public sector is a more gender-equal employer than the private sector, female bureaucrats are less corrupt than male; second, corruption and development are jointly determined allowing the possibility of a poverty trap; and third, a policy to increase female participation in the public sector potentially reduces corruption and fosters economic development.

## KEYWORDS

corruption, economic development, gender inequality

## JEL CLASSIFICATION

D73; J16; J71; O11

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## 1 | INTRODUCTION

Despite the efforts of governments and multilateral institutions to fight corruption and reduce gender inequality, there still seems to be a long road ahead. Particularly in developing economies, the incidence of corruption and the extent of gender inequality are considerably greater than in advanced economies. With multiple policy objectives competing for limiting resources, governments have to be profound in designing policies. In this paper we seek to contribute to this task. We illustrate why increasing female participation in government may be an effective anti-corruption policy, simultaneously contributing to reduce gender inequality and foster economic development.

Our theory is based on the seminal studies by Dollar et al. (2001) and Swamy et al. (2001) and subsequent studies (Chen, 2013; Esarey & Chirillo, 2013; Esarey & Schwindt-Bayer, 2018, 2019; Grimes & Wängnerud, 2012; Jha & Sarangi, 2018; Michailova & Melnykovska, 2009; Paweenawat, 2018; Samimi & Hosseinmardi, 2011; Treisman, 2007; Wängnerud, 2010) which found a negative correlation between women in politics and corruption using country/state-level studies. However, based on evidence from individual-level studies, there is no consensus on the proposition that women are intrinsically more honest than men (Alhassan-Alolo, 2007; Alatas et al., 2009; Bowman & Giligan, 2008; Debski et al., 2018; Esarey & Chirillo, 2013; Goetz, 2007; Lee & Guven, 2013; Mukherjee & Gokcekus, 2004; Schulze & Frank, 2003; Torgler & Valev, 2010; Rivas, 2013; Vijayalakshmi, 2008).

Without relying on gender differences in moral attitudes, our paper provides an economic explanation for the negative correlation between female participation in government and corruption. Our theory rests on the idea that the private sector serves as an outside option for dismissed bureaucrats. As women are more wage-discriminated against in the private sector than in the public sector, female bureaucrats have a lower-value outside option than their male counterparts. Consequently, female bureaucrats have lower incentives to be corrupt than male bureaucrats. There is ample evidence of wage discrimination against women in both the public and private sectors. Moreover, in a wide range of countries, there is evidence that women are less wage-discriminated against in the public sector than in the private sector. We summarize this evidence in Table 1. The World Bank (2012) also reported the same findings for a wide range of countries. Furthermore, other studies found that corruption is negatively associated with the public–private sector wage ratio (Goel & Rich, 1989; Van Rijckeghem & Weder, 2001).

We have two objectives in this paper: first, to show how increasing female participation in the public sector may result in lower bureaucratic malfeasance, without assuming gender differences in tolerance of corruption; and second, to explore the dynamic general equilibrium interactions between female participation in the public sector, corruption, and economic development. We establish our results within a dynamic general equilibrium framework where corruption and development are determined jointly and endogenously as the outcomes of the individuals' decision given the structure of the economy. A key feature of our model is the existence of multiple development regimes and multiple (history-dependent) equilibria, including a poverty trap.

To the best of our knowledge, our paper is the first to present a theoretical analysis of the links between female participation in the public sector, corruption, and economic development in a macroeconomic framework. To date, the work of Echazu (2010) is the only formal theoretical investigation on the effects on corruption of increasing female participation in the government. Unlike our study, Echazu assumes gender empathy to explain the gender–corruption nexus in a microeconomic partial equilibrium framework.

The remainder of this paper is organized as follows. In Section 2 we give a brief literature review. In Section 3 we present our basic framework and discuss the implications of increasing female participation in the government. Section 4 concludes.

**TABLE 1** Evidence of smaller gender wage gaps in the public sector than in the private sector

Authors	Countries
Arulampalam et al. (2007)	Austria, Belgium, Denmark, France, Germany, Ireland, United Kingdom
Aslam and Kingdon (2009)	Pakistan
Baron and Cobb-Clark (2010)	Australia
Chatterji et al. (2007)	United Kingdom
Daoud and Shanti (2016)	Palestine
Fuller (2005), Gunderson (1979), Mueller (1998)	Canada
Glinskaya and Lokshin (2007)	India
Gornick and Jacobs (1998)	Belgium, Germany, Netherlands, Sweden, United Kingdom, USA
Hou (1993)	Taiwan
Kolberg (1991)	Norway
Panizza and Qiang (2005)	Colombia, Costa Rica, El Salvador, Honduras, Mexico, Panama, Paraguay, Peru, and Venezuela
Freeman (1987), Smith (1976)	USA
Tansel (2005)	Turkey

## 2 | LITERATURE REVIEW

Dollar et al. (2001) and Swamy et al. (2001) found a strong and statistically significant negative association between female participation in the government and corruption in their cross-country studies. Despite a few critiques (Branisa et al., 2013; Debski et al., 2018; Hazarika, 2018; Sung, 2003, 2012), there exist later studies, in various contexts, lending further support to the findings of Dollar et al. and Swamy et al. Some based their findings on the analysis of a world sample (Jha & Sarangi, 2018; Treisman, 2007). Others provided evidence which is region-specific, country-specific, or context-specific. These include evidence found in developing countries (Samimi & Hosseinmardi, 2011), transition countries (Michailova & Melnykovska, 2009), Mexican states (Grimes & Wängnerud, 2012; Wängnerud, 2010), developed countries (Chen, 2013), democratic-leaning countries (Esarey & Chirillo, 2013; Esarey & Schwindt-Bayer, 2019), democratic-leaning countries with high electoral accountability (Esarey & Schwindt-Bayer, 2018), and Asian countries (Paweenawat, 2018). Some of these studies have employed instrumental variable techniques and/or controlled for fixed effects, thereby providing further evidence of causality (Chen, 2013; Esarey & Schwindt-Bayer, 2018, 2019; Jha & Sarangi, 2018; Paweenawat, 2018). Grimes and Wängnerud (2012) and Esarey and Schwindt-Bayer (2019) also found evidence of a two-way causal relationship between women in politics and corruption. Considering the weight of the existing evidence, there seems to be a consensus that increasing female participation in the government reduces corruption.

However, the existing evidence from individual-level studies has not led to a consensus about women's moral superiority. Some found women are less likely to approve corrupt behavior than men (Armantier & Boly, 2013; Bowman & Giligan, 2008; Lee & Guven, 2013; Lee & Guven, 2013; Michailova & Melnykovska, 2009; Rivas, 2013; Schulze & Frank, 2003; Swamy et al., 2001; Torgler & Valev, 2010) due to differences in biology, psychology, and experiences including risk profile. Others pointed out women may be less corrupt than men due to their limited opportunities attributed to the restricted access to male-dominated public office (Alhassan-Alolo, 2007;

Esarey & Chirillo, 2013; Goetz, 2007), culture (Alatas et al., 2009; Debski et al., 2018), institutional contexts (Esarey & Chirillo, 2013, 2018; Vijayalakshmi, 2008) and gender balance (Mukherjee & Gokcekus, 2004). To date, the notion that women are intrinsically less corrupt than men is still subject to debate.

### 3 | THE MODEL

Time is discrete in our framework and is indexed by  $t = 0, 1, 2, \dots$ . We consider an economy inhabited by two-period-lived agents belonging to overlapping generations of dynastic families. Agents work when they are young and consume when they are old. Population is constant and equal to  $x$ . Half of the population are male (denoted by  $m$ ) and the other half are female (denoted by  $f$ ). Formally,  $x = x^m + x^f$  and  $x^m = x^f$ . The size of the skilled labor force in this economy is denoted by  $n$ , and not all agents are skilled:  $n \subset x$ , where  $n = n^m + n^f$ . Skilled agents are homogeneous in terms of productivity and can work in either the private or public sector. In turn, the private sector is divided into two sectors: modern and traditional. Firms in the modern sector hire labor from skilled agents and rent capital from all agents. Modern sector workers are denoted by  $h = h^m + h^f$ . There is also a fixed number of unskilled agents, denoted by  $l = l^m + l^f$ , who work for firms in the traditional sector. The public sector hires labor from skilled agents to administer public funds. Public sector workers or bureaucrats are denoted by  $b = b^m + b^f$ . Finally, all agents are assumed to be risk-neutral. Given this setting, we can express the total population,  $x$ , as follows:

$$x \equiv n + l \equiv h + b + l. \quad (1)$$

The government offers a limited number of positions  $b \subset n$ , whereas the modern sector can hire any worker willing to supply labor inelastically. Skilled agents have preferences regarding the sector they would like to join. If they work in their preferred sector, they derive additional utility, otherwise no additional utility is derived. We assume that male and female agents derive the same additional utility from working in their preferred sector. Hence, skilled agents with a preference for public service will obtain an additional utility of  $\phi^b$  if they work in the public sector, and 0 if they work for a private firm. Similarly, skilled agents with a preference for the private sector will obtain an additional utility of  $\phi^h$  if they work in the modern sector, and 0 if they work in the public sector. Adding a parameter restriction on  $\phi^h$ , skilled agents with a preference for the private sector will effectively choose to work in the modern sector.

