Gender Bias and Male Backlash as Drivers of Crime Against Women: Evidence from India

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Abstract

We explore the relationship between the gender gap in earning potential and crime against women in India. We propose a model with two groups in society that have opposing preferences on gender bias in institutions and technology. A shock to the gender bias in technology that increases productivity of women, and their earning potential, increases the feeling of alienation within the group which benefits from status-quo. We call them Patriarchs. In response, both groups invest resources to manipulate outcomes in their favor. This increases the level of hostility between those who want to lower gender bias and those who prefer status-quo. We argue that increased hostility results in more crime against women in society. A decrease in the gender gap in earning potential is hence associated with increased crime against women. We call this a backlash effect. We exploit survey data from India between 2004 and 2011 to construct measures of earning potential for men and women and combine them with administrative records on both domestic violence and rapes and indecent assaults in Indian districts. We provide evidence of backlash. In particular, we find that a lower gender gap is associated with more rapes and indecent assaults. This negative relationship is exacerbated when we focus on the gap among individuals with less than high-school education, in Indian states with high institutional gender bias, and states with a greater percentage of arguably patriarchal households, where women have lower bargaining power than men. As seen in developed counties, a smaller gender gap is associated with lower domestic violence. This is consistent with better outside options for women affording them greater bargaining power in the home. However, this result only holds for states with low gender bias and a low percentage of patriarchal households. There is evidence of backlash in the home in other states. Our study highlights that gender equity may exacerbate crime against women, particularly in the presence of gender biased institutions or culture.

Keywords: Crime Against Women, Backlash, Gender Bias, Gender gaps, India

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1 Introduction

The World Bank identifies violence against women and girls as a global pandemic that is not just devastating for victims, but has significant economic costs[1]. Recognizing its importance, a large literature in economics and other social sciences has investigated drivers of crime against women. Recent studies challenge the conventional wisdom that crime against women will duly fall as economic development brings greater opportunities for women[2]. We contribute to this debate by exploring the relationship between the gap in earning potential between genders (henceforth, gender gap) and crime against women, including rapes, indecent assaults and domestic violence. We propose that the increase in the relative productivity of women that often accompanies the process of economic development (Galor & Weil (1996); Rendall (2017)) can engender male backlash, whereby individuals subscribing to a gender biased regime feel alienated and expend resources to preserve the status-quo, increasing hostility and hence, crime against women. Utilizing rich micro data from India, our empirical analysis provides evidence of such a backlash effect, where a lower gender gap in earning potential is associated with more rapes and indecent assaults against women, particularly in a gender biased environment.

Much of the literature on crime against women in economics focuses on domestic violence. Income shocks, such as exchange rate shocks or rainfall shocks in agrarian societies, have been identified as important drivers of domestic violence against women (Sekhri & Storeygard (2014); Cools *et al.* (2015); Munyo & Rossi (2015); Abiona & Koppensteiner (2016)). Female empowerment, captured by the relative income or employment of women, has been identified as another key contributor (Angelucci (2008); Aizer (2010); Eswaran & Malhotra (2011); Hidrobo *et al.* (2016); Munyo & Rossi (2015); Anderberg *et al.* (2015)). The literature on domestic violence finds four main channels via which female empowerment, captured by lower gender gaps in labor market outcomes, may affect domestic violence. Firstly, in a household bargaining model, a lower gender gap increases the woman's bargaining power and leads to lower domestic violence by improving her outside option (Aizer (2010); Abiona & Koppensteiner (2016); Munyo & Rossi (2015)). Anderberg *et al.* (2015) find that greater unemployment of men is associated with lower levels of domestic violence due to the reduced position of men in the household. These studies imply that gender equality may reduce crime against women. Secondly, in an exposure context, Chin (2012) finds that greater employment of women (and hence a lower employment gap) is associated with women being out of the house and a lower exposure to domestic violence. Hence, better relative employment opportunities for women are associated with lower domestic violence.

A third channel affecting the relationship between gender gaps and domestic violence is evolutionary backlash. Eswaran & Malhotra (2011) argue that domestic violence stems from paternity uncertainty in our evolutionary past, where males feel jealous when their partners are exposed to other males, which is likely to be the case with

[1]'Violence Against Women and Girls', Brief, The World Bank, Washington DC, April 4 2018, accessed on 13 September at http://www.worldbank.org/en/topic/socialdevelopment/brief/violence-against-women-and-girls. The brief estimates the economic cost of violence against women in Latin America as 3.7% of GDP.

[2]See Brysk & Mehta (2017) and references therein.

better employment opportunities for women. They posit that violence may be used by men to keep women in the home and away from other men. In their framework, a lower gender employment gap resulting from greater employment opportunities for women would lead to a backlash from men and more domestic violence.

The final channel is the interaction between gender gaps, social norms and gender biased institutions. For example, a lower gender wage gap may be associated with greater marital conflict when this violates established gender identity norms. Bertrand *et al.* (2015) find that when the wife earns more than the husband, marriage satisfaction is lower and divorce rates are higher. In contrast, Amaral (2017) find that institutional improvement in female inheritance leads to greater bargaining power for women within a marriage and decreases domestic violence. Alesina *et al.* (2016) look across countries in Africa and find that historical social norms which rendered women more valuable are associated with less family violence today. Amaral & Bhalotra (2017) posit that violence against women can be expressed as a function of sex ratios. Using district level data, they estimate that the elasticity of violence with respect to the surplus of men aged 20-24 is unity. They suggest that one channel for increased number of males leading to increased domestic violence is the cultural bias generated by a male dominated sex ratio at birth.

Studies focusing on crime against women outside of domestic violence are scarce in the economics literature. One of the few papers to do so, Amaral *et al.* (2015), looks at India's National Rural Employment Guarantee Scheme and studies the impact of increased employment for women on crimes committed against them. The study finds evidence that increased female labor force participation is associated with increased gender based violence, potentially driven by increased exposure to unsafe work spaces. The study does not look at how this relationship varies by institutional gender bias, nor does it explore the relationship between male labor market outcomes and crime against women to uncover backlash. While the backlash channel has been explored in other social sciences[3], it is understudied in the economics literature.

In this paper, we propose to fill this gap in the literature. We study the relationship between gender gaps and crime against women both in the domestic context and outside. We argue that the backlash channel driving crime against women is particularly relevant in the context of economic growth and development. We propose a model of conflict, building on Esteban & Ray (2008). In the model, there are two political groups: Patriarchs and Feminists. Female bargaining power relative to men in the family is a function of the extent of gender bias in institutions and technology. Patriarchs prefer a regime where women have lower bargaining power relative to men while Feminists prefer equality. Families pay a subscription to the group in which they are born. A shock to the gender bias in technology that increases productivity of women, and their earning potential, increases the feeling of alienation within the group which benefits from status-quo, Patriarchs. In response, both groups invest resources to manipulate outcomes in their favor. This increases the level of hostility between the two groups. We argue that increased hostility results in more crime against women in society. A decrease in the gender gap in

[3] for example see Martin *et al.* (2006), Whaley (2001) and the references therein.

earning potential is hence associated with increased crime against women. We call this a backlash effect. Using numerical examples from our model, we illustrate the role of institutional and cultural gender bias and diversity, (percentages of Patriarchs and Feminists in society), in determining the relationship between the gender gap and crime against women. Finally, we posit that domestic violence is an increasing function of the distance between the value of men and women in the family, the level of gender bias in institutions and culture that informs perceptions of violence, and the gender gap in earning potential that matters for womens' ability to report domestic violence.

For our empirical analysis, we use data from India on reported crime against women across districts, including rapes, assaults, harassment and domestic violence. We construct district level gender gaps in earning potential using survey data. Our measure of earning potential for each gender in an Indian district is the gender-specific employment weighted average across industries of wages earned nationally by that gender. This is arguably exogenous to shocks to labor supply from crime in the district. To account for measurement error in self-reported earnings, we use an instrumental variable (IV) estimation strategy that exploits trade-induced shocks affecting earnings of each gender differently. Our IV strategy also allows us to account for the endogeneity in the gender gap in total employment at the district level, which we use to investigate the exposure effect - the idea that more women employed exposes them to crime. Next, to investigate the role of education in driving backlash, we decompose our gender gap measure into two gap measures, one among individuals with less than high-school education and the other among individuals with high-school education or more. Finally, we exploit the wide variation in institutions and culture across Indian states to delve into the role of gender bias in determining the relationship between gender gaps and crime against women. Our regional measures of gender bias include an index of womens' access to public services and the number of "missing women", to capture the idea that women are less valued. We measure the percentage of Patriarchs by looking at the percentage of households in the region who report either needing permission from a senior family member to visit friends in the local area or practicing Purdah (a 'facial covering').

Our results show that a lower gender gap in earning potential is associated with higher levels of rapes and indecent assaults committed against women. A one percent decrease in the gender gap is associated with an increase in rapes and indecent assaults of 0.8 percent. Decomposing the effect of the gap into effects coming from changes in male and female earning potential, we find that lower male and higher female earning potential are associated with an increase in rapes and indecent assaults. These relationships are consistent with a backlash. To our knowledge, ours is the first study to present evidence of backlash in crime against women outside of the domestic violence context. We find that a narrower gender gap in employment is associated with an increase in rapes and indecent assaults. This is driven by higher levels of female employment, consistent with both a backlash effect, or a greater exposure to unsafe spaces. We find that the earning potential and employment gap effects are exacerbated for the gender gap among individuals with less than high-school education, in states with high gender bias and in states with a larger percentage of patriarchs.

A potential concern for many studies on crime, including ours, is that our data are on reported crimes. Any effect of gender gaps on crime against women may be driven by an increase in reporting of crime, rather than an increase in instances of crime. We tackle this in several ways. First, we exclude reports of harassment from our main analysis and focus on the more physical crimes of rape and indecent assault. Instances of rapes, indecent assaults and harassment are likely to stem from similar root causes. Although all of these crimes will suffer from under reporting, harassment is likely to be the most sensitive and rape and assault the least sensitive to it, given that evidence is easier to obtain in the case of the latter. Next, we repeat our main regressions with harassment included to ask if our results change meaningfully. We find that our results are qualitatively and quantitatively similar without harassment included. Finally, we find that the negative relationship between the gender gap and crime against women is magnified in gender biased states, where institutions are typically more favorable to men. We argue that this is evidence against the alternate hypothesis to backlash - that lower power for men may be associated with less intimidation against reporting of crime.

For domestic violence, we find that a one percent decrease in the gender gap, is associated with a 1.2 percent decrease in domestic violence, consistent with the bargaining effect seen in developed countries (Aizer (2010)). This is much larger among individuals with less than high-school education and in states where gender bias is low. Additionally, there is evidence of the opposite relationship in states with high gender bias. In gender biased areas, a decrease in the gap is associated with an increase in domestic violence. Separating out male and female earning potential, we find that, in biased areas, male earning potential is negatively associated with domestic violence. This demonstrates a potential backlash effect from men in high gender bias states. Overall, the domestic violence results suggest that an increase in bargaining power can reduce violence against women in the home, in line with developed countries. However, this holds only in areas of low gender bias[4].

Our study contributes to the literature on the drivers of crime against women, both in and outside the home. We provide evidence for a backlash effect in rapes and indecent assault. Our results are robust to controlling for a battery of correlates to crime against women and to utilizing alternate measures of gender gaps, gender bias and diversity. We show that this backlash effect is exacerbated in regions with high gender bias and regions with a high percentage of patriarchal households. We hence highlight that the process of development, often associated with technological advancement that increases relative female productivity and narrows gender gaps in labor market outcomes, may involve increasing crime against them. This increase in crime is likely to be more acute when institutions or culture are gender biased or in the presence of diverse groups with opposing preferences on the bargaining power of women. We hence complement the literature on gender norms that argues that historic gender biased allocation of tasks and resulting gender norms may present barriers to women's labor force

[4]Note that reporting bias in this case would work against the bargaining power channel. Our result hence underestimates the bargaining power effect in the presence of reporting bias.

participation today (Alesina *et al.* (2013); Sanghi *et al.* (2015); Sorsa (2015) and Eswaran *et al.* (2013)). For domestic violence, we find evidence for the bargaining effect as seen in developed countries, but only in areas of low gender bias. There is evidence for backlash within the home in areas of high gender bias. Finally, we also contribute to the growing literature on gender gaps and their implications for growth and economic performance (Klasen *et al.* (2018)).

2 The Model

We apply the Esteban & Ray (2008) model of conflict to examine how reported crime against women may increase as the gender gap in earning potential falls. Our model broadly captures the political contest for building social institutions for facilitating new technology adoption. This typically occurs over the course of economic development, thereby underscoring the relationship between development and crime against women.

There are two political groups: Patriarchs (P) and Feminists (F) made up of two types of families (i). There are a continuum of families n_i with $0 < n_i < 1$, $i = P, F$ such that $\sum_{i=P,F} n_i = 1$. Each family consists of a man (m) and a woman (w). Both are endowed with one unit of labor from which each $k = m,\ w$ uses l_k units to earn $z_k l_k$ units of income for the family.

The technology is less developed relative to the (world) frontier. In particular, it is relatively brawn (rather than brain) intensive and hence has a male bias such that it rewards a woman less than a man: $z_w < z_m$. This assumption builds on earlier research. Galor & Weil (1996) and Rendall (2017) present a novel mechanism of economic growth in which capital is more complementary to labor supplied by women than men. Consequently, economic growth raises women's relative wages.

We define the technology driven "relative female productivity" f_T in the economy

$$f_T \equiv \frac{z_w}{z_m}. \tag{1}$$

To simplify notation we define $z = z_m$, so the returns to labor for men and women become zl_m and $f_T z l_w$ respectively. We assume that the frontier technology provides $f_T = 1$ while a gender biased regime keeps $f_T < 1$ in the operating technology of a country. The utility U_k for each $k = m,\ w$ as functions of consumption c_k and leisure $(1 - l_k)$ are as follows:

$$U_k = \ln c_k + \theta_k \ln(1 - l_k),\ k = m,\ w.$$

We assume that $\theta_m < \theta_w$ to capture women's evolutionary home-bias. To simplify notation we choose $\theta_m = \theta$.

Next, we modify the utility function of a woman by considering the impact of crime on her utility. We assume that a greater likelihood p of crime against women, either on her way to work, or at work, induces a utility loss from work. We model such loss by assuming that the value of her leisure increases with p such that $\theta_w = 1 + p$.

We assume that society governs the family by directly influencing the bargaining power of women in the family. It does so by establishing its legal and judicial system through a political hierarchy, which we do not model. However, we assume that a gender biased culture would promote institutions in which a women's bargaining power σ_I relative to the man of the family would be less than unity. In addition, we assume that relative female productivity f_T also influences the woman's bargaining power inside the family by determining her productivity and thereby her market value and implied opportunities in the labor market, including her earning potential.

A family pays a subscription r_i set by the group $i = P$ and F in which they are born. Each family is too small to influence their subscription and, therefore, takes that subscription payment r_i as a given parameter. The family weighs the utility of the man and woman depending upon the social regime $\sigma = \sigma(\sigma_I,\, f_T)$ which governs how it evaluates the woman's utility relative to the man's, while determining the optimal allocation for the family. Household utility is given by:

$$U_{HH} = U_M + \sigma U_F$$

$$U_{HH} = \ln c_m + \theta \ln(1 - l_m) + \sigma\left(\ln c_w + (1+p)\ln(1 - l_w)\right).$$

The budget constraint for the household is given by:

$$c_m + c_w + r_i = z l_m + f_T z l_w, \qquad i = P, F.$$

Which implies the following Lagrangian:

$$\max_{c_k, l_k,\ k=m,w} L \equiv \ln c_m + \theta \ln(1 - l_m) + \sigma\left(\ln c_w + (1+p)\ln(1 - l_w)\right) - \mu(c_m + c_w + r_i - z(l_m + f_T l_w)), \quad i = P, F. \tag{2}$$

The resulting optimal consumption and participation at work outside the home are given by:

$$c_m = \frac{z(1 + f_T) - r_i}{1 + \theta + (2 + p)\sigma}, \quad c_w = \sigma c_m, \qquad i = P,\ F. \tag{3}$$

$$l_m = 1 - \frac{\theta c_m}{z}, \qquad l_w = 1 - \frac{\sigma(1+p)c_m}{z f_T}. \tag{4}$$

Given the outside opportunity in the market implied by the technology-bias f_T against women and the institutional bias σ_I against the woman's bargaining power in decision making within her family, the above family allocation of (3) and (4) together implies the following values of a man (V_m) and a woman (V_w) in society, in the absence of activities of political groups. We call this the status-quo valuation:

$$V_m = \ln\left(\frac{z(1+f_T)}{1+\theta+(2+p)\sigma}\right) + \theta \ln\left(\frac{\theta(1+f_T)}{1+\theta+(2+p)\sigma}\right) \tag{5}$$

$$V_w = \ln\left(\frac{\sigma z(1+f_T)}{1+\theta+(2+p)\sigma}\right) + (1+p)\ln\left(\frac{\sigma(1+p)(1+f_T)}{(1+\theta+(2+p)\sigma)\, f_T}\right) \tag{6}$$

Leaders operating the two political groups, the Patriarchs (P) and the Feminists (F), have two conflicting preference orderings over the outcome of technology and social institutions that govern family-based decisions. Patriarchs (P) prefer a lower value of both σ_I and f_T and a higher value V_m of the man in the family. Feminists (F) prefer the outcome bundle of equality, $f_T = 1$ and $\sigma_I = 1$ over any other outcome and hence, a higher value of V_w of the woman in the family. In particular, we assume that the welfare functions for the two political groups: P and F satisfy:

$$W_P = V_m, \quad W_F = V_w. \tag{7}$$

where V_m and V_w satisfy (5) and (6) respectively.

Thus, the two political parties $i = P, F$ differ in terms of their preferred outcome $X_i = (f_T, \sigma_I)$ for the social institution I that determines the degree of gender equality σ measured by the women's autonomy in deciding over her family's allocation of resources, or, equivalently, the woman's bargaining power in the family, where, $\sigma = f_T\sigma_I$. We assume that the status-quo in a society insulated by gender biased institutions is such that $f_T < 1$, $\sigma_I < 1$ while the frontier offers a feasible alternative outcome where $f_T = 1$, $\sigma_I = 1$. Given the choice between the status-quo and its alternative, Patriarchs P prefer the status-quo $X_P = (f_T < 1,\, \sigma_I < 1)$ while Feminists F prefer $X_F = (f_T = 1, \sigma_I = 1)$ to X_P.

We argue, following the findings of Iyer *et al.* (2012), that women's political representation and associated innovations in the social, legal and judicial system determine the degree σ_I of autonomy that women enjoy in the family's decision making. Also, we argue that technological improvements that increase relative female productivity f_T may increase σ by expanding the outside opportunities for women, which, in turn, increases their bargaining power $\sigma = f_T\sigma_I$ within a family. This is consistent with studies showing that womens' value in society and their bargaining power in the family increases as the share of the brain-intensive sectors in the economy grow (see Damjanovic & Selvaretnam (2019)) and as the gender wage gap declines (see Ho (2016)).

