Gender Discrimination and Growth: Theory and Evidence from India

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Abstract

Gender inequality is an acute and persistent problem, especially in developing countries. This paper argues that gender discrimination is an inefficient practice. We model gender discrimination as the complete exclusion of females from the labor market or as the exclusion of females from managerial positions. The distortions in the allocation of talent between managerial and unskilled positions, and in human capital investment, are analyzed. It is found that both types of discrimination lower economic growth; and that the former also implies a reduction in per capita GDP, while the latter distorts the allocation of talent. Both types of discrimination imply lower female-to-male schooling ratios. We discuss the sustainability of social norms or stigma that can generate discrimination in the form described in this paper. We present evidence based on panel-data regressions across Indian states over 1961-1991 that is consistent with the model's predictions.

Keywords: growth, gender discrimination, labor market, allocation of talent, India

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“Woman’s participation in employment outside the home is viewed as inappropriate, subtly wrong, and definitely dangerous to their chastity and womanly virtue. When a family recovers from an economic crisis or attempts to improve its status, women may be kept at home as a demonstration of the family’s morality and as a symbol of its financial security. (…) Well-off and better-educated families may send their daughters to school, but are able to afford the cultural practice of keeping women at home after schooling is complete.”
[“Women and the Economy in India”]

“In terms of skill development, women are impeded by their lack of mobility, low literacy levels and prejudiced attitudes toward women. When women negotiate with banks and government officials, they are often ostracized by other men and women in their community (…). Government and bank officials have preconceived ideas of what women are capable of, and stereotypes of what is considered women’s work.”
[“Chronic Hunger and the Status of Women in India”]

“There is a popular notion among many employers who feel that the men have a greater responsibility in supporting the family than the women and therefore have a greater right to the job.”
[“Report of the Survey of Women Workers’ Working Conditions in Industry”]

I. Introduction

Gender discrimination against women in the market place reduces the available talent in an economy, which has negative economic consequences. Gender discrimination takes many forms. Many social practices seen as *normal* from a religious or cultural point of view (which may have deep historical roots) leave women out of the economic mainstream. These social practices may have profound economic consequences because they do not allow society to take advantage of the talent inherent in women. This paper investigates these economic consequences. Although gender discrimination may have a myriad of other important consequences, including psychological, sociological, and religious, these are not discussed in this paper.

We develop a theoretical model that allows us to explore the economic implications of gender discrimination in the labor market. In the model, individuals are born with a given endowment of entrepreneurial talent and decide how much human capital to acquire, and whether to become managers or workers. Individuals can also engage in home production. Their choices depend on what everyone else is doing, because other people's decisions affect the returns to investment in human capital and the relative returns to becoming a manager or a worker. We study three possible scenarios. First, we analyze the labor market equilibrium without discrimination. Second, we model gender discrimination as an exogenous exclusion of females from managerial positions. Our model shows how this discriminatory practice affects the labor market, the equilibrium wage rate, the allocation of talent across working and managerial positions, the investment in education by individuals (males and females), and economic growth. We show that discrimination tends to lower equilibrium wages for female and male workers, and to reduce investment in human capital by all females and by male workers. We also show that the average talent of managers is smaller in case of discrimination, which accounts for reduced innovation in the economy, and that the average productivity of

workers, which accounts for technology adoption in the economy, is reduced too. Both factors lower economic growth. The fact that the relative average earnings of females relative to males are lower due to occupational segregation matches empirical evidence about the gender wage gap.[1]

Third, we model gender discrimination as a complete exclusion of females from the labor market. That is, women can only engage in home production. In this case, the equilibrium wage rate—and, hence, the average talent and productivity—is the same as in the case of no discrimination. Nevertheless, this type of discrimination is inefficient, because per capita GDP is lower than without discrimination, as home production productivity is lower than that of production outside the home Economic growth is also lower because, even if the innovation and adoption dimensions are not affected, females optimally decide not to invest in human capital. Finally, we discuss why discrimination in the labor market of either type can be sustainable. In particular, the reason that gender discrimination in either managerial positions only or the overall labor market persists may be the existence of substantial transaction costs in marital bargaining, as is argued in the context of noncooperative (separate spheres) bargaining in the marriage market.

While gender discrimination against women in the labor market in developed countries is usually identified with differential wage rates, it is in developing countries that this discrimination appears to take the form of differential access to wage employment (Collier (1994)). To test the implications of the model we take the particular case of India. This is a relevant case for the current study since cultural reasons are there (as in many other countries) known to restrict women's access to work (Kumar *et al.* (1999)).

[1] Treiman and Hartman (1981) for instance using U.S. Census data estimated that as much as 35% of the pay gap was explained by occupational segregation. For more on occupational gender segregation, see Preston (1999), Reskin and Roos (1990), and Strober (1984).

The existence of a great variability in gender sensitivity and customs among Indian states makes it suitable for the sort of econometric analysis that we pursue. Regions in northern India (which tends to be more patriarchal and feudal) have lower female labor force participation rates than southern regions (where generally women have relatively more freedom and a more prominent presence in society). Although the cultural restrictions women face are changing, women are not still as free as men to participate in the formal economy (Drèze and Sen (1995), Dunlop and Velkoff (1999), Nihila (1999)).

In order to make use of the variability over time among states, we then use panel data from sixteen Indian states over 1961-1991. We find that, as predicted by the model, the ratio of female-to-male managers and the ratio of female-to-male total workers are positively and statistically significantly related to total output per capita. Specifically, an increase of 10 percent in the female-to-male ratio of managers would increase per capita total output by 2 percent, while an increase of 10 percent in the female-to-male ratio of total workers would increase per capita total output by 8 percent. Our regressions control for female and male literacy rates, socioeconomic controls, political controls, and state and year fixed effects. Robustness is checked controlling for potential endogeneity of the gender composition of the labor force by using the ratio of prosecutions launched to the number of complaints received under the Maternity Benefits Act (1961) as instrumental variable. We also find that the negative effects of gender discrimination are more serious for particular sectors of the economy like the non-agricultural sector.

The paper is organized as follows. In Section II we discuss some background information. Section III presents some related literature. Section IV contains the model. Section V turns to the empirical evidence, and Section VI concludes and discusses some policy implications.

II. Women and the Labour Market in India: Some Background

Female labor participation in India figures are still low: 22 percent according to the Census of India of 1991, and 28 percent according to the National Sample Survey (Kundu (1999)). The definition of economic activity used by both the Census and the National Sample Survey is somewhat restrictive, even though it takes into account involvement in some household enterprises such as farm activities or small-scale artisan production or transacted service provision.

The evolution of female labor force participation rates in modern India has differed by state. Furthermore, female labor participation in India was lower in 1991 than in 1901-1951, when the participation rate ranged between 28 and 34 percent. While women in the middle classes do not tend to participate in the labor force, women from poorer households cannot afford to not engage in productive activity outside the home. However, women in the upper classes are increasingly free to participate in the labor force, especially in the cities.[2] This suggests the existence of a U-shaped relationship between female labor participation and development as documented in Goldin (1994), who argues that the initial decline in female participation is because of an income effect—due to the change from home production to manual work market production, against which a social stigma (what in this paper we call *social norm*) exists—while, as economies develop, women enter the labor force through white-collar work, against which no social stigma exists.[3] Therefore female labor force participation in India is most likely the result of the interaction between social norms (enforced by social stigma

[2] In India, not until women receive specialized post-secondary education do they see significant improvements in their employment rates (Dunlop and Velkoff (1999)).

[3] "The social stigma against wives working in paid manual labor outside the home is apparently widespread and strong (…). The prohibition is so ubiquitous that it seems likely to be connected with many of the most basic norms in society—those which bind the family together as a productive unit." (Goldin (1994)).

that obliges men to provide for their families) and economic conditions: as Goldin (1994) shows with a simple model, the probability that the stigma will be binding will be greater the larger the family income. In this paper we identify the aggregate consequences of this so-called social stigma (or the social norm that it enforces), in not allowing women to participate in the labor market at certain stages of the development process.

Figure A1 displays the female labor participation rate as a function of logged per capita output, by Indian state.[4] Northwestern states (Bihar, Haryana, Jammu & Kashmir, Punjab, and Uttar Pradesh, with the possible exception of Rajasthan, which shows a slightly increasing pattern) plus Assam, in the North as well, not only have lower female labor participation rates for a given level of development but also are the only states which do not display the increasing part of the U-shape relationship. That is, in these states, development is not easing female access to the labor market—these states are characterized by highly unequal gender relations (large literacy gap by gender, strictly restricted female property rights, strong boy preference, and neglect of female children). In contrast, in South India, where gender relations are less patriarchal and for instance female education has extended relatively rapidly (Drèze and Sen (1995)), states are in the increasing part of the U-shape relationship. This paper addresses the consequences of social norms or stigma that do not allow women to have access to the same labor market opportunities as men which, in India, seem to be stronger in Northwestern states.

[4] The female labor force participation rate used here contains female employers, employees, single workers, and family workers, as a percentage of the female population aged 15 to 59 (see the data appendix for more details and definitions). Examined by group, the proportions of females as both employees and employers have been increasing with respect to development (only slightly for Northwestern states), while the proportion of women as single workers has decreased. The proportion of women as family workers has changed little for most states.

The Government of India has tried to improve the status of women workers through legislation directly targeting women (Maternity Benefits Act (1961), Equal Remuneration Act (1976)), or indirectly (Plantations Labor Act (1951), Contract Labor (1970), Inter-State Migrant Workers Act (1979), Factories Act (1948), and Mines Act (1952)).

Despite the Government's attempts at improving women's working conditions, inequalities remain. Men are more likely to get promotions than women—besides, for men the nature of their jobs often changed with these promotions, unlike women, who usually only got increased responsibility and higher workload. Promotion policies are better in the public sector and unionized companies (Kumar *et al* (1999)). However, the provision for facilities at the workplace is inadequate, regardless of whether the company is unionized.

III. Related Literature

Even though an extensive literature tries and assesses the equity implications of gender inequality (e.g. the existence of unexplained inequality in wages,[5] potential gender gaps in the intra-household allocation of goods through demand analysis[6]) not much has been said about the efficiency costs of this inequality. It is sometimes said that discrimination hinders economic development, but how does this happen? Some studies explore the empirical relationship between different forms of gender inequality and growth. Most of them consist of cross-country analyses that measure gender inequality in terms of

[5] Instances are Blau (1996), Blau and Kahn (1994, 1999), Horrace and Oaxaca (2001), and Tam (1996). For the case of India, see Madheswaran and Lakshmanasamy (1996), who also consider how much of the gender gap among female and male science graduates is due to occupational segregation, and Duraisamy and Duraisamy (1996, 1999a, 1999b).

[6] Deaton (1989, 1997), Burgess and Zhang (2001).

schooling, life expectancy,[7] or the gender wage gap, so that the usual problems arise (e.g. unobserved heterogeneity across countries). Therefore the use of panel data from Indian states constitutes an alternative empirical analysis that might manage to overcome these shortcomings—in fact, to our knowledge this is the first paper that quantifies the aggregate effects of gender discrimination that does not consist of a cross-country analysis.

The type of discrimination used in this paper is related to the concept of discrimination on grounds of employers' tastes, which was first used by Becker (1971), and may be rational in the context of religious or traditional beliefs that may operate as social norms in many countries.[8] The concept of social norm that we use as to explain what we call total discrimination is related to the concept of social stigma in Goldin (1994). We consider discrimination as exogenous while there may certainly be a bunch of factors that can account for discrimination up to some degree. However, we do explore the sustainability of the operating social norm. We argue that inefficiencies arise due to distortions in the allocation of talent. The idea that distortions in the allocation of talent across occupations or sectors have negative growth implications is not new (Murphy *et al.* (1991), Fershtman *et al.* (1996)), but to our knowledge this is the first study to use it in order to analyze the consequences of discrimination.

[7] See Dollar and Gatti (1999), Klasen (1999), Esteve-Volart (2000), Knowles *et al.* (2002), Seguino (2000), or World Bank (2001a) for a survey. Tzannatos (1992) uses simulation and occupational data from a few Latin American countries to assess what would be the change in the gender composition of the labor force and in output were there wage equality across genders.

[8] Nirmala and Parthasarthy (1999) find that marginalisation of women workers in India has been more in low growth states like Bihar and Orissa than in technology-intensive areas such as Punjab. According to the authors, cultural factors, more than technology, lead to women's marginalisation in the Indian labor market.

