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ABSTRACT

Violence and Female Labor Supply*

This paper explores whether fear and safety concerns have an impact on behavior such as female labor supply in a developing country context. The effect of media reported physical and sexual assaults on urban women's labor force participation in India is investigated by combining nationally representative cross-sectional microeconomic surveys carried out between 2009 and 2012 with a novel geographically referenced data source on media reports of assaults. I find that a σ increase in lagged sexual assault reports within one's own district reduces the probability that a woman is employed outside her home by 0.44 percentage points (or 3.6% of the sample average). I find this effect despite ruling out several sources of unobserved heterogeneity. This effect is also robust to a number of sensitivity checks. Consistent with a model in which women make investments to overcome fear in the presence of economic incentives, I find that the effect of local violence on labor supply is weaker among women from poorer households. I also find this effect to be weaker among high caste Hindu women, but strong among Muslim women.

JEL Classification: J16, J22

Keywords: economics of gender, labor supply

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1 Introduction

Gender gaps or differences in labor market outcomes across men and women exist worldwide, but these differences are particularly stark in much of the developing world (Jayachandran 2015). For instance, labor markets in developing countries are likely to be characterised by large gender gaps in labor force participation. Low female labor force participation, in turn, is associated with reduced incentives to invest in female human capital, reduced female bargaining power within households, and worse child health outcomes (Heath & Jayachandran 2005). Female labor supply within developing countries might be particularly sensitive to sudden incidents of violence against women which are reported in the media since such reporting can make the extreme consequences of being a violence victim salient. This paper investigates and quantifies these relationships using data from urban India.

An important feature of the Indian labor market today is the presence of large gender gaps in labor force participation (Fletcher et al. 2018). Despite high economic growth, increases in education attainment and declining fertility over the last thirty years, female labor force participation rates have stagnated in urban households (Klasen & Pieters 2015) and fallen in rural households (Afridi et al. forthcoming). This is in contrast to developed countries which have seen large gains by women in labor force participation over time (Blundell & MaCurdy 1999). For instance, in 2011-2012 just 20% of working age Indian women (age 15-65) in urban households and 27% in rural households were in the labor force, while 81% of working age Indian men in urban households and 84% in rural households were in the labor force.¹ Labor force participation rates in 2012 for women in the US were 68%, in the UK were 71%, in Sweden were 78% and in Germany were 72%.² India's female labor force participation rates also compare unfavourably with other developing countries. For instance, using Demographic and Health Survey data from 63 developing countries between 1986 and 2006, Bhalotra & Umana-Aponte (2010) note that employment among women age 20-49 was 64% in Africa, 43% in Asia and 50% in Latin America.

This paper investigates labor force participation decisions of urban women age 18-50 in India to

¹Based on own calculations from the Employment and Unemployment schedule of the 68th round of the Indian National Sample Survey. Labor force status is defined using activity status over the previous year; a person is in the labor force if they are self employed, an unpaid family worker, a regular salaried employee, a casual worker or unemployed.

²Data extracted from <http://stats.oecd.org>.

understand how these women might play a more active role within the labor market. Specifically, it examines a potential determinant of women’s labor force participation decisions which is currently under-explored in the literature on female labor supply. Recent increases in media reports of interpersonal violence against women in India, particularly of sexual assaults and rapes, may have an unintended negative effect of deterring women from going out for work in a society where the stigma costs of sexual assaults are high by making the extreme consequences of being a violence victim salient. This paper quantifies the effect of such reporting on whether women seek employment outside their homes. It makes a contribution to the literature on the distortive effects of fear as well as contributing to the literature on labor supply determinants of women in a developing country context, and a smaller literature examining the causes and consequences of violence against women.