A social change creates conditions where one group finds itself alienated by the outcome that prevails in the society relative to its preferred outcome. The difference in the group preferences over the outcome σ_I and f_T creates a welfare gap or "alienating distance" $d_{i,j}$, which measures the welfare loss that the group i suffers when the political process implements group j's preferred outcome. Following Esteban & Ray (2008) we define the alienating distance (δ_P, δ_F) for the two groups P and F as follows:

$$\delta_P = W_P(X_P) - W_P(X_F), \tag{8}$$

and

$$\delta_F = W_F(X_F) - W_F(X_P). \tag{9}$$

A prospect of social change that may cause alienation encourages the groups to invest resources to achieve or maintain the preferred outcome. In the contest for institutional and technological changes or the resistance to change, we treat σ_I and f_T as public goods. The expected profit from welfare gain that potentially comes from changes in institutions and technology measures the value of such investments in resources for political purpose. To make these political investments, each group collects a tax r_i from each of its n_i followers to increase the probability λ_i of success, which depends on the group's share of total resources R devoted by both groups. In particular, we assume the probability of success: λ_i, $i = P$,F satisfy

$$\lambda_i = \frac{n_i r_i}{R}, \text{ where, } R = \sum_{i=P,F} n_i r_i.$$

The leader of each group uses its funds $n_i r_i$ to influence the media, to lobby politicians and to undermine the objective of its opponents. Group leaders choose optimal r_i to maximize the expected profit from a conflict ($\Pi_{i=P,F}$) given by the expected befit minus cost:

$$\mathit{\Pi}_F = \lambda_F \delta_F - C_F\left(X_p, r_F\right), \tag{10}$$

$$\mathit{\Pi}_P = \lambda_P \delta_P - C_P\left(X_p, r_P\right), \tag{11}$$

where the cost functions are the forgone utility in the status-quo, given up when making a contribution:

$$C_i\left(X_p, r_i\right) = W_i\left(X_P\right) - W_i\left(X_P, r_i\right), \;\; i = P, F,$$

where X_p is the status-quo. It is assumed no resources or needed to maintain the status-quo. Groups invest resources only to create or resists change. Differentiating the profit functions yields the First Order Conditions (FOCs): For feminists, the optimal contribution r_F^* satisfies:

$$\frac{\partial \mathit{\Pi}_F}{\partial r_F} = \left(\frac{n_F \delta_F}{R}\right)\left(1 - \frac{n_F r_F^*}{R}\right) + \frac{\partial W_F}{\partial r_F}\left(X_P, r_F^*\right) = 0, \tag{12}$$

and for patriarchs, r_P^* satisfies:

$$\frac{\partial \Pi_P}{\partial r_P} = \left(\frac{n_P \delta_P}{R}\right)\left(1 - \frac{n_P r_P^*}{R}\right) + \frac{\partial W_P}{\partial r_P}\left(X_P, r_P^*\right) = 0. \tag{13}$$

The aggregate consistency condition satisfies:

$$R = n_f r_f^* + n_P r_p^*, \tag{14}$$

and:

$$p(R) = 1 - \frac{1}{(1+R)^\gamma}, \ \gamma > 0. \tag{15}$$

We argue that the total measure R of resources that the two groups devote for such hostile political activities increases the likelihood p of crime against women in the economy. Note that $p(R)$ is a negative externality in the group optimization exercise.

The set of r_p, r_f, p and R that satisfies equations (12) - (15) defines the equilibrium or the outcome of the model economy. We establish numerically the existence of a locally stable equilibrium, which allows us to do comparative statics.

We now follow the Esteban & Ray (2008) algorithm to map the index of diversity D and hostility (or polarization) H in the population to conflict between the two groups. The diversity index D satisfies

$$D \equiv \sum_{i=P,\ F} n_i(1-n_i) = 1 - \sum_{i=P,\ F} n_i^2, \tag{16}$$

and, the index for hostility H satisfies:

$$H \equiv \sum_i n_i^2(1-n_i)\delta_i, \ i = P, \ F.$$

A high degree of hostility increases the cost of conflict and hence lowers the likelihood of its occurrence and crime against women. An economy stuck with a low value of σ, that is, a low degree of women's autonomy in decision making, illustrates such a case. Therefore, we expect a strong positive relationship between H and p but when H is neither too high nor too low. Similarly, we expect an inverted-U shaped relationship also between D and p. In general, increased diversity, coupled with a low degree of polarization increases the frequency of crime against women. A greater degree of gender bias in social institutions reduces women's bargaining power. If that bias is coupled with a greater welfare loss from a potential change in σ or f_T, then it causes a higher degree of hostility which ironically lowers crime against women. In a highly polarized or hostile environment, a substantial change in f_T can increase the total resources R devoted to conflict and cause a significant increase in crime against women.

2.1 Domestic violence

We interpret domestic violence to be positively related to (or proxied by) the difference in the values of the man and the woman in the family, scaled by institutional bias against women, σ_I (which accounts for what people perceive as domestic violence), and f_T, capturing the ability of women to report domestic violence, which we argue increases with her outside options. Therefore, if the adoption of new technology increases a women's bargaining power σ within their family, then domestic violence will decline. Utility here is calculated ignoring any household contributions to patriarch or feminist causes, but taking account of the level of outside crime in a region:

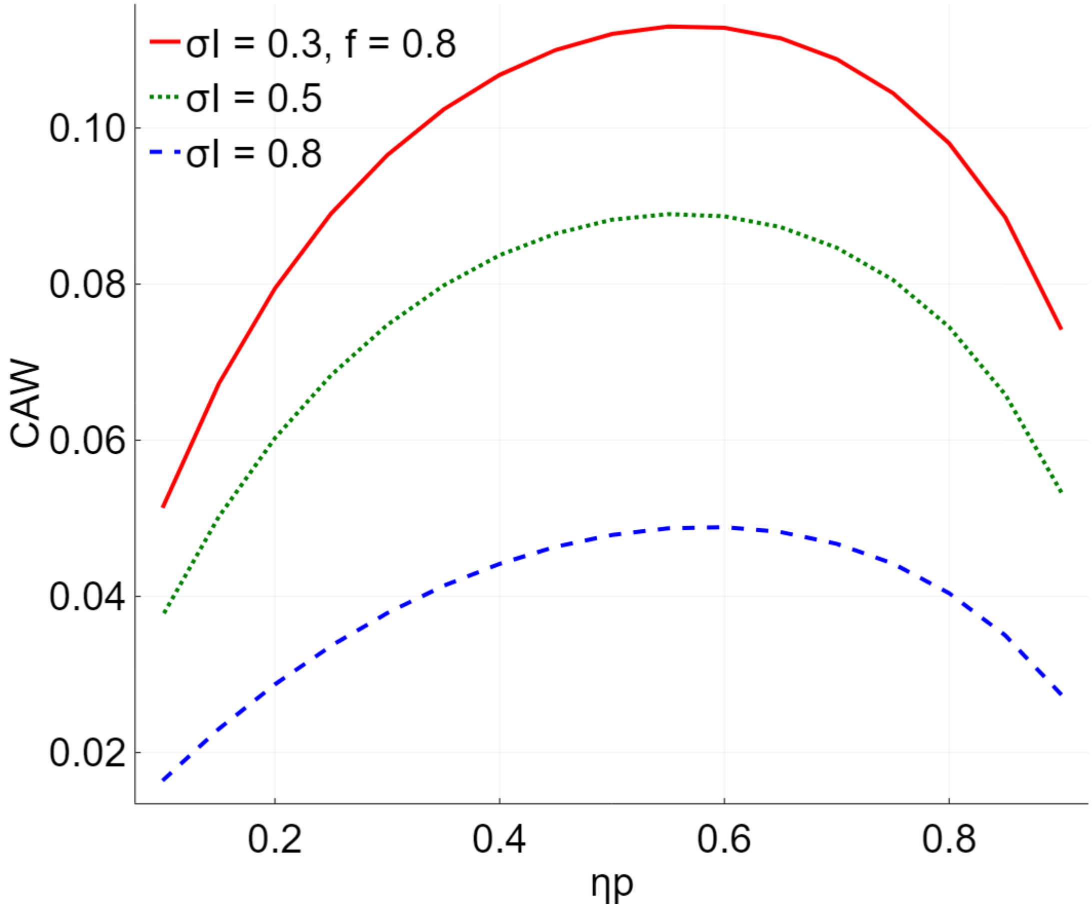
$$DV \equiv \sigma_I^{\zeta_1} f_T^{\zeta_2}(V_m - V_w),\ \zeta_1, \zeta_2 > 0. \tag{17}$$

Here ζ_1 and ζ_2 capture the relative elasticity of the perception and reporting effects on domestic violence.

2.2 Numerical simulations

Solving equations (12), (13) and (14) yields optimal contributions r_p^*, r_f^*, total resources devoted to conflict $R^*$and the likelihood of crime against women p^*. We choose $\theta = 0.8, \gamma = 0.1$, and simulate and solve the model for a range of parameters $f_T, \sigma_I, \zeta_1, \zeta_2$ and η_p. Figures 1 through 6 present numerical simulations from the model to derive implications for the relationship between relative female productivity and crime against women along with the role played by gender bias in determining this relationship. We first look at the relationship between diversity, (Equation 16), and the likelihood of crime against women, given by (15) for $f_T = 0.8$ and various levels of institutional gender bias σ_I. We find that the relationship is an inverse U-shape. The likelihood of crime against women is highest when the percentage of Patriarchs in society is approximately one half, such that diversity is maximized. Also, for a fixed level of relative female productivity, greater institutional gender bias is associated with a higher likelihood of crime against women.

Figure 1: Simulation results for predicted crime, plotted against the percentage of patriarchs in a region, for different level of institutional bias, σ_I



Note: CAW represents: Rape and Indecent Assault. ηp represents the percentage of patriarchs in a region. σI represents the level of institutional bias against women in a region, σI=1 is equality, σI<1 is bias against women. f_T is the relative return to female labor compared to men, $f_T = 1$ is equality between genders in returns to labor. Here $f_T = 0.8$. It is clear in the above that crime is predicted to be greatest for any given σ_I when there is a greater diversity of patriarchs and feminists. In addition, crime is higher for any level of diversity when there is more bias (as shown by a lower σ_I).

Next, the top panel of Figure 2 plots the relationship between relative female productivity and alienating distance for Patriarchs and Feminists given by (8) and (9) for three values of σ_I, assuming that the percentage of Patriarchs is fixed at 0.5. The bottom panel does the same for Feminists. As f_T increases, technology is relatively more favorable to women and is associated with better labor market opportunities for them. This increases the alienating distance for Patriarchs, but reduces the alienating distance for Feminists, capturing the inherent tension associated with technological development that favors women relative to men by, for instance, reducing the relevance of physical strength. The plots also show that the relationship between f_T and alienating distance is heterogeneous across levels of institutional gender bias, with alienation for Patriarchs rising more rapidly in the presence of institutional gender bias (where σ_I is low).

Figure 3 explores the relationship between f_T and the likelihood of crime against women given by (15) when the percentage of Patriarchs is fixed at 0.5 for varying levels of institutional gender bias. As relative female productivity increases, we see an increase in the likelihood of crime against women, capturing male backlash. This backlash effect is exacerbated if institutional gender bias is high (or the bargaining power of women is low). In addition, the relationship between f_T and the likelihood of crime against women is reversed if institutional gender bias is low. In other words, we see a bargaining effect, whereby greater relative earning potential for women is associated with a lower likelihood of crime against them in society.

Figure 4 explores the same relationship when the level of institutional gender bias is fixed at 0.5 percentage of Patriarchs is varied in a region. We again see male backlash in the increase in crime as relative female productivity increases. However, in areas with a high percentage of patriarchs we see a bargaining effect, where crime begins to decrease as f_T continues to rise. The highest level of crime is predicted when diversity is greatest.

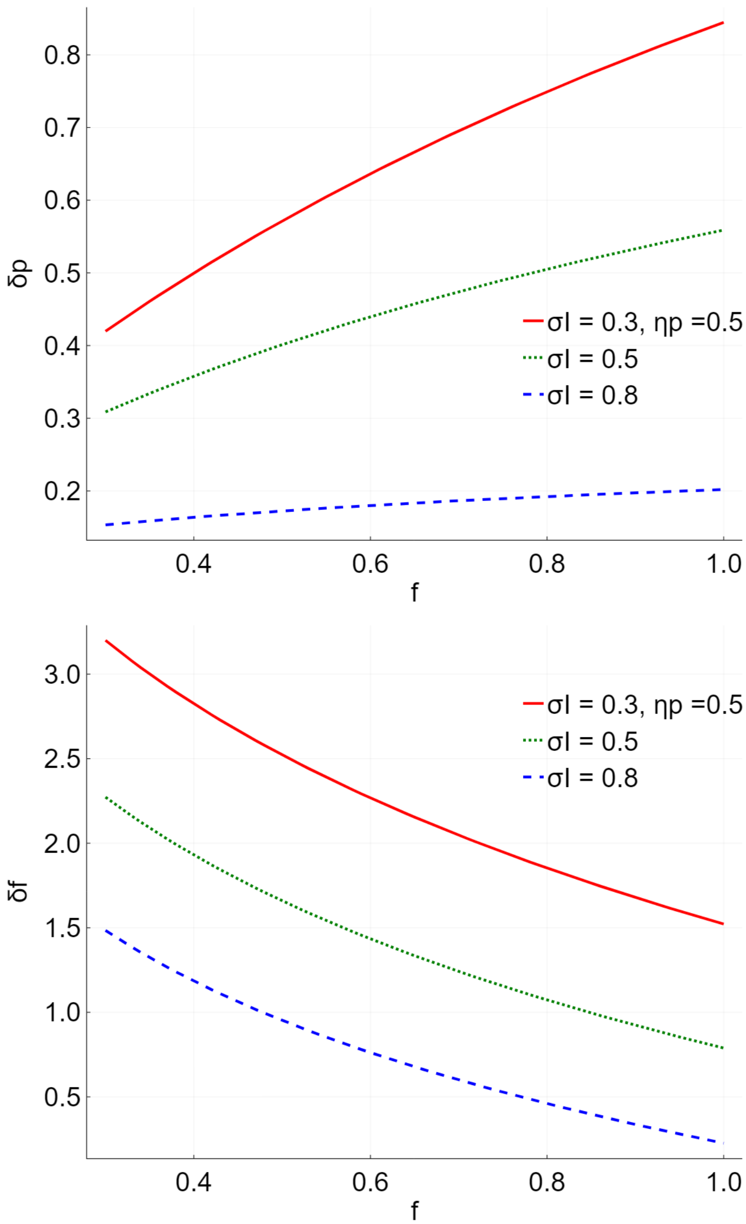
In real world data, we expect the level of institutional bias and the percentage of patriarchs in a region to be highly correlated. Figure 5 plots the relation between f_T and the likelihood of crime against women for varying percentages of Patriarchs n_p along with associated changes in the levels of institutional gender bias. I.e. for a high percentage of patriarchs we model high institution bias, and vice versa for low levels. The plot shows a backlash effect for all values of n_p and σ_I. However, backlash is highest when institutional gender bias and the percentage of Patriarchs is highest.

Finally, Figure 6 plots the relationship between relative female productivity f_T and domestic violence given by (17) for varying levels of institutional gender bias[5], with $\eta_p = 0.5$ and two sets of parameter values: $\zeta_1 = \zeta_2 = 0.4$ and $\zeta_1 = \zeta_2 = 0.75$. An increase in f_T is associated with less domestic violence, particularly for low and medium levels of institutional gender bias. This result is consistent with findings for advanced countries like the United States where institutional gender bias is low. For a high level of institutional gender bias captured by low σ_I, this relationship is diminished or even reversed. The extent of this reversal is dependent on the exact values of ζ_1 and ζ_2. Higher values means a greater impact of the reporting or perceptions effect. In the bottom panel of Figure 6, in regions of high bias, an increase in f_T may increase V_w and hence reduce conflict in the home, however it increases $f_T^{\zeta_2}$ to a greater extent, simulating a higher impact of a woman's outside option, resulting in more reports of domestic violence. This models a situation where the reporting effect dominates the bargaining effect. The exact values to use for ζ_1 and ζ_2 should be trained from empirical analysis.

To summarize, our model of crime against women outside the home and domestic violence predicts that, an increase in relative female productivity that leads to improved earning potential for women relative to men, may be associated with increased crime against women outside the home due to male backlash. This effect is exacerbated in the presence of gender biased institutions. An increase in relative earning potential for women is likely to reduce domestic violence, but only when institutional gender bias is not very high. The following sections of the paper undertake an empirical analysis to explore the implications of the model using data on crime against women from India.

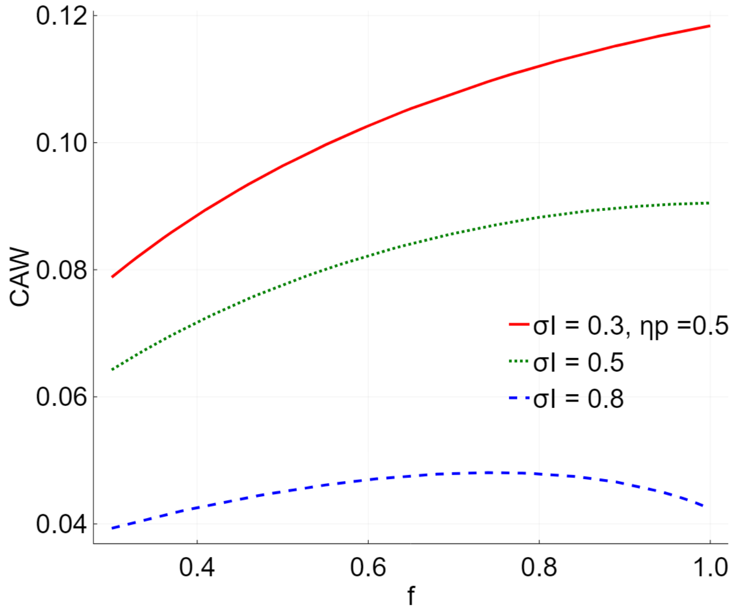
[5] as currently constructed DV does not vary with the percentage of patriarchs in a region.

Figure 2: Simulation results for degree of alienation of patriarchs and feminists, plotted against the relative bias against female earning potential



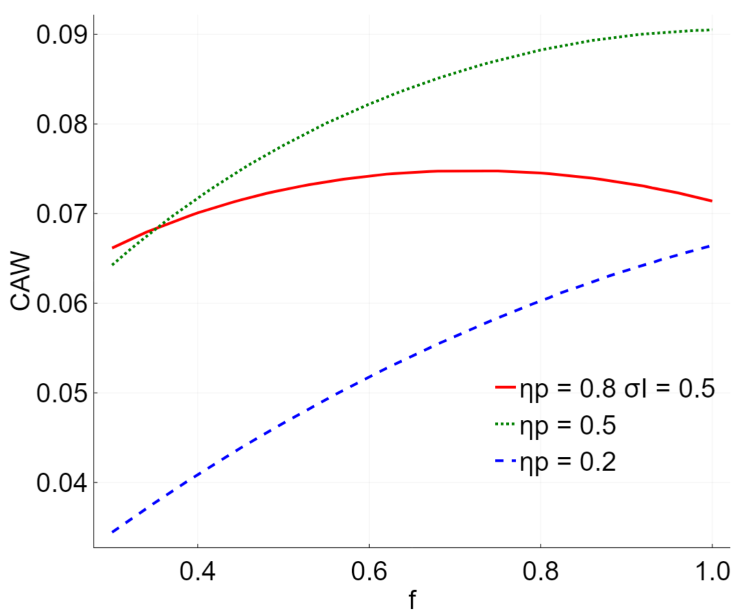
Note: δp represents the distance between the status-quo and patriarchs preferred outcome. δf represents the distance between the status-quo and feminists preferred outcome f is the relative return to female labor compared to men, $f = 1$ is equality between genders in returns to labor. σI represents the level of institutional bias against women in a region, σI=1 is equality, σI<1 is bias against women. In this simulation percentage of patriarchs $\eta p = 0.5$. It is clear that patriarchs become more alienated as f rises, and feminists become less alienated. For both this alienation is highest in high biased regions (shown by low σ_I).