Specifically, when deciding in which sector to work, agents take into account the public–private wage differential and the additional utility derived from working in their preferred sector. In principle, the value of  $\phi^h$  should compensate for the wage differential (if any) to induce skilled agents with a preference for the private sector to choose to work for a firm in the modern sector. Consequently, only skilled agents with a public sector preference will apply to work as bureaucrats. We assume there are more skilled agents with a public sector preference than civil service vacancies. As such, public sector positions are always filled, and some skilled agents with a taste for working in the public sector have to work in the modern sector. This assumption is not crucial in deriving our result. However, it ensures that the government is always able to fill all public sector vacancies and get replacements for dismissed corrupt bureaucrats.

The government hires bureaucrats to administer public funds. Bureaucrats supply productive public goods and services which are used in the traditional sector. Corruption arises as a result of the opportunities public officials have to embezzle public money. The government cannot perfectly monitor

the actions of bureaucrats. If a civil servant is discovered embezzling public funds, they are fined the full amount of their legal and illegal income. We assume all corruptible bureaucrats who get caught are able to find another position in the modern sector. Rational bureaucrats take into consideration the public–private wage differential when calculating their expected utility from being corrupt.

### 3.1 | Private sector

#### 3.1.1 | Firms

Output in this economy is produced in two sectors: modern and traditional. These sectors have different production technologies and use different types of inputs of production. Each sector is represented by a unit mass of firms. Firms hire inputs in perfectly competitive markets.

The representative firm in the modern sector produces output using skilled labor and capital with positive production externalities as a result of learning by doing (or learning by investing). Formally, units of output are produced according to the following technology:

$$y_t^h = (h_{mt} + h_{ft})^\alpha k_t^{1-\alpha} K_t^\alpha, \quad (2)$$

where  $\alpha \in (0, 1)$ ,  $h_{it}$  denotes skilled labor of gender  $i$  ( $i = f, m$ ),  $k_t$  denotes capital, and  $K_t$  denotes aggregate capital which serves as the usual proxy for the stock of disembodied knowledge.<sup>1</sup>

We assume the government derives revenue from this sector by imposing a constant proportional tax rate of  $\tau \in (0, 1)$  on its output. Furthermore, following Becker (1971), we assume firms have a “taste for discrimination.” Firms are therefore willing to pay in terms of reduced profits to reduce their association with female workers; firms are utility maximizers rather than profit maximizers. The representative firm is interested in finding the level of wages  $w_{it}^h$  that maximizes its utility. In particular, the firm will act as if the *net* cost of employing a female worker is  $w_{it}^h (1 + d)$ , where  $d > 0$  is Becker (1971)'s “discrimination coefficient” and is assumed to be exogenous. The parameter  $d$  represents the non-monetary cost of discrimination against hiring female workers for the firm.

Assuming the price of output in the modern sector is equal to 1, the firm's utility is given by.

$$U_t^h = (1 - \tau) (h_{mt} + h_{ft})^\alpha k_t^{1-\alpha} K_t^\alpha - w_{mt}^h h_{mt} - w_{ft}^h (1 + d) h_{ft} - r_t k_t. \quad (3)$$

The utility maximization conditions are therefore given by

$$w_{mt}^h = \frac{(1 - \tau) \alpha k_t^{1-\alpha} K_t^\alpha}{h_t^{1-\alpha}}, \quad (4)$$

$$w_{ft}^h = \frac{(1 - \tau) \alpha k_t^{1-\alpha} K_t^\alpha}{(1 + d) h_t^{1-\alpha}}, \quad (5)$$

$$r_t = (1 - \tau) (1 - \alpha) h_t^\alpha k_t^{-\alpha} K_t^\alpha. \quad (6)$$

Given  $d > 0$ , firms discriminate against women,

$$w_{ft}^h = \frac{w_{mt}^h}{1 + d} < w_{mt}^h,$$

where  $1/(1+d) \in (0, 1)$ . To simplify the algebra in our analysis, we define  $\delta \equiv 1/(1+d)$ , where  $\delta \in (0, 1)$ , and consequently

$$w_{ft}^h = \delta w_{mt}^h. \quad (7)$$

In equilibrium,  $h_t = h$  and  $k_t = K_t$ , thus Equations (4)–(6) can be written as.

$$w_{mt}^h = \frac{(1-\tau)\alpha k_t}{h^{1-\alpha}}, \quad (8)$$

$$w_{ft}^h = \frac{\delta(1-\tau)\alpha k_t}{h^{1-\alpha}}, \quad (9)$$

$$r_t = r = (1-\tau)(1-\alpha)h^\alpha. \quad (10)$$

Thus, we find that, in equilibrium, wages are a (linear) function of the capital stock and the return of capital is constant over time.

Next, output in the traditional sector is produced by unskilled agents whose productivity is augmented by the provision of public goods and services that are targeted towards the poor (e.g., health care and education). As the poorer and the less educated members of society tend to gain the most from public goods provision (Anand & Ravallion, 1993; Bidani & Ravallion, 1997), we assume public goods only play a role in the traditional sector. We also assume the government does not impose any taxes on this sector and there is no wage discrimination in this sector. The production function of the traditional sector is given by.

$$y_t^l = l_t g_t, \quad (11)$$

where  $l_t$  denotes unskilled labor and  $g_t$  denotes government expenditure on public goods and services.

Each unskilled agent receives a wage of  $w_t^l$  for providing their labor. Assuming the price of output in the traditional sector is equal to 1, profit is given by

$$\pi_t^l = (l_{mt} + l_{ft}) g_t - w_t^l (l_{mt} + l_{ft}), \quad (12)$$

and profit maximization implies

$$w_t^l = w_{mt}^l = w_{ft}^l = g_t. \quad (13)$$

The government is implicitly taxing skilled workers (male and female) and using these resources to finance expenditure in health care and education to increase the productivity of unskilled workers. Provided the population of unskilled workers is not lower than the population of skilled agents (which is always the case), the wages of skilled workers will always be higher than the wages of unskilled agents:

$$w_{mt}^h > w_{ft}^h > w_t^l. \quad (14)$$

### 3.1.2 | Agents

The population of agents is divided into skilled agents and unskilled agents. Each skilled agent supplies one unit of labor to firms in the modern sector, and each unskilled agent supplies one unit of labor to firms in the traditional sector. Each young agent of generation  $t$  and gender  $i$  working as a worker of type  $j$  ( $j = l, h$ ) receives a salary of  $w_{it}^j$  from supplying inelastically one unit of their labor

endowment to a (modern/traditional) firm. All agents save their total income at the market rate of interest  $r$  to obtain a final level of wealth  $(1+r)z_{it}^l$  when they reach old age.

A modern sector agent consumes part of its wealth and bequeaths the remainder to their offspring. We assume workers in the traditional sector do not leave bequests to their offspring because their income is too low. This is consistent with the notion of bequest as a luxury good (Kopczuk & Lupton, 2007).

Agents working in the modern sector are of two types: those with private sector preference; and those with public sector preference who could not obtain a job in the public sector. As described earlier, the former derive additional utility from working in the private sector, while the latter obtain no additional utility. Agents with a private sector preference and working in the private sector derive a lifetime utility of

$$u_{it}^{hh} = (1+r)(w_{it}^h + q_{it}) - q_{it+1} + v(q_{it+1}) + \phi^h, \quad (15)$$

and agents with a public sector preference but working in the private sector derive a lifetime utility of

$$u_{it}^{hb} = (1+r)(w_{it}^h + q_{it}) - q_{it+1} + v(q_{it+1}). \quad (16)$$

Agents working in the traditional sector derive a lifetime utility of

$$u_{it}^l = (1+r)z_{it}^l. \quad (17)$$

The role of bequests in the model is to ensure the existence of the non-degenerate steady-state equilibrium. Thus, we adopt the simplest form of motive for giving bequests which is altruism consistent with the simple “warm glow” or “joy of giving”; this assumption is reflected by a strictly concave function  $v(\cdot)$  that satisfies the usual Inada conditions. Utility is maximized by setting  $v'(\cdot) = 1$ , implying an optimal fixed size of bequest from one generation to the next,  $q_{it} = q_{it+1} = q$ .

As the rate of interest  $r$  is constant in equilibrium, the expected utility of an agent is fully determined once their expected income or saving is determined. Therefore, each modern sector agent saves  $z_{it}^h = w_{it}^h + q$  and each traditional sector agent saves  $z_{it}^l = w_{it}^l$ .