[Becker & Rubinstein \(2011\)](#) provide a framework to illustrate how small probability events (such as becoming a victim of violence) can have a large affect on people’s behavior. They incorporate into expected utility theory “situations in which the extreme consequences associated with the consumption of risky goods (or engaging in outside work) and the extent these turn into a salient phenomenon affect persons’ mental state, generate fear, and by that affect peoples’ utility and well-being.” However, people can make investments to overcome fear provided the benefits from consumption of risky goods or activity are sufficiently large. Those for whom the benefits are not sufficiently large substitute out of the risky activity so that the affect on their behavior appears to overstate the objective probability of being harmed by terror. [Becker & Rubinstein \(2011\)](#) test their theoretical predictions by examining how the fear of terrorist attacks in the US and Israel has an impact on usage of goods and services subject to these attacks.

Recent research indicates that fear and safety concerns of women outside the home are likely to play an important role in whether they seek outside employment in India. [Muralidharan & Prakash \(2017\)](#) find that providing girls in the Indian state of Bihar with a bicycle improved education enrollment by making it safer for girls to travel to school. [Borker \(2018\)](#) finds that women are willing to choose a college in the bottom half of the quality distribution over a college in the top half at the University of Delhi for a travel route that they perceive to be one standard deviation safer. [Chakraborty et al. \(2018\)](#) use cross-sectional data from the 2005 wave of the India Human Development Survey (IHDS) to find that in urban neighborhoods where the self reported level of

sexual harassment against women is high, women are far less likely to seek outside employment.³

Fear of public spaces following media coverage of sexual assaults can create stress and anxiety, deterring women from going out for work. According to a survey carried out in Delhi in 2012 following the rape and subsequent death of a Delhi woman on a moving bus which was widely reported in the media, nearly 73% respondents said that women face sexual violence in their neighborhoods, and more than half stated that these spaces are unsafe at all times. Almost 20% of the respondents stated they were fearful when going out alone in the daytime and an additional 10% percent stated they would not venture out alone at all. These fractions were 63% and 21% when respondents expressed safety concerns for going out after it was dark (UN & ICRW 2013).

Much of the literature on labor supply in developing countries has examined the role of individual characteristics (such as age, education, race/ethnicity) or family attributes (such as spouse variables, number of children) in labor force participation decisions. For instance Klasen & Pieters (2015) and Afridi et al. (forthcoming) investigate the role of these variables in participation decisions of married women in urban and rural India. A consistent finding across studies using Indian labor market data is that women from Muslim and high caste Hindu households have persistently low labor force participation rates compared to women from low caste Hindu households. This is attributed to a higher cost of social stigma associated with outside work assigned by these social groups compared to low caste Hindu households (Jayachandran 2015, Klasen & Pieters 2015).

A small but increasing literature in economics looks at the causes and consequences of violence against women. Whilst improvements in women's economic position relative to men have been found to reduce violence against them within developed countries (Aizer 2010, Anderberg et al. 2016), such improvements actually increase violence against them in developing country settings due to a backlash effect (Bhalotra et al. 2018). This paper looks at the flip side of this relationship ie whether violence against women (specifically that publicised in the media) has an impact on women's labor force participation. Therefore it makes a contribution to research examining the consequences of violence against women. Apart from the direct costs of such violence on victims

³Note several distinctions of this paper from Chakraborty et al. (2018); first, the regressor is not self-reported sexual harassment but media reports of violence. Hence, while Chakraborty et al. (2018) find a general effect of sexual harassment, this paper finds the effect of violence incidents becoming salient via a fear channel. Second, the measure of media reports on sexual assaults used in this paper is less prone to measurement error in comparison with self-reported sexual harassment. Third, by using a panel this paper exploits variation over time as well as space in the empirical analysis.

as well as the harmful affects of such violence on health outcomes of children born to victims (Aizer 2011, Currie et al. 2018, Rawlings & Siddique 2018), this paper makes the case for an additional negative consequence. This involves the reduced involvement of women in the labor market following the incidence of publicised violence incidents due to a fear channel. This is the first study to examine and quantify such a channel.

This paper uses data from the 2009-10 and 2011-12 rounds of the Indian National Sample Surveys (NSS), and combines these data with a novel geographically referenced data source on media reports of physical and sexual assaults that occur in each respondent's