Figure 3: Simulation results for predicted crime, plotted against the bias against female labor in the workforce, for different level of institutional bias, σ_I



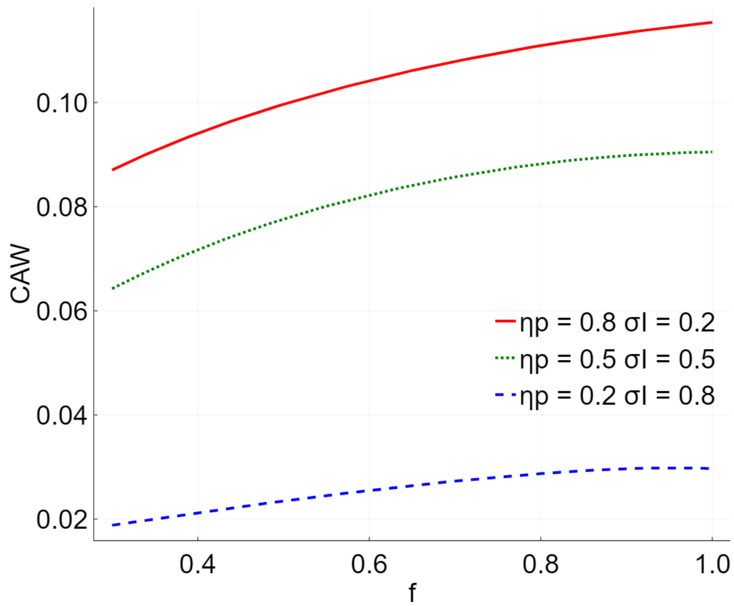
Note: CAW represents: Rape and Indecent Assault. ηp represents the percentage of patriarchs in a region, here $\eta p = 0.5$ and 0.8. σI represents the level of institutional bias against women in a region, σI=1 is equality, σI<1 is bias against women. f is the relative return to female labor compared to men, $f = 1$ is equality between genders in returns to labor. It is clear in the above that crime is increasing with f for any given σ_I. In addition, this effect is exacerbated in regions where there is more bias (as shown by a lower σ_I). When there is a low degree of bias, $\sigma I = 0.8$ we actually see a negative relationship between f and CAW at high level of f.

Figure 4: Simulation results for predicted crime, plotted against the bias against female labor in the workforce, for different percentages of patriarchs ηp



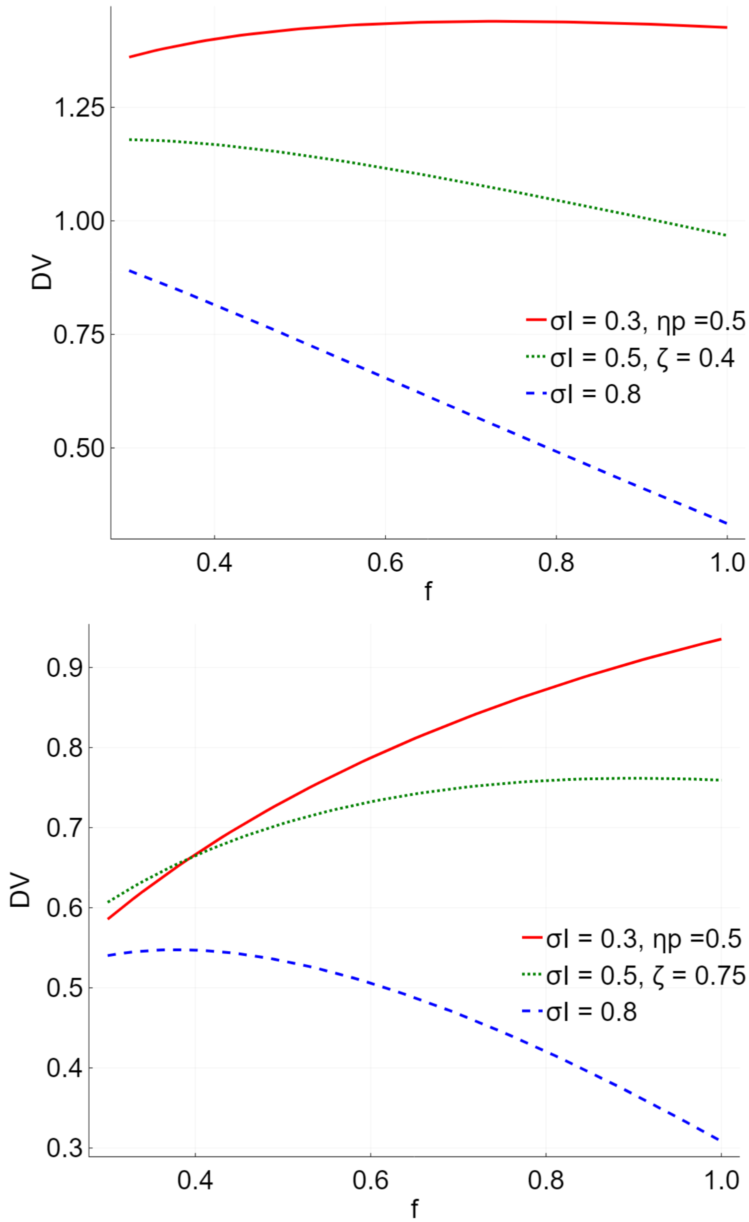
Note: CAW represents: Rape and Indecent Assault. ηp represents the percentage of patriarchs in a region. σI represents the level of institutional bias against women in a region, σI=1 is equality, σI<1 is bias against women. Here $\sigma I = 0.5$. f is the relative return to female labor compared to men, $f = 1$ is equality between genders in returns to labor. In the above, crime is generally increasing with f for low and medium ηp, however for high ηp and high f, crime is decreasing with f. The maximum amount of crime is predicted in regions where there is maximum diversity (as shown by $\eta p = 0.5$).

Figure 5: Simulation results for predicted crime, plotted against the bias against female labor in the workforce, for different percentages of patriarchs and different levels of σ_I



Note: CAW represents: Rape and Indecent Assault. ηp represents the percentage of patriarchs in a region. σI represents the level of institutional bias against women in a region, σI=1 is equality, σI<1 is bias against women. f is the relative return to female labor compared to men, $f = 1$ is equality between genders in returns to labor. It is clear in the above that crime is increasing with f for any given σI. In addition, this effect is exacerbated in regions where there is high bias and a high percentage of patriarchs (as shown by $\sigma I = 1$ and $\eta p = 0.5$).

Figure 6: Simulation results for predicted domestic violence, plotted against the bias against female labor in the workforce, for different level of institutional bias, σ_I



Note: DV represents: domestic violence. ηp represents the percentage of patriarchs in a region, here $\eta p = 0.5$. σI represents the level of institutional bias against women in a region, σI=1 is equality, σI<1 is bias against women. f is the relative return to female labor compared to men, $f = 1$ is equality between genders in returns to labor. It is clear in the above that for medium and high σ_I, crime is decreasing with f. This represents the household bargaining effect. We also see that in very low σI we crime may be increasing with f. This effect is exacerbated when ζ is high. here $\zeta = \zeta_1 = \zeta_2$

3 Empirical Analysis

3.1 Empirical specification

Our empirical analysis studies the relationship between a decrease in the earning potential of men relative to women (or, an increase in the relative earning potential of women) and crime against women. If a decrease in the relative earning potential of men leads to a backlash effect, a narrow gender gap will be associated with a higher level of crime against women. Next, we hypothesize that these effects are stronger in areas with more gender bias. To examine these hypotheses, we first estimate the following specification:

$$lnCAW_{i,t} = \alpha + \beta_1 lnG_{i,t} + \boldsymbol{\beta}_2 \boldsymbol{X}_{i,t} + \mu_i + \tau_t + \epsilon_{i,t}. \tag{18}$$

Here, $CAW_{i,t}$ is indecent assaults and rapes in district i at time t, $G_{i,t}$ refers to the gender gap, $\boldsymbol{X}_{i,t}$ includes a set of control variables at the district level. μ_i and τ_t are district and year fixed effects respectively and $\epsilon_{i,t}$ is the idiosyncratic error term. In the fully specified model, control variables include log total crime, log mean per capita household expenditure to capture the level of development, log working-age population of men and women, inequality (measured as mean per capita expenditure of the household at the seventy-fifth percentile relative to the household at the twenty-fifth percentile), controls for district composition including percentage of urban working-age population, percentage of employment in manufacturing, percentage of employment in agriculture, controls for education levels including the percentage of working-age individuals with a high-school education or above, the education gap (ratio of men to women of working-age with a high-school education or above) and the number of female elected representatives to the state legislature to control for political voice of women (Iyer *et al.* (2012)).

Since total crime is controlled for, the resulting analysis highlights the relationship between key independent variables and crime against women relative to overall crime. Note that total crime accounts for law and order in the district. District fixed effects account for time-invariant, unobserved shocks at the district level that determine both gender gaps and crime against women. Year effects control for year-specific shocks to crime and the gender gaps. Standard errors are clustered at the district level. The coefficient β_1 on the gender employment or earning potential gap is expected to be negative with backlash - a smaller gap between men and women is associated with more crime against women. Further, we expect any backlash effect to be strongest in areas of high institutional gender bias, consistent with the theory. Finally, we expect backlash to be strongest when diversity is highest.

Our measures of gender bias are the percentage of females with access to Essential Services and Opportunities (ESO) sourced from McKinsey and a variation on the Missing Women variable as in (Anderson & Ray (2010, 2012)). Our measures of diversity use the percentage of households reporting that they need permission to visit friends in the local area or practice Purdah or face covering, both sourced from the India Human Development

Survey I, 2005[6]. For each gender bias and diversity variable, the states are ordered from best to worst, then grouped into low, medium and high levels of relative gender bias or percentage of Patriarchs[7]. From this, we estimate separately:

$$lnCrime_{i,t} = \alpha_B + \beta_{1,B} lnG_{i,t} + \boldsymbol{\beta}_{2,B}\boldsymbol{X}_{i,t} + \mu_i + \tau_t + \epsilon_{i,t} \quad i \in I_B \quad B = \{low, med, hig\}. \tag{19}$$

Here, i is a district in set I_B, the set of all districts in states that have gender bias or percentage of Patriarchs level B. The hypothesis is that $|\beta_{1,low}| < |\beta_{1,med}| < |\beta_{1,high}|$ since a lower gender gap is associated with greater crime in areas with higher gender bias.

Next, we study domestic violence by estimating equation (18) and equation (19) with domestic violence as the dependent variable. From the theory, we expect a bargaining effect such that β_1 is positive and a lower gender gap in earning potential is associated with lower domestic violence. However, we expect this relationship to hold only in areas of low or medium institutional gender bias. Our theory predicts a backlash effect in areas of high institutional gender bias.

3.2 Earning potential

Our key independent variable of interest captures the gap in earning potential between men and women in Indian districts. We first calculate earning potential for groups of individuals: male or female, further broken down into high qualified, (Hq), and low qualified, (Lq), male or female[8]. The higher (lower) the potential earnings for a group, the more (less) economically empowered individuals are. Changes in power structures between groups are likely to influence criminal power dynamics. For example, previously dominant individuals may attempt to regain lost power by acting against the newly enfranchised, particularly when group identity is strong, as is likely in gender biased areas.

Earning potential for a group k in i is the weighted average national earnings (wage) for the group across industries, where the weights are industry employment shares of the group in the district:

$$ln\overline{EP}_{i,t,k} = \frac{\sum_{j=1}^{J_i} \left(Emp_{i,04,k,j} * ln\overline{Wage}_{t,k,j}\right)}{\sum_{j=1}^{J_i} Emp_{i,04,k,j}}, \tag{20}$$

where, $ln\overline{Wage}_{t,k,j}$ is the India average wage at time t for an individual in group k in industry j. This is a version of the classic Bartik instrument. We use the total weekly earnings and the total number of days worked in the week to derive the average daily wage for each person[9]. k is the person's group, either $male$ or $female$ or, in

[6]Desai, Sonalde, Reeve Vanneman, and National Council of Applied Economic Research, New Delhi. India Human Development Survey (IHDS), 2005. ICPSR22626-v8. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2010-06-29. http://doi.org/10.3886/ICPSR22626.v8

[7]Detailed descriptions of variables are presented in the Data Appendix.

[8]An individual is classified as Hq if they have a high-school education or above, otherwise they are classified as Lq

[9]Each day of part time work is counted as 0.5 of a day. Full detail on variable creation is provided in the Data Appendix.

the detailed analysis: $Hq\ male$, $Hq\ female$, $Lq\ male$ and $Lq\ female$. j is the two digit NIC 1998 industry code for the industry of principal employment for the individual. $Emp_{i,04,k,j}$ is the total number of people in district i of type k employed in industry j in 2004, the first period for our data.[10]

The relative gap in earning potential in district i is defined as follows:

$$ln\overline{EP}_{i,t,gap} = ln\overline{EP}_{i,t,male} - ln\overline{EP}_{i,t,female}. \tag{21}$$

Similarly, Hq and Lq gaps are defined using the earning potential for Hq or Lq men and women. Given that earning potential in i is derived from industry national average wages, it could be argued that this variable is independent of the level of crime in i[11].

3.3 IV Estimation

A concern is that our measure of the gender gap in earning potential is susceptible to measurement error coming from self-reported earnings (wage) information. This is particularly the case for women in India, who are more likely to work in the informal sector where wage information is less easily recalled. Furthermore, in our dataset, ~60% of female and ~55% of male survey participants who report employment do not report wage information of any kind. If there is measurement error in earnings information, our estimates on the relationship between female and male earning potential and crime against women may suffer from attenuation bias. To tackle this concern, we use an instrumental variable approach that uses trade shocks to instrument for industry wages. We instrument for the national industry wage using import tariffs on the final good produced by the industry and on inputs it employs in production. Adapting the specification in Topalova (2010), we define the exposure to tariffs (ETT) for group k in district i at time t as the weighted average of all the industry tariffs at time t, weighted by the first period (2004) industry employment composition of group k in district i :

$$ETT_{i,t,k} = \frac{\sum_{j=1}^{J_i} \left(Emp_{i,04,k,j} * \overline{Tar}_{t,j}\right)}{\sum_{j=1}^{J_i} Emp_{i,04,k,j}} \quad j \in J_{i,04}$$

Similarly, exposure to input tariffs (EIT), is defined as the weighted average of all industry input tariffs:

$$EIT_{i,t,k} = \frac{\sum_{j=1}^{J_i} \left(Emp_{i,04,k,j} * \overline{inpTar}_{t,j}\right)}{\sum_{j=1}^{J_i} Emp_{i,04,k,j}} \quad j \in J_{i,04}$$

[10] Any individual not reporting a wage, along with their associated survey weightings, are excluded when calculating the average wages for individuals of type k. If average wage information is missing for an industry, those industries are excluded from the employment weightings in i and excluded from $\sum_{j=1}^{J_i} Emp_{i,04,k,j}$. If the denominator is zero, we define $ln\overline{EP}_{i,t,k}$ as zero. For example, 38 districts out of 565 (6%) report zero employed Hq women in 2004, so earning potential for Hq women in these districts is set to zero. If Hq women are not employable in a district, then the measure of earning potential for Hq women is definitionally zero.

[11] Aizer (2010) uses a similar gender gap measure to study the relationship between gender gaps and domestic violence in the United States.

In the above $\overline{Tar}_{t,j}$ is the simple average of the tariff on all goods produced in industry j at time t[12]. j is the NIC 1998 2 digit industry classification. $\overline{inpTar}_{t,j}$ is the weighted average of the tariff on each good used as inputs in industry j, weighted by the fraction of total inputs to j represented by each good. $Emp_{i,04,k,j}$ is the total number of people in district i of type k employed in industry j in 2004. For non-trade industries we set $\overline{Tar}_{t,j}$ and $\overline{inpTar}_{t,j}$ to zero. $\sum_{j=1}^{J_i} Emp_{i,04,k,j}$ is the total number of people of type k employed in i in 2004.[13] Employment in non traded industries is included when deriving total employment in i so that the impact of any tariffs or input tariffs are also scaled by the relative size of the tradeable sector in a district.

The resulting exposure variables provide the potential exposure to tariffs or input tariffs at time t for each type of worker in district i. They hence capture the potential level of protection from competition groups in a district experience, which is likely to influence potential wages and employment for that group in a district. Tariff data are less susceptible to measurement error than self-reported earnings information. Additionally, these instruments allow us to account for the endogeneity of the gender gap in total employment at the district level, which we use to investigate the exposure effect of employed women to crime. Trade exposure at the district level affects employment, but is exogenous to local crime since tariffs are set for India as a whole by the central (federal) government.

4 Data

Full detail on all data is included in the Data Appendix. Data on gender gaps and control variables are sourced from the Employment and Unemployment surveys of the National Sample Survey Organization (NSSO), India. Five rounds of data are used for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. The surveys collect information on household per capita expenditure, the district, state and rural or urban area the household is located in, and individual variables like age, gender, level of education, employment status in the principal activity (we consider both paid and unpaid employment in both the formal and informal sectors), industry of employment and the daily cash wage (adjusted for working for half the day) during the week. From the survey information, we construct district level variables using survey weights.

Data on crime are at the district level, sourced from the National Crime Records Bureau (NCRB), India. We consider Rapes and Assaults on the Modesty of Women (Indecent Assaults) under crimes against women. A variation of this variable that is more sensitive to reporting bias also includes Insult to the Modesty of Women (Harassment). Cruelty by Husband or his Relatives is used as the measure of Domestic Violence. Data on total crimes at the district level registered under the Indian Penal Code are also sourced from the NCRB. We collect data on the number of female representatives in the district elected to the state legislature from the Election

[12] Full detail available in the Data Appendix

[13] If this total is zero, then there are no workers of type k to be exposed to tariff effects and definitionally our exposure measures are zero for this also. Hence we set $ETT_{i,t,k} = 0$ and $EIT_{i,t,k} = 0$ if $\sum_{j=1}^{J_i} Emp_{i,04,k,j} = 0$.

Commission's Election Results[14]. Data on import tariffs come from product level data from the TRAINS database (downloaded from the WITS World Bank database). Information on the inputs used by each industry come from the input-output transactions table (IOTT 1994).