We adopt a broad concept of discrimination in understanding that inequality or differences in the access to resources (here, the labor market) by gender are in part due to underlying discrimination against women. Several studies report that in many countries it is more difficult for females to have access to human capital, land, and financial or other assets that allow them to be entrepreneurs (Blackden and Bhanu (1999), International Labour Organization (1995)). Even in the 30 most developed countries in the world, the average incidence of females among managers is less than 30 percent. For Africa and Asia (including Pacific countries), according to the International Labour Organization (1995), the rates are lower than 15 percent (data refer to 1985-95), while female labor activity rates figures for 1999 are as low as 9.3 percent for Oman, 10.8 percent for Iraq, 14.5 percent for Jordan, 23.1 percent for Egypt, and 29.4 percent for India (World Bank (2001b)).

There also exists an extensive literature that investigates a reverse relationship, i.e. how gender inequality changes along the development process. Some studies find the linear negative relationship that would be predicted by the neoclassical model, a second array of papers seem to find the U-shaped relationship described by Boserup (1970), in the same way as Kuznets (1955) established for income inequality, while finally another set of papers finds either no robust relationship or mixed results.[9]

This paper can also be related to some studies that explore other types of discrimination or discrimination in a broad sense. Coate and Tennyson (1992) explore what happens when individuals belonging to a group that is discriminated against face higher interest rates in borrowing to enter self-employment. This statistical discrimination is not derived from credit market discrimination, but from labor market discrimination, which spills

[9] See Forsythe *et al.* (2000) for a complete literature review and description of the different approaches.

over to the credit market in the context of asymmetric information regarding borrowers. A related hypothesis could be used to explain the form of partial discrimination that we use in this paper, as we explain later.

Our model is based on a model by Rosen (1982), who analyzed the individual's decision between becoming a manager or a worker in order to match the empirical observation that managers' earnings at the highest hierarchies in large organizations are skewed to the right. As in that paper, we assume that 1) there are multiplicative productivity interactions and 2) the quality of supervision gets congested Models where the decision between being a manager or a worker is given by latent talent (or alternatively, risk aversion) can also be found in Lucas (1978), Kanbur (1979), and Kihlstrom and Laffont (1979).

IV. Model

IV. A. The Division Between Managers and Workers in the Labor Market

Following Rosen (1982), we consider an economy where each firm is run by one manager, who employs workers. Workers, in turn, follow the directions that are given by the manager. In our model, however, individuals can also not participate in the labor market as either workers or managers but rather work in home production.[10]

Individuals are born with a given endowment of underlying managerial talent, denoted by T.[11] Each individual can optimally choose whether she wants to become a manager or a worker. Each person is described by a vector of skills (r,q,q_H), where r denotes managerial skills, q denotes productivity as a (market) worker, and q_H denotes

[10] Home production here refers to productive activity that could be done outside the home (at firms).

[11] This concept is similar to the notion of *energy* used in Becker (1985).

productivity as a home worker. The type of skill she actually utilizes is determined by her decision to be either a manager, a worker, or a home worker, while the other skills remains latent. In our model, we also introduce the possibility of investing in human capital to increase the amount of skills. Also differently from Rosen (1982), talent is only useful for managers.[12] In particular, individuals can acquire higher education and/or primary education. We assume that those who want to become workers acquire only primary education, while those who want to be managers can acquire both primary and higher education. An individual cannot acquire higher education without first having completed primary schooling. No education is assumed to be necessary for the home production sector. Productivity of home workers is then constant and equal to one. That is, individuals can decide whether to become managers, workers, or home production workers. If they are workers, they can study and improve their productivity over one by acquiring primary education; however, if they are engaged in the home production sector then their productivity is equal to one. We assume that skills are given by the following:

$$\begin{aligned} r &= cT\overline{H}_p + (1-c)T^{\beta}H_h^{1-\beta} \\ q &= 1 + H_p^{\sigma} \\ q_H &= 1, \end{aligned} \qquad (1)$$

with $0<\beta<1$ and $0<\sigma<1$, for some constant $0<c<1$. If a (market) worker does not invest in human capital, he has a skill equal to 1. H_j , $j=\{p, h\}$ denotes the level of primary and higher schooling acquired by individuals. Complete primary schooling is denoted by $\bar{H}_p$.

[12] In contrast, Rosen (1982) uses a broader concept of talent (ξ) and assumes that skills are given and equal to $q = a_q + b_q\xi$ and $r = a_r + b_r\xi$, for some constants a_k, b_k, $k = \{q, r\}$.

We assume that entrepreneurial talent at birth is distributed uniformly for males and females. The total population is *P*, one-half of which is female. The product attributable to a manager with *r* skills supervising a total quantity of labor skills $Q = \sum_{i=1}^{N_j} q_i$ is,

$$Y_r = sg(r)f(Q), \qquad (2)$$

where $f' \geq 0$, $f'' < 0$ (diminishing returns), $g' > 0$, *s* is the current state of technology, which is a nonrival, nonexcludable good, and N_j denotes the amount of workers hired by firm *j*'s entrepreneur.[13]

The form *g(r)* can be thought of as the analytical representation of the quality of management decisions, so that greater *r* implies greater *g(r)*. In other words, higher-quality managers make better management decisions. In particular, the term *g(r)* gives a representation of the quality of the entrepreneur who is running the firm, so that there are multiplicative productivity interactions.[14] It also captures the idea that the quality of managers is embodied. This formulation implies scale economies since the marginal product of the additional quality of workers is increasing in *g(r)*. However, the diminishing returns to *Q* imply that this scale economy is congested so that the best manager does not take all the workers.

We assume that Y_r exhibits constant returns to scale and that *f* and *g(·)* are a Cobb-Douglas function; therefore we can rewrite (2) as

[13] We therefore add technology to the original specification in Rosen (1982).

[14] This is related to the production function used in Kremer (1993), where the author considers multiple tasks, and explains how failure of one task can have a knock-on effect on other tasks.

$$Y_r = sr^{\alpha}Q^{1-\alpha}, \qquad (3)$$

with $0<\alpha<1$.

Next we study the occupational decision of individuals. An individual can decide between a managerial position, a working position, and production at home. We assume that an individual who engages in home production does not get any salary—therefore, whatever their level of underlying managerial talent, individuals will prefer being managers or workers in the labor market rather than engaging in the home production sector.[15]

The decision between becoming a manager or a worker does depend on the endowment of managerial talent and is analyzed next.

The managers' problem

A manager with *r* skills faces a two-stage decision. First, how much education (primary and higher) does she want to acquire as a manager? Second, how many workers is she going to hire? She takes wages (*w*) as given. We solve the problem by working backward.

Stage 2: Given skills *r*, the manager's problem is to choose the size of her company (or the size of her labor force, Q_r) that maximizes gross income:[16]

[15] This assumption is not necessary—it is only necessary that the wage received for home production is lower than the wage from market production (which is true in this model, as market workers invest in human capital and hence they are rewarded by their higher productivity), but it simplifies the analysis.

[16] The manager's gross income is profits, while net income corresponds to profits minus total cost of education; net income is ignored here because it plays a role only in stage 1.

$$\max_{Q_r} \quad \pi_r = sr^{\alpha} Q_r^{1-\alpha} - wQ_r \ ,$$

where the price of output is normalized to one and w is the market efficiency price for Q_r (which we call the wage), so that the amount Q_r of worker skills that maximizes profits is given by the first-order condition

$$Q_r = \left[\frac{s(1-\alpha) r^{\alpha}}{w} \right]^{\frac{1}{\alpha}} . \qquad (4)$$

Equation (4) is the demand function for worker skills for the firm, which determines the size of the firm. The greater the manager's skills (r), the larger is her firm; the higher the wage, the lower the hiring; and the better the technology (s), the more workers are hired by r. We can rewrite managers' gross income as

$$\pi_r \equiv \left[s^{\frac{1}{\alpha}} w^{\frac{-(1-\alpha)}{\alpha}} \alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}} \right] r \ . \qquad (5)$$

That is, the profit is a linear function of skills, where the factor of proportionality is a combination of wages and technology.

Stage 1: Given that she knows that she will be rewarded according to (5), the manager chooses a level of human capital that maximizes her net income. We distinguish between primary and higher education, and the manager can only choose her investment in higher education because she needs to acquire $\bar{H}_p$ units of primary education in order to get to higher schooling. Therefore, we can write the manager's problem as

$$\max_{H_{h,r}} \quad \pi_r^{net} \equiv \pi_r - a_p \bar{H}_p - a_h H_{h,r} \ , \qquad (6)$$

where a_j, $j = \{p,h\}$ denotes the cost of each unit of education of primary and higher schooling, respectively.

It makes sense to think that the opportunity cost of education is given by human time and also other inputs, which are combined in the same proportions as in the production of GDP. In particular, it makes sense that a_j and s grow at the same rate. For this reason, we assume that the cost of education evolves according to changes in GDP. That is, $a_j = \lambda_j s$ for positive constants λ_j. The first-order condition for problem (6) implies

$$H_h = \left[(1-c)^{\frac{1}{\beta}} \hat{\alpha} s^{\frac{1}{\alpha\beta}} w^{\frac{-(1-\alpha)}{\alpha\beta}} a_h^{\frac{-1}{\beta}} \right] T , \qquad (7)$$

where $\hat{\alpha} \equiv \alpha^{\frac{1}{\beta}} (1-\alpha)^{\frac{1-\alpha}{\alpha\beta}} (1-\beta)^{\frac{1}{\beta}}$.

That is, since $a_p \bar{H}_p$ is a fixed cost to entrepreneurs, it enters their net income function (6) but does not affect their marginal decisions.

Using (1) and (7), we see that a manager's skill is optimally determined as a function of entrepreneurial talent at birth:

$$r = \left[c\bar{H}_p + (1-c)^{\frac{1}{\beta}} s^{\frac{1-\beta}{\alpha\beta}} w^{-\frac{(1-\alpha)(1-\beta)}{\alpha\beta}} a_h^{-\frac{1-\beta}{\beta}} \hat{\alpha} \right] T , \qquad (8)$$

where $\hat{\alpha} \equiv \hat{\alpha}^{1-\beta}$.

Notice that there is a linear relationship between the person's underlying entrepreneurial talent, T, and her managerial skills, r. Substituting (7) and (8) into (6) and (5) allows us to write managers' net income as a linear function of talent at birth:

$$\pi_T^{net} = \left[c\bar{\alpha}\bar{H}_p s^{\frac{1}{\alpha}} w^{-\frac{1-\alpha}{\alpha}} + (1-c)^{\frac{1}{\beta}} s^{\frac{1}{\alpha\beta}} w^{-\frac{1-\alpha}{\alpha\beta}} a_h^{-\frac{1-\beta}{\beta}} \bar{\alpha}\beta(1-\beta)^{\frac{1-\beta}{\beta}} \right] T - a_p \bar{H}_p, \qquad (9)$$

where $\bar{\alpha} \equiv \alpha(1-\alpha)^{\frac{1-\alpha}{\alpha}}$. That is,

$$\pi_T^{net} = \underset{(-)}{\psi}(\underset{(-)}{w}, \underset{(+)}{s}, \underset{(-)}{a_h}) \cdot T - a_p \bar{H}_p .$$

Managers' net income is depicted as in the profit line in Figure 1.

Since *s* and a_h are proportional, then ψ is homogeneous of degree one in *s* (because the wage rate will also grow at the same rate as *s*). That is, since *s* and a_j grow at the same rate, in the steady state profits, wages and, therefore, GDP all grow at the same rate. However, H_h will remain constant over time.

The workers' problem

(Market) workers earn *qw* as gross income. They can increase their productivity (*q*) by studying. Education for workers is primary education, with unit cost equal to a_p. Since the maximum amount of primary schooling is $\bar{H}_p$, more schooling does not benefit workers. Using (1), we can write the problem of workers as

$$\begin{aligned} \max_{H_p} \quad & I_w^{net} = wq - a_p H_p \\ s.t. \quad & H_p \le \bar{H}_p \\ & q = 1 + H_p^{\sigma} . \end{aligned}$$

The optimal investment in primary education by workers is given by the first-order condition

$$H_{p,w} = \left[\frac{w\sigma}{a_p} \right]^{\frac{1}{1-\sigma}}. \qquad (10)$$

The optimal decision in (10) is smaller than $\bar{H}_p$ as long as the wage rate is relatively low, in particular, as long as

$$w \leq \frac{a_p \bar{H}_p^{1-\sigma}}{\sigma}. \qquad (11)$$

Also, according to (10), the human capital investment for all workers is the same, regardless of underlying entrepreneurial talent. As long as the cost of schooling is the same, we can write

$$I_w^{net} = w + w^{\frac{1}{1-\sigma}} a_p^{-\frac{\sigma}{1-\sigma}} \hat{\sigma},$$

where $\hat{\sigma} \equiv \sigma^{\frac{\sigma}{1-\sigma}}(1-\sigma)$. That is, the workers' net income is increasing in the wage rate and decreasing in the cost of schooling. The net income schedule for workers as a function of T is drawn in Figure 1. It is a horizontal line in T because the underlying managerial talent is only useful for managers.