## 3.2 | Public sector

### 3.2.1 | Government

The objective of the government is to foster economic development and reduce inequality. The government achieves this by providing public goods and services, represented by  $g_t$ , which contribute to the efficiency of output production in the traditional sector, such as health care and education. The government hires bureaucrats to distribute these public funds. Corruption may arise due to the opportunity of bureaucrats to benefit by abusing their positions of authority.

The government determines the salaries of bureaucrats,  $w_{it}^b$ , as follows. Any bureaucrat of gender  $i$  can work for a modern sector firm to receive an income equal to the wage paid to the modern sector worker of gender  $i$ ,  $w_{it}^h$ . The government is interested in attracting agents with a preference for the public sector, but avoiding agents that seek to supplement their income through corruption. To achieve this, the government compares the expected utility of agents from working in the private and public sectors, and sets the salaries of bureaucrats within the range.

$$w_{it}^h - \frac{\phi^b}{1+r} < w_{it}^b < w_{it}^h + \frac{\phi^h}{1+r}.$$



The lower bound,  $w_{it}^h - \phi^b / (1 + r)$ , is the minimum salary that makes an (honest) agent with a public sector preference indifferent between working for a private company and the government. The upper bound,  $w_{it}^h + \phi^h / (1 + r)$ , is the corresponding minimum salary that makes an agent with a private sector preference indifferent between the private and public sectors. Within this range it is convenient to set  $w_{it}^b = w_{it}^h$ .<sup>2</sup> Thus, by paying the same as in the private sector, the government attracts agents with a government preference and provides potentially corrupt agents a disincentive to join. Finally, it is important to mention that the government is not pursuing a wage-based policy to tackle corruption. This is consistent with a recent survey by Gans-Morse et al. (2018) that provides evidence that low wages are associated with high corruption, but high wages are not a sufficient condition to reduce corruption.

Moreover, we assume the government also follows an anti-discriminatory policy. This assumption is based on existing evidence that the public sector discriminates against women less than the private sector. These findings are generally taken as evidence that anti-discrimination enforcement is more effectively and aggressively implemented in the public sector than in the private sector (Arulampalam et al., 2007; Barón & Cobb-Clark, 2010; Fuller, 2005; Melly, 2005; Panizza & Qiang, 2005; Tansel, 2005). Our main results will remain if the government also wage-discriminates against female workers as long as the public sector wage-discriminates against females less than the private sector. To simplify the analysis, we assume that male and female bureaucrats are paid the same wage.

Given all the above considerations, salaries for all bureaucrats in the public sector are set as follows:

$$w_{mt}^b = w_{ft}^b = w_t^b = w_{mt}^h. \quad (18)$$

Assuming that the value of  $\phi^h$  is uniform across gender, we need to set  $\phi^h \geq (1 - \delta) w_{mt}^h$  to make sure that only skilled females with public sector preference apply to work as bureaucrats. In other words, women with private sector preference are willing to accept a lower wage in the modern sector, provided the loss in income is compensated by the extra utility they derive from working in their preferred job.

The government finances its expenditures each period by running a balanced budget. Its revenue consists of the taxes paid by firms plus income recovered from bureaucrats caught engaging in corruption. The government uses the remaining public funds to pay for public goods and services, bureaucrats' salaries and an imprecise surveillance technology to monitor the behavior of public officials. Corruption occurs after the tax rate has been set, and consequently, the government cannot replace the amount stolen by bureaucrats by raising taxes. The government is fully aware when corruption is occurring but it cannot retrieve all stolen income due to its imperfect powers of detection. This implies that corrupt bureaucrats face the probability of detection,  $p \in (0, 1)$ , for each individual corrupt act.

### 3.2.2 | Bureaucrats

The population of bureaucrats is a measure of mass  $b$ . Each bureaucrat supplies one unit of labor to the government for the purpose of administering public funds for the procurement of public goods and services. Such delegation of authority may lead to corruption as bureaucrats may be tempted to appropriate a fraction of public funds under their responsibility. As our focus is on gender differences in incentives to be corrupt, we assume for simplicity that all bureaucrats are corruptible. Generally, bureaucrats may try to avoid detection in various ways, including hiding their illegal income and investing it differently from their legal income. Similar to Blackburn and Sarmah (2008), we consider a simple scenario where bureaucrats hide their illegal income instead of investing it in capital in order to minimize the risk of detection.



Furthermore, we assume that all bureaucrats who get caught can find work in the modern sector. That is, the modern sector is the bureaucrats' outside option. We adopt this assumption due to the evidence of a relationship between the public–private sector wage ratio and corruption (Goel & Rich, 1989; Van Rijckeghem & Weder, 2001). This evidence supports our argument that working in the modern sector is an outside option for a bureaucrat.

After the dismissal of corrupt bureaucrats who get caught, the government conducts a second wave of hiring to fill the vacancies. The government replaces dismissed bureaucrats by attracting skilled agents from the modern sector with a preference to work in the public sector. To preserve the clarity of our subsequent analysis, we assume that the government keeps the gender ratio constant in the first and second wave of hiring. Finally, we assume that after uncovering and dismissing corrupt bureaucrats, the government will very closely monitor the public projects that were under their supervision. As such, the replacement bureaucrats face an implicit probability of detection equal to 1.

Bureaucrats' incentives to be corrupt are modeled as in Van Rijckeghem and Weder (2001), using a variant of Becker and Stigler's (1974) model. Their expected income from being corrupt is determined by the amount of embezzlement, the number of times the embezzlement takes place, the probability of being detected, and the penalties incurred in the event of detection. Corrupt bureaucrats can commit embezzlement more than once during their service. To simplify, the embezzled amount is exogenous and normalized to 1. The level of corruption is therefore determined by the number of corrupt acts. A bureaucrat of gender  $i$  who engages in corruption gets caught with probability  $pC_{it} \in (0, 1)$ , and avoids detection with probability  $1 - pC_{it}$ . The overall probability of detection,  $pC_{it}$ , equals the probability of detection for each individual corrupt act,  $p$ , multiplied by the number of times the corrupt act is committed by a bureaucrat of gender  $i$ ,  $C_{it}$ .<sup>3</sup> If a bureaucrat is found engaging in corruption, then they are fired and subsequently have to find a job in the modern sector. Based on our specification, the modern sector is always hiring. Thus, dismissed bureaucrats will always be able to find a job in the modern sector.

Each young bureaucrat of generation  $t$  and gender  $i$  receives an income of  $z_{it}^b$  comprising a salary of  $w_{it}^b$  from supplying their labor inelastically to the government plus a bequest  $q_{it}$  which they save at the market interest rate  $r$  to obtain a final level of wealth of  $(1+r)z_{it}^b + C_{it}$  when they reach old age. A bureaucrat consumes part of their wealth and bequeaths the remainder to their offspring. As all bureaucrats are skilled agents who prefer to work in the public sector, they derive an additional utility of  $\phi^b$  from working in the government. With probability  $1 - pC_{it}$  a corrupt bureaucrat of gender  $i$  is successful and obtains a lifetime utility of  $(1+r)(w_{it}^b + q_{it}) + C_{it} + \phi^b - q_{it+1} + v(q_{it+1})$ . With probability  $pC_{it}$  a corrupt bureaucrat of gender  $i$  is caught and goes to the modern sector and obtains a lifetime utility of  $(1+r)(w_{it}^h + q_{it}) - q_{it+1} + v(q_{it+1})$ . A corruptible bureaucrat will choose the optimum number of corrupt acts by maximizing their expected utility while balancing the costs and benefits from corruption. We assume that all bureaucrats are risk-neutral. Thus, the expected utility of a corruptible bureaucrat is given by

$$E(u_{it}^b) = (1 - pC_{it}) [(1+r)(w_{it}^b + q_{it}) + C_{it} + \phi^b - q_{it+1} + v(q_{it+1})] + pC_{it} [(1+r)(w_{it}^h + q_{it}) - q_{it+1} + v(q_{it+1})]. \quad (19)$$

In the same way as for the modern sector agents,  $v(\cdot)$  is a strictly concave function that satisfies the usual Inada conditions and utility is maximized by setting  $v'(\cdot) = 1$ , implying an optimal fixed size of bequest from one generation to the next,  $q_{it} = q_{it+1} = q$ . Maximizing Equation (19) with respect to  $C_{it}$  yields

$$C_{it} = \frac{1}{2} \left[ \frac{1}{p} - \phi^b - (1+r)(w_{it}^b - w_{it}^h) \right]. \quad (20)$$

The bureaucrat takes the probability of detection for a single corrupt act as given and ignores the behavior of other bureaucrats.<sup>4</sup> From Equation (20), it is evident that if  $w_{mt}^b - w_{mt}^h \leq w_{ft}^b - w_{ft}^h$  and all other variables are the same across gender, then  $C_{mt} \geq C_{ft}$ . Since the expression  $w_{mt}^b - w_{mt}^h \leq w_{ft}^b - w_{ft}^h$  can be rewritten as  $w_{mt}^b - w_{ft}^b \leq w_{mt}^h - w_{ft}^h$ , Equation (20) tells us that, ceteris paribus, if the gender wage gap in the public sector is smaller than the gender wage gap in the private sector, male bureaucrats will commit more corrupt acts than female bureaucrats.