Variables describing potential institutional gender bias and the percentage of Patriarchs are derived from three survey sources. Our first measure of institutional gender bias uses an index of access for women to essential services and opportunities in each state produced by the McKinsey Global Institute in 2015[15]. The second measure uses demographic information from the NSSO survey to construct a variation of the Missing Women measure described in Anderson & Ray (2012). This measure varies at the district level. To capture the percentage of Patriarchs, we use the India Human Development Survey, Round I 2005 to obtain the percentage of households in each state where women report having to ask permission to visit friends in the local area or practicing Purdah, or other face covering[16].

Table 1 shows total crime, crime against women and domestic violence over the years in our sample. Total crime per 10,000 working age population is roughly stationary or even declining over time. However, crime against women displays an upward trend. Domestic violence shows a noticeable upward trend over time. Table 2 shows the evolution of gender gaps in earning potential and employment over time. Note that gaps are in logs, such that a positive number indicates a gap in favor of men. All gaps are positive showing a bias towards men. The gap in earning potential shows a downward trend over time, consistent with improving relative earning opportunities for women. The employment gap shows the opposite trend.

Table 1: Average Indian district-level crime per 10,000 working age population

year	Total Crime	CAW	DV
2004	31.81	1.03	0.80
2005	29.65	1.03	0.86
2007	30.81	1.07	1.02
2009	30.99	1.07	1.13
2011	30.94	1.11	1.21

Note: CAW represents: Rape and Indecent Assault. DV represents domestic violence. Total crime remains fairly constant over time, however CAW and DV show an upward trend.

[14]Data accessed from http://eci.nic.in/eci_main1/ElectionStatistics.aspx on 13 November 2017

[15]Data accessed from https://www.mckinsey.com/featured-insights/employment-and-growth/the-power-of-parity-advancing-womens-equality-in-india on 13 November 2017

[16]In Table 15 in Appendix I we explore the link between the diversity index 16 constructed with our two measures of the percentage of Patriarchs and crime against women. We find that the diversity indices related to the percentage of households practicing Purdah or where women report needing permission to visit friends is strongly correlated in the expected way with crime against women (high diversity is significantly related to more crime).

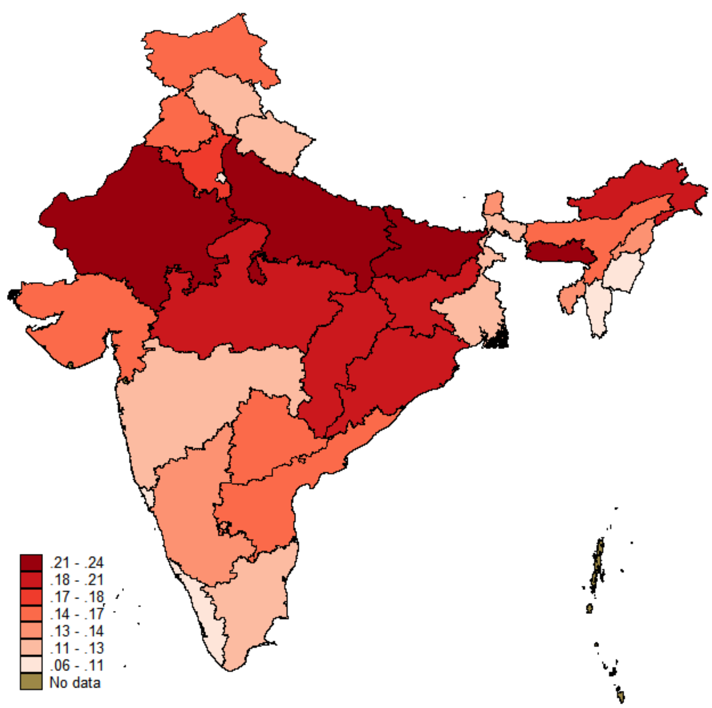
Table 2: Evolution of gender gaps in employment and EP over time

Year	ln(Bartik EP Gap)	ln(Emp Gap)
2004	0.555	1.18
2005	0.487	1.33
2007	0.500	1.31
2009	0.430	1.47
2011	0.389	1.58

Note: ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. Both variables as presented here are India wide averages of the district level variables for each year. By construction, parity between genders is 0. A positive (negative) gap is in favor of men (women).

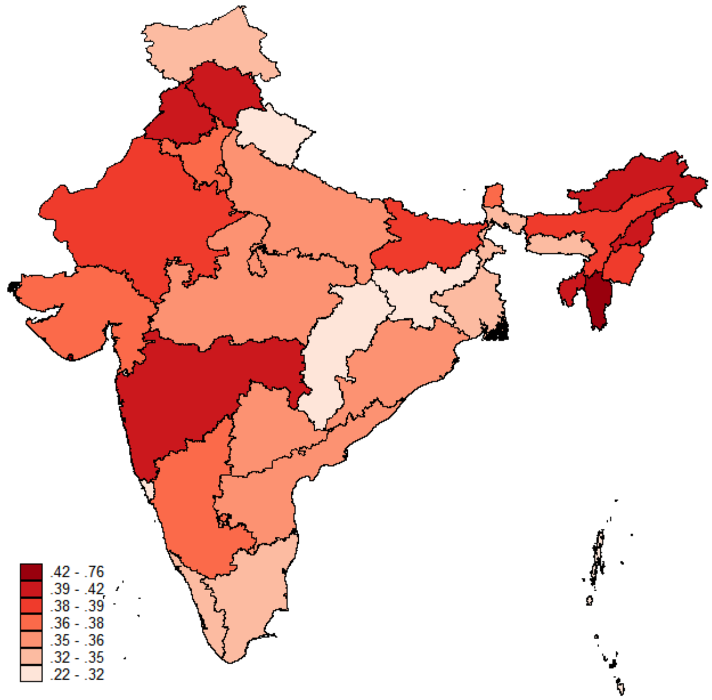
Figures 7 to 10 show the regional variation in our measures of institutional gender bias and the percentage of Patriarchs across India. In Figures 7 and 8, darker colors signify higher gender bias. Figures 9 and 10 employ two colors. A darker red represents a greater percentage of Patriarchs and a darker blue represents a greater percentage of Feminists (lower percentage of Patriarchs). Lighter shade of either colors represent greater diversity, where the percentages of both groups are similar. All figures show substantial variation in institutional gender bias and the percentage of Patriarchs across the country, reflective of India's rich cultural and institutional diversity. Broadly, southern and eastern states display lower levels of gender bias and percentage of Patriarchs relative to northern states. We exploit this variation to identify the role of gender bias in determining the relationship between gender gaps and crime against women.

Figure 7: Inverse of the 2015 McKinsey global institute Index for access of Women to Essential Services and Opportunities



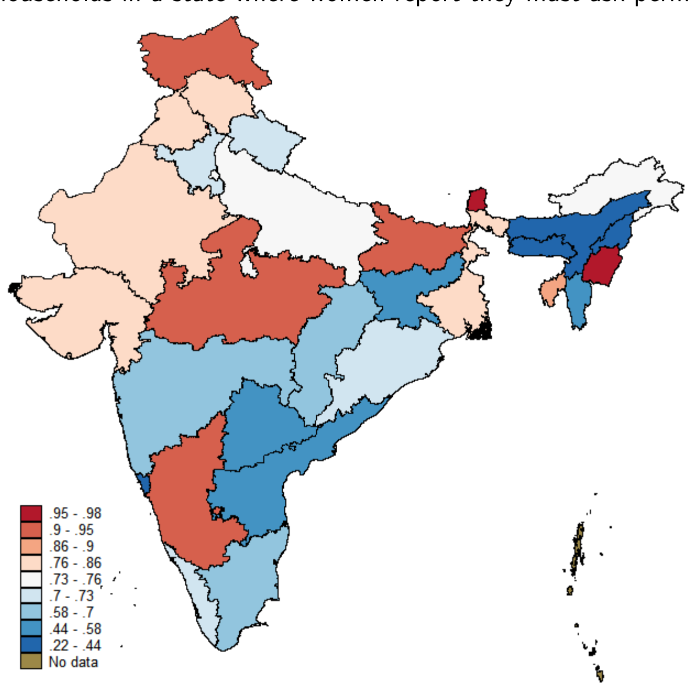
Note: Inverse ESO is the inverse of the McKinsey Institute index for the percentage of women in a state with access to essential services and opportunities. Darker color indicates more bias.

Figure 8: Missing Women ratio by state in 2004



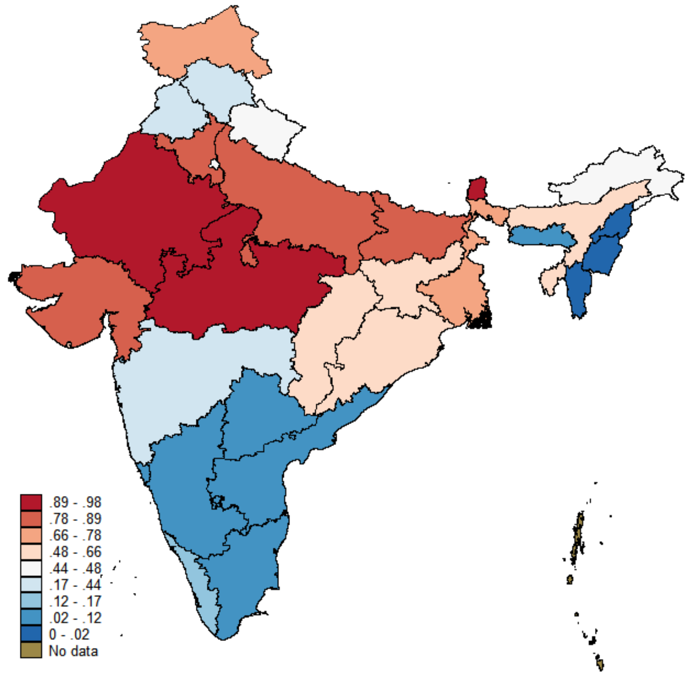
Note: Missing Women is the ratio of men to women under 5 years old in a district, divided by the expected ratio for men to women outside in that age range, with the expected ratio based on India and state averages. The higher this number, the greater the number of "missing" women under 5 years old compared to men, suggesting a greater bias against female infants in the region. Demographic data comes form the 2004-2005 round of the NSS survey. Darker color indicates more bias

Figure 9: Percentage of households in a state where women report they must ask permission to leave the house



Note: This is the percentage of households with women in each state who responded that they must ask permission form a senior family member (male or female) before they can leave the house to visit friends in the local area. Red represents a greater percentage of women require permission, and subsequently suggests there are a higher percentage of patriarchs in that region. Blue represents the opposite. Lighter areas in each color represent more diversity

Figure 10: Percentage of households in a state who report they practice Purdah or other religious face coverings



Note: This is the percentage of households in each state where women responded that they practice Purdah or another form of religious face covering. Red represents a greater percentage of women practicing, and subsequently suggests there are a higher percentage of patriarchs in that region. Blue represents the opposite. Lighter areas in each color represent more diversity

5 Results

5.1 Rapes and Indecent Assaults

5.1.1 Earning Potential: Baseline

Table 3 presents results from the estimation of equation (18), where the dependent variable is rapes and indecent assaults against women and the independent variable of interest, the gender gap in earning potential, is defined as in equation (21). The gender gap in total employment is included to account for potential exposure effects. All columns include an exhaustive set of control variables. Column (1) presents OLS results, while columns (2) and (3) present IV results. Across all three columns, a smaller gender gap in employment is significantly associated with an increase in crime against women, consistent with a greater exposure of women to unsafe spaces accompanying increased relative employment or with backlash. The coefficient on the gap in earning potential is insignificant in the OLS regression in column (1). Total crime shows statistically significant positive associations with crime against women. In contrast to the findings of Iyer *et al.* (2012), who looked at older data for India, we find higher female representation is significantly associated with lower crime against women.

Columns (2) and (3), show results from the instrumental variables estimation strategy. In column (2), the gender gap in earning potential is instrumented using district exposure to input and output tariffs for $Hq\,men$, $Hq\,women$, $Lq\,men$, $Lq\,women$. In this regression, the employment gap enters as a control variable only and is not instrumented. In column (3), we instrument both the gap in earning potential and the employment gap. Although not the main variable of interest, the employment gap is likely to be endogenously determined if female employment choices are influenced by the level of crime against women in a district. Similarly, if improved employment opportunities for women is associated with evolutionary backlash or an increased exposure to unsafe working spaces, a smaller employment gap will be associated with more crime against women.

The first stage regressions are presented in Table 16 in Appendix I, and show that our instruments are strong. Seven of the eight instruments are strongly correlated with the gap in earning potential as seen in column (1). The first stage regressions when instrumenting the decomposed gap, presented in the same table in columns (3a) and (3b), show that these correlations are driven by the expected gender associations. Exposure to tariffs, as weighted by Hq and Lq male employment, is positively correlated with male earning potential. The reverse is the case for input tariffs, where lower tariffs may mean cheaper factor inputs and a higher return for labor. The same relationships hold for female earning potential, with the exception of tariff exposure for Hq females, which is uncorrelated with any variable and included only for completeness. The first stage when both employment and earning potential gaps are instrumented together is shown in columns (2a) and (2b). For the employment gap, a high exposure to input tariffs as weighted by employment of Lq women and Hq men, is correlated with a smaller employment gap between men and women, with the opposite effect for exposure to tariffs. We present first stage statistics in all our tables, all of which show we can comfortably reject the null hypothesis of weak instruments.

From Table 3 column (2), which represents our baseline specification, the coefficient on the earning potential gap is now negative and strongly significant. A one percent decrease in the gender gap in earning potential is associated with a 0.8 percent increase in crime against women, consistent with the backlash hypothesis. From column (3), the coefficient on the gender employment gap is an order of magnitude larger after instrumentation. Large coefficients in each IV regression are consistent with measurement error in gender gaps attenuating coefficients toward zero. Overall, the evidence is consistent with backlash - better relative opportunities for women relative to men are associated with greater crime against women.

5.1.2 Earning Potential: Robustness Checks

For robustness, we create several other versions of the earning potential variable defined in equation (20) by replacing $ln\overline{Wage}_{t,j,k}$ with other variations of industry average wages. Firstly, we create CPI adjusted earning potential using the industry average wages when each individual wage has been adjusted by a state level urban and rural CPI modifier[17]. Secondly, in addition to reported cash wages, we include payments received "in kind" (goods or services received in lieu of wages and other income such as rent, returns on assets). Table 4 displays results when the regression in column (2) of Table 3 is repeated using the alternative measures of earning potential. The

[17] Consumer Price Index (CPI) data comes from the State Level Consumer Price Index (Rural/Urban) for 2011, published by the Central Statistics Office of India. Data accessed from https://data.gov.in/resources/state-level-consumer-price-index-ruralurban-2011 on 13 November 2017

baseline results are repeated in column (1) for comparison. Each measure is instrumented using the tariff and input tariff variables.

The results in Table 4 show a consistent and significant negative association between the earning potential gender gaps and rapes and indecent assaults against women. The coefficients on the gaps are broadly similar in magnitude, with the exception of total earning potential, which includes wages and payments in kind. This coefficient is much larger in magnitude, and still very significant. Total earnings are recorded with a lot more noise than standard wages, and hence earning potential derived from wages alone is used in our main specification.

Table 3: Gender gaps regressed on Rapes and Indecent Assaults

	ln(Rapes, Indecent Assaults)		
VARIABLES	OLS (1)	IV (2)	IV(3)
ln(Bartik EP gap)	0.056	-0.765***	-1.456***
	[0.109]	[0.266]	[0.505]
ln(Emp gap)	-0.050***	-0.051***	-0.589***
	[0.012]	[0.012]	[0.143]
ln(Total Crimes)	0.753***	0.776***	0.788***
	[0.055]	[0.048]	[0.055]
ln(MPCE)	-0.108**	-0.104**	-0.064
	[0.049]	[0.047]	[0.085]
ln(Male Working population)	-0.046	-0.046	0.737***
	[0.068]	[0.069]	[0.236]
ln(Female Working population)	0.098	0.045	-0.753***
	[0.071]	[0.075]	[0.247]
ln(Inequality)	0.015	0.026	-0.146*
	[0.046]	[0.042]	[0.080]
urbanization %age	0.004	0.006	0.003
	[0.014]	[0.015]	[0.020]
%age emp.in Agriculture	-0.121	-0.127	-1.205***
	[0.075]	[0.082]	[0.303]
%age emp. in Manufacturing	0.226	0.229	-1.036**
	[0.146]	[0.146]	[0.407]
%age with Hq education	0.008	0.009	-0.060
	[0.020]	[0.021]	[0.042]
ln(Hq gap)	0.020	0.019	-0.001
	[0.016]	[0.015]	[0.029]
Elected female representatives	-0.045***	-0.047***	-0.039*
	[0.015]	[0.013]	[0.021]
Year and District FE	Yes	Yes	Yes
Observations	2,840	2,840	2,840
Number of Panel	568	568	568
R-Squared	0.260	-	–
First-stage Statistics			
Sanderson-Windmeijer F-stat: ln(Bartik EP gap)		61.51	24.02
Sanderson-Windmeijer F-stat: ln(Emp gap)		-	3.14
Kleibergen-Paap rk Wald F-stat:		61.51	2.74
Stock Yogo LIML 10% maximal IV bias critical value:		3.97	3.78
Stock Yogo LIML 15% maximal IV bias critical value:		3.04	2.73

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. EP gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All variables are district level totals or averages for each time period: ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for male over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. ln(Male Working population) is the log of the total number of males aged 15-64. ln(Female Working population) is the log of the total number of females aged 15-64. ln(Inequality) is the log of the ratio of MPCE of the household at the seventy-fifth percentile relative to the household at the twenty-fifth percentile. Urbanization %age is the the percentage of households that are located in urban sectors. %age emp. in Agriculture is the percentage of individuals employed in farming, forestry and fishing as a proportion of total working population. %age emp. in Manufacturing is the percentage of individuals employed in manufacturing as a proportion of total working population. %age with Hq education is the percentage of individuals with a high school education or above as a proportion of total working population. ln(Hq gap) is the log of the ratio of total number of high school educated males over total high school educated females. Elected female representatives is the total number of sitting female elected representatives to the state legislature. To guard against a weak instruments problem, IV regressions use continuously updated GMM estimators (CUE). In column (3) ln(Bartik EP) is instrumented. In column (4) ln(Emp Gap) is instrument, in column (5) both ln(Bartic EP) and ln(Emp Gap) are instrumented.