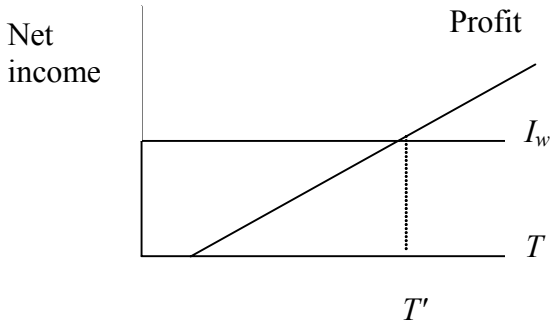

Figure 1. Net Income Schedules for Workers and Managers

The determination of workers and managers

In Figure 1, we see that individuals with underlying entrepreneurial talent less than *T'* optimally decide to be workers, while those with more underlying entrepreneurial talent than *T'* optimally decide to be managers. We call *T'* the cutoff level of talent since this is the level of underlying talent of the least-talented manager in the economy.[17]

Proposition 1 *A decrease in wages decreases the cutoff level of talent in the economy.*

Proof: see appendix.

[17] The single-crossing property in the model, which determines who will be a manager and who will be a worker according to latent talent, is a simple feature in Rosen (1982) that we get with only assuming that net income schedules have different slopes (see footnote 12). Here we endogenize income schedules for two reasons: first, in order to see how a change in the labor market equilibrium affects occupational decisions of individuals and hence potential distortions, and second, to study the role of human capital.

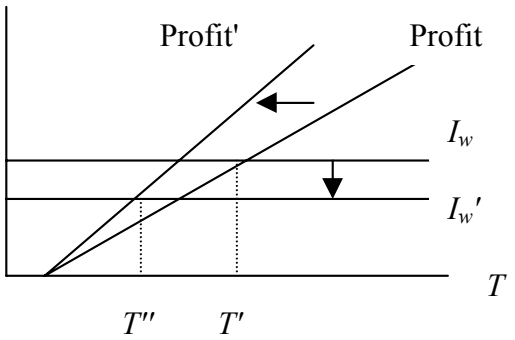

Figure 2. Effects of a Decrease in Wage Rates

The intuition of Proposition 1 is that, when wages fall, the incentive to be a manager increases. Since talent is uniformly distributed, some of those who were previously workers now decide to be managers, so that the least-talented manager is less talented than was the case at the higher level of wages.

As shown in Figure 2, a decline in wages, which entails a decline in workers' net income from I_w to I_w' and hence an increase in profits, from Profit to Profit', unambiguously results in a decline in *T',* the cutoff level of talent of managers, to *T''*.

IV.B. Labor Market Equilibrium Without Gender Discrimination

In order to solve for the equilibrium wage rate *w*, we need to compute the aggregate supply and demand for worker skills. Notice that in this scenario, no individual engages in home production, because they get higher income from working as either workers or managers.

Aggregate supply of workers' skills without gender discrimination

We assume that the distribution of initial talent is uniform between 0 and 1 (Figure 3).

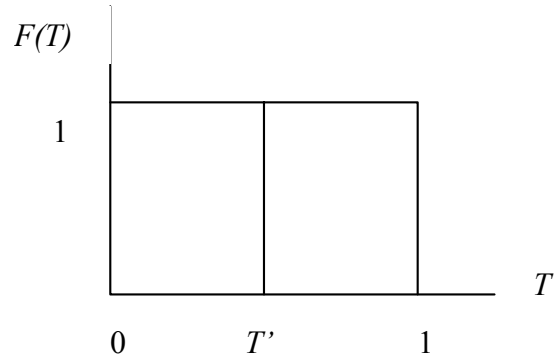

Figure 3. Distribution of Underlying Managerial Talent in Population

The fraction of the entire population that becomes workers is the integral between 0 and *T'*. From (9) we know that each of them will acquire the same amount of education, so that the skill of each worker is

$$q = 1 + \left[\frac{w\sigma}{a_p} \right]^{\frac{\sigma}{1-\sigma}}.$$

The aggregate supply of worker skills (Q) is, hence, given by

$$Q_s^{ND} = \int_0^{T'(w^{ND})} P \left[1 + \left[\frac{w^{ND}\sigma}{a_p} \right]^{\frac{\sigma}{1-\sigma}} \right] dT = P \cdot T'(w^{ND}) \cdot \left[1 + \left[\frac{w^{ND}\sigma}{a_p} \right]^{\frac{\sigma}{1-\sigma}} \right], \qquad (12)$$

where *ND* stands for nondiscrimination. As we showed in Proposition 1, the cutoff level of talent is an increasing function of the wage rate. Hence, the supply of workers is an increasing function of the wage rate for two reasons. First, higher wages lead to more workers and fewer managers (this is represented by the *T'(w)* term). Second, higher wages increase the incentive to acquire worker skills. Note than even if we do not allow workers to acquire skills, the labor supply is still upward sloping.

Aggregate demand for worker skills without gender discrimination

Each firm's demand for worker skills is given by (4). There is a one-to-one relationship between managerial skills (r) and underlying entrepreneurial talent (T), given by (8), so that we can write the demand for labor of one firm in terms of T:

$$Q_T = s^{\frac{1}{\alpha}}(1-\alpha)^{\frac{1}{\alpha}} w^{ND-\frac{1}{\alpha}} \left[c\overline{H}_p + (1-c)^{\frac{1}{\beta}} s^{\frac{1-\beta}{\alpha\beta}} w^{ND-\frac{(1-\alpha)(1-\beta)}{\alpha\beta}} a_h^{-\frac{1-\beta}{\beta}} \hat{\alpha} \right] T \equiv \mu(\underset{(-)}{w^{ND}}, \underset{(+)}{s}, \underset{(-)}{a_h}) T .$$

The aggregate demand for worker skills is the sum of individual demands across all entrepreneurs; this demand can be represented as the individuals from the cutoff level of talent (T') to talent equal to 1 (Figure 3), multiplied by P, the total population:

$$Q_D^{ND} = \int_{T'(w^{ND})}^{1} \left(\mu(w^{ND}, s, a_h) \cdot T \right) P \cdot dT = P\, \mu(w^{ND}, s, a_h) \left[\frac{1}{2} - \frac{T'^2(w^{ND})}{2} \right]. \qquad (13)$$

Holding constant T', the aggregate demand for worker skills is decreasing in wages, increasing in technology, and decreasing in the unit cost of higher education. Holding these three constant, aggregate demand for worker skills is decreasing in T'. Since we showed that T' is increasing in wages, it follows that the aggregate demand function depends negatively on wages for two reasons. First, as wages increase, each firm will demand fewer workers. Second, when wages rise, the cutoff level of talent increases, that is, fewer people want to be managers and the number of firms demanding workers declines. Hence, the overall effect of wages on labor demand is negative.

The equilibrium wage rate is given by the equalization of (12) and (13), as seen in Figure 4.

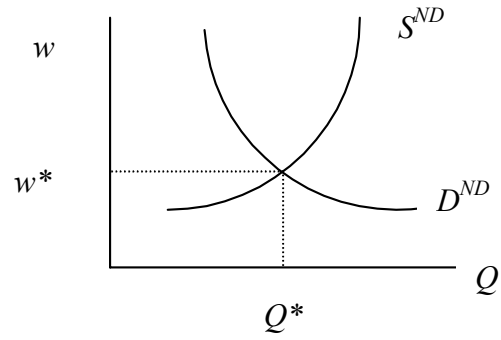

Figure 4. Labor Market Equilibrium Without Discrimination

The number of entrepreneurs

Let the total number of managers be M, which is the sum of male and female entrepreneurs, $M=M^f+M^m$. Since males and females are each one-half of the total population, and both genders are assumed to have the same underlying entrepreneurial talent, the total number of entrepreneurs without discrimination is

$$M^{ND} = M^{m,ND} + M^{f,ND} = \frac{P}{2}\int_{T'(w^{ND})}^{1} 1\,dT + \frac{P}{2}\int_{T'(w^{ND})}^{1} 1\,dT = \left[1 - T'(w^{ND})\right]P. \qquad (14)$$

Economic growth

How does the allocation of talent determine the growth rate of the economy? We assume that the increase in technology is determined by three factors.

First, we consider that one determinant of growth is the average quality of ideas in the economy, where the quality of ideas can be represented by the underlying entrepreneurial talent of managers (this is the *innovation* aspect of growth).[18] The reason

[18] This is related to Murphy *et al.* (1991), where it is assumed that technology is determined by the underlying entrepreneurial talent of the most talented of the entrepreneurs.

is that managers are heterogeneous, implying that the average quality of ideas will be a combination of *good* and *bad* ideas. Whether an idea is good or bad is apparent only after it has been tried out. If the idea turns out to be good, then it is adopted and the level of technology increases. If it is bad, time and effort are wasted without any benefit. If more talented people tend to have good ideas and less talented people tend to have bad ideas, then people with smaller-than-average talent will tend to hurt the economy. Hence, one important factor is the average talent of managers.

Second, we assume that economic growth also depends positively on the average workers' productivity (*adoption* aspect of growth). The intuition is that more productive workers will be more able to follow the manager's instructions and hence will adopt innovation better.[19]

Finally, we assume that there is a *residual* dimension to growth that is related to health issues and is basically determined by the education of individuals who engage in home production. The intuition is that, even if some people in the economy may not work in the labor market, increasing their education increases growth because they become more aware of e.g. health issues (this is empirically plausible especially in developing countries).[20]

[19] These two factors are related to Acemoglu *et al.* (2002), who assume that there is an innovation and adoption or investment dimensions to growth; however in their setting there is a trade-off between the two dimensions.

[20] Pritchett and Summers (1996) and Martin *et al.* (1983) provide empirical evidence for less developed countries that higher levels of education (controlling for income) are associated with lower levels of infant and child mortality. Rajna *et al.* (1998) estimate that, even controlling for socioeconomic factors, illiterate women in Uttar Pradesh (India) face a 1.6 times higher risk of later childhood deaths of their children compared with women educated to at least the middle school level. More generally, recent evidence (Topel (1999), Krueger and Lindahl (2001)) suggests there is a positive correlation between education and economic growth (using both the change and initial level of education, even though the latter is appropiate for countries with very low levels of education only).

In particular,

$$s(t) = s(t-1) \cdot \{1 + f(AT(T'(w)), AP(H_p(w)), NE)\},$$

where *f'* is positive in all of its arguments and *AT* denotes average talent of managers, *AP* denotes average workers' productivity, and *NE* denotes average education of individuals who engage in home production.

Then it follows that the rate at which technology, costs of education, wages, and profits grow in this economy is some combination of *AT*, *AP*, and *NE* (in case there are home workers). Therefore, the growth rate of the economy is given by some combination of

$$AT = \frac{1}{2}(1 + T'(w)) \qquad (15)$$

$$AP = 1 + H_p(w)$$

$$NE = H_p(0).$$

IV.C. Labor Market Equilibrium with Gender Discrimination in Managerial Positions

We now consider the implications of gender discrimination. We analyze two cases. First, gender discrimination can occur in managerial positions (that is, the case in which women are not allowed to be entrepreneurs). In the next section, we look at the stronger case of discrimination in which women cannot take part in the labor force either as managers or as workers. We refer to the former as *partial* discrimination (*PD*), and the latter, as *total* discrimination (*TD*). Instead, we could model partial discrimination assuming that setting a firm requires a fixed investment, such that the entrepreneur has to borrow some amount of money. Then partial discrimination would for instance consist of women facing higher interest rates in the credit market. For interest rates high enough,

no female would decide to be an entrepreneur. That is, this type of discrimination in the labor market could be the result of discrimination in the credit market.[21] A more subtle way to think about this is in the context of a low self-esteem hypothesis: suppose that individuals cannot observe their endowment of *T*, the underlying managerial talent, and that women are told (e.g. by society in general) that they are not talented enough to be managers—this would become self-fulfilling in the sense that women will not invest into higher education and disproportionately fill working positions.