Furthermore, deriving  $C_{it}$  with respect to  $p$  in Equation (20) yields

$$\frac{\partial C_{it}}{\partial p} = -\frac{1}{2p^2} < 0 \quad (21)$$

This implies that the higher the probability of being detected for each individual corrupt act, the lower the number of corrupt acts that will be committed. As such, if female bureaucrats face a higher probability of being caught (Wängnerud, 2010), they will have lower incentives to be corrupt in the public sector. This is also true if  $p$  represents perceived instead of actual probability of detection and, in fact, if women perceive a higher probability of detection than men as suggested by Richards and Tittle (1981).

By combining Equations (7), (18), and (20), we obtain the number of corrupt acts of male and female bureaucrats respectively as follows:

$$C_{mt} = \frac{1}{2} \left( \frac{1}{p} - \phi^b \right), \quad (22)$$

$$C_{ft} = \frac{1}{2} \left[ \frac{1}{p} - \phi^b - (1+r)(1-\delta)w_{mt}^h \right]. \quad (23)$$

By choosing optimum  $C_{it}$ , a bureaucrat of gender  $i$  maximizes their expected utility; this maximum expected utility is higher than the bureaucrat's utility from being honest (see Appendix A). By comparing Equations (22) and (23), and taking into account that  $\delta \in (0, 1)$ , it should be clear that  $C_{mt} \geq C_{ft}$  for any given value of  $p$  and  $\phi^b$ . In particular,

$$C_{mt} - C_{ft} = \frac{1}{2} (1+r)(1-\delta)w_{mt}^h \geq 0. \quad (24)$$

Equation (24) reveals that the higher the gender discrimination women face in the private sector relative to the public sector (i.e., the lower the value of  $\delta$ ), the fewer the corrupt acts that female bureaucrats commit relative to their male counterparts. The economic intuition behind this is that female bureaucrats face lower incentives to be corrupt than male bureaucrats when the value of their outside option relative to their earnings in the public sector is lower. Equations (23) and (24) also tell us that as the economy develops (i.e., with a higher  $k_t$  and consequently higher  $w_{mt}^h$ ), female bureaucrats reduce their number of corrupt acts.<sup>5</sup> Higher  $w_{mt}^h$  decreases the value of the female bureaucrats' outside option relative to their earnings in the public sector, thereby lowering their incentives to be corrupt. This is because female and male bureaucrats are paid the same wage as male workers in the modern sector ( $w_{mt}^h$ ), but female workers in the modern sector earn only a fraction of  $w_{mt}^h$  due to gender discrimination.

Moreover, depending on the value of  $p$ , which is exogenously given and the same across gender, it is possible that for a certain probability of detection all corruptible female bureaucrats choose to

be honest while male bureaucrats still choose to be corrupt. In fact, male bureaucrats require a higher threshold value of  $p$  than female bureaucrats to have incentives to behave honestly. We can find these probability threshold values for bureaucrats of gender  $i$ ,  $p_{it}^*$ , by setting  $C_{mt} = 0$  and  $C_{ft} = 0$  to obtain

$$p_{mt}^* = \frac{1}{\phi^b}, \quad (25)$$

$$p_{ft}^* = \frac{1}{\phi^b + (1+r)(1-\delta)w_{mt}^h}. \quad (26)$$

Comparing Equations (25) and (26) reveals that  $p_{mt}^* \geq p_{ft}^*$  for any given value of  $\phi^b$ . This implies that male bureaucrats need to face a higher probability of being detected than female bureaucrats to behave honestly. To ensure that  $p_{mt}^*, p_{ft}^* \in (0, 1)$ , we set  $\phi^b \geq 1$ .

Also, if  $p_{ft}^* < p < p_{mt}^*$ , all women in the public sector behave honestly while all men in the public sector are corrupt (i.e.,  $C_{ft} = 0, C_{mt} > 0$ ). As  $p_{ft}^*$  is a decreasing function of  $w_{mt}^h$ , there is a critical level of wage below which  $C_{ft}, C_{mt} > 0$  and above which  $C_{ft} = 0, C_{mt} > 0$ :

$$(w_m^h)^C = \frac{\frac{1}{p} - \phi^b}{(1+r)(1-\delta)}. \quad (27)$$

Moreover, if we combine Equations (8) and (27), we can find a critical level of capital below which both men and women bureaucrats are corrupt, and above which only men bureaucrats are corrupt while women bureaucrats are honest:

$$k^C = \frac{h^{1-\alpha} \left( \frac{1}{p} - \phi^b \right)}{\alpha(1-\tau)(1+r)(1-\delta)}. \quad (28)$$

To ensure that  $(w_m^h)^C, k^C > 0$ , we need to set  $\frac{1}{p} - \phi^b > 0$ . Consequently, we establish a relationship between corruption and development where higher development reduces corruption by inducing female bureaucrats to be less corrupt.<sup>6</sup>

In equilibrium, the total number of bureaucrats is equal to the number of successful corrupt bureaucrats (i.e., those who are not caught) plus the number of replacement bureaucrats. As mentioned earlier, the replacement bureaucrats are honest as they face  $p = 1$ . The utility of a replacement bureaucrat of gender  $i$  is given by

$$u_{it}^{rb} = (1+r)z_{it}^b - q_{it+1} + v(q_{it+1}), \quad (29)$$

and the utility of a successful corruptible bureaucrat of gender  $i$  is given by:

$$u_{it}^{sb} = (1+r)z_{it}^b + C_{it} - q_{it+1} + v(q_{it+1}). \quad (30)$$

As indicated earlier, each successful corrupt bureaucrat of gender  $i$  hides their illegal income,  $C_{it}$ , instead of saving it as part of productive investment; and  $q_{it} = q_{it+1} = q$ . On reaching old age, a bureaucrat

retires and consumes all of their remaining wealth. Each bureaucrat's productive savings are therefore  $z_{it}^b = w_{mt}^h + q$

### 3.3 | General equilibrium

We obtain the dynamic path of capital accumulation in the economy by imposing the equilibrium condition in the capital market by which the total demand for capital is equal to the total supply. To determine the supply of capital (savings), it is necessary to establish the level of government expenditure on public goods and services.

The budget of the government is derived as follows. The only source of revenue for the government is taxes collected from the modern sector,  $\tau y_t^h = \tau h_t^\alpha k_t^{1-\alpha} K_t^\alpha$ . Moreover, in equilibrium  $k_t = K_t$  and  $h_t = h$ , therefore  $\tau y_t^h = \tau h^\alpha k_t$ . The government uses this revenue to pay salaries to bureaucrats,  $b w_{mt}^h$ , to provide public goods and services,  $g_t$ , and to finance an imperfect monitoring (or surveillance) technology at an exogenously given cost of  $s$ .<sup>7</sup> In addition, due to the opportunity for corruption, an amount  $E_t$  is embezzled by corrupt bureaucrats. Thus, corruption affects this economy through its impact on  $g_t$ . Specifically, corruption causes public goods provision to be lower by the amount  $E_t$  and  $s$ . The government runs a balanced budget by equating revenue and expenditure such that

$$g_t = \tau h^\alpha k_t - b w_{mt}^h - E_t - s, \quad (31)$$

where

$$E_t = \begin{cases} (1-pC_{mt}) C_{mt} b_{mt} + (1-pC_{ft}) C_{ft} b_{ft} & \text{if } k_t < k^C, \\ (1-pC_{mt}) C_{mt} b_{mt} & \text{if } k_t \geq k^C. \end{cases} \quad (32)$$

Substituting the optimum value for  $C_{mt}$  and  $C_{ft}$  into Equation (32) yields

$$E_t = \begin{cases} \frac{b}{4} \left[ \frac{1-p}{p} (\phi^b)^2 \right] - \frac{b_{ft}}{4} \left\{ [p(1+r)(1-\delta) w_{mt}^h]^2 + 2p(1+r)(1-\delta) w_{mt}^h \phi^b \right\} & \text{if } k_t < k^C, \\ \frac{b_{mt}}{4} \left[ \frac{1-p}{p} (\phi^b)^2 \right] & \text{if } k_t \geq k^C. \end{cases} \quad (33)$$

Finally, by substituting Equations (4) and (33) into Equation (31), we get the final expression for  $g_t$ :

$$g_t = \begin{cases} \frac{p b_{ft}}{4} \left[ \frac{(1+r)(1-\delta)(1-\tau)\alpha}{h^{1-\alpha}} \right]^2 k_t^2 + \left\{ \frac{\tau h - \alpha(1-\tau) \left[ b - \frac{1}{2} p(1+r)(1-\delta) \phi^b b_{ft} \right]}{h^{1-\alpha}} \right\} k_t - \frac{b}{4} \left[ \frac{1-p}{p} (\phi^b)^2 \right] - s & \text{if } k_t < k^C, \\ \left[ \frac{\tau h - \alpha b(1-\tau)}{h^{1-\alpha}} \right] k_t - \frac{b_{mt}}{4} \left[ \frac{1-p}{p} (\phi^b)^2 \right] - s & \text{if } k_t \geq k^C. \end{cases} \quad (34)$$

Notice that, given that the government runs a balanced budget,  $g_t \geq 0$  for all  $t$ . In other words, bureaucrats cannot embezzle more resources than are available for the provision of public goods.