Table 4: Robustness Checks for Gender gap in Earning Potential regressed on Rapes and Indecent Assaults:

	ln(Rapes, Indecent Assaults)		
VARIABLES	IV (1)[18]	IV (2)	IV (3)
ln(Bartik EP gap):	-0.765***		
	[0.266]		
ln(Bartik EP gap, CPI adj.)		-0.780***	
		[0.269]	
ln(Bartik Total EP gap)			-2.434***
			[0.616]
ln(Emp. gap)	-0.051***	-0.051***	-0.055***
	[0.012]	[0.012]	[0.012]
ln(Total Crimes)	0.776***	0.776***	0.773***
	[0.048]	[0.048]	[0.049]
ln(MPCE)	-0.104**	-0.104**	-0.077
	[0.047]	[0.047]	[0.050]
Other Controls	Yes	Yes	Yes
District and Year Fixed Effects	Yes	Yes	Yes
Observations	2,840	2,840	2,840
Number of panel	568	568	568
R-Squared	-	-	-
First-stage Statistics			
Sanderson-Windmeijer F-stat:	61.51	60.17	18.46
Kleibergen-Paap rk Wald F-stat:	61.51	60.17	18.46
Stock Yogo LIML 10% maximal IV bias critical value: 3.97			

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. EP gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All variables are district level totals or averages for each time period: ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. In the EP variables, CPI adj means the earning potential has been adjusted by a state level urban and rural CPI modifier. Total EP means both cash payments and "payment's in kind" have been included as earnings. Payments in kind represents transfers of goods or services in lieu of monetary payment. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. To guard against a weak instruments problem, IV regressions use continuously updated GMM estimators (CUE). In column (1-3) the Bartik EP variables are instrumented.

5.1.3 Heterogeneous effects of the gender gap

In Table 5, we split the sample into two groups based on the magnitude of change in the gender gap in earning potential. The idea is to examine if larger changes in the gender gap are related to greater backlash. Column (1) reproduces the baseline regression for comparison. Columns (2) and (3) present the relationship between smaller and larger changes in the gender gap in earning potential crime against women respectively. Results show that backlash is strongest when the decrease in the gender gap is relatively large.

[18] reproduced from table 3

Table 5: Gender gaps regressed on Rapes and Indecent Assaults, in regions that had large and small change in Earning potential from the previous period

	ln(Rapes, Indecent Assaults)		
	Base[19]	Change in wage gap	
VARIABLES	All IV (1)	Low IV (2)	High IV (3)
ln(Bartik EP gap):	-0.765***	-0.453	-1.817***
	[0.266]	[0.516]	[0.697]
ln(Emp gap)	-0.051***	-0.054**	-0.043***
	[0.012]	[0.024]	[0.014]
ln(Total Crimes)	0.776***	0.642***	0.773***
	[0.048]	[0.102]	[0.083]
ln(MPCE)	-0.104**	-0.016	-0.116
	[0.047]	[0.099]	[0.082]
Other Controls	Yes	Yes	Yes
Year and District FE	Yes	Yes	Yes
Observations	2,840	976	1,004
Number of Panel	568	407	421
R-Squared	-	-	-
First-stage Statistics			
Sanderson-Windmeijer F:	61.51	26.80	31.46
Kleibergen-Paap rk Wald F:	61.51	26.80	31.46
Stock Yogo LIML 10% maximal IV bias critical value: 3.97			

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. EP gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. Singleton groups are dropped. All variables are district level totals or averages for each time period: ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. For each EP variable, the first difference the gap was taken, then regions ranked from smallest to largest change in EP, (across all years). The sample is split into regions which experienced an above average and below average change in EP. The baseline regression for each EP variables was then repeated in each sub-sample.To guard against a weak instruments problem, IV regressions use continuously updated GMM estimators (CUE). In column (1-3) the Bartik EP variables are instrumented.

5.1.4 Relationship Between Earning Potential and Gender Bias

Table 6 presents IV regressions for the gender gap in earning potential when the sample is separated by districts in states with relatively low, medium and high levels of gender bias[20]. Column (1) presents the baseline results for the whole sample, reproduced from Table 3 for comparison. Columns (2-4) show the regressions for regions with varying institutional gender bias as determined by the inverse measure of Essential Services and Opportunities for women (ESO index). Columns (5-7) show similar regressions when gender bias is measured by the the Missing Women variable in Anderson & Ray (2012).

Across all measures of gender bias, the results are consistent. The negative correlation between rapes and indecent assaults and the gender gap in earning potential is driven by areas of high gender bias. This is consistent

[19] reproduced from table 3

[20] Instruments for the employment gap are less strong than for earning potential. Also, IV results obtained from instrumenting for the employment gap are almost always in line with OLS results. Hence, in subsequent analyses, we only instrument for earning potential and use employment as a control.

with numerical simulations from our model. In such regions, the magnitude of the effect is larger than in the overall sample. In low gender bias regions, the sign on the coefficient sometimes changes direction, although it also becomes insignificant. The negative relationship between the gender gap in employment and rapes and indecent assaults is only significant in regions of medium and high gender bias, suggesting that the exposure effect may not hold in regions of low gender bias. In other words, more women out in employment relative to men does not necessarily mean more crime against women, unless there is gender bias.

Table 6: Gender gaps regressed on Rapes and Indecent Assaults, in regions with differing level of gender bias

	ln(Rapes, Indecent Assaults)						
Measure of bias:	Base[21]	Inverse ESO			Missing Women		
level of bias:		Low	Med	High	Low	Med	High
VARIABLES	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)	IV (6)	IV (7)
ln(Bartik EP gap)	-0.765***	-0.500	-0.421	-1.222***	0.088	-0.678	-1.335***
	[0.266]	[0.508]	[0.431]	[0.404]	[0.395]	[0.482]	[0.444]
ln(Emp. Gap)	-0.051***	0.033	-0.103***	-0.045***	-0.047*	-0.062***	-0.035**
	[0.012]	[0.046]	[0.029]	[0.013]	[0.025]	[0.020]	[0.016]
ln(Total Crimes)	0.776***	0.794***	0.554***	0.828***	0.893***	0.711***	0.656***
	[0.048]	[0.069]	[0.113]	[0.077]	[0.068]	[0.088]	[0.082]
ln(MPCE)	-0.104**	-0.183**	-0.043	-0.092	-0.070	-0.168**	-0.106
	[0.047]	[0.086]	[0.072]	[0.077]	[0.085]	[0.076]	[0.084]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	915	650	1,255	945	945	945
Number of panel	568	183	130	251	189	189	189
First-stage Statistics							
SW F:	61.51	43.99	16.46	39.90	22.07	14.32	40.73
KPW F:	61.51	43.99	16.46	39.90	22.07	14.32	40.73
Stock Yogo LIML 10% maximal IV bias critical value:					3.97		

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Column headings Low, Med and High refer to states with low, medium and high levels of gender bias. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All non-gender bias variables are district level totals or averages for each time period. ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. Gender bias variables define methods to group districts in states of varying degrees of gender bias. Inverse ESO is the inverse of the McKinsey Institute index for the percentage of women in a state with access to essential services and opportunities. Missing Women is the ratio of men to women under 5 years old in a district, divided by the expected ratio for men to women outside in that age range, with the expected ratio based on India and state averages. The higher this number, the greater the number of "missing" women under 5 years old compared to men, suggesting a greater bias against female infants in the region. Demographic data comes form the 2004-2005 round of the NSS survey. This variable is standardized to a range between 0 and 1 to match the other bias variables. The sub-sample regressions for regions of low gender bias are presented in columns (2) and (5). Medium gender bias is represented in columns (3), and (6). High gender bias is shown in columns (4) and (7). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

[21] Reproduced from Table 3

Results in Table 6 also allow us to argue against an alternate empirical explanation to backlash. If earning potential does influence institutions, then a large gender gap in favor of men may favor institutions where women are intimidated against reporting crime. For example, if reports are dismissed or blame reversed to victims because males make up the majority of contributors to community groups or tax payers in a region. Following this, a narrower gender gap in earning potential may be associated with high levels of crime against women not due to backlash, but due to reporting effects. For example a narrower gap may mean institutions are less biased and take reports of crime against women more seriously. However, in regions of high gender bias, institutions are fixed in favor of men due to historical precedence. The strong negative correlation between the size of gap and crime seen in the sub-sample regressions with high gender bias, shown in columns (4), (7) hence highlights a plausible backlash effect.

Table 7: Gender gaps regressed on Rapes and Indecent Assaults, across regions with differing percentages of patriarchal households

	ln(Rapes, Indecent Assaults)						
Measure of bias:	Base[22]	% Permission			% Purdah		
Level of bias		Low	Medium	High	Low	Medium	High
VARIABLES	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)	IV (6)	IV (7)
ln(Bartik EP gap)	-0.765***	1.573***	-0.438	-1.865***	1.159***	-1.313**	-1.244***
	[0.266]	[0.532]	[0.376]	[0.459]	[0.395]	[0.536]	[0.365]
ln(Emp gap)	-0.051***	-0.014	-0.017	-0.085***	0.084*	-0.097***	-0.040***
	[0.012]	[0.033]	[0.012]	[0.019]	[0.043]	[0.024]	[0.014]
ln(Total Crimes)	0.776***	0.674***	0.889***	0.616***	0.837***	0.772***	0.831***
	[0.048]	[0.094]	[0.063]	[0.117]	[0.083]	[0.080]	[0.092]
ln(MPCE)	-0.104**	-0.119	-0.081	-0.070	-0.260***	-0.008	-0.124
	[0.047]	[0.083]	[0.075]	[0.092]	[0.085]	[0.084]	[0.079]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year and District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	825	1,045	960	890	910	1,030
Number of Panel	568	165	209	192	178	182	206
First-stage Statistics							
SW F:	61.51	14.70	37.43	24.27	24.25	15.62	45.82
KPW F:	61.51	14.70	37.43	24.27	24.25	15.62	45.82
Stock Yogo LIML 10% maximal IV bias critical value:				3.97			

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Column headings Low, Med and High refer to states with low, medium and high percentages of patriarchs in a region. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All non-diversity variables are district level totals or averages for each time period. ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. Percentage of patriarch variables define methods to group districts in states of varying degrees of gender bias. % Permission is the percentage of households with women in each district who responded that they must ask permission form a senior family member (male or female) before they can leave the house to visit friends in the local area. % Purdah is is the percentage of households in each district where women responded that they practice Purdah, or another form of religious face covering. Both of these variables come from the IHDS for 2005. The sub-sample regressions for regions of low percentage of Patriarchs are presented in columns (2) and (5). Medium percentage of Patriarchs is represented in columns (3), and (6). High percentage of Patriarchs is shown in columns (4) and (7). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

Table 7 studies the relationship between the gender gap in earning potential and crime against women when

[22] Reproduced from Table 3

the sample is separated by districts in states with relatively low, medium and high levels of the percentage of Patriarchs. Column (1) reproduces the baseline. Columns (2-4) look at states with varying levels of the percentage of households with women who need permission to visit local friends and columns (5-7) focus on states with varying levels of the percentage of households practicing Purdah. Overall, results indicate that backlash is strongest in areas with a high or medium percentage of Patriarchs. In fact, in areas with a low percentage of Patriarchs, we see the opposite effect, where a lower gender gap in earning potential is associated with fewer crimes against women.

5.1.5 Earning Potential: Decomposing male and female effects and the role of education

Table 8 shows the results when the gender gap in earning potential is broken down first by male and female earning potential, and then by high qualified and low qualified males and females. For completeness, the employment gap is decomposed to match. Column (1) shows a significant and negative relationship between male earning potential and reports of rapes and indecent assaults, consistent with the backlash hypothesis. The coefficient on female earning potential is positive and significant. The female effect is consistent with either backlash from men when females have more societal power, or more reporting by females of existing crimes for the same reason. From the employment result in column (1), we see the negative relationship between the employment gap and crime comes from female employment. This is consistent with the exposure effect, where more females in employment results in more crimes committed against them.

Further decomposition of earning potential by Hq and Lq individuals in column (2) shows that the main backlash and exposure effects are driven by individuals with a "less than high-school" level of education. The coefficient on Hq female earning potential is negative and significant, suggesting that higher earning potential for Hq women is associated with lower crime. The absence of a backlash effect with an increase in earning potential for Hq women could be due to the fact that they have more to lose when making a report of a rape or indecent assault. They may have a highly valued job or a position that is hard to come by and may risk losing it by making a criminal report. This is particularly true if the perpetrator is a colleague or supervisor. Lq women may face less pressure to under-report.

Table 8: Decomposition of the gap in Earning Potential, regressed on Rapes, and Indecent Assaults

VARIABLES	ln(Rapes, Indecent Assaults) IV (1)	IV (2)
ln(Bartik Male EP)	-0.967***	
	[0.306]	
ln(Bartik Female EP)	0.529*	
	[0.272]	
ln(Bartik Lq Male EP)		-0.699*
		[0.423]
ln(Bartik Lq Female EP)		1.239**
		[0.500]
ln(Bartik Hq Male EP)		0.261
		[0.430]
ln(Bartik Hq Female EP)		-1.152***
		[0.292]
ln(Male Emp.)	0.032	0.009
	[0.104]	[0.145]
ln(Female Emp.)	0.049***	0.045***
	[0.012]	[0.016]
ln(Total Crimes)	0.760***	0.811***
	[0.049]	[0.059]
ln(MPCE)	-0.108**	-0.148**
	[0.047]	[0.064]
Other Controls	Yes	Yes
District and Year Fixed Effects	Yes	Yes
Observations	2,840	2,840
Number of panel	568	568
First-stage Statistics		
Sanderson-Windmeijer F:	60.15	31.34
Kleibergen-Paap rk Wald F:	44.79	3.79
Stock Yogo LIML 10% maximal IV bias:		

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All variables are district level totals or averages for each time period. ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Bartik Male EP) is the log of the Bartik earning potential for males, and ln(Bartik Female EP) is the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. Hq earning potential represents the earning potential among individuals with a high school and above level of education. Lq is the same for those with a below high-school level. ln(Emp Male) is the log of total male employment. ln(Emp female) is the log of total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) . Bartik Earning Potential variables are instrument in columns (1) and (2).

5.1.6 Earning Potential and Harassment

Table 9 shows the results when reports of harassment are included along with reports of rapes and indecent assaults. Column (3) shows the results using the gender gap in earning potential and column (4) displays the decomposition of the gap into male and female effects. Columns (1) and (2) reproduce our baseline results for rapes and indecent assaults alone. Harassment is much more sensitive than rapes and indecent assaults to issues of under-reporting and our idea in this table is to ask if including harassment qualitatively changes our key results. If a change in reporting was the most significant driver of our results, we would expect to see substantial differences in coefficient estimates when we include Harassment, a crime category that is most sensitive to reporting. Our results show that this is not the case. Across all columns, coefficient estimates are similar in magnitude and significance. This Table hence provides further confidence that what we identify is backlash and not changes in reporting of crime against women.

Table 9: Male and female Earning Potential, regressed on Rapes, Indecent Assaults, and Harassment

	ln(Rapes, Indecent Assaults)		ln(Rapes, Indecent Assaults, Harassment)	
VARIABLES	IV (1)[23]	IV (2)[24]	IV (3)	IV (4)
ln(Bartik EP gap)	-0.765***		-0.758***	
	[0.266]		[0.284]	
ln(Bartik Male EP)		-0.967***		-0.842***
		[0.306]		[0.325]
ln(Bartik Female EP)		0.529*		0.568*
		[0.272]		[0.297]
ln(Emp. gap)	-0.051***		-0.046***	
	[0.012]		[0.012]	
ln(Male Emp.)		0.032		0.053
		[0.104]		[0.106]
ln(Female Emp.)		0.049***		0.044***
		[0.012]		[0.012]
ln(Total Crimes)	0.776***	0.760***	0.681***	0.676***
	[0.048]	[0.049]	[0.046]	[0.046]
ln(MPCE)	-0.104**	-0.108**	-0.072	-0.074
	[0.047]	[0.047]	[0.049]	[0.049]
Other Controls	Yes	Yes	Yes	Yes
District and Year FE	Yes	Yes	Yes	Yes
Observations	2,840	2,840	2,840	2,840
Number of panel	568	568	568	568
R-Squared	-	-	-	-
First-stage Statistics				
Sanderson-Windmeijer F:	61.51	55.36	61.51	55.36
Kleibergen-Paap rk Wald F:	61.51	44.79	61.51	44.79
Stock Yogo LIML 10% maximal IV bias:			3.97	

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All variables are district level totals or averages for each time period. ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Rapes, Indecent Assaults, Harassment) is the same but with reports of harassment included. ln(Bartik Male EP) is the log of the Bartik earning potential for males, and ln(Bartik Female EP) is the Bartik earning potential of females. The gap is the log of the ratio of the two. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp Male) is the log of total male employment. ln(Emp female) is the log of total female employment, and the gap is the log of the ratio of the two. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE). Bartik Earning Potential variables are instrument in columns (1), (2), (5) and (6).

[23] Reproduced from Table 3

[24] Reproduced from Table 8

Table 10: Gender gaps regressed on Domestic Violence

VARIABLES	ln(Domestic Violence) OLS (1)	IV (2)	IV(3)
ln(Bartik EP gap)	0.276	1.168***	1.168***
	[0.250]	[0.370]	[0.400]
ln(Emp gap)	0.013	0.015	0.016
	[0.019]	[0.018]	[0.113]
ln(Total Crimes)	0.869***	0.840***	0.840***
	[0.068]	[0.061]	[0.061]
ln(MPCE)	0.081	0.119*	0.119*
	[0.073]	[0.072]	[0.072]
ln(Male Working population)	0.050	0.056	0.055
	[0.089]	[0.093]	[0.190]
ln(Female Working population)	0.116	0.109	0.109
	[0.098]	[0.101]	[0.192]
ln(Inequality)	-0.047	-0.089	-0.089
	[0.064]	[0.059]	[0.066]
urbanization %age	-0.068***	-0.063***	-0.063***
	[0.018]	[0.019]	[0.019]
%age emp. in Agriculture	-0.087	-0.110	-0.109
	[0.132]	[0.123]	[0.269]
%age emp. in Manufacturing	-0.111	-0.100	-0.099
	[0.218]	[0.229]	[0.355]
%age with Hq education	0.030	0.030	0.030
	[0.031]	[0.032]	[0.037]
ln(Hq gap)	-0.004	-0.005	-0.005
	[0.016]	[0.018]	[0.018]
Elected female representatives	-0.007	-0.015	-0.015
	[0.025]	[0.020]	[0.020]
Year and District FE	Yes	Yes	Yes
Observations	2,840	2,840	2,840
Number of Panel	568	568	568
R-Squared	0.240	-	-
First-stage Statistics			
Sanderson-Windmeijer F-stat: ln(Bartik EP gap)		61.51	24.02
Sanderson-Windmeijer F-stat: ln(Emp gap)		-	3.14
Kleibergen-Paap rk Wald F-stat:		61.51	2.735
Stock Yogo LIML 10% maximal IV bias critical value:		3.97	3.97
Stock Yogo LIML 15% maximal IV bias critical value:		3.04	3.04

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. EP gaps are defined as in equation (21). Standard errors are clustered at the district level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All variables are district level totals or averages for each time period: ln(Domestic Violence) is the log of the total number of reports of domestic violence in the district. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for male over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. ln(Male Working population) is the log of the total number of males aged 15-64. ln(Female Working population) is the log of the total number of females aged 15-64. ln(Inequality) is the log of the ratio of MPCE of the household at the seventy-fifth percentile relative to the household at the twenty-fifth percentile. Urbanization %age is the the percentage of households that are located in urban sectors. %age emp. in Agriculture is the percentage of individuals employed in farming, forestry and fishing as a proportion of total working population. %age emp. in Manufacturing is the percentage of individuals employed in manufacturing as a proportion of total working population. %age with Hq education is the percentage of individuals with a high school education or above as a proportion of total working population. ln(Hq gap) is the log of the ratio of total number of high school educated males over total high school educated females. Elected female representatives is the total number of sitting female elected representatives to the state legislature. To guard against a weak instruments problem, IV regressions use continuously updated GMM estimators (CUE). In column (3) ln(Bartik EP) is instrumented. In column (4) ln(Emp Gap) is instrument, in column (5) both ln(Bartic EP) and ln(Emp Gap) are instrumented.