Aggregate supply of worker skills with partial gender discrimination

Suppose gender discrimination consists of not allowing women to have access to managerial positions. Women, however, may still have access to schooling and worker positions. Notice that since earnings as home worker are zero, women who would be managers without discrimination will still prefer to work in the labor market (even as workers) and earn wages than to engage in home production. Therefore, in this scenario no individuals become home workers. For every wage, partial discrimination affects the demand and supply of worker skills. The supply of workers will tend to increase because all women are now workers:

$$Q_s^{PD} = \frac{P}{2}\cdot T'(w^{PD})\cdot\left[1+\left[\frac{w^{PD}\sigma}{a_p}\right]^{\frac{\sigma}{1-\sigma}}\right]+\frac{P}{2}\cdot q(w^{PD}) = P\left[1+\left[\frac{w^{PD}\sigma}{a_p}\right]^{\frac{\sigma}{1-\sigma}}\right]\left(\frac{T'(w^{PD})+1}{2}\right). \qquad (16)$$

Since $T'(w)<1$, the rightmost term is larger than $T'(w)$. Hence, for every wage, the supply curve with partial discrimination is to the right of the curve without discrimination.

[21] In what would be the opposite case, Coate and Tennyson (1992) show that, under some condition, individuals who are discriminated against in the labor market will face higher interest rates and will hence have less incentive to enter self-employment than those who are not discriminated against, even after allowing for investments in human capital. In both cases though, discrimination in one market spills over to another market.

Aggregate demand for worker skills with partial gender discrimination

Demand for worker skills will tend to fall because there are no female managers:

$$Q_D^{PD} = \int_{T'(w^{PD})}^{1} \left(\mu(w^{PD}, s, a_h) \cdot T\right) \frac{P}{2} dT = \frac{P}{2} \mu(w^{PD}, s, a_h) \left[\frac{1}{2} - \frac{T'^{2}(w^{PD})}{2}\right].$$

For every wage, demand for worker skills is one-half of what it was without discrimination. In other words, the demand curve with partial discrimination is to the left of the curve without discrimination. Hence, the equilibrium wage unambiguously declines (see Figure 5). The change in the total quantity of worker skills that is hired in equilibrium is ambiguous because, with discrimination, we have higher supply and lower demand.

The intuition is that, for a given wage rate, the human capital investment decisions of men and the cutoff level of talent for men remain unchanged. Hence, discrimination against women in managerial positions has two consequences. First, it increases the supply of workers, as all women become workers. Second, it decreases the demand for workers, as all firms that would have been headed by women no longer exist. Both factors work to lower the wages of workers.

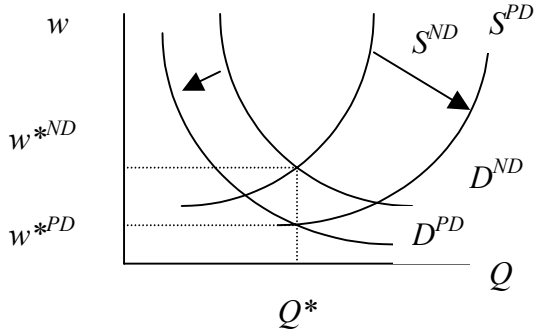

Figure 5. Labor Market Equilibrium with Partial Gender Discrimination

The number of managers with partial gender discrimination

In this case, the total number of female managers is zero (by definition); at a given wage, therefore, the total number of entrepreneurs will decline. Since the equilibrium wage is lower, the cutoff level of talent for the remaining male managers is lower, so more males are going to become entrepreneurs. Hence, the total number of managers is

$$M^{PD} = M^{m,PD} + M^{f,PD} = \frac{P}{2}\int_{T'(w^{PD})}^{1} 1\,dT + 0 = \left[1 - T'(w^{PD})\right]\frac{P}{2}.$$

Since $T'(w^{PD}) < T'(w^{ND})$ while $P/2 < P$ (that is, the number of male managers is larger because of lower wages while the number of female managers drops to zero), the overall effect of this type of discrimination on the number of entrepreneurs is ambiguous. Since the fraction of the population who are managers (1-T') is very small, it is possible that we end up with more managers when there is partial gender discrimination, because a higher proportion of men will decide to become managers; it depends on the sensitivity to wages of the cutoff level of talent for males and the sensitivity of the wage rate to the requirement that all women work as workers. In sum, the change in the number of entrepreneurs is ambiguous, but it is likely that the decrease in the number of managers due to the prohibition of female managers is larger than the increase of male managers due to the lower equilibrium wage.

Proposition 2 *For wages high enough, workers complete primary school even in the case of partial discrimination (which implies a wage cut). In that case, the ratio of female-to-male primary education is the same as without discrimination, that is, equal to one. However, for wages low enough, the ratio of female-to-male primary education is lower in the case of partial discrimination than in the absence of discrimination.*

Proof: see appendix.

Corollary *For developed countries, where wages tend to be high, there is no gender inequality in primary education even in the case of partial discrimination. In contrast, for developing countries, where wage rates tend to be low, partial discrimination implies gender inequality in primary education.*

Propositions 3 and 4 establish the implications of the effects of partial discrimination from the first case (developing countries), which is empirically the most plausible:

Proposition 3 *Discrimination against females in managerial positions implies (i) lower female education than without discrimination, (ii) more education for male managers and less education for male workers, and (iii) lower average education for females than for males in both primary and higher education.*

Proof: On the one hand, by (10) lower equilibrium wages imply that workers will optimally invest less in education. Therefore it follows that females (who cannot become managers by definition) will all invest less in education. The same applies for male workers. By (7), lower wages on the other hand imply that male managers will increase their investment in higher education (primary education for managers is fixed). Finally, females have lower average education than males in both primary and higher education, since 1) females who were managers without discrimination will, with partial discrimination, reduce their investment in primary education as workers because the returns are lower, and 2) women who were workers without discrimination reduce their acquirement of primary studies. QED

The change in average male education is however ambiguous because the change in the number of managers is ambiguous.

Proposition 4 *Discrimination against females in managerial positions implies lower economic growth.*

Proof: Lower equilibrium wages in the case of partial discrimination implies, according to Proposition 1, a lower cutoff level of talent. On the one hand, according to (15), the latter in turn implies that the average talent of entrepreneurs is smaller (which leads to less innovation). On the other hand, workers' productivity depends on their primary education, which in turn depends on wages. By Proposition 3 we know that male workers optimally decide to study less than without discrimination, so average workers' productivity is lower (leading to less adoption). Both factors imply a lower rate of economic growth. QED

Therefore discrimination in the form of a social norm that does not allow women to be managers has negative implications for growth.[22]

IV.D. Labor Market Equilibrium with Total Gender Discrimination in the Labor Market

[22] A similar conclusion might be reached through an alternative type of discrimination. Suppose that girls face a larger cost of higher schooling than boys, that is, $a_{h,f} > a_{h,m}$, where *f* denotes female and *m* denotes male. This could be the result of a social norm where paternalistic parents are willing to pay for their daughter's primary education if they have the means but not the extra amount needed for higher education, because women are not expected to enter the labor force in the future, therefore there are no private gains from girls' higher education. Then it can be shown that since women face lower incentives to be managers, in equilibrium wages are lower than without discrimination, and a larger proportion of men than of women become managers—nevertheless those women who become managers are in average more talented than male managers, even though their average education will be lower than their male counterpart. Furthermore, under a certain condition it can be shown that this situation lowers the average cutoff level of talent and hence economic growth.

Aggregate supply of worker skills with total gender discrimination

Suppose gender discrimination consists of not allowing women to have access to managerial positions or to become workers. We interpret this as a social norm that is enforced by the existence of social stigma, in the same spirit as Goldin (1994) describes social stigma as a deterrent to women's participation in the labor market.[23] In particular, she models this social stigma as a cost to the household: each family has a value S giving the utility that would be lost from the social stigma of having a wife work for wages ("only a husband who is lazy, indolent, and entirely negligent of his family would allow his wife to do such labor"). This cost is not a function of the number of hours at work but is "all or none". In this paper, in order to see the aggregate costs of such social stigma, we assume that the cost that this social norm or stigma represents is large enough for women to turn to the home production sector. This could be modeled in an intrahousehold context, as in Goldin (1994), and the result would be the same.

In this case, females' human capital is zero because, in this model, education is only useful to individuals who take part in the labor market. For every wage, this affects the demand and supply of worker skills. Supply in this case is

$$Q_s^{TD} = \frac{P}{2} \cdot T'(w^{TD}) \cdot \left[1 + \left[\frac{w^{TD}\sigma}{a_p} \right]^{\frac{\sigma}{1-\sigma}} \right]. \qquad (13')$$

Hence, for a given wage, the supply of worker skills is one-half of the supply without gender discrimination.

[23] More precisely she associates social stigma to having a wife work as a manufacturing operative or manual labourer.

Aggregate demand for worker skills with total gender discrimination

As in the case of gender discrimination in managerial positions, demand for worker skills is simply one-half of what it was without discrimination.

$$Q_D^{TD} = \int_{T'(w^{TD})}^{1} \left(\mu(w^{TD}, s, a_h)\cdot T\right) \frac{P}{2}\, dT = \frac{P}{2}\ \mu(w^{TD}, s, a_h)\left[\frac{1}{2} - \frac{T'^{2}(w^{TD})}{2}\right].$$

Hence, relative to the situation of discrimination in managerial positions, the equilibrium wage unambiguously increases, while the amount of worker skills hired in equilibrium decreases (see Figure 6). Unlike in the nondiscrimination case, since both aggregate supply of, and demand for, worker skills change in the same proportion, the wage rate is the same, although in the total discrimination equilibrium less worker skills are hired.

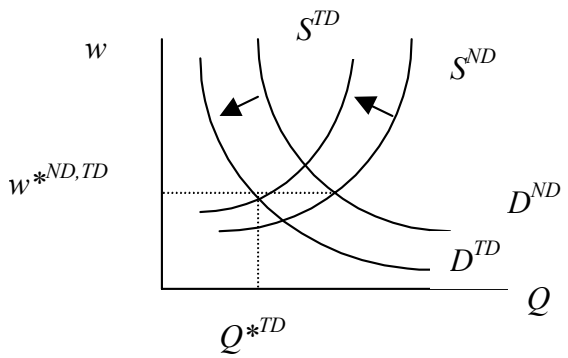

Figure 6. Labor Market Equilibrium with Total Gender Discrimination

The number of managers with total gender discrimination

The total number of managers is

$$M^{TD} = M^{m,TD} + M^{f,TD} = \frac{P}{2}\int_{T'(w^{TD})}^{1} 1\, dT + 0 = \left[1 - T'(w^{TD})\right]\frac{P}{2}. \qquad (14')$$

Since the equilibrium wage rate increases, the number of managers is unambiguously smaller than in the case of discrimination in managerial positions. By (14) and (14'), and

given that the cutoff level of talent with total discrimination is the same as without discrimination, the number of managers with total discrimination is one-half of the number without discrimination. Propositions 5 and 6 summarize the effects of total gender discrimination.

Proposition 5 *Gender discrimination in the overall labor market implies that (i) average female education is lower, for both primary and higher education, (ii) male education is the same as without discrimination, and (iii) average female education is lower than male education.*

Proof: (i) follows from the fact that in the model, education is only useful if in the labor market, while (ii) follows from (7) and (10). Finally, (iii) follows from (i) and (ii). QED

Proposition 6 *Gender discrimination in the overall labor market implies (i) lower economic growth, and (ii) lower per capita GDP*.[24, 25]

Proof: (i) follows from the *residual* determinant of economic growth, as some individuals (half the population—all females in the economy) who were previously working outside the home and hence investing in some positive level of education in the existence of discrimination optimally decide not to get any education. Part (ii) follows from the fact that population is the same as without discrimination while women who were managers or workers without discrimination have to engage in home production

[24] Hence this prediction of total gender discrimination is similar to the one from the model in Galor and Weil (1996) where, taking into account fertility and assuming two different types of skills among individuals, as long as women do not participate in the labor force the rate of economic growth declines over time.

[25] This is consistent with no scale effects in the sense that the average talent of managers and the average productivity of (market) workers are the same as without discrimination.

with discrimination, which is less productive than production outside the home; hence per capita GDP decreases. QED

IV.E. Discussion: Sustainability of Gender Discrimination

After analyzing the negative consequences of discrimination we must explore the reasons why discrimination can persist. This may be particularly unclear in the case that the total household income, i.e. of husband and wife, is less as a consequence of discrimination. In the context of a unitary model of the household, discrimination could not persist. A bargaining approach is needed to understand the sustainability.[26]

For instance, a man who is married to a woman who is a manager in a situation of no discrimination may be worse off by the introduction of partial discrimination (where she can only be a worker) or total discrimination (where she cannot participate in the labor market), due to the fact that her income decreases. However, in the case of partial discrimination, this also depends on whether the husband's own working status (and hence his income) change due to discrimination.