From Equation (32), we can see that a higher number of corrupt acts increases the overall probability of being detected and at the same time increases the total amount that is successfully embezzled.

Consequently, if  $k_t < k^C$  the net effect of increasing the female proportion in the public sector on total embezzlement is not obvious. Let us explore this in more detail. By finding the derivative of Equation (33) with respect to  $b_{ft}$  and taking into account that  $b_{mt} = b - b_{ft}$ , we obtain

$$\frac{\partial E_t}{\partial b_{ft}} = \begin{cases} -\frac{(1+r)(1-\delta)(1-\tau)p\alpha k_t}{4h^{1-\alpha}} \left[ \frac{(1+r)(1-\delta)(1-\tau)\alpha k_t}{h^{1-\alpha}} + 2\phi^b \right] < 0 \text{ if } k_t < k^C, \\ -\frac{1}{4} \left[ \frac{1}{p} - p(\phi^b)^2 \right] < 0 & \text{if } k_t \geq k^C. \end{cases} \quad (35)$$

Considering Equations (31) and (35), it is easy to see that the higher the number of female bureaucrats (the higher  $b_{ft}$ ), the lower is embezzlement, and the higher is the provision of public goods and services. We will return to this discussion in our subsequent analysis.

We now deduce total savings in the economy and the equation that governs capital accumulation. Each agent employed in the traditional sector, of whom there are  $l$ , saves  $g_t + q$ . Each male agent in the modern sector, of whom there are  $h_{mt}$ , saves  $w_{mt}^h + q$ . Each female agent in the modern sector, of whom there are  $h_{ft}$ , saves  $w_{ft}^h + q$ . Each of the bureaucrats, of whom there are  $b$ , saves  $w_{mt}^h + q$ . By collecting all these terms together, we find the total savings in the economy:

$$S_t = lg_t + h_{mt}(w_{mt}^h + q) + h_{ft}(w_{ft}^h + q) + b(w_{mt}^h + q). \quad (36)$$

Substituting Equations (1), (4), and (7) into Equation (36), and imposing the equilibrium condition in the capital market,  $k_{t+1} = S_t$ , we obtain the dynamic capital accumulation equation:

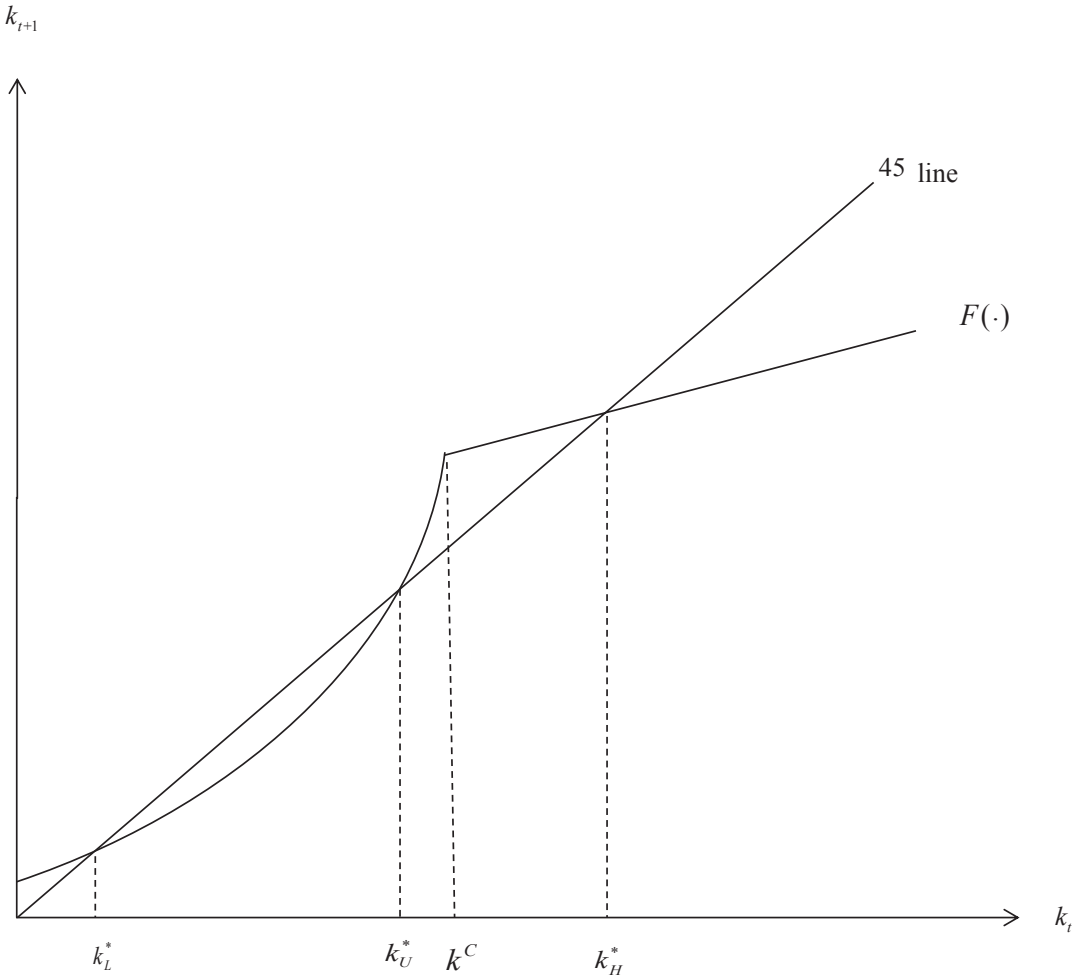
$$k_{t+1} = F(k_t) = lg_t + \frac{(1-\tau)(h_{mt} + \delta h_{ft} + b)\alpha k_t}{h^{1-\alpha}} + nq. \quad (37)$$

From this equation we can see that  $g_t$  affects capital accumulation and therefore development. As corruption affects this economy by reducing  $g_t$  (see Equation (31)), we establish how corruption affects economic development in this economy. Taken together, the results in Equations (34) and (37) imply a two-way causal relationship between corruption and development. The full implications of this are shown by consolidating the results into a single expression that characterizes the capital accumulation process given by the following transition paths:

$$F(k_t) = \begin{cases} \frac{pb_{ft}l}{4} \left[ \frac{(1+r)(1-\delta)(1-\tau)\alpha}{h^{1-\alpha}} \right]^2 k_t^2 + \left\{ \frac{l[\tau h - \alpha\chi(1-\tau)] + \alpha(1-\tau)(h_{mt} + \delta h_{ft} + b)}{h^{1-\alpha}} \right\} k_t + nq - \varepsilon l \text{ if } k_t < k^C, \\ \left\{ \frac{l[\tau h - \alpha b(1-\tau)] + \alpha(1-\tau)(h_{mt} + \delta h_{ft} + b)}{h^{1-\alpha}} \right\} k_t + nq - \frac{b_{mt}}{4} \left[ \frac{1}{p} - p(\phi^b)^2 \right] l - sl & \text{if } k_t \geq k^C. \end{cases} \quad (38)$$

where

$$\chi = b - \frac{p\phi^b b_{ft}(1+r)(1-\delta)}{2}, \quad \varepsilon = \frac{b}{4} \left[ \frac{1}{p} - p(\phi^b)^2 \right] + s.$$



**FIGURE 1** Multiple steady-state equilibria

In what follows we assume that  $(l[\tau h - \alpha \chi(1 - \tau)] + \alpha(1 - \tau)(h_{mt} + \delta h_{ft} + b)) / h^{1-\alpha} \in (0, 1)$  and  $nq - \epsilon l \geq 0$  in order to ensure the feasibility of steady-state equilibria.<sup>8</sup>

Based on the above, we are able to differentiate between two types of development regime for the economy. The first, where  $k_t < k^C$ , is a low-development regime in which the incidence of corruption is at its highest (both male and female bureaucrats are corrupt). The second, where  $k_t \geq k^C$ , is a high-development regime in which the incidence of corruption is at its lowest (only male bureaucrats are corrupt). Those regimes are shown in Figure 1 which depicts the shape of the transition function  $F(\cdot)$  in this economy. A steady-state equilibrium is defined by a stationary point of this function such that  $k^* = F(k^*)$ . The equilibrium is stable if  $F'(k^*) < 1$  and unstable if  $F'(k^*) > 1$ . Three possible equilibria are illustrated in Figure 1. However, only two of them are stable and they may exist simultaneously. One of these (associated with  $C_{mt} > 0, C_{ft} = 0$ ) is a high-development equilibrium in which the steady-state level of capital is

$$k_H^* = \frac{nq - \frac{b_{mt}}{4} \left[ \frac{1}{p} - p(\phi^b)^2 \right] l - sl}{1 - \frac{l[\tau h - \alpha \chi(1 - \tau)] + \alpha(1 - \tau)(h_{mt} + \delta h_{ft} + b)}{h^{1-\alpha}}} > k^C;$$

the other (associated with  $C_{mf} > 0, C_{ff} > 0$ ) is a low-development equilibrium in which the steady-state level of capital  $k_L^*$  satisfies

$$k_L^* < k^C, \quad F'(k_L^*) < 1.$$

In addition, the unstable equilibrium is an intermediate equilibrium in which the steady-state level of capital  $k_U^*$  satisfies

$$k_L^* < k_U^* < k^C, \quad F'(k_U^*) > 1.$$

Our analysis above reveals that the feasibility of transition between development regimes determines the overall evolution of the economy. The complete process of transition is from the low-development regime to the high-development regime. Depending on initial conditions, this transition may or may not be accomplished such that the economy may end up locked in a low-development equilibrium.