5.2 Domestic Violence

5.2.1 Earning Potential Baseline

Table 10 presents results from the estimation of equation (18), where the dependent variable is reports of domestic violence (cruelty by the husband or his relatives). Column (1) presents OLS results. In column (2), the gender gap in earning potential is instrumented using the eight trade variables, and both earning potential and employment gaps are instrumented in column (3). Across all three columns, a larger gender gap in earning potential is associated with more domestic violence, however, OLS results are not statistically significant. Total crime shows statistically significant positive associations with domestic violence, in line with policing or law and order effects. Increased urbanization percentage shows a negative association with domestic violence, which could be due to close proximity with neighbors reigning in the actions of some urban males. Female political representation, and the gender gap in employment, are insignificant for domestic violence. In fact, the coefficient on the gender gap in employment is very close to zero in economic significance. From columns (2-3), a one percent decrease in the gender employment gap is associated with a 1.2% decrease in domestic violence. This is consistent with relative female empowerment increasing bargaining power and hence reducing the levels of domestic violence. The employment gap remains insignificant after instrumentation.

5.2.2 Relationship Between Earning Potential and Gender Bias

Table 11 presents the IV regression for the gender gap in earning potential on domestic violence when the sample is separated by districts in states with relatively low, medium and high levels of gender bias. Across all measures of gender bias, we observe a positive, significant and large coefficient on the gap in earning potential in regions of low to medium gender bias, as seen in columns (2), (5) and (6). These coefficients are much larger than the baseline result, repeated in column (1), suggesting that the bargaining effect may be stronger in relatively low gender biased areas[25]. From column (4), we see that the relationship between the gap in earning potential and domestic violence is reversed, indicating backlash. However, this result is not statistically significant. To probe the backlash effect in highly gender biased regions further, we decompose the gender gap into male and female earning potential in Table 12. In areas of low gender bias (columns (2-3) and (5-6)), we see standard bargaining effects. In column (4), we see that the backlash effect in areas of high gender bias comes from a decrease in male earning potential increasing domestic violence.

Table 13 conducts a similar analysis, but for states with percentages of Patriarchs that are low, medium and high. Again, from columns (2), (5) and (6), we see that the positive relationship between an increase in the gender gap in earning potential and domestic violence is strongest in areas of low or medium gender bias. In column

[25] As discussed in the Data Appendix, all of India is potentially gender biased, with our variables just capturing differing degrees in this bias. The "low" gender biased areas are likely to be more biased than developed countries where the bargaining effect is well documents (Aizer (2010)).

(7), we observe a reversal of the sign on the earning potential gap, indicating a backlash effect, in areas where a large percentage of households have women who report practicing Purdah. Table 14 decomposes the gender gap into male and female earning potential to probe further. While standard bargaining effects are visible in areas with low or medium percentages of Patriarchs, in areas where a large percentage of households practicing Purdah (column (7)), we observe that lower male earning potential is associated with higher domestic violence. This may indicate a potential backlash effect overriding the bargaining effect when institutions or culture are more gender biased. Overall we provide evidence for the existence of a bargaining effect documented for the United States by Aizer (2010) also in the case of developing countries like India. However, this effect is only present in regions with less gender bias. In areas of high gender bias, we find that a potential backlash effect dominates. Broadly, these results are consistent with our model and numerical simulations.

Table 11: Gender gaps regressed on Domestic Violence, in regions with differing level of gender bias

			ln(Domestic Violence)				
Measure of bias:	Base[26]		Inverse ESO			Missing Women	
level of bias:		Low	Med	High	Low	Med	High
VARIABLES	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)	IV (6)	IV (7)
ln(Bartik EP gap)	1.168***	2.367***	0.969	-0.435	1.432**	1.570**	0.787
	[0.370]	[0.582]	[0.635]	[0.512]	[0.654]	[0.665]	[0.534]
ln(Emp. Gap)	0.015	0.003	-0.042	0.020	0.033	0.032	-0.009
	[0.018]	[0.042]	[0.042]	[0.021]	[0.027]	[0.032]	[0.029]
ln(Total Crimes)	0.840***	0.669***	0.705***	1.056***	0.919***	0.733***	0.821***
	[0.061]	[0.076]	[0.154]	[0.099]	[0.089]	[0.116]	[0.109]
ln(MPCE)	0.119*	0.064	0.159	0.134	0.122	0.015	0.245
	[0.072]	[0.093]	[0.155]	[0.112]	[0.137]	[0.095]	[0.152]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	915	650	1,255	945	945	945
Number of panel	568	183	130	251	189	189	189
			First-stage Statistics				
SW F:	61.51	43.99	16.46	39.90	22.07	14.32	40.73
KPW F:	61.51	43.99	16.46	39.90	22.07	14.32	40.73
Stock Yogo LIML 10% maximal IV bias critical value:					3.97		

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Column headings Low, Med and High refer to states with low, medium and high levels of gender bias. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All non-gender bias variables are district level totals or averages for each time period. ln(Domestic Violence) is the log of the total number of reports of domestic violence in the district. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. Gender bias variables define methods to group districts in states of varying degrees of gender bias. Inverse ESO is the inverse of the McKinsey Institute index for the percentage of women in a state with access to essential services and opportunities. Missing Women is the ratio of men to women under 5 years old in a district, divided by the expected ratio for men to women outside in that age range, with the expected ratio based on India and state averages. The higher this number, the greater the number of "missing" women under 5 years old compared to men, suggesting a greater bias against female infants in the region. Demographic data comes form the 2004-2005 round of the NSS survey. This variable is standardized to a range between 0 and 1 to match the other bias variables. The sub-sample regressions for regions of low gender bias are presented in columns (2) and (5). Medium gender bias is represented in columns (3), and (6). High gender bias is shown in columns (4) and (7). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

[26] Reproduced from Table 10

Table 12: Male and Female Earning Potential regressed on Domestic Violence, in regions with differing level of gender bias

	ln(Domestic Violence)						
Measure of bias:	Base	Inverse ESO			Missing Women		
level of bias:		Low	Med	High	Low	Med	High
VARIABLES	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)	IV (6)	IV (7)
ln(Bartik Male EP)	1.010**	2.952***	1.008	-1.322**	1.172*	2.086**	0.213
	[0.427]	[0.686]	[0.847]	[0.608]	[0.695]	[0.833]	[0.730]
ln(Bartik Female EP)	-1.259***	-2.185***	-1.011	-0.417	-1.679**	-1.523**	-0.854
	[0.399]	[0.572]	[0.678]	[0.591]	[0.794]	[0.663]	[0.540]
ln(Emp male)	-0.039	-0.136	-0.338	0.116	0.182	0.077	-0.243
	[0.140]	[0.199]	[0.327]	[0.221]	[0.284]	[0.247]	[0.215]
ln(Emp fem)	-0.017	0.026	0.038	-0.035	-0.037	-0.027	0.004
	[0.018]	[0.044]	[0.045]	[0.023]	[0.029]	[0.032]	[0.030]
ln(Total Crimes)	0.832***	0.693***	0.710***	1.019***	0.907***	0.740***	0.806***
	[0.061]	[0.076]	[0.152]	[0.100]	[0.092]	[0.117]	[0.109]
ln(MPCE)	0.109	0.094	0.165	0.138	0.084	0.028	0.219
	[0.073]	[0.095]	[0.168]	[0.111]	[0.149]	[0.096]	[0.153]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	825	1,045	960	890	910	1,030
Number of panel	568	165	209	192	178	182	206
First-stage Statistics							
Smallest SW F:	55.36	7.51	37.44	23.30	28.18	12.96	38.49
KPW F:	44.79	6.420	32.50	20.05	24.27	10.99	33.65
Stock Yogo LIML 10% maximal IV bias critical value:					3.97		

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Column headings Low, Med and High refer to states with low, medium and high levels of gender bias. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All non-gender bias variables are district level totals or averages for each time period. ln(Domestic Violence) is the log of the total number of reports of domestic violence in the district. ln(Bartik Male EP) is the log of the Bartik earning potential for males, and ln(Bartik Female EP) is the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp Male) is the log of total male employment. ln(Emp female) is the log of total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. Gender bias variables define methods to group districts in states of varying degrees of gender bias. Inverse ESO is the inverse of the McKinsey Institute index for the percentage of women in a state with access to essential services and opportunities. Missing Women is the ratio of men to women under 5 years old in a district, divided by the expected ratio for men to women outside in that age range, with the expected ratio based on India and state averages. The higher this number, the greater the number of "missing" women under 5 years old compared to men, suggesting a greater bias against female infants in the region. Demographic data comes form the 2004-2005 round of the NSS survey. This variable is standardized to a range between 0 and 1 to match the other bias variables. The sub-sample regressions for regions of low gender bias are presented in columns (2) and (5). Medium gender bias is represented in columns (3), and (6). High gender bias is shown in columns (4) and (7). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

Table 13: Gender gaps regressed on Domestic Violence, across regions with differing percentages of patriarchal households

	ln(Domestic Violence)						
Measure of bias:	Base	% Permission			% Purdah		
Level of bias		Low	Medium	High	Low	Medium	High
VARIABLES	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)	IV (6)	IV (7)
ln(Bartik EP gap)	1.168***	4.165***	0.336	0.936*	2.442***	2.692***	-0.719*
	[0.370]	[1.093]	[0.571]	[0.484]	[0.727]	[0.790]	[0.414]
ln(Emp gap)	0.015	0.000	0.033	-0.001	0.029	-0.022	0.025
	[0.018]	[0.059]	[0.037]	[0.018]	[0.045]	[0.043]	[0.021]
ln(Total Crimes)	0.840***	0.615***	0.869***	0.858***	0.552***	0.777***	1.159***
	[0.061]	[0.112]	[0.082]	[0.120]	[0.087]	[0.104]	[0.105]
ln(MPCE)	0.119*	0.166	0.051	0.159	0.116	0.218*	-0.009
	[0.072]	[0.165]	[0.110]	[0.111]	[0.113]	[0.128]	[0.113]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year and District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	825	1,045	960	890	910	1,030
Number of Panel	568	165	209	192	178	182	206
First-stage Statistics							
SW F:	61.51	14.70	37.43	24.27	24.25	15.62	45.82
KPW F:	61.51	14.70	37.43	24.27	24.25	15.62	45.82
Stock Yogo LIML 10% maximal IV bias critical value:					3.97		

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Column headings Low, Med and High refer to states with low, medium and high percentages of patriarchs in a region. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All non-diversity variables are district level totals or averages for each time period. ln(Domestic Violence) is the log of the total number of reports of domestic violence in the district. ln(Bartik EP Gap) is the log of the ratio of Bartik EP for males over the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp Male) is the log of total male employment. ln(Emp female) is the log of total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. Percentage of patriarch variables define methods to group districts in states of varying degrees of gender bias. % Permission is the percentage of households with women in each district who responded that they must ask permission form a senior family member (male or female) before they can leave the house to visit friends in the local area. % Purdah is is the percentage of households with women in each district who responded that they practice Purdah, or another form of religious face covering. Both of these variables come from the IHDS for 2005. The sub-sample regressions for regions of low percentage of Patriarchs are presented in columns (2) and (5). Medium percentage of Patriarchs is represented in columns (3), and (6). High percentage of Patriarchs is shown in columns (4) and (7). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

Table 14: Male and Female Earning Potential regressed on Domestic Violence, across regions with differing percentages of patriarchal households

	ln(Domestic Violence)						
Measure of bias:	Base	% Permission			% Purdah		
Level of bias		Low	Medium	High	Low	Medium	High
VARIABLES	IV (1)	IV (2)	IV (3)	IV (4)	IV (5)	IV (6)	IV (7)
ln(Bartik Male EP)	1.010**	4.154***	0.457	0.086	3.436***	2.194**	-1.378**
	[0.427]	[1.118]	[0.713]	[0.698]	[0.912]	[0.881]	[0.546]
ln(Bartik Female EP)	-1.259***	-4.266***	-0.330	-1.806***	-2.402***	-3.670***	0.354
	[0.399]	[1.213]	[0.586]	[0.587]	[0.729]	[1.141]	[0.473]
ln(Emp male)	-0.039	-0.006	-0.053	-0.127	0.071	-0.296	0.289
	[0.140]	[0.282]	[0.219]	[0.224]	[0.210]	[0.275]	[0.217]
ln(Emp fem)	-0.017	-0.001	-0.034	-0.014	-0.001	-0.004	-0.036
	[0.018]	[0.060]	[0.037]	[0.019]	[0.045]	[0.050]	[0.022]
ln(Total Crimes)	0.832***	0.610***	0.873***	0.850***	0.600***	0.735***	1.131***
	[0.061]	[0.115]	[0.083]	[0.122]	[0.091]	[0.111]	[0.107]
ln(MPCE)	0.109	0.164	0.054	0.107	0.162	0.152	-0.013
	[0.073]	[0.166]	[0.113]	[0.115]	[0.119]	[0.136]	[0.113]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year and District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,840	825	1,045	960	890	910	1,030
Number of Panel	568	165	209	192	178	182	206
First-stage Statistics							
Smallest SW F:	55.36	7.51	37.44	23.30	28.18	12.96	38.49
KPW F:	44.79	6.420	32.50	20.05	24.27	10.99	33.65
Stock Yogo LIML 10% maximal IV bias critical value:				3.97			

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Column headings Low, Med and High refer to states with low, medium and high percentages of patriarchs in a region. Gender gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All non-diversity variables are district level totals or averages for each time period. ln(Domestic Violence) is the log of the total number of reports of domestic violence in the district. ln(Bartik Male EP) is the log of the Bartik earning potential for males, and ln(Bartik Female EP) is the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp gap) is the log of the ratio of total male employment over total female employment. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. Percentage of patriarch variables define methods to group districts in states of varying degrees of gender bias. % Permission is the percentage of households with women in each district who responded that they must ask permission form a senior family member (male or female) before they can leave the house to visit friends in the local area. % Purdah is is the percentage of households with women in each district who responded that they practice Purdah, or another form of religious face covering. Both of these variables come from the IHDS for 2005. The sub-sample regressions for regions of low percentage of Patriarchs are presented in columns (2) and (5). Medium percentage of Patriarchs is represented in columns (3), and (6). High percentage of Patriarchs is shown in columns (4) and (7). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

6 Conclusion

We study the relationship between gender gaps and crime against women. We find that a smaller gender gap in earning potential is associated with increased crime against women, consistent with backlash. To our knowledge, ours is the first study in the economics literature to find evidence for backlash leading to more crime against women outside of the context of domestic violence. The backlash effect is exacerbated for individuals with less than high-school education and in areas exhibiting gender bias. For domestic violence, we find evidence for empowerment leading to lower violence as bargaining power for women increases in areas with low gender bias. This is in line with evidence from advanced countries like the United States. There is evidence that poorer earning potential for men in states with high gender bias is associated with more domestic violence. Our study underscores the role of gender biased institutions or culture in exacerbating crime against women as a result of backlash to better opportunities for women relative to men. In the home, female empowerment can be associated with lower violence against women by affording them greater bargaining power. More broadly, as emerging economies develop and technological growth improves the relative productivity of women and expands labor market opportunities for them, the presence of gender bias may be associated with an increase in crime against women.

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Appendix I

Table 15: Regressions to check whether potential gender bias variables represent the distribution of feminist and patriarchs.

		ln(Rapes, Indecent Assaults)	
VARIABLES		OLS (1)	OLS (2)
	% Permission	1.674***	
Diversity Indices:		[0.400]	
	% Purdah		1.644***
			[0.308]
	ln(Total Crimes)	0.785***	0.782***
		[0.031]	[0.032]
	ln(MPCE)	-0.205***	-0.193***
		[0.045]	[0.045]
	Other Controls	Yes	Yes
	Year FE	Yes	Yes
	Observations	2,830	2,830
	Number of Panel	566	566
	R-Squared	0.243	0.244

Note: Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. EP gaps are defined as in equation (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. District fixed effects are not included. All bias variables are district or state level, and identical for all rounds of data. In checking for diversity, each variable is assumed to represent the percentage of patriarchs in a region. E.g if 70% of households have women reporting they need permission to leave the house, then for this test it is assumed the region is made up of 70% patriarch households and 30% feminist households. A diversity index is created for each variable which is maximized when there is an equal percentage in each group. Theory predicts crime should be maximized at this point. A positive correlation between the diversity index and crime suggest the underlying variable does represent the percentage of patriarchs in a region. An insignificant correlation suggest we have no evidence for this assumption. ln(Rapes, Indecent Assaults) is the log of the total number of reports of rapes and indecent assaults. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. % Permission is the percentage of households with women in each district who responded that they must ask permission form a senior family member (male or female) before they can leave the house to visit friends in the local area. % Purdah is is the percentage of households with women in each district who responded that they practice Purdah, or another form of religious face covering. Both of these variables come from the IHDS for 2005.

APPENDIX II: DATA APPENDIX

Table 16: First Stage for IV Regressions when Instrumenting the gap in Earning Potential, the gap in Earning Potential and the gap in Employment, and when Instrumenting Male and Female Earning Potential.