Since our aim is to address the sustainability of discrimination, we use nondiscrimination as a benchmark and compare it to either partial discrimination or total discrimination. We assume that every household consists of a husband and a wife.

How is this relevant for the cases of discrimination explored in this paper? From the point of view of a cooperative bargaining framework, where the threat point is divorce, the individuals' bargaining strength depends positively in their own outside option,

[26] Additionally, empirical evidence seems to reject the unitary model, in particular, income pooling is rejected (Mansen (1993), Thomas (1993)).

while depends negatively on their partners' outside option. That is, in general, if the woman's earnings increase with the suppression of discrimination, her outside option is stronger (as she would still be able to earn a wage in the case of divorce), which would decrease the husband's utility.[27] Generally, however, to the extent that the woman's participation in the labor market increases the size of the cake, this would increase the husband's utility (note that this is not always true, as in the case of males that are workers with the suppression of partial discrimination but are managers under partial discrimination).[28]

Nevertheless, the type of discrimination in this paper is more consistent with the predictions of a model of (noncooperative) separate spheres bargaining, as introduced by Lundberg and Pollak (1993). This is preferred to a cooperative framework for several reasons. A perhaps subtle reason is that the latter requires the threat point to depend on divorce, while in developing countries with very unequal gender relations, such as India and other countries relevant for this analysis, divorce either involves substantial transaction costs or can be dominated by sharing public goods within an intact but noncooperative marriage, where a division of labor based on socially recognized and sanctioned gender roles emerges without explicit bargaining. In this case, the relevant threat point is not divorce but the noncooperative, voluntary equilibrium within marriage. Cooperative bargaining is distinguished by the ability of players to make binding agreements within marriage. Then, as shown by Lundberg and Pollak (1993), it

[27] In the cooperative bargaining model the increase in the wife's earnings can be either represented by an increase in her outside option or an increase in her weight in the maximization problem.

[28] In the case of men who are workers even without discrimination, if their wife's outside option increases in the same proportion as the total cake, then they are not better off by the removal of discrimination. Notice that this is the relevant comparison if there is assortative matching. The analysis is the same in the case of the suppression of total discrimination.

will be optimal for couples with high transaction costs (which arise because of the negotiation, monitoring, and enforcement of such agreements) or low expected gains from cooperation to remain at the stereotypical non-cooperative solution, where the division of labor is based on socially recognized gender roles. More importantly, the argument that cooperation does break down seems especially appropriate in the case of India, where borrowing constraints are severe and therefore agents have low discount rates.

Let us use an example as illustration. Think of couple A, where Mr A is not very talented in terms of managerial ability (T) and therefore would naturally choose to be a worker, while Mrs A is relatively more endowed with managerial talent and therefore she optimally is a manager (under no discrimination). Would cooperation work? We can think of the surplus from cooperation as being positively given by total income and negatively given by the male disutility from her wife's higher occupation (this could be some sort of stigma or simply the fact he is teased by colleagues) or the fact that she is working. We can think of some sort of distribution of this disutility among males—for some males it may be equal to zero, for others, infinite—so as long as the disutility is larger than income, cooperation can break down.

Finally, there is an issue regarding the existence of assortative matching across households. In particular, if the most talented man marries the most talented woman, it is efficient for women to work at home (or hold unskilled—less demanding— positions) as long as there is some comparative advantage of men over women in working outside home, and the cost of providing household goods and services is lower than the external

market rate. [29] This would undermine the misallocation of talent explored in this paper—unless, as argued before, there are transaction costs that lead to the dominated equilibrium. We will come back to this issue after the empirical analysis.

V. Empirical Evidence

The theoretical section provides motivation for the hypothesis that a lower number of females relative to males in 1) managerial positions and 2) worker positions as a whole has negative implications for development. In particular, the model in section four argues that gender discrimination in managerial positions implies a misallocation of talent that leads to lower economic growth through the innovation and adoption dimensions of economic growth, while gender discrimination in the overall labor market has negative economic consequences through the education dimension of growth. We test the implications of the theoretical section using data from sixteen Indian states over 1961-91. The output measure we use is per capita net domestic product.

The gender discrimination variables we use are based on the number of female and male managers and total workers:[30] in the model, and by the definition of discrimination that is used in it, these variables would perfectly measure discrimination. We expect the ratio of female-to-male managers or workers to partly reflect gender inequality that is driven by gender discrimination, as of the types described in the theoretical section.

[29] The model is in this feature similar to the one in Francois (1998), where gender discrimination is inefficient (in particular, there are gains from trading occupations within the household) only when members in the household differ.

[30] The variable we call *managers* corresponds to the variable that is called *employers* in the Census of India and is described as "a person who had necessarily to employ other persons in order to carry on the business from which he served his likelihood." See the data appendix for definitions and sources of the data.

In Table 1 we present means and standard deviations of the main variables used in the empirical analysis, by state, averaged for the period 1961-91. Typically, states with the highest ratios of female-to-male managers and total workers are southern states (Karnataka, Kerala, Andhra Pradesh) while states with the lowest ratios are usually in North India (Haryana, Jammu and Kashmir, Punjab). Interestingly, there is no strong direct relationship between these variables and income. For instance, Haryana and Punjab are relatively rich, while Jammu and Kashmir is at about the all-India average income, while there is also diversity among states with higher female-to-male employment ratios: Kerala and Orissa have lower-than-average income, while Andhra Pradesh and Karnataka have approximately average income. In fact, it seems that as explained in Section II, these statistics would in fact tend to suggest that female labor participation relative to male is higher in poorer states.

We take advantage of the panel nature of the data and run regressions of the type:

$$y_{st} = \delta r_{st} + x_{st}\xi + \alpha_s + \gamma_t + \varepsilon_{it} \qquad (17)$$

where y is the log of per capita net state domestic product, r denotes the ratio of the number of females to males in a certain class of the labor force (namely managers and total workers), x denotes controls (human capital, and other socioeconomic controls such as population growth, the ratio of urban to total population, and the ratio of capital to labor), α is a state effect, and γ is a year fixed-effect. State effects pick up effects that vary among states but are constant over time, as well as heterogeneous initial conditions; year effects pick up shocks that are common to all states but differ over time.

An important issue with output level estimation is potential serial correlation. In fact, a Baltagi-Wu (1999) locally invariant test, which tests for the presence of serial correlation

in the context of unequally spaced panel data, rejects the null hypothesis of no serial correlation of the disturbances at the 5 percent level. Hence, and in light of recent research about fixed-effects panel models estimation (Bertrand *et al.* (2003), Kézdi (2002)) showing that the cluster estimator behaves well with finite samples, we cluster our standard errors by state to deal with concerns with serial correlation.

In Table 2 we present the results of estimating (17). Columns (1) and (3) represent the key basic results in the paper: in line with the theory, the estimates show that gender discrimination acts as a brake on economic development. In column (1), the ratio of female-to-male managers is positively related to total output growth, and this relationship is significant at the 1 percent level, controlling for female and male literacy rates, population growth, the ratio of urban to total population, and the ratio of capital to labor (the latter is introduced as a proxy for technology). We run the respective regression for the ratio of female-to-male total workers, and find a lower coefficient. The relationship, however, is also significant at the 1 percent level. In columns (2) and (4) we additionally control for caste (introducing the percentage of the population that belongs to scheduled castes or scheduled tribes) and the total size of the labor force. The estimated coefficients for our variables of interest are of the same size and still significant at the 1 percent level.

We can think of the quality of institutions as a possible covariate of gender composition of the labor force. However, to the extent that institutions have not changed much over the period of study, or that they may not differ by state, this effect is captured by the fixed effects. We also control for time-varying institutional quality using political controls as described below.

There is an issue regarding home production. In particular, if women's participation in the labor force relative to men's has been increasing (which may have therefore decreased their—officially not accounted for—home production) along with per capita GDP, as predicted by the model, the positive effect that we find might appear because of this accounting fact rather than because of discrimination itself. However, a quick look at Figures A2 and A3 in the appendix suggests that this cannot be the case, as female-to-male ratios of managers and workers have evolved over time differently by state.

An issue could be raised regarding omitted policy bias: there exists the possibility that our variables of interest might be capturing some other sort of policy that is undertaken at the state level. Even though gender sensitive legislation and policy-making exist only at the national level, some other type of policy at the state level might happen to be related to gender-wise work participation. We cannot possibly control for any state-level policy but we can follow the strategy in Besley and Burgess (2002) and control for government responsiveness using the following political controls: electoral turnout lagged one period, a measure of political competition (the absolute difference in the share of seats occupied by the main political party and its main competitor), and a dummy for whether it is an election year. The results from adding these political controls are in columns (3) and (6) respectively; results are unchanged. Therefore, our results are robust to the inclusion of proxies for government and institutional quality.

An obvious concern is causality. In particular, we might worry that the statistical positive relationship we are estimating is arising due to the possibility that richer states have higher female-to-male employment ratios. We try and control for potential endogeneity using the ratio of prosecutions launched to the number of complaints received under the Maternity Benefits Act (1961). According to India's First Report for the Convention on the Elimination of all forms of Discrimination against Women (CEDAW),

the Government of India recognizes that provision of maternity benefit is the most crucial element which affects women workers, therefore it is doing its utmost to extend maternity benefits to all women. [31]

The administration of the Act in States is the responsibility of the Factory Inspectorates. Inspectors are appointed by the corresponding State Governments. This is a proper instrument as long as the determinants of the launch of a prosecution are not a direct determinant of per capita output. The state with larger values is the one furthest south—Tamil Nadu—with approximately average per capita income relative to other states during the period.

In order to further study the exogeneity of the instrument, we take a look at the correlation between this variable and some variables—first, log of per capita net domestic income, but also other variables that could proxy for the level of development. In Table 3 we provide the estimates of regressing the ratio of prosecutions launched under the Maternity Benefit Act to the number of complaints received, controlling for state and year fixed effects. The number of prosecutions to complaints received is not significantly correlated with income (column (1)), the quality of the judiciary ((2)), and two proxies for the size of the state level budget (expenditure on the organs of the state and on administration services, in columns (3) and (4) respectively).[32] Given these results we expect differences in number of prosecutions to proxy for variation in cultural values that promote female labor force participation, hence being fairly exogenous.

[31] For more details regarding the Maternity Benefits Act (1961) see the data appendix.

[32] The quality of the judiciary is measured by annual pendency rates, where the pendency rate is constructed by Besley and Burgess (2003) by adding the number of cases pending at the beginning of the year to cases filed in the year and dividing this by cases resolved during the year.

Therefore our prior that this variable is capturing cultural values seems validated. Apart from validating the instrumental variable procedure, these results are interesting in that they suggest that cultural attitudes are not closely linked to economic development. This would suggest that development will not be enough to erode gender discrimination. This is a theme to which we will return in the conclusions.

We present the instrumented results in Table 4. The estimated coefficients for the female-to-male ratios of managers and workers (columns (1) and (2)) are positively significant at the 5 percent level (p-values equal 2 percent).[33] Interestingly, estimated coefficients for these two variables are higher than without being instrumented, suggesting that the relationship from income to female labor participation is actually negative. This is consistent with the hypothesis that it is poorer women who engage in working activity, and that the social norm is binding. That is, if anything, endogeneity was biasing our coefficients downwards. The bottom line is that our main result, that gender discrimination hinders development, goes through in the instrumented regressions. Taking the results from these instrumented regressions, we find that an increase of 10 percent in the female-to-male ratio of managers would increase per capita net domestic product by 2 percent, while an increase of 10 percent in the female-to-male ratio of total workers would increase per capita net domestic product by 8 percent. These results suggest that gender inequality in the access to working positions is a bigger brake on growth than gender inequality in the access to managerial positions. In particular, an increase in one standard deviation in the number of female-to-male managers would increase output per capita by approximately 12%, while the increase would be equal to

[33] Other potential instrumental variables have been tried (e.g. the percentage of women elected for seats at state-level legislative assemblies, gender-wise turnout) and discarded because they have turned out being *bad* instruments at standard significance levels, in the sense that they are not correlated to female-to-male ratios of managers or workers.