Figure 1 illustrates a possible configuration with multiple steady states: two stable steady-state equilibria at  $k_L^*$  and  $k_H^*$  and one unstable at  $k_U^*$ . If the economy starts with a level of capital stock  $k_0 < k_U^*$ , it is inescapably destined to converge to the low-development equilibrium  $k_L^*$ , where all male and female bureaucrats are corrupt. In contrast, if the economy starts with a level of capital stock  $k_0 > k_U^*$ , the economy converges to the high-development equilibrium  $k_H^*$ , where only male bureaucrats are corrupt (and all female bureaucrats are honest). Specifically, when the initial stock of capital is such that  $k_U^* < k_0 < k^C$ , the economy makes the transition from a low-capital-accumulation path to a high-capital-accumulation path after reaching the critical level of capital  $k^C$  and converging to  $k_H^*$  in the long run. In contrast, if the initial stock of capital is such that  $k_0 > k^C$ , the economy is already on a high capital accumulation path and converges to  $k_H^*$ . Hence, the model presents a situation in which initial conditions determine limiting outcomes.

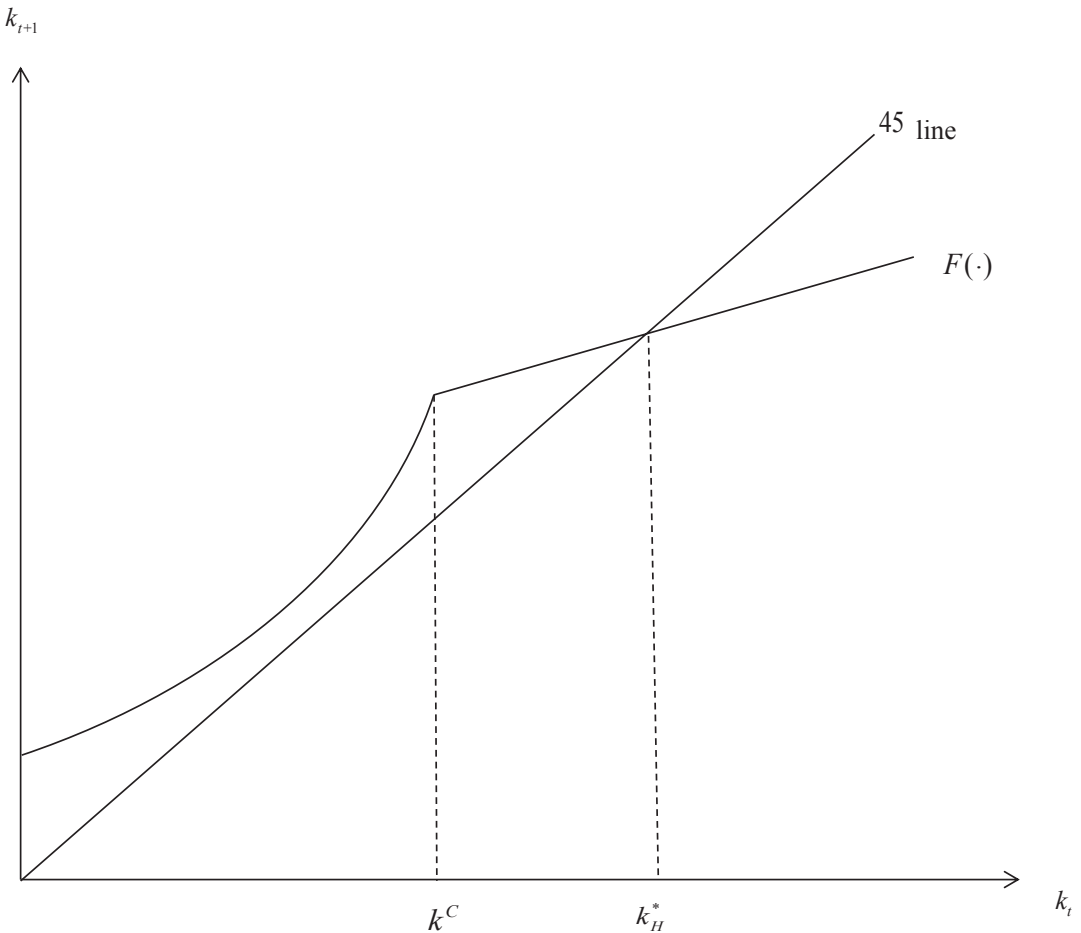
Figure 2 depicts a second possible scenario where there is only a unique stable steady-state equilibrium at  $k_H^*$ . If the initial stock of capital  $k_0 < k^C$ , the economy makes the transition from a low-capital-accumulation path to a high-capital-accumulation path after reaching the critical level of capital  $k^C$ , converging eventually to  $k_H^*$ . In contrast, if the initial stock of capital  $k_0 > k^C$ , the economy is already on a path to converge to the high-development and low-corruption equilibrium  $k_H^*$ . Consequently, regardless of the initial level of capital stock  $k_0$ , the economy undergoes a complete transition towards the high-development equilibrium with declining female corruption, and consequently declining overall corruption, along the transition.

Figure 3 displays a scatter plot of average log real gross domestic product per capita (a proxy for economic development) and average percentage of women in parliament based on available data from 186 countries for the period 1997–2019 (World Bank, 2021). Discounting countries that can be considered as outliers, the figure shows a positive relationship between the share of women in parliament and economic development. This simple but powerful illustration validates our theoretical findings.

### 3.3.1 | Increasing female participation in government

We will now show how an economy in which women are wage-discriminated against in the private sector can potentially move from a low-capital-accumulation path to a high-capital-accumulation path by increasing the proportion of females in the public sector. Analyzing the effect of higher  $b_{ff}$  in





**FIGURE 2** Unique steady-state equilibrium

Equations (34) and (38) reveals that increasing the share of women in the government leads to a higher capital accumulation path and a higher steady-state equilibrium due to the following effects:

1. As illustrated by Equation (35), increasing the female proportion in the public sector reduces the total amount successfully stolen by corrupt bureaucrats. As a result, the actual provision of goods and services in the economy is higher, leading to higher savings and capital accumulation.
2. Given a fixed number of skilled workers of each gender, increasing the female share in the government leads to a lower female share in the modern sector. As a result, there are fewer women being wage-discriminated against in the economy by working in the public sector. Therefore, total savings and capital accumulation in the economy increase.