VARIABLES	E.g. Table 3 column (2) ln(Bartik EP gap) IV First-Stage (1)	E.g. Table 3 column (3) ln(Bartik gap) IV First-Stage (2a)	ln(Emp gap) IV First-Stage (2b)	E.g. Table 8 column (1) ln(Bartik EP male) IV First-Stage (3a)	ln(Bartik EP fem) IV First-Stage (3b)
ETT for Lq males	0.021***	0.021***	-0.040	0.023***	0.002
	[0.004]	[0.004]	[0.032]	[0.001]	[0.003]
ETT for Lq females	-0.017***	-0.018***	0.043**	-0.000	0.017***
	[0.002]	[0.002]	[0.020]	[0.001]	[0.002]
ETT for Hq males	0.007***	0.007***	0.051*	0.007***	0.001
	[0.002]	[0.002]	[0.028]	[0.001]	[0.002]
ETT for Hq females	-0.001	-0.001	-0.011	-0.000	0.001
	[0.001]	[0.001]	[0.019]	[0.000]	[0.001]
EIT for Lq males	-0.029***	-0.029***	0.030	-0.033***	-0.004*
	[0.003]	[0.003]	[0.027]	[0.001]	[0.003]
EIT for Lq females	0.029***	0.030***	-0.074***	-0.001	-0.030***
	[0.003]	[0.003]	[0.028]	[0.001]	[0.003]
EIT for Hq males	-0.005***	-0.005***	-0.085***	-0.005***	0.000
	[0.001]	[0.001]	[0.028]	[0.000]	[0.001]
EIT for Hq females	0.003***	0.003***	0.025	0.000	-0.002***
	[0.001]	[0.001]	[0.019]	[0.000]	[0.001]
ln(Emp. gap)	-0.004**				
	[0.002]				
ln(Emp. male)				-0.001	-0.001
				[0.004]	[0.013]
ln(Emp. fem)				-0.001	-0.004***
				[0.000]	[0.002]
ln(Total Crimes)	0.004	0.004	0.022	0.002	-0.002
	[0.003]	[0.003]	[0.063]	[0.002]	[0.003]
ln(MPCE)	0.003	0.003	0.066	-0.000	-0.003
	[0.009]	[0.009]	[0.125]	[0.002]	[0.008]
Other Controls	Yes	Yes	Yes	Yes	Yes
Year and District FE	Yes	Yes	Yes	Yes	Yes
Observations	2,840	2,840	2,840	2,840	2,840
Number of panel	568	568	568	568	568
Sanderson-Windmeijer F-stat:	61.51	24.02	3.17	135.30	55.36
Sanderson-Windmeijer p value:	0.0000	0.0000	0.0025	0.0000	0.0000

Note: These first stage results are the same for all regression in this paper which instrument the same variable or set of variables. Data are for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. Gender gaps are defined as in equations (21). Standard errors are clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1. All variables are district level totals or averages for each time period: ln(Bartik Male EP) is the log of the Bartik earning potential for males, and ln(Bartik Female EP) is the Bartik earning potential of females. Bartik EP represents the average earning potential of each gender in a district, based on India wide average industry wages, and the industrial employment composition for that gender in the district. ln(Emp Male) is the log of total male employment. ln(Emp female) is the log of total female employment, and the gap is the log of the ratio of the two. ln(Total Crimes) is the log of the total number of crimes. ln(MPCE) is the log of mean per capita household expenditure. ETT for Lq males is the district exposure to trade tariffs, as weighted by employment of low qualified males. ETT for Lq females is the district exposure to trade tariffs, as weighted by employment of low qualified females. ETT for Hq males is the district exposure to trade tariffs, as weighted by employment of high qualified males. ETT for Hq females is the district exposure to trade tariffs, as weighted by employment of high qualified females. EIT for Lq males is the district exposure to input trade tariffs, as weighted by employment of low qualified males. EIT for Lq females is the district exposure to input trade tariffs, as weighted by employment of low qualified females. EIT for Hq males is the district exposure to input trade tariffs, as weighted by employment of high qualified males. EIT for Hq females is the district exposure to input trade tariffs, as weighted by employment of high qualified females. Individuals are classified as High qualified (Hq) if they posses a high-school level of education or above. Otherwise they are are classified as Low qualified (Lq). To guard against a weak instruments problem IV regressions use continuously updated GMM estimators (CUE) .

Appendix II: Data Appendix

Data sources

Industry, district, household, and individual level information from several large datasets for multiple time periods are integrated and aggregated in this paper. Data on gender gaps and control variables are sourced from the Employment and Unemployment surveys of the National Sample Survey Organization (NSSO), India. We use five rounds of data for the years 2004-05, 2005-06, 2007-08, 2009-10 and 2011-12. The surveys collect information on household per capita expenditure, the district, state and rural or urban area the household is located in, and individual variables like age, gender, level of education, employment status in the principal activity, industry of employment and daily wages. State and district administrative changes in effect in later rounds are concorded to the geopolitical boundaries as defined in NSS 61 for 2004-05, the first round of our data. Similarly, NIC industry classifications defined in 2004 and 2008 are concorded to NIC 1998. Each survey begins in July and ends in June the following year. We classify all information collected in a given round under the year in which the survey began. For example, NSSO round 61 collected data though 2004 to 2005. This is classified in this study as $t = 2004$.

Data on crime are at the district level, sourced from the National Crime Records Bureau (NCRB), India. We consider Rapes and Assaults on the Modesty of Women (Indecent Assaults) under crimes against women. A variation of this variable that is more sensitive to reporting bias also includes Insult to the Modesty of Women (Harassment). Cruelty by Husband or his Relatives is used as the measure of domestic violence. Data on total crimes at the district level registered under the Indian Penal Code are also sourced from the NCRB. Crime data is recorded as year end crime statistics for crime committed during the years of 2005, 2006, 2008, 2010 and 2012. Our interest is the effect of employment and wage gaps on crime hence crime data is concorded with a half year lead on the NSSO information. For example, crimes committed during January to December 2005 is allocated to $t = 2004$ in this analysis. This helps to correct for some of the potential reverse causation of crime on employment or wages, which is further accounted for with the IV analysis.

We collect data on the number of female representatives in the district elected to the state legislature from the Election Commission's Election Results for 2000-2010[27]. This is implanted as a snapshot of the number of sitting female politicians as of the year end for each year of 2003, 2004, 2006, 2008 and 2010. We are interested in controlling for any impact female representation has on gender gaps or crime. Hence this data is integrated with a 6 month lag on the NSSO data. For example, the total number of female representatives at year end in 2003 is allocated to $t = 2004$.

Data on import tariffs come from product level data from the WITS World Bank database. This is converted to overall tariffs for each NIC industry classification based on the simple average of tariffs on the products being

[27] Data accessed from http://eci.nic.in/eci_main1/ElectionStatistics.aspx on 13 November 2017

produced by each industry. Input tariffs are calculated using a weighted average of the tariffs on products used as inputs to each industry. Tariff information is recorded as a snapshot of product tariffs at year end for the years of 2003, 2004, 2006, 2008 and 2010. Given that we expect employment and wages to react sluggishly to changes in tariff levels, we integrate tariffs with a half year lag on the NSSO data. For example tariff data for the year ending in 2003 is allocated to $t = 2004$.

Two state level variables estimating the percentage of patriarchs in a region come from the India Human Development Survey (IHDS) for 2005[28]. We use survey responses from the woman's questionnaire to estimate the percentage of households in a state where women must ask permission before they leave the house to visit friends. In addition we use a separate variable to estimate the percentage of women who practice religious face covering.

A state level variable estimating the gender bias against female decision making is created from the inverse of the McKinsey Global Institute index of access for women to essential services and opportunities in the workplace produced in 2015[29]. A second measure of such gender bias uses demographic information from the NSSO survey to constructs a district level variable representing a variation of the Missing Women measure described in Anderson & Ray (2012).

Consumer Price Index (CPI) data comes from the State Level Consumer Price Index (Rural/Urban) for 2011, published by the Central Statistics Office of India[30]. This dataset contains state-wise urban and rural CPI modifiers for 2011 which are used to deflate the wage data.

Definition of types of individuals

Many of the following variables are defined for a person of group k. Primary classification is either $male$ or $female$ according to the gender information provided by an individual in the NSSO survey. We further categorize individuals into 2 sub-types based on their reported education level. An individual is $High\,Qualified$ (Hq) if they have a high-school education or above, and $Low\,Qualified$ (Lq) if not. The detailed classification hence defines 4 types of individual: Hq $male$, Hq $female$, Lq $male$ and Lq $female$. Individuals not reporting an education level are included in any variables using the gender classifications and excluded from any variables using the gender-skill classifications (~2,000 observations out of ~2,500,000).

Mean Per Capita Expenditure (MPCE)

MPCE is derived from the NSSO household level survey data. Monthly household consumer expenditure is defined in the survey as the following: Total household spending on non-durable goods for the 30 days prior to the survey,

[28] Desai, Sonalde, Reeve Vanneman, and National Council of Applied Economic Research, New Delhi. India Human Development Survey (IHDS), 2005. ICPSR22626-v8. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2010-06-29. http://doi.org/10.3886/ICPSR22626.v8.

[29] Data accessed from https://www.mckinsey.com/featured-insights/employment-and-growth/the-power-of-parity-advancing-womens-equality-in-india on 13 November 2017

[30] Data accessed from https://data.gov.in/resources/state-level-consumer-price-index-ruralurban-2011 on 13 November 2017

added to a monthly average from the previous 365 days of spending on durable goods and services. Non-durable goods include taxes, rent, transportation and utilities. Examples of durable goods include furniture, appliances, vehicles and long term services such as tuition fees and institutional medical expenses.

To create per person expenditure, we divide the monthly consumer expenditure for each household by the number of individuals in that household. Similar to wages and other income data, there is a large right tail in the distribution of per person expenditure in a district. There are also a non-zero number of households reporting no per person expenditure. These mainly represent agrarian households who consume their own production and barter for other goods and services. To facilitate comparison and preserve those zeros we take the natural logarithm of one plus the per person expenditure. Finally, to aggregate to the district level, this variable is averaged across all households in a district using the household level weightings provided in the NSSO survey data. To summarize, MPCE in district i at time t as defined as:

$$lnMPCE_{i,t} = \sum_{h=1}^{H_{i,t}} ln\left(1 + \frac{E_h}{N_h}\right) * \frac{W_h}{W_{H_{i,t}}} \qquad h \in H_{i,t},$$

where, h belongs to set $H_{i,t}$, the total number of households in district i at time t. E_h is the monthly household consumer expenditure in household h. N_h is the total number of individuals in household h. W_h is the household survey weighting for household h. $W_H = \sum_{h=1}^{H_{i,t}} W_h$, hence $\frac{W_h}{W_{H_{i,t}}}$ is the average household survey weighting for household h when aggregating to the district level. Using this weighting means that the average per person expenditure is as representative as possible at the district level, given the nature of the survey process. $ln\,(x)$ represents the natural logarithm transformation of x.

Households not reporting any expenditure are excluded from the MPCE calculations, along with their associated survey weightings (7 out of ~530,000 households). These households, and the individuals therein, are not necessarily excluded from other variable calculations.

Inequality

The level of inequality in a district is derived from the per person expenditure for each household in a district, as defined in 6. Inequality in i at time t is defined as the ratio of per person expenditure of the 75th percentile household, divided the per person expenditure of the 25th percentile household. Percentiles are calculated after taking account of the representative survey weighting. Hence: inequality is in district i at time t is defined as following:

$$lnIneq_{i,t} = ln\left(1 + \frac{E_{h=p75}}{N_{h=p75}}\right) - ln\left(1 + \frac{E_{h=p25}}{N_{h=p25}}\right) \qquad h \in H_{i,t},$$

where $h = p25\,(p75)$ represents the household in i at the 25th (75th) percentile after taking account of the survey weighting for each household in a district. E_h is the monthly household consumer expenditure in household h. N_h is the total number of individuals in household h. Households not reporting any expenditure are excluded from the Inequality calculations, along with their associated survey weightings.

Employment

Information on employment comes from the individual data in the NSSO surveys. Individuals reported their usual principal activity over the 7 days prior to the survey date, which is classified into one of 13 different categories. Examples of such categories include: attended domestic duties, attended educational institution, and did not work but looking for work. We categorize a person as being employed if they met one of the following 6 categories: worked in household enterprise (self-employed) as own account worker, worked in household enterprise (self-employed) as an employer, worked as helper in household enterprise (unpaid family worker), worked as regular salaried / wage employee, worked as casual wage labor in public works, or worked as casual wage labor in other types of work. The total employment of people of type k in district i at time t is given by:

$$lnEmp_{i,t,k} = ln\left(1 + \sum_{n=1}^{N_{i,t,k}} emp_n * W_n\right) \quad n \in N_{i,t,k},$$

where, n is in the set of $N_{i,t,k}$, which is the total number of individuals of type k in district i at time t. emp_n is a dummy variable that is 1 if person n is categorized as employed, and 0 otherwise. W_n is the survey weighting for person n. Some districts have zero employed people of a certain type, so we take the natural logarithm of one plus this variable to preserve these zeros. The relative gaps in employment in district i at time t are defined as follows:

$$lnEmp_{i,t,gap} = lnEmp_{i,t,male} - lnEmp_{i,t,female},$$

$$lnEmp_{i,t,Lq\,gap} = lnEmp_{i,t,Lq\,male} - lnEmp_{i,t,Lq\,female},$$

$$lnEmp_{i,t,Hq\,gap} = lnEmp_{i,t,Hq\,male} - lnEmp_{i,t,Hq\,female}.$$

Industry level employment for 2004, the first period of data, is used when deriving the wage and trade variables. The number of people of type k employed in industry j in district i in 2004 is given by:

$$Emp_{i,04,k,j} = \sum_{n=1}^{N_{i,04,k,j}} emp_n * W_n \quad n \in N_{i,04,k,j},$$

where, n is in the set of $N_{i,04,k,j}$, which is the total number of individuals of type k in district i in 2004 in j, where j is a NIC 1998 2 digit industry classification. emp_n is a dummy variable that is 1 if person n is categorized as employed, and 0 otherwise. (Definitionally, there is no industry information for individuals who are not classified as employed). W_n is the survey weighting for person n. Similarly, district level employment is defined as:

$$Emp_{i,04,k} = \sum_{n=1}^{N_{i,04,k}} emp_n * W_n \quad n \in N_{i,04,k},$$

where, n is in the set of $N_{i,04,k}$, which is the total number of individuals of type k in 2004 in district i. emp_n is a dummy variable that is 1 if person n is categorized as employed, and 0 otherwise. W_n is the survey weighting for person n.

Bartik Earning Potential

Industry Average wages

Wage data comes from the NSSO survey. Individuals reported their daily earnings for each of the 7 days prior to the survey date and the intensity of work on that day (either full or part time). The NIC industry code for the industry category for the work done on each day is also recorded. When deriving the total number of days worked by an individual in each NIC in a week, each full time day is counted as 1, and each day of part time work is counted at 0.5. We use the total weekly earnings in each NIC, and the total number of days worked in that NIC, to derive the average daily wage for each person, for each NIC. For individuals that have more than 1 NIC code (approximately 6% of the survey respondents who report wage information), we assign them an average daily wage for each NIC. The India average wage at time t for an individual of type k in industry j is now defined as follows:

$$ln\overline{Wage}_{t,k,j} = \sum_{n=1}^{N_{t,k,j}} ln\left(1 + \overline{wage}_n\right) * \frac{W_n}{W_{N_{t,k,j}}} \quad n \in N_{t,k,j},$$

where, n belongs to the set of $N_{t,k,j}$ which is the total number of individuals at time t of type k who have an average daily wage for industry j. $\overline{wage}_n$ is the average daily cash wage for individual n in that industry, from work recorded over the previous 7 days. k is the person's type. j is the two digit NIC industry code for industry of employment associated with that daily average wage. All rounds of data are concorded to NIC 1998 industry codes. At the two digit level we have ~60 industry categories. W_n is the individual weighting for person n. $W_{N_{t,k,j}} = \sum_{n=1}^{N_{t,k,j}} W_n$, hence $\frac{W_{n_{k,j}}}{W_{N_{k,j}}}$ is the individual average survey weighting.

Individuals not reporting a wage are excluded from the average wage calculations, even if they report employment. The associated survey weightings for such individuals are also excluded. Any individual of group $-k$, along with their associated survey weightings, are excluded when calculating the average wages for individuals of group k. There are also some individuals reporting zero wages (~2,300 out of ~387,000). For example, some of these individuals report working in family run business. To preserve these zeros we add one to each reported wage before performing the natural logarithm transformation.

For robustness, several other versions of this variable are created. Firstly, in addition to reported cash wages, we also include payments received "in kind", i.e goods or services received in lieu of wages and other income like rent, returns on assets etc. We define $\overline{wage\,tot}_n$as the average of the sum of cash and payments in kind received over the last 7 days, adjusted for part time work as appropriate. An individual reporting cash wage information but no "in kind" information is treated as reporting zero "in kind" payments, and vice versa. Any individual not reporting either wage is excluded.

State level urban/rural CPI adjustment is achieved by replacing $\overline{wage}_n$ with $\overline{wage\,CPI}_n$ where $\overline{wage\,CPI}_n = \overline{wage}_n * CPI$. CPI is a specific purchasing power adjustment based on an individual's state of residence and their urban or rural status. This CPI information is for the earliest time period available (2011)[31] and the same deflater is used for each round of survey data. Inflation over time, and district level CPI adjustments, are naturally captured in the time and district fixed effects in each regression. The purpose of the urban-rural state deflater is to account for CPI differences not captured in those fixed effects.

Bartik Earning Potential (EP)

Earning potential in i is now defined as the potential a person of type k could earn in district i, based on the India average earnings for their type, and the industrial employment composition of the district in which they reside. This is a version of the classic Bartik instrument, where local industry shares and national industry average wages are interacted:

$$ln\overline{EP}_{i,t,k} = \frac{\sum_{j=1}^{J_i} \left(Emp_{i,04,k,j} * ln\overline{Wage}_{t,k,j} \right)}{\sum_{j=1}^{J_i} Emp_{i,04,j,k}}$$

where, $Emp_{i,04,k,j}$ is the total number of people in district i of type k employed in industry j in 2004, the first period for our data. If there are no reported wages at time t for type k in industry$j$ (across the whole of India), then the number of type k people employed in j in district i (in 2004) are excluded when calculating the total employment of type k in i. This means that if average wage information is missing for an industry, those industries are excluded in i from the employment weightings and from $\sum_{j=1}^{J_i} \Upsilon_{t,k,j} * Emp_{i,04,k,j}$. Industries with wages of zero are included. (We will show wage information is much more sparse than employment information in the next few paragraphs). There are a few districts where total employment is zero for some k. For example 38 districts out of 565, (6%), report zero employed Hq women in 2004. In these circumstances we define the earning potential for Hq women as zero. If Hq women are not employable in a district, then the earning potential for Hq women is definitionally zero. Hence if $\sum_{j=1}^{J_i} \Upsilon_{t,k,j} * emp_{i,04,k,j} = 0$ we set $ln\overline{WD}_{i,t,k} = 0$.

It could be more useful to create state level earning potential using state level industry average wages instead of the all India averages. However, we are not able to do this as wage information is relatively under-reported in our dataset.To illustrate the relative lack of wage information, we can look at the 2004-2005 survey information. Of

[31] Data accessed from https://data.gov.in/resources/state-level-consumer-price-index-ruralurban-2011 on 13 November 2017

~602,000 individual survey participants (prior to survey weighting), ~220,000 reported employment and ~86,000 reported a wage. It is not appropriate to replace the missing wage information with zeros. Some individuals may have chosen not to report a wage, others may be business owners who don't officially take a salary but make all purchases through the business. To ensure that the wage information is as representative as possible we minimize the number of bins into which these data points are categorized. These categories multiply quickly when using 60 industry classifications and 4 groups of individuals. Further subdivision by the 32 states spreads the data too thin, even if we use the NIC 1 digit codes which results in 10 industry classifications instead of 60. Too few individuals in a given category can amplify any sampling errors and result in unrepresentative information for that category after survey weighting multipliers are applied.