37% if the number of female-to-male total workers increases in one standard deviation. In terms of India's states, we can calculate the increase in total output per capita that would have occurred if all states would have had Karnataka's female employment figures. Female-to-male managers and workers are of the highest in the state of Karnataka. Had India's states have had Karnataka's figures, total output would have increased by over a third (35%) due to more female-to-male managers, and by almost 10% due to more female-to-male total workers. That is, the efficiency costs from gender discrimination in the labor market are big.

Results from the first-stage regressions are also presented in Table 4 (columns (3) and (4)). As suspected, the ratio of prosecutions launched to the number of complaints received under the Maternity Benefits Act is positively correlated with female-to-male managers and total workers, suggesting that states where more prosecutions are started have better conditions for female labor force participation (p-values for the instrument are 5 and 8 percent respectively).

In Table 5 we take a closer look at the picture by using disaggregated output measures as dependent variables. The estimated coefficient for the female-to-male managers is in fact not significantly related to agricultural output (column (1)), while it is significant at the 5 percent level in the case of female-to-male workers (column (2)). This suggests that the way in which agricultural output is hindered by gender discrimination is not through women not being able to be managers but from restricted access to work participation in general. This is in accord with the model as the inefficiency generated by discrimination in managerial positions works through the misallocation of managerial talent, which plays a minor role in the agricultural sector. This may be interpreted as consistent with distortions in the allocation of talent being more important where there are fewer e.g. physical comparative advantages—in the case of agriculture, comparative advantages by

gender in e.g. physical strength would presumably be more important, while in the case of non-agricultural sectors, where managerial skills play a greater role rather than physical skills, comparative advantages are less important.

Regarding non-agricultural output (columns (3)-(4)), coefficients for both the female-to-male managers and total workers are significant at the 1 and 5 percent level respectively. These results seem to suggest that the way in which gender inequality may hinder development is twofold. While social norms that restrict women's access to the labor market in general lower output in general, distortions in the allocation of talent between managerial and unskilled positions also affect output negatively in sectors where managerial talent is relatively important (that is, sectors where physical skills are relatively less important). In sum, this empirical evidence suggests that states where the female-to-male ratios of managers and workers are lower do have lower output. This is consistent with the predictions from the model described in section four.

In the theoretical section we have raised the issue of how the existence of assortative matching and comparative advantage might prove discrimination efficient. Although this is theoretically plausible, in light of the empirical evidence that we have just examined—whereby *ceteris paribus* states that have larger numbers of women at work have experienced larger per capita GDP—we conclude that this theoretical possibility is not empirically relevant, but rather, that there exist substantial transaction costs in intrahousehold bargaining so that the suboptimal, nooncoperative equilibrium can be sustained. Moreover, the efficiency costs of gender discrimination are big.

VI. Conclusion

This paper provides theoretical and empirical support for the view that gender discrimination acts as a brake on economic development. We find that a 10 percent

increase in the female-to-male managers ratio in India would increase total output per capita by 2 percent, while a 10 percent increase in the female-to-male workers ratio would increase total output per capita by 8 percent. This is in accord with the theoretical predictions of our model, according to which gender discrimination in either managerial positions or the overall labor market has negative economic consequences. The intuition is as follows. If women cannot gain access to managerial positions, the equilibrium wage rate declines, and the cutoff level of talent of managers declines as well, so that the average talent of entrepreneurs and economic growth both decline. If females cannot participate in the labor market, but have to engage in home production, the wage rate is the same as without discrimination, so that the cutoff level of talent is the same and, therefore, there are no innovation or adoption implications. Nevertheless, growth decreases due to the fact that half the population acquires zero education. Moreover, the theory predicts that per capita output is lower than it is without discrimination.

We find that the effects of gender discrimination are more serious in particular sectors of the economy. In particular, we find that lower ratios of female-to-male workers significantly reduce total output in both the agricultural and the non-agricultural sector, while lower numbers of female-to-male managers reduce output in the non-agricultural sector, but not in the agricultural sector This is in line with the model in this paper in that distortions in the allocation of managerial talent play a larger role in sectors where higher skills are needed—as opposed to sectors that require more physical abilities, as agriculture. Therefore, these results can be matched to the model's predictions in the sense that while gender discrimination in the form of restricting women's access to work lowers output in all sectors, gender discrimination in managerial positions that distorts the allocation of talent between managerial and unskilled positions lowers output in sectors where managerial talent is relatively more important than physical comparative advantages.

The fact that we find a close matching of the empirical results to the theoretical predictions and that our results are robust to the inclusion of various controls for omitted variables and to potential endogeneity make us more confident that gender discrimination has a detrimental effect on economic development, and that this effect is large.

Moreover, our results also suggest that female labor participation will not necessarily increase with economic growth. In fact, it seems that richer states tend to have lower ratios of female-to-male labor participation, suggesting indeed the existence of a discriminatory social norm that is binding. This is also related to the theoretical section, where we also discuss how it is possible that gender discrimination, despite its harmful economic consequences, is a sustainable social norm. Therefore for economic development it is crucial to try and erode this discriminatory social norm by encouraging policies and education that underline the value of women in society and in particular in the labor market. We need to think about targeted policies that change social norms and society's perceptions of what women are capable of. In that sense, our understanding of what policies are effective in shifting deeply embedded cultural norms like gender discrimination is extremely limited. Nevertheless, there is a role for the government in financing projects like *Mahila Samakhya*, a women's empowerment project launched in 1986 by the Ministry of Human Resource Development which, through the building of village level collectives, seeks to bring about a change in women's perception about themselves and that of society regarding women's traditional roles.

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Table 1. Summary of main variables in the analysis, 1961-1991

STATE	Female-to-male managers	Female-to-male total workers	Share of female managers	Share of male managers	Share of female employees	Share of male employees	Share of female single workers	Share of male single workers	Share of female family workers	Share of male family workers	Female literacy rate	Male literacy rate	Net per capita real income
Andhra Pradesh	0.082 (0.020)	0.211 (0.043)	3.832 (2.358)	8.586 (2.827)	36.27 (6.570)	49.86 (3.687)	34.84 (3.870)	31.32 (3.801)	25.05 (5.641)	10.24 (3.239)	0.185 (0.043)	0.426 (0.044)	1004 (260)
Assam	0.037 (0.018)	0.275 (0.028)	0.671 (0.097)	4.778 (1.365)	90.93 (6.238)	71.54 (3.934)	4.636 (2.678)	17.48 (3.192)	3.764 (3.526)	6.208 (2.170)	0.203 (0.058)	0.599 (0.084)	903 (196)
Bihar	0.030 (0.011)	0.086 (0.025)	2.273 (1.195)	6.331 (2.244)	57.03 (12.65)	60.95 (4.550)	33.15 (15.26)	27.21 (4.557)	7.548 (2.549)	5.505 (1.947)	0.116 (0.037)	0.419 (0.050)	633 (110)
Gujarat	0.023 (0.009)	0.126 (0.030)	0.788 (0.402)	3.988 (1.691)	52.13 (10.40)	58.51 (1.522)	27.87 (11.44)	26.39 (1.592)	19.20 (9.570)	11.11 (1.420)	0.303 (0.065)	0.596 (0.059)	1176 (272)
Haryana	0.014 (0.004)	0.071 (0.009)	2.224 (1.099)	9.321 (3.011)	77.57 (2.412)	59.17 (2.424)	17.28 (2.785)	27.71 (4.176)	2.924 (0.955)	3.799 (1.304)	0.223 (0.052)	0.541 (0.066)	1444 (357)
Jammu & Kashmir	0.016 (0.010)	0.061 (0.006)	1.699 (1.935)	4.800 (3.593)	56.25 (13.15)	59.96 (0.383)	14.67 (29.56)	29.56 (2.782)	27.38 (10.82)	5.681 (0.996)	0.096 (0.037)	0.313 (0.068)	1021 (228)
Karnataka	0.053 (0.010)	0.219 (0.029)	2.038 (0.631)	7.882 (1.874)	62.20 (8.787)	61.11 (1.950)	27.46 (9.208)	25.47 (3.509)	8.298 (0.504)	5.542 (0.227)	0.251 (0.071)	0.535 (0.062)	1037 (217)
Kerala	0.034 (0.006)	0.239 (0.013)	0.599 (0.139)	4.470 (0.674)	74.68 (8.44)	59.20 (6.778)	21.61 (8.676)	33.57 (7.193)	3.109 (0.287)	2.767 (0.344)	0.650 (0.118)	0.825 (0.066)	864 (182)
Madhya Pradesh	0.044 (0.006)	0.122 (0.071)	2.054 (0.850)	4.373 (1.658)	49.76 (11.52)	67.73 (15.64)	36.61 (9.893)	22.32 (11.14)	11.57 (2.329)	5.579 (2.934)	0.140 (0.049)	0.444 (0.069)	843 (190)
Maharashtra	0.046 (0.016)	0.143 (0.018)	2.423 (1.371)	6.602 (2.017)	68.13 (7.552)	69.93 (2.080)	21.44 (5.695)	18.91 (2.247)	8.011 (2.420)	4.558 (0.598)	0.309 (0.084)	0.640 (0.069)	1288 (331)
Orissa	0.069 (0.055)	0.181 (0.081)	0.620 (0.243)	1.882 (0.416)	37.69 (12.24)	55.47 (4.962)	42.85 (16.06)	32.37 (7.21)	18.84 (4.105)	10.28 (2.247)	0.180 (0.066)	0.520 (0.063)	873 (186)
Punjab	0.016 (0.005)	0.070 (0.010)	0.531 (0.373)	1.976 (1.279)	70.48 (18.31)	53.86 (4.621)	22.79 (15.17)	36.98 (4.820)	6.194 (3.084)	7.182 (1.193)	0.287 (0.087)	0.487 (0.068)	1732 (384)
Rajasthan	0.033 (0.012)	0.109 (0.029)	3.807 (1.048)	11.55 (1.440)	45.48 (9.303)	51.92 (2.288)	34.83 (8.114)	28.46 (3.052)	15.89 (3.381)	8.068 (0.810)	0.107 (0.033)	0.391 (0.078)	786 (137)
Tamil Nadu	0.036 (0.015)	0.193 (0.038)	0.837 (0.377)	4.463 (0.957)	67.46 (18.49)	68.06 (9.791)	25.52 (19.08)	24.12 (9.266)	6.179 (2.003)	3.355 (1.059)	0.303 (0.082)	0.623 (0.053)	1015 (272)
Uttar Pradesh	0.027 (0.007)	0.073 (0.019)	3.941 (1.829)	9.135 (3.391)	54.09 (13.16)	54.67 (4.062)	32.32 (11.55)	32.43 (6.409)	9.648 (3.163)	3.763 (0.842)	0.129 (0.040)	0.419 (0.068)	874 (141)
West Bengal	0.022 (0.006)	0.118 (0.014)	0.872 (0.106)	4.132 (0.549)	76.72 (5.940)	67.54 (3.676)	18.84 (4.680)	25.56 (3.371)	3.571 (1.471)	2.770 (0.478)	0.298 (0.073)	0.583 (0.055)	1173 (191)
Observations	476	476	476	476	476	476	476	476	476	476	457	457	505

Standard deviations in parentheses. For details about data sources and definitions see the data appendix

Table 2. Output and gender composition of the labor force, by class
Indian states 1961-1991

Dependent variable: log per capita total output

OLS	(1)	(2)	(3)	(4)	(5)	(6)
Female-to-male managers	1.43	1.57	1.61			
	(7.27)	(4.44)	(4.53)			
Female-to-male workers				1.00	1.09	1.08
				(3.45)	(2.71)	(3.04)
Female literacy rate	1.14	1.08	1.12	0.93	0.86	0.90
	(3.05)	(2.84)	(2.56)	(2.44)	(2.03)	(1.98)
Male literacy rate	0.14	-0.11	-0.15	-0.19	-0.44	-0.46
	(0.13)	(0.11)	(0.15)	(0.20)	(0.46)	(0.47)
Population growth	-0.02	0.001	0.03	-0.04	-0.01	0.01
	(0.33)	(0.10)	(0.49)	(0.55)	(0.20)	(0.10)
Ratio of urban to total population	0.56	0.41	0.61	1.95	1.60	1.67
	(0.27)	(0.22)	(0.33)	(0.95)	(0.76)	(0.79)
Ratio of capital to labor	48.8	24	19.9	36.3	13.8	11.7
	(0.69)	(0.35)	(0.28)	(0.49)	(0.18)	(0.15)
Scheduled tribes and scheduled castes population (%)		-0.01	-0.01		-0.01	-0.01
		(1.80)	(1.49)		(1.64)	(1.44)
Total work force		0.01	0.001		0.002	0.002
		(0.53)	(0.36)		(0.99)	(0.84)
Election dummy			0.01			0.01
			(0.96)			(0.77)
Election turnout			-0.001			-0.001
			(0.21)			(0.05)
Political competition			0.001			0.001
			(1.08)			(0.86)
State effects	YES	YES	YES	YES	YES	YES
Year effects	YES	YES	YES	YES	YES	YES
Number of observations	289	289	288	289	289	288

Note: t-statistics calculated with robust standard errors clustered at the state level in parentheses. See section 5 for details about the estimation procedure. Data sources and definitions are in the data appendix.