Figure 4 illustrates a possible scenario where increasing the female proportion in the public sector may result in the economy moving from a multiple steady-state equilibria to a unique steady-state equilibrium. We begin the analysis with the case described in Figure 1, in which the capital accumulation path  $F(\cdot)$  is generating two stable ( $k_L^*$  and  $k_H^*$ ) and one unstable ( $k_U^*$ ) steady-state

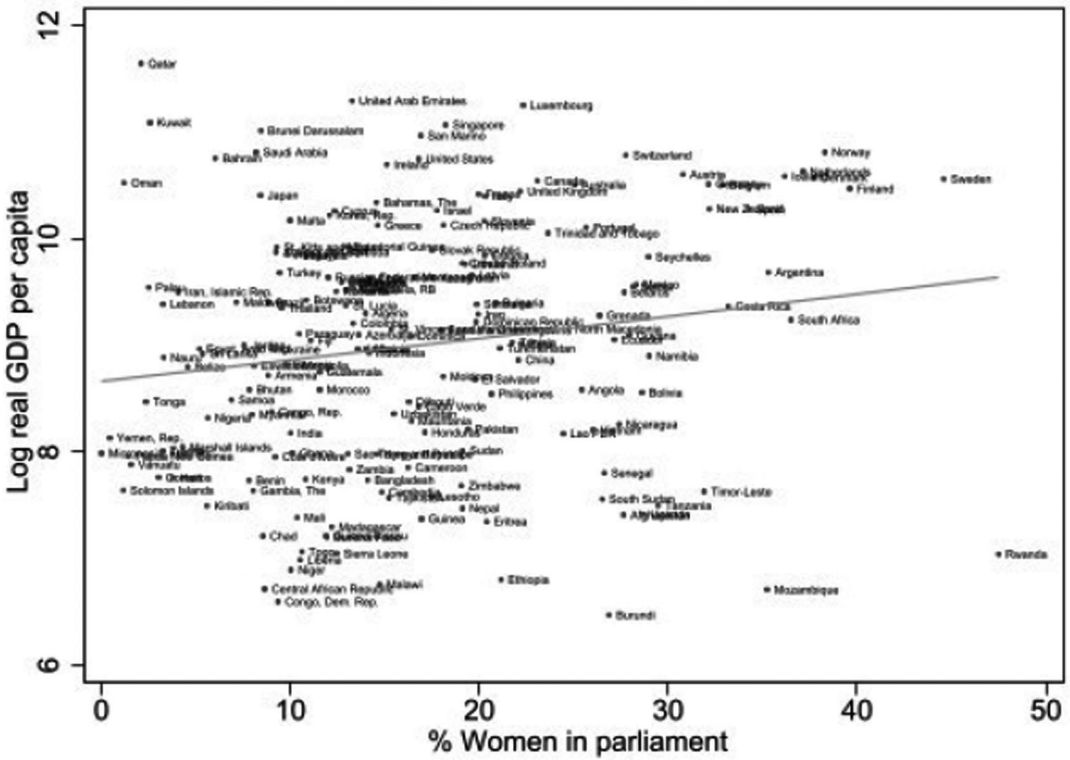
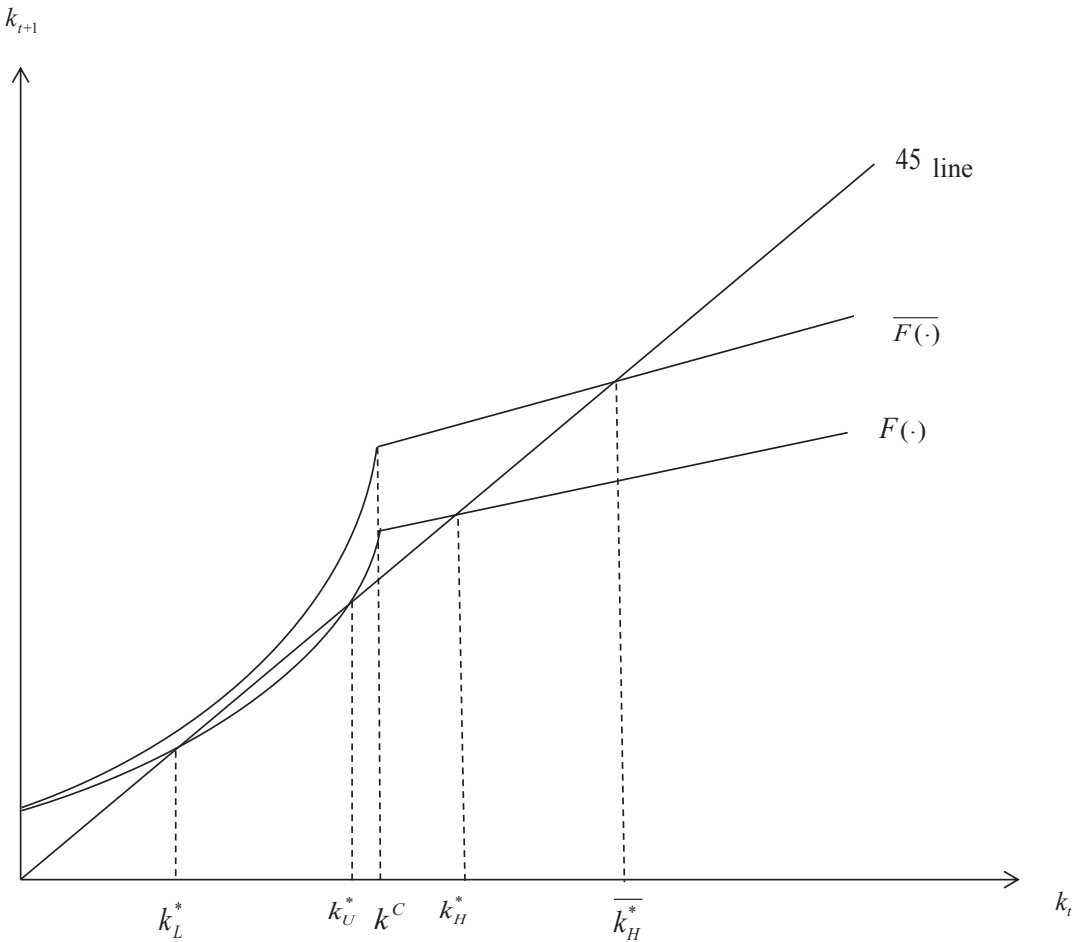


FIGURE 3 Women in parliament and economic development. Data source: World Development Indicators online database (World Bank, 2021)

equilibria. As described before, if the economy starts from  $k_0 < k_U^*$ , it converges to a low steady-state equilibrium  $k_L^*$ . Conversely, if  $k_0 > k_U^*$ , the economy eventually reaches the high steady-state equilibrium  $k_H^*$ . Now let us define  $\bar{F}(\cdot)$  as a capital accumulation path with a higher female proportion in the public sector,  $\bar{b}_{fi} > b_{fi}$ . By inspecting Equation (38), it can be observed that the effect of a higher proportion of women bureaucrats is a steeper and higher capital accumulation path. If  $\bar{b}_{fi}$  is sufficiently high, regardless of the initial level of capital, the economy undergoes a complete transition towards the high-development equilibrium  $\bar{k}_H^*$ . In conclusion, increasing the share of female bureaucrats may result in a situation in which the initial conditions do not determine the economy's limiting outcomes. In addition, even the high-development equilibrium improves with respect to the case with multiple equilibria ( $\bar{k}_H^* > k_H^*$ ).

We would also like to consider a scenario in which increasing the female share of bureaucrats reduces the wage discrimination against women in the private sector.<sup>9</sup> Men and women may differ in terms of their policy preferences (Edlund & Pande, 2002; Lott & Kenny, 1999). Moreover, a higher representation of women in politics could result in more policy outcomes that are in line with women's preferences (Chattopadhyay & Duflo, 2004; Chen, 2010). Based on this evidence, a higher proportion of women bureaucrats may also increase the policies to reduce discrimination in the labor market. In Appendix B we explain our analysis when increasing the female share of bureaucrats also decreases the firms' taste discrimination.



**FIGURE 4** Effects of an increase in the share of women in the public sector

## 4 | CONCLUSION

Our paper provides an economic explanation for the observed negative correlation between female participation in the government and corruption. We do not rely on the existence of gender differences in moral attitudes toward corruption. Thus, we contribute to the gender-corruption literature by proposing another possible factor that may cause women to act more honestly than men. Specifically, female bureaucrats are less corrupt than male bureaucrats given that the public sector discriminates against women less than the private sector. An interesting avenue for future research would be to investigate the disproportionate impact of corruption on women, which has not received as much coverage in the literature.

Given that in most countries women are still under-represented in government, increasing female participation in government should be a primary goal in its own right to foster equal opportunity. Nevertheless, as illustrated in this paper, when the government is a more gender-equal employer than the private sector, increasing women's participation in government could result in lower corruption and higher development, in turn leading to lower corruption and greater gender equality. Therefore, a policy that increases female participation in the public sector must be accompanied by government's continuous efforts to promote overall gender equality in the public sector.

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## DATA AVAILABILITY STATEMENT

Data sharing not applicable.