In the robustness checks, $ln\overline{Wage}_{t,j,k}$ is replaced by $ln\overline{Wage\,tot}_{t,j,k}$, or $ln\overline{Wage\,CPI}_{t,j,k}$, as defined in section 6. The relative gaps in earning potential in district i are defined as follows:

$$ln\overline{EP}_{i,t,gap} = ln\overline{EP}_{i,t,male} - ln\overline{EP}_{i,t,female},$$

$$ln\overline{EP}_{i,t,Lq\,gap} = ln\overline{EP}_{i,t,Lq\,male} - ln\overline{EP}_{i,t,Lqfemale},$$

$$ln\overline{EP}_{i,t,Hq\,gap} = ln\overline{EP}_{i,t,Hqmale} - ln\overline{EP}_{i,t,Hq\,female}.$$

Working population and Qualification level,

Information on the working population and skill level comes from the NSSO surveys where individuals reported their age and level of education. We categorize a person as being of working population if they are aged between 15 and 64. We categorize a person as being Hq if they posses a high school level of education or above. Otherwise they are categorized as Lq. For the following variables the notation k' is used to signify that only 2 types of person are considered: $male$ and $female$. Any person not reporting an education level is excluded from the education calculation and not the working population variable (~2,000 observations out of ~2,500,000). The total number of working age population of people of type k' in district i at time t is given by:

$$lnWorkPop_{i,t,k'} = ln\left(1 + \sum_{n=1}^{N_{i,t,k}} wp_n * W_n\right) \qquad n \in N_{i,t,k'},$$

and the total number of working age people of type k' with high school education or above in district i at time t is given by:

$$lnHHC_{i,t,k'} = ln\left(1 + \sum_{n=1}^{N_{i,t,k}} hhc_n * wp_n * W_n\right) \quad n \in N_{i,t,k'},$$

where, n is in the set of $N_{i,t,k'}$, which is the total number of individuals of type k' in district i at time t. wp_n is a dummy variable that is 1 if person n is categorized as of working population, and 0 otherwise. hhc_n is a dummy variable that is 1 if person n has a high school level of education or above, and 0 otherwise. W_n is the survey weighting for person n. There are no districts with zero working population or Hq individuals, however if there were, these zeros would need to be preserved. In keeping with other variables, we take the natural logarithm of one plus. Working population is used in the regressions as $male$ and $female$ separately. The qualification level is used as a gap, defined by:

$$lnHq_{i,t,gap} = lnHHC_{i,t,male} - lnHHC_{i,t,female}.$$

Further to this, the overall working age qualification level of district i at time t is defined as the total number of high school and above educated individuals of working age, divided by the total number of working age individuals:

$$lnHq\,Level_{i,t} = ln\left(1 + HHC_{i,t,male} + HHC_{i,t,female}\right) - ln\left(1 + WorkPop_{i,t,male} + WorkPop_{i,t,female}\right),$$

where $HHC_{i,t,k'}$ is the total number of high-school educated individuals of working age of type k'. $WorkPop_{i,t,k'}$ is the total number of individuals of working age of type k'.

Urbanization Percentage

The urbanization percentage of a district is derived from the NSSO household level survey data. Households are recorded as being either urban or rurally located. The urbanization percentage is defined as the total number of individuals living in urban households divided by the total number of individuals in all households in the district:

$$lnUrban\%_{i,t} = ln\left(1 + \sum_{h=1}^{H_{i,t}} N_h * ub_h * W_h\right) - ln\left(1 + \sum_{h=1}^{H_{i,t}} N_h * W_h\right) \quad h \in H_{i,t},$$

where, h belongs to set $H_{i,t}$, the total number of households in district i at time t. ub_h is a dummy variable that is 1 if household h is classified as urban and 0 otherwise. N_h is the total number of individuals in household h. W_h is the household survey weighting for household h. In keeping with other variable creation, the natural logarithm of 1 plus the variable is used to preserve any potential zeros.

Agricultural and Manufacturing percentage of a district

The percentages of people employed in agriculture and in manufacturing are derived from the NSSO individual level survey data. We categorize a person as being employed in Agriculture if they report a NIC98 industry code corresponding to Agriculture, Forestry or Fishing. We categorize a person as working in the manufacturing sector if they report one of 22 manufacturing NIC98 industry codes. The total number of employed people at time t in agriculture or manufacturing in district i is defined as follows:

$$lnEmp_{i,t,Agriculture} = ln\left(1 + \sum_{n=1}^{N_{i,t}} empA_n * W_n\right) \quad n \in N_{i,t},$$

$$lnEmp_{i,t,manufacturing} = ln\left(1 + \sum_{n=1}^{N_{i,t}} empM_n * W_n\right) \quad n \in N_{i,t},$$

where, n is in the set of $N_{i,t}$, which is the total number of individuals in district i at time t. $empA_n$ is a dummy variable that is 1 if person n is categorized as employed in agriculture, and 0 otherwise. $empM_n$ is the same for manufacturing. W_n is the survey weighting for person n. The relative percentages of employment in district i at time t are defined as follows:

$$lnEmp\%_{i,t,Agriculture} = lnEmp_{i,t,Agriculture} - ln\left(1 + Emp_{i,t,male} + Emp_{i,t,female}\right)$$

$$lnEmp\%_{i,t,manufacturing} = lnEmp_{i,t,manufacturing} - ln\left(1 + Emp_{i,t,male} + Emp_{i,t,female}\right),$$

where $Emp_{i,t,male}$ and $Emp_{i,t,female}$ are as defined in section 6.

Elected Female representatives

Data on female representation come from the Election Commission's Election Results. The number of female candidates elected to any Assembly Constituency (AC) in a district is recorded for each year between 2000 and 2011. Representatives sit for a term of five years, however AC elections are staggered so there are a number of AC elections every year in each district. We count the number of elected females currently sitting as of the end of the year preceding the survey date. i.e. the current number of elected representatives as of the end of 2003 is allocated to $t = 2004$. This variable is created by adding up the number of female representative elected in a district in each of the preceding five years:

$$ElecFem_{i,t} = \sum_{y=t-5}^{y=t-1} elecfem_{i,y},$$

where $elecfem_{i,y}$ is the number of female representatives elected in district i in year y. Note that the available Electoral Commission results only go as far back as the year 2000. Hence for $t = 2004$ we miss any incumbents who were elected in 1999 and are sitting their fifth year. Districts that do not report any elected females for a given year are considered to have elected zero female representatives in that year.

Gender Bias and Percentage of Patriarchal households

% of households with women who need permission to visit friends (%permission) and % who practice Purdah (%Purdah)

Two measures to estimate the percentage of patriarchal households in a region come from the India Human Development Survey (IHDS) for 2005. Part of this survey is a woman's questionnaire, given to one female in each household. The responses are amalgamated through survey weightings to be representative of households at the state level. In the following two binary variables, a female that responds in the affirmative is determined to belong to a patriarchal household, and in the negative to a feminists household. Clearly this is a gross simplification. As can be seen in the India averages in the following variables, all of India is potentially gender bias. Rather than observing actual "Feminist" households, we are most likely picking up "slightly less patriarchal" households. Nevertheless, differing views between these groups, for example, on whether a woman's face should be covered in public, may be a source of tension or conflict. The assumption of patriarch vs feminist simply allows us to group states by those with higher or lower percentages of more extreme patriarchal households.

The %permission variable is the percentage of households in a state with women who responded they need to ask permission from a senior family member, either male or female, before they may leave the house to visit a friend in their village or community. The India wide average of this variable shows that 73% of households require women to ask permission before they can leave. This best demonstrates how all of India may have a large percentage of patriarchal households. In some states this increases to almost 98%. Across all of India, over 75% of the households where women who responded they must ask for permission are older than 25 years old. The %Purdah variable is the percentage of households in a state where women report that they practice Purdah or another form of religious face covering. The India average for this variable is 59%. This variable ranges from 100% of women surveyed in some states, to 0% in others.

Missing Women

Following Anderson & Ray (2012) we consider a relative lack of females aged 5 years old or younger (U5), to be a potential indicator of gender bias in a district. To create a structural measure of gender bias, only the first period is considered, hence in the following $t = 2004$ and has been omitted for simplicity. We use individual age information reported in the NSSO survey data. The population of U5 $male$ or $female$ individuals in a district is given by:

$$P_{d,k'} = \sum_{n=1}^{N_{d,k'}} p_n * W_n \quad n \in N_{d,k'},$$

where, k' is either $male$ or $female$. n is in the set of $N_{d,k'}$, which is the total number of individuals of type k' in district d. p_n is a dummy variable that is 1 if person n is aged 5 years old or under, and 0 otherwise. W_n is the survey weighting for person n. We further define the expected U5 population of individuals of type k' for district d as the following:

$$\hat{P}_{d,k'} = \gamma_d * \sum_{d=1}^{D} P_{d,k'},$$

where $\sum_{d=1}^{D} P_{d,k'}$ is the total U5 population of type k' in all districts in India. γ_d is the fraction of India's total population attributable to district d. When working out the population fractions, all ages are included. This creates an expected U5 population for the district based on how many U5 individuals of that type there are in India, and the overall percentage of the total Indian population residing in that district. We now define the missing women ratio for a district d as the ratio of U5 males to U5 female, divided by the expected ratio of U5 males to U5 females:

$$MW_d = \frac{\frac{P_{d,male}}{P_{d,female}}}{\frac{\hat{P}_{d,male}}{\hat{P}_{d,female}}} = \frac{P_{d,male}}{P_{d,female}} * \frac{\hat{P}_{d,female}}{\hat{P}_{d,male}},$$

where, $\hat{P}_{d,k'}$ represents the expected U5 population of individuals of type k', aged 5 years or younger, for district d.

The intuition behind the missing women variable is as follows: if there are fewer young children in a district than expected, it could be due to poor healthcare options. If this affects males and females equally, then this variable will be 1. However if there is just a lack of female children, this variable will be greater than 1 and this could represent gender bias against women in the district. The implication being there may be some institutional or societal conventions that lead to individuals having a preference for male babies, and/or to prioritize resources towards males over female. By only including individuals aged 5 years and under, we are excluding any migration effects, and any mortality differences between adult men and women.

This variable effectively represents deviation from the district average ratio of males to females aged 5 and under. Although the baseline for this result is the India average, which itself may be biased when compared to other countries, it allows districts to be ranked, from least to most extreme results. Table 17 shows the comparison between all the gender bias variables and the missing women variables presented in Anderson & Ray (2012). Broadly, our district level missing women variables produce state averages that are in line with the state level results in Anderson and Ray.

Essential Services and Opportunities (ESO)

An alternative to Missing Women for a potential measure of institutional gender bias comes from the McKinsey Global Institute (MGI) report: the power of parity: advancing women's equality in India, from November 2015. Given the nature of institutional gender bias, it is likely areas of high gender bias in 2015 were also of high gender bias in 2004-2011. Furthermore, the MGI variables are derived from different datasets, which acts as a robustness check on our measure of gender bias. We use their index for essential services and enablers of economic opportunity. This state level variable is made up of 5 components: The percentage of women with unmet needs for family planning, the maternal mortality rate, and the male/female gaps in education level, financial inclusion, and digital inclusion. This index is produced as a percentage, where higher ESO means more progressive scores in the 5 components, and hence could indicate less institutional gender bias in a state. In keeping with our other gender bias variables, we take the inverse of this percentage:

$$invESO = \left(\frac{100 - ESO}{100}\right),$$

here, higher $invESO$ may indicated more gender bias in a state.

Gender bias comparison Tables

Table 17: Gender Bias comparison

State	Average MW	invESO%	%Permission	%Purdah	%age of MW[32]
		Measure of Gender Bias			
Uttaranchal	0.85	0.13	0.73	0.48	-
Chhattisgarh	0.88	0.20	0.65	0.60	-
Jharkhand	0.90	0.21	0.58	0.64	-
GOA	0.90	0.09	0.28	0.03	-
West Bengal	0.94	0.13	0.78	0.71	0.53
Meghalaya	0.95	0.23	0.37	0.04	-
Kerala	0.99	0.06	0.73	0.16	0.24
Jammu & Kashmir	0.99	0.17	0.95	0.78	-
Tamilnadu	1.01	0.13	0.70	0.12	0.29
Orissa	1.01	0.21	0.71	0.64	0.57
Andhra Pradesh	1.02	0.17	0.57	0.12	0.39
Madhya Pradesh	1.03	0.21	0.93	0.94	0.93
Uttar Pradesh	1.04	0.22	0.76	0.89	0.65
Haryana	1.04	0.18	0.73	0.85	1.23
Sikkim	1.04	0.14	0.97	0.98	-
Delhi	1.05	0.11	0.76	0.48	
Gujarat	1.07	0.17	0.86	0.81	0.4
Karnataka	1.09	0.14	0.92	0.11	0.45
Manipur	1.11	0.11	0.96	0.00	-
Bihar	1.11	0.23	0.95	0.89	0.77
Rajasthan	1.12	0.24	0.80	0.95	0.42
Assam	1.12	0.16	0.44	0.66	0.67
Maharashtra	1.13	0.13	0.60	0.39	0.79
Himachal Pradesh	1.13	0.12	0.86	0.44	0.58
Arunachal Pradesh	1.16	0.21	0.74	0.45	-
Tripura	1.17	0.14	0.90	0.66	-
Punjab	1.18	0.17	0.86	0.36	0.86
Nagaland	1.20	0.14	0.22	0.00	-
Mizoram	1.22	0.11	0.45	0.02	-

Key, based on conclusions from Anderson & Ray (2012)

Red	Make up 37% of all missing women in India
Blue	Have lowest level of missing women

Note: Ordered by Average MW, low to high. Data for MW, % Purdah and %Permission are for the years 2004-05. Data for invESO% is from 2015. Average MW is the state average of the district level Missing Women variable. All other variables are concorded directly to the state level, either in our analysis, as in the case of %Purdah and %Permission, or by the original authors, as is the case with ESO and Anderson and Ray's Missing women. Average MW is the ratio of males to females under 5 years old, divided by the expected ratio for males to female for that age range, with the expected ratio based on India and state averages. invESO% is Inverse ESO, the inverse of the McKinsey Institute index for the percentage of women in a state with access to essential services and opportunities. %Permission is the percentage of households with women in each state who responded that they must ask permission form a senior family member (male or female) before they can leave the house to visit friends in the local area. %Purdah is is the percentage of households with women in each state who responded that they practice Purdah, or another form of religious face covering. Both of these variables come from the IHDS for 2005. %age of MW comes from Anderson & Ray (2012) and represents the total number of missing women as a percentage of total observed women in a state, - indicates a state not considered in that paper.

Crime

Data on crime are at the district level, sourced from the National Crime Records Bureau (NCRB), India. We consider Rapes, Assaults on the Modesty of Women (Indecent Assaults) as our main crime against women variable,

[32] from Anderson & Ray (2012)

denoted in the equation below as CAW. A version of this variable, denoted here as CAWR, that is potentially more sensitive to any reporting bias is achieved by including Insult to the Modesty of Women (Harassment) under crimes against women. We denote Cruelty by Husband or his Relatives as Domestic Violence, (DV). Data on total crimes at the district level registered under the Indian Penal Code are also sourced from the NCRB. Crime data is recorded as year end crime statistics for crime committed during that year. Our interest is the effect of employment and wage gaps on crime hence crime data is concorded with a half year lead on the NSSO information. For example, crimes committed during January to December 2005 is allocated to $t = 2004$ in this analysis. The dependent variables in this investigation are now defined as follows:

$$lnCAW_{i,t} = ln\left(1 + \sum Rapes_{i,t} + \sum IndecentAssaults_{i,t}\right),$$

$$lnCAWR_{i,t} = ln\left(1 + \sum Rapes_{i,t} + \sum IndecentAssaults_{i,t} + \sum Harassment_{i,t}\right),$$

$$lnDV_{i,t} = ln\left(1 + \sum DomesticViolence_{i,t}\right),$$

where $\sum Crime_{i.t}$ is the total reported $Crime$ in district i at time t. The natural logarithm of 1 plus the variable is used to preserve any districts that have zero reported crimes. Any districts for which crime data are missing are excluded from this report.

Exposure of a District to Trade Tariffs

The exposure of a district to trade tariffs (ETT) describes the potential level of protection from competition workers in a district experience. This may influence wages and employment in a district. Tariffs are set for India as a whole, hence ETT is exogenous to the level of crime in a district, providing useful instruments in our investigation. Data on product level tariffs comes from the WITS world Bank database. Information on the inputs and output to each industry come from the input-output transactions table (IOTT 1994).

We define the average tariff for industry j in time period t as the simple average of the tariffs on all goods produced by industry j:

$$\overline{Tar}_{t,j} = \frac{1}{G_{t,j}} * \sum_{g=1}^{G_{t,j}} tar_g \quad g \in G_{t,j},$$

where, g is in the set of $G_{t,j}$ which is all goods produced in industry j at time t. tar_g is the tariff on good g at time t[33]. For non-trade industries we set $\overline{Tar}_{t,j} = 0$. Following this, input tariffs are defined as the weighted average of the tariff on each good used as an input to industry j, adjusted for the fraction of total inputs to j

[33] Technically, $\overline{Tar}_{t,j}$ is the simple average tariff on all HS (Harmonized System) 4-digit products in industry j. We first concord HS 4-digit products to input-output sectors from the IOTT 1994. Each IOTT sector is then mapped to a 3-digit NIC 1998 sector.

represented by each good:

$$\overline{inpTar}_{t,j} = \frac{\sum_{y=1}^{G_{t,j}} tar_g * input\,to\,j_g}{\sum_{g=1}^{G_{t,j}} input\,to\,j_g} \quad g \in G_{t,j},$$

where g is a good in the set of $G_{t,j}$, which is all goods used as inputs for industry j at time t. $input\,to\,j_g$ is the total inputs of g to industry j at time t. If no inputs to j are recorded for a given g, $input\,to\,g = 0$. Note: goods produced by industry j are included in the set $G_{t,j}$ as some products of j may be also used as inputs in j. $\sum_{g=1}^{G_{t,j}} input\,to\,j_g$ is total inputs to j. tar_g is the tariff on good g at time t. Non-trade industries are not included in $G_{t,j}$.

We now adapt the specification in Topalova (2010) and define ETT for people of type k in district i at time t as the weighted average of the all industry tariffs at time t, weighted by the first period industry employment composition for type k in district i :

$$ETT_{i,t,k} = \frac{\sum_{j=1}^{J_i} \left(Emp_{i,04,k,j} * \overline{Tar}_{t,j}\right)}{\sum_{j=1}^{J_i} Emp_{i,04,k,j}} \quad j \in J_{i,04},$$

Similarly, exposure to input tariffs (EIT), is defined as the weighted average of all industry input tariffs:

$$EIT_{i,t,k} = \frac{\sum_{j=1}^{J_i} \left(Emp_{i,04,k,j} * \overline{inpTar}_{t,j}\right)}{\sum_{j=1}^{J_i} Emp_{i,04,k,j}} \quad j \in J_{i,04}.$$

In the above, $Emp_{i,04,k,j}$ is the total number of people in district i of type k employed in industry j in 2004, as defined in section 6. For non-traded industries, there are no tariffs or input tariffs, so our exposure measures are definitionally zero[34]. $\sum_{j=1}^{J_i} Emp_{i,04,k,j}$ is the total number of people of type k employed in i in 2004. If this total is zero, then there are no workers of type k to be exposed to tariff effects and definitionally our exposure measures are zero for this also. Hence we set $ETT_{i,t,k} = 0$ and $EIT_{i,t,k} = 0$ if $\sum_{j=1}^{J_i} Emp_{i,04,k,j} = 0$. We include employment in non traded industries when deriving total employment in i. This means that the impact of any tariffs are also scaled by the relative size of the tradeable sector is in a district. The resulting exposure variables provide the potential impact of tariffs or input tariffs at time t for each type of worker in district i.

[34] This is not strictly true, particularly for input tariffs. For example, if you are in the restaurant business you may use imported tables and chairs and be exposed to input tariffs in that regard.