Table 3. Exogeneity of Maternity Benefits Act (1961) Instrument
Indian states 1961-1991

Dependent variable: Ratio of prosecutions launched to complaints received				
	OLS			
	(1)	(2)	(3)	(4)
Log real output per capita	22.3 (0.89)			
Annual pendency rates at high courts		4.43 (0.59)		
Expenditure on organs of the state			-0.0005 (0.91)	
Expenditure on administration services of the state				1.08 (1.02)
State effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
Adjusted R^2	0.28	0.30	0.30	0.29
Number of observations	421	319	270	384

Notes: t-statistics calculated with robust standard errors clustered at the state level in parentheses. See section 5 for details about the estimation procedure. Data sources and definitions are in the data appendix.

Table 4. Output and instrumented gender composition of the labor force, by class - Indian states 1961-1991

	Dependent variable			
	(1) Log total output	(2) Log total output	(3) Female-to-male managers	(4) Female-to-male workers
Female-to-male managers	5.13 (2.92)			
Female-to-male workers		4.93 (3.00)		
Female literacy rate	1.47 (2.36)	-0.21 (0.22)	0.04 (0.53)	0.38 (4.46)
Male literacy rate	-0.67 (0.41)	-1.18 (0.60)	-0.16 (1.09)	-0.06 (0.35)
Socioeconomic controls	YES	YES	YES	YES
Political controls	YES	YES	YES	YES
State effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
Ratio of prosecutions launched to complaints received			0.00003 (1.96)	0.00003 (1.72)
Adjusted/Centered R^2	0.99	0.99	0.67	0.93
Number of observations	244	244	244	244

Notes: t-statistics calculated with robust standard errors clustered at the state level in parentheses. Socioeconomic controls are population growth, the ratio of urban to total population, and the ratio of capital to labor. Political controls are the absolute difference between the percentage of seats of the Congress party and its main competitor, lagged election turnout, and a dummy for an election year. The ratio of female-to-male managers/workers is instrumented with the ratio of prosecutions launched to the number of complaints received from factories under the Maternity Benefit Act (1961). See section 5 for details about the estimation procedure. Data sources and definitions are in the data appendix.

Table 5. Disaggregated output and gender composition of the labor force, by class
Indian states 1961-1991

Dependent variable:	log per capita agricultural output		log per capita non-agricultural output	
	OLS			
	(1)	(2)	(3)	(4)
Female-to-male managers	-0.21 (0.38)		2.40 (7.06)	
Female-to-male workers		0.83 (2.13)		1.18 (2.25)
Female literacy rate	-0.20 (0.46)	-0.37 (0.90)	1.73 (2.41)	1.47 (1.88)
Male literacy rate	0.56 (0.71)	0.32 (0.42)	0.23 (0.14)	-0.17 (0.10)
Socioeconomic controls	YES	YES	YES	YES
Political controls	YES	YES	YES	YES
State effects	YES	YES	YES	YES
Year effects	YES	YES	YES	YES
Adjusted/Centered R^2	0.70	0.70	0.93	0.92
Number of observations	288	288	288	288

Notes: t-statistics calculated with robust standard errors clustered at the state level in parentheses. Socioeconomic controls are population growth, the ratio of urban to total population, and the ratio of capital to labor. Political controls are the absolute difference between the percentage of seats of the Congress party and its main competitor, lagged election turnout, and a dummy for an election year. See section 5 for details about the estimation procedure. Data sources and definitions are in the data appendix.

VII. Appendix: PROOFS OF SOME RESULTS

Proof of Proposition 1:

The particular function for the cutoff level of talent is as follows:

$$T'(w) = \frac{w + w^{\frac{1}{1-\sigma}} a_p^{-\frac{\sigma}{1-\sigma}} \hat{\sigma} + a_p \bar{H}_p}{c\bar{\alpha}\bar{H}_p s^{\frac{1}{\alpha}} w^{-\frac{1-\alpha}{\alpha}} + (1-c)^{\frac{1}{\beta}} s^{\frac{1}{\alpha\beta}} w^{-\frac{1-\alpha}{\alpha\beta}} a_h^{-\frac{1-\beta}{\beta}} \bar{\alpha}\beta(1-\beta)^{\frac{1-\beta}{\beta}}} \quad .$$

All the important endogenous variables depend on the wage rate, *w*. After solving for the equilibrium wage rate, the remaining variables are endogenously determined. In particular, it can be checked that $\frac{\partial T'(w)}{\partial w} > 0$. QED

Proof of Proposition 2:

Recall by (10) that $H_{p,w} \le \bar{H}_p$, as long as $w \le \frac{a_p \bar{H}_p^{1-\sigma}}{\sigma}$, because higher wages mean incentives for the worker to invest more in primary education. There are two possibilities:

In the first case, workers are in the range where $H_{p,w} < \bar{H}_p$. In this case, discrimination lowers the primary human capital of workers. Since some males are entrepreneurs, they will still go through the whole primary schooling process; as a result, the average primary education for males compared to females is

$$AH_p^{males} = \frac{N H_{p,w} + M \bar{H}_p}{P} > H_{p,w} = AH_p^{females},$$

where *AH* denotes average human capital and *N* denotes the number of workers. In this case, therefore, the ratio of female-to-male primary education decreases with partial discrimination.

The second possibility is that $H_{p,w} = \bar{H}_p$, which was also true before discrimination because wages were higher. In this case, gender discrimination does not reduce the human capital of workers.

Moreover, workers and entrepreneurs, males and females, all go to primary school, so discrimination does not show up in the female-to-male ratio of primary education, but only in the ratio of higher education. QED

VIII. Data Appendix

We use data from sixteen Indian states over the period 1961-91. Our data base builds on Özler, Datt and Ravallion (1996) and Besley and Burgess (2002, 2003). In particular, state per capita **net domestic product** at current prices comes from *Estimates of State Domestic Product* [Department of Statistics, Department of Statistics, Ministry of Planning, Government of India]. **Education** (female and male literacy rates) and **population** (population growth, and the percentage of urban population to total population) measures come from *Education in India* [Ministry of Education, Government of India] and *Selected educational statistics* [Ministry of Education, Government of India] and from the *Census of India* (*General Economic Tables*, *Socio-Cultural Tables*). Both education and population measures correspond to census issues for 1961, 1971, 1981 and 1991, and have been interpolated between census years. Data on **capital** stock (productive capital) come from the *Annual Survey of Industries* [Central Statistical Office, Industrial Planning Wing, Department of Statistics, Ministry of Planning and Programme Implementation, Government of India]. Data on **politics**— political competition (the absolute difference between the percentage of seats occupied by the Congress party and its main competitor), election turnout (percentage of electors who voted), and information on election years, are calculated from figures in Butler *et al.* (1995).

The quality of the judiciary (in particular high courts) is measured by **annual pendency rates**, where the pendency rate is constructed by Besley and Burgess (2003) by adding the number of cases pending at the beginning of the year to cases filed in the year and dividing this by cases resolved during the year.

The gender composition of the **labor force** figures come from the *Census of India* 1961, 1971, 1981 and 1991 (*General Economic Tables*), where we find data on four classes of worker: *employers*, *employees*, *single workers*, and *family workers*, which we interpolate between census years. We use

the first category as it is and then define *total workers* as the sum of the four. There are however some changes of definitions in the census over the years.

In the census issues of 1961 and 1971, the population was divided into either *workers* or *non-workers*. A *worker* is a person whose main activity was participation in any economically productive work by his physical or mental activity. In the case of regular employment in any trade, profession, service, business or commerce, the criterion of work was satisfied if the person had been employed during any 15 days preceding the day on which he was enumerated. This is somewhat different in the census of 1971 since the reference period is a week.

In the census issues of 1981 and 1991, population is instead divided into *main workers*, *marginal workers*, and *non-workers*. A *main* (*marginal*) *worker* is defined as a person whose main activity was participation in any economically productive work by his physical or mental activities and who had worked for 183 days or more (less than 183 days). For the 1991 issue, we then use the sum of main and marginal workers, so that the same information as in census 1961 and 1971 is used. However, information on the class of worker is only available in the 1981 issue for main workers. Marginal workers typically reflect a very small percentage of total workers, so we do not expect this to affect results in a significant way.

Definitions of every class of worker are as follows. An *employer* is "a person who had necessarily to employ other persons in order to carry on the business from which he served his likelihood." In that sense, "if a person employed a cook or other person for domestic service, he was not to be recorded as employer merely for that reason." An *employee* is "a person who ordinarily worked under some other person for a salary or a wage in cash or in kind as a means of earning a likelihood." A *single worker* is "a person who is doing her/his job without employing others except casually, and without the help of other members of the family except casually and a participant in work as member of co-operative." Finally, a *family worker* is "a person who is doing her/his work in a family enterprise along with the other members of the family without wages or salary in cash or kind."

To make sure it is not the interpolated data that generates our results, we run two respective basic regressions with only the non-interpolated employment data (see appendix Tables A1 and A2).

Annual data on **maternity benefits**, in particular the number of complaints received under the Maternity Benefits Act (1961) and the respective number of prosecutions launched are taken from the *Indian Labour Year Book* [Labour Bureau, Ministry of Labour], years 1962-92. Due to data availability, the data used in this study refer to women employees in factories only.

Women who work in factories, mines, plantations, performance establishments and shops with more than 10 employees and who have worked in an establishment for 80 days in the 12 months immediately preceding the day of her delivery are entitled to receive maternity benefit. The Act establishes that payment consists of 12 weeks paid maternity leave, and 6 weeks paid leave in relation to miscarriage or termination of pregnancy. The maternity benefit consists of payment at the rate of average daily wage for the period of actual absence. In addition, a woman is entitled to prescribed medical bonus if no free-natal/post-natal care is provided by the employer.[34] The Act does not apply to employees covered by the Employees' State Insurance Act (1948). The administration of the Maternity Benefits Act in States is the responsibility of the Factory Inspectorates, who are constituted by the appropriate State Governments and are in charge of administering the Factories Act (1948). Factory Inspectorates then appoint inspectors, who possess wide powers such as entry into the factory, inspection of premises, plant and machinery, making on-the-spot enquiries, requiring production of documents, etc., for effective enforcement of the acts (Indian Labour Year Book 1963, Chapter 9, Labour Legislation).

The Maternity Benefits Act specifies the power of inspectors regarding direct payments and complaints and prosecutions in section 17 ((Government of India, Ministry of Law and Justice):

17. Power of Inspector to direct payments to be made:

(1) Any woman claiming that

[34] India's First Report, Convention on the Elimination of all forms of Discrimination against Women (CEDAW).

(a) maternity benefit or any other amount to which she is entitled under this Act and any person claiming that payment due under section 7 has been improperly withheld;

(b) her employer has discharged or dismissed her during or on account of her absence from work in accordance with the provisions of this Act, may make a complaint to the Inspector.

(2) The Inspector may, of his own motion or on receipt of a complaint referred to in sub-section (1), make an inquiry or cause an inquiry to be made and if satisfied that

(a) payment has been wrongfully withheld, may direct the payment to be made in accordance with his orders;

(b) she has been discharged or dismissed during or on account of her absence from work in accordance with the provisions of this Act, may pass such orders as are just and proper according to the circumstances of the case.

Appendix Table A1. Output and gender composition of the labor force, by class

Indian states 1961-1991 – Non-interpolated data

Dependent variable: log per capita total output				
	Fixed-Effects		Fixed-Effects IV	
Female-to-male managers	3.01 (2.41)		9.59 (2.72)	
Female-to-male workers		1.56 (3.74)		2.47 (11.2)
Number of observations	60	59	51	50

Notes: robust t-statistics in parentheses. A constant term, state fixed-effects and a year trend are included in all regressions. The corresponding regressor is instrumented with the number of prosecutions launched relative to the number of complaints received under the Maternity Benefits Act (1961). See section 5 for more details about the estimation procedure. Data sources and definitions are in the data appendix.