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## ENDNOTES

- <sup>1</sup> This “learning by investing” externality is widely used in endogenous growth models.
- <sup>2</sup> We choose this value, given that setting  $w_{it}^b = w_{it}^h - \phi^b / (1 + r)$  will only make agents indifferent. To actually attract them to work for the government, we need to set  $w_{it}^b = w_{it}^h - \phi^b / (1 + r) + \epsilon$ , where  $0 < \epsilon < \phi^b / (1 + r)$ . In practice, estimating the values of  $\phi^b$  and  $\phi^h$  may be very difficult, hence by making  $w_{it}^b = w_{it}^h$  the government avoids this issue. In addition, even if we assume that agents will choose to work in the public sector when indifferent, by setting  $w_{it}^b = w_{it}^h - \phi^b / (1 + r)$ , the parameter  $\phi^b$  vanishes from our equations. This has no impact on our results, but we can no longer observe the role of the agents' public sector preference on the incentive to be corrupt.
- <sup>3</sup> As in Van Rijckeghem and Weder (2001), in the case of independent probabilities and for low values of  $p$ , this overall probability of detection approximates the true value. In addition, notice that, defining the overall probability of detection as  $1 - (1 - p)^{C_{ii}}$ , we can use a Taylor series approximation to show that around  $p = 0$ , the function is close to  $pC_{ii}$ ; and around  $p = 1$ , the function approximates 1. However, the result is not clear-cut for a value of  $p = a$ , where  $a \in (0, 1)$ . We can show this by using a first-order Taylor approximation around  $p = a$ . Notice that the overall probability of detection then approximates  $C_{ii}(p - a)(1 - a)^{C_{ii} - 1} + 1 - (1 - a)^{C_{ii}}$ , which creates nonlinearities that would inevitably complicate our analysis. Hence, provided we are in a world in which the probability of detection for a single act of corruption is low, our model still holds.
- <sup>4</sup> We could allow for the behavior of bureaucrats to depend on the actions of their peers. To enrich this extension, we could add a disutility of getting caught when behaving corruptly. Thus, the optimal number of corrupt acts of a bureaucrat of gender  $i$  will be given by  $C_{ii} = \frac{1}{2} \left[ \frac{1}{p} - \phi^b - \gamma - (1 + r)(w_{it}^b - w_{it}^h) \right]$ , where  $\gamma > 0$  is the “shame” of being discovered. We could denote by  $p_c(p_n)$  and  $\gamma_c(\gamma_n)$ , respectively, the probability of getting caught and the disutility of being exposed when everybody else is corrupt (non-corrupt). Based on the literature of frequency-dependent models of corruption (e.g., Andvig and Moene, 1990), we can assume that  $p_c < p_n$  and  $\gamma_c < \gamma_n$ . Hence, it is evident that the number of corrupt acts is greater when the incidence of corruption is high, than when the incidence of corruption is low.
- <sup>5</sup> From Equation (8), we can see that wage level is driven by capital accumulation. Higher wages therefore indicate higher development.
- <sup>6</sup> Based on our discussion in footnote 4, you may recall that we denoted by  $p_c(p_n)$  and  $\gamma_c(\gamma_n)$ , respectively, the probability of detection and the disutility of being ‘shamed’ when everybody else is corrupt (non-corrupt). Using this notation, the critical level of capital described by Equation (28) can take the following form under different levels of corruption:  $k_n^C = [h^{1-\alpha} / \alpha (1 - \tau)(1 + r)(1 - \delta)] \left( \frac{1}{p_c} - \phi^b - \gamma_c \right)$  under high incidence and  $k_n^C = [h^{1-\alpha} / \alpha (1 - \tau)(1 + r)(1 - \delta)] \left( \frac{1}{p_n} - \phi^b - \gamma_n \right)$  under low incidence. Notice that, given that  $p_c < p_n$  and  $\gamma_c < \gamma_n$ , we have that  $k_n^C < k_n^C$ . In other words, the critical level of capital above which female bureaucrats are honest is lower when everybody else is honest than when everybody else is corrupt. This discussion illustrates how our model could be extended to incorporate the issues highlighted by the frequency-dependent literature.
- <sup>7</sup> As in other studies (e.g., Blackburn & Forgues-Puccio, 2007, 2010), we include an exogenous cost of monitoring to illustrate the effect of this additional cost on public finances. One can argue that the probability of detection is a function of the amount spent on monitoring. However, we decided to abstract from these considerations, given that

the probability of detection may depend on a wide range of factors that may reflect the current state of governance in the country. These considerations are outside of the scope of this paper.

<sup>8</sup> Blackburn and Forgues-Puccio (2007) use specific assumptions for the production function and bequests to generate a linear capital accumulation path to study the links between income inequality, corruption, and development. We use the same assumptions to focus on the links between gender inequality, corruption, and development. We are conscious that having fixed bequests when wages are increasing is a simplification. However, this simplification allows us to illustrate our points in a straightforward manner without complicating the model unnecessarily. As we explain later, having public officials separated by gender will result in a nonlinear capital accumulation path anyway.

<sup>9</sup> We thank an anonymous referee for providing this feedback.

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## APPENDIX A

We will prove that the maximum utilities of male and female bureaucrats obtained by choosing the optimum level of  $C_{mt}$  and  $C_{ft}$  given by Equations (22) and (23) respectively are higher than the utility obtained from being honest. The expected utility of a corruptible bureaucrat is given by Equation (19) and the utility from being honest is obtained by setting  $C_{it} = 0$  in that equation. A corruptible bureaucrat of gender  $i$  will commit corrupt acts if the expected utility from being corrupt is higher than the utility from being honest, that is, if

$$\begin{aligned} & \{ (1 - pC_{it}) (1 + r) (w_{it}^b + q_{it}) + C_{it} + \phi^b - q_{it+1} + v(q_{it+1}) \\ & + pC_{it} [(1 + r) (w_{it}^h + q_{it}) - q_{it+1} + v(q_{it+1})] \} \\ & > (1 + r) (w_{it}^b + q_{it}) + \phi^b. \end{aligned} \quad (39)$$

Combining Equations (18) and (39), we obtain the incentive condition for a male bureaucrat:

$$\begin{aligned} & \{ (1 - pC_{mt}) [(1 + r) (w_{mt}^h + q_{it}) + C_{mt} + \phi^b - q_{it+1} + v(q_{it+1})] \\ & + pC_{mt} [(1 + r) (w_{mt}^h + q_{it}) - q_{it+1} + v(q_{it+1})] \} \\ & > (1 + r) (w_{mt}^h + q_{it}) + \phi^b. \end{aligned} \quad (40)$$

Substituting Equation (22) into Equation (40) and rearranging yields

$$p < \frac{1}{\phi^b}. \quad (41)$$

Thus, as long as Equation (41) holds, it pays for a male bureaucrat to be corrupt by choosing the optimum  $C_{mt}$ . Note that the condition expressed in Equation (41) is consistent with the threshold probability of detection for a male in Equation (25). As such, we confirm that the condition represented by Equation (40) is fulfilled.

Combining Equations (39), (7), and (18), we obtain the equivalent incentive condition for a female bureaucrat:

$$\begin{aligned} & \{ (1 - pC_{ft}) [(1 + r) (w_{mt}^h + q_{it}) + C_{ft} + \phi^b - q_{it+1} + v(q_{it+1})] \\ & + pC_{ft} [(1 + r) (\delta w_{mt}^h + q_{it}) - q_{it+1} + v(q_{it+1})] \} \\ & > (1 + r) (w_{mt}^h + q_{it}) + \phi^b. \end{aligned} \quad (42)$$

Substituting Equation (23) into Equation (42) and rearranging yields

$$p < \frac{1}{\phi^b + (1 + r)(1 - \delta)w_{mt}^h}. \quad (43)$$

Thus, as long as Equation (43) holds, it pays for a female bureaucrat to be corrupt by choosing the optimum  $C_{ft}$ . Note that the condition in Equation (43) is consistent with the threshold probability of detection for a female in Equation (26). As such, we confirm that the condition in Equation (42) is fulfilled.

## APPENDIX B

We now relax our earlier assumption of constant discrimination parameter,  $d$ . Instead, we consider a situation where increasing the female share of bureaucrats also decreases the firms' taste discrimination,  $d$ ,

and consequently increases the private sector's female workers' wages by increasing  $\delta$ , the ratio of the private sector's female workers' wages to the private sector's male workers' wages, where  $\delta = 1/(1+d)$ . Equation (9) clearly illustrates this point. Specifically, we assume  $\delta = f(b_{ft})$ ,  $\delta(0) \geq 0$ ,  $\delta(b) \leq 1$ ,  $\delta'(b_{ft}) \geq 0$ , maintaining the assumption of  $\delta \in (0, 1)$ .

As a consequence, this raises the female bureaucrats' outside option in the event that they get detected when they are being corrupt and in turn increases their incentive to commit corrupt acts. This results in a higher  $C_{ft}$ , that is, the optimum number of corrupt acts committed by female bureaucrats (see Equation (23)). A higher  $\delta$  also increases the critical level of capital below which women bureaucrats are corrupt, and above which only men bureaucrats are corrupt while women bureaucrats are honest (see Equation (28)). This means it takes a longer path and higher development to induce women bureaucrats to be honest.

Nevertheless, Equation (35) shows that when  $k_t < k^C$ , increasing the female proportion of bureaucrats unambiguously results in lower total embezzlement as long as  $0 \leq \delta \leq 1$ . This is because as long as women in the private sector face higher wage discrimination than women in the public sector, female bureaucrats will be less corrupt than male bureaucrats, that is Equation (24) still holds. Therefore, a policy to increase the share of women in the government will still have similar effects to the case with constant discrimination. Additionally, lower wage discrimination means higher wages for private sector women and consequently higher savings and capital accumulation. All in all, increasing the female proportion of bureaucrats results in higher development by reducing corruption and increasing wage equality in the economy.