Appendix Table A2. Disaggregated output and gender composition of the labor force, by class

Indian states 1961-1991 – Non-interpolated data

Dependent variable:	log per capita agricultural output		log per capita non-agricultural output	
	Fixed-Effects			
Female-to-male managers	1.82 (1.43)		3.54 (2.82)	
Female-to-male workers		0.93 (1.95)		1.92 (4.04)
Number of observations	60	59	51	50

Notes: robust t-statistics in parentheses. A constant term, state fixed-effects and a year trend are included in all regressions. See section 5 for more details about the estimation procedure. Data sources and definitions are in the data appendix.

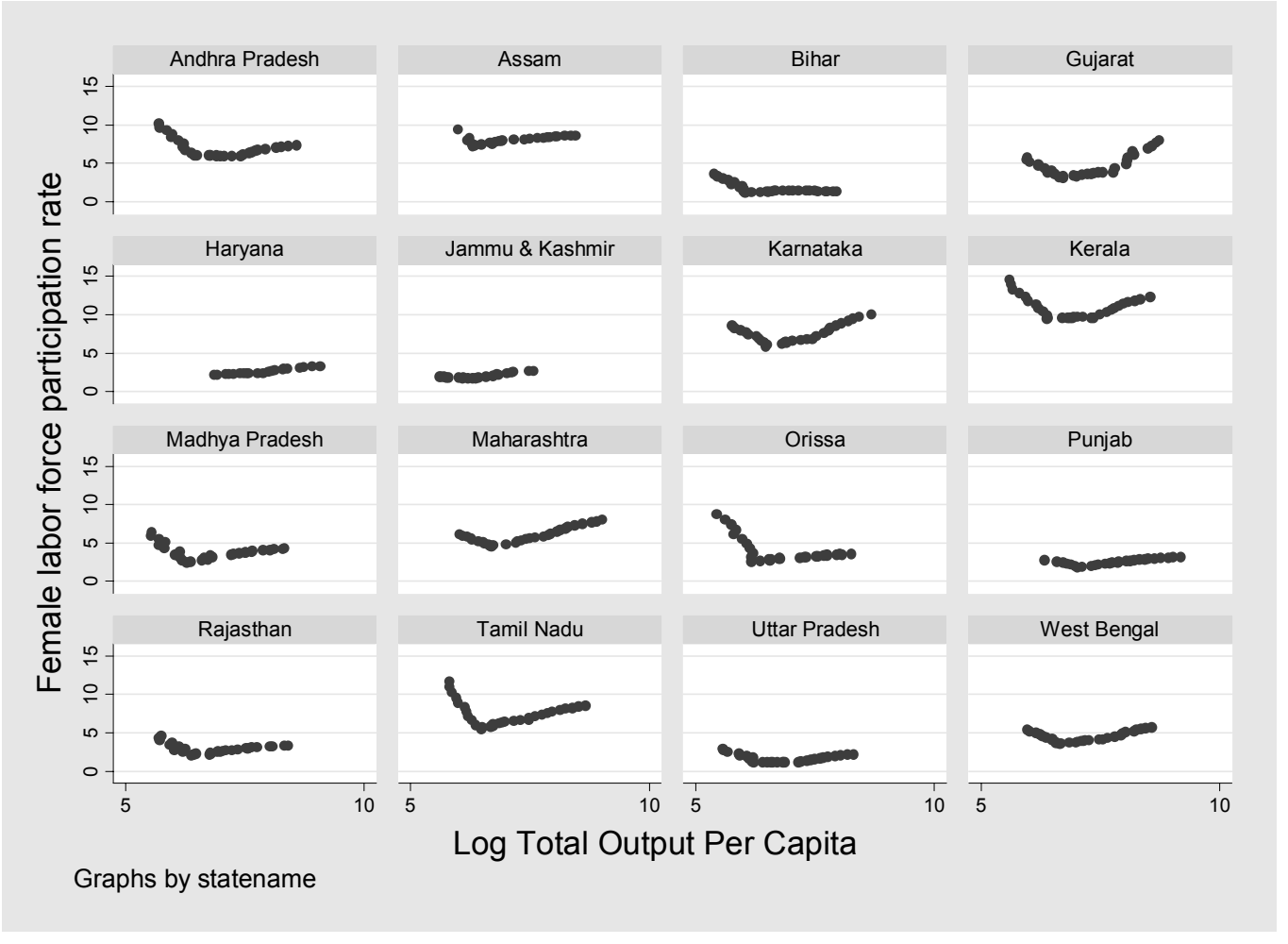

Figure A1. Female labor force participation as a function of total output per capita, India, 1961-1991

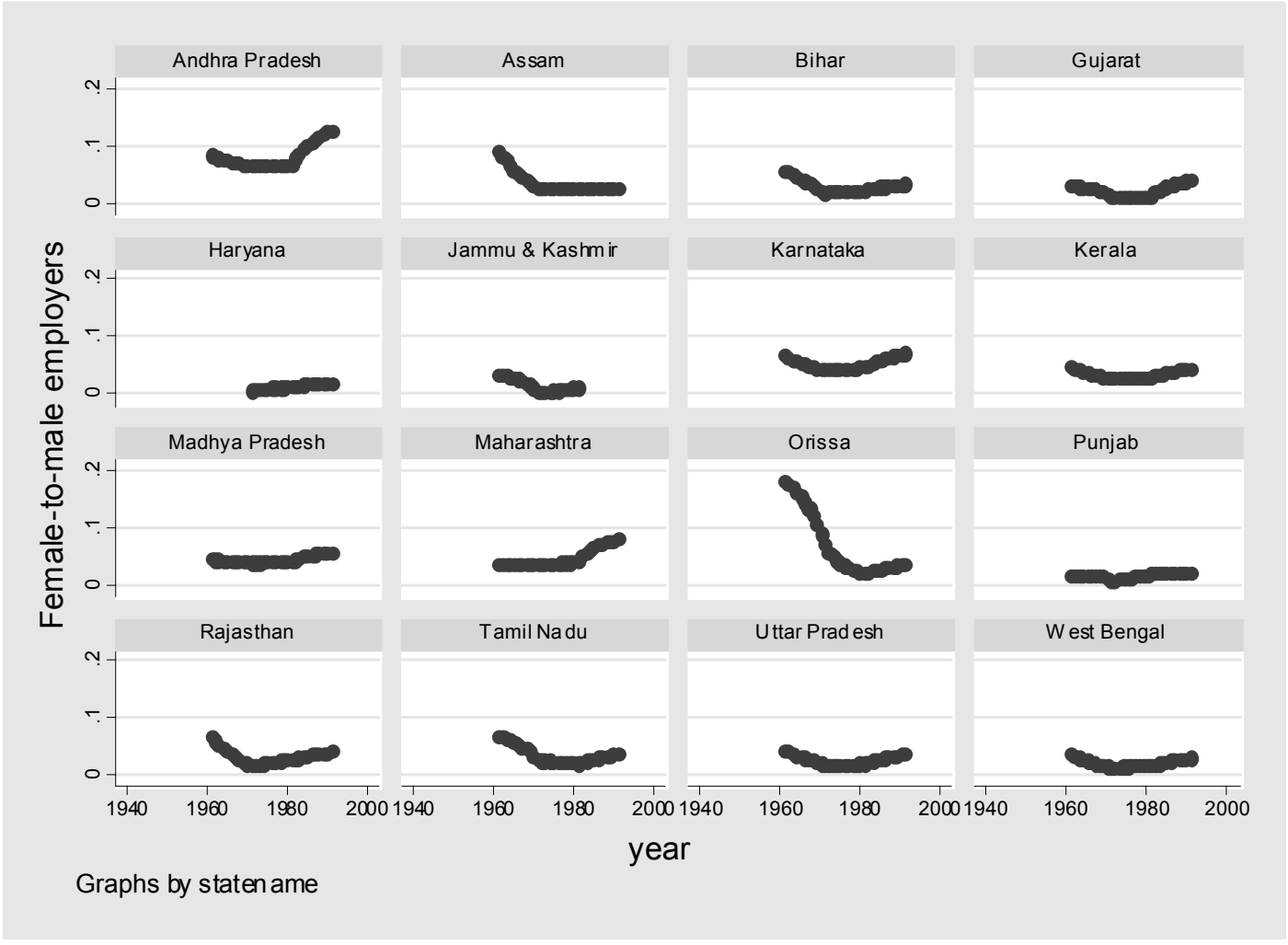

Figure A2. Ratio of female-to-male managers by state, India, 1961-1991

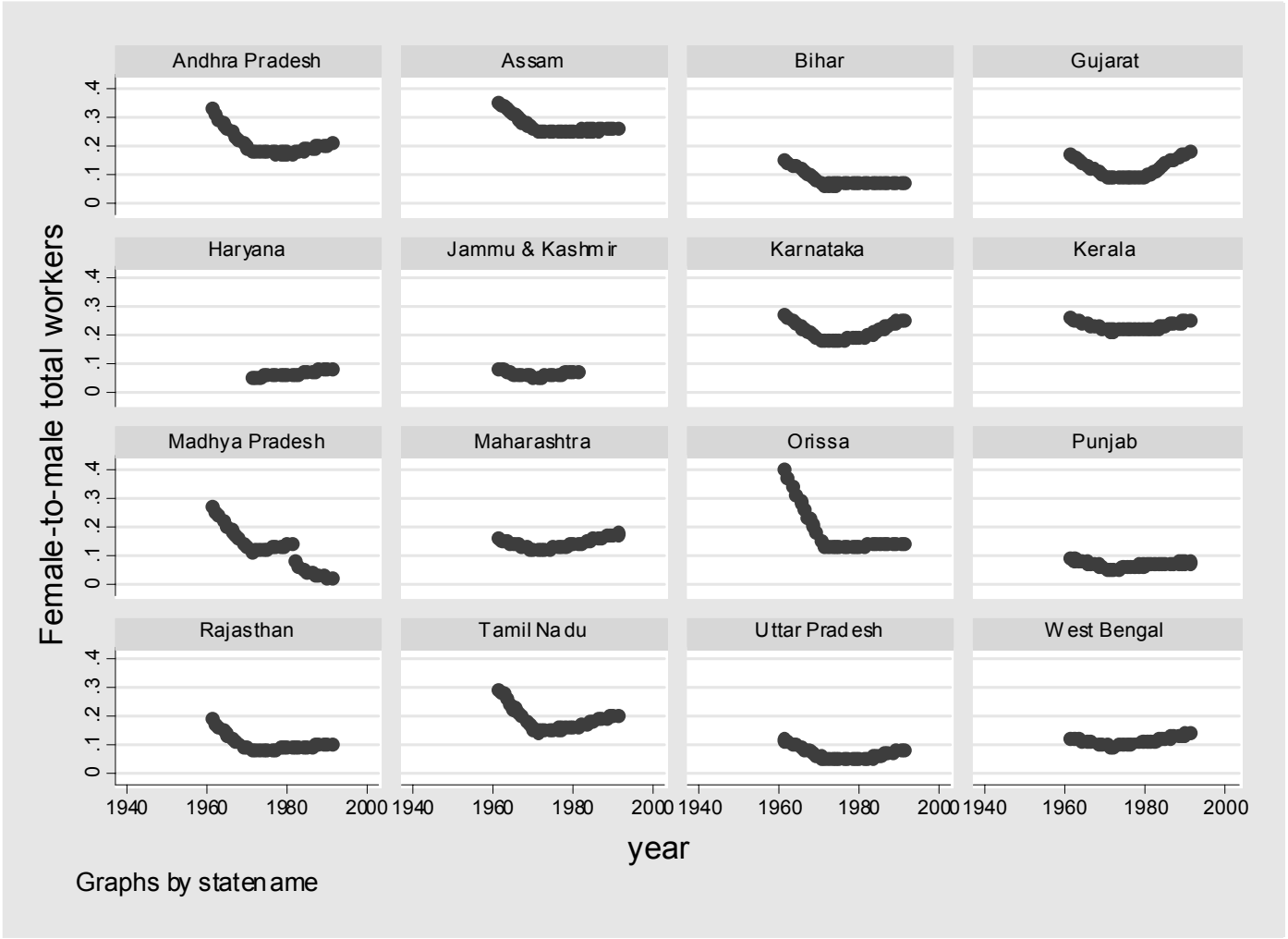

Figure A3. Ratio of female-to-male total workers, by state, India, 1961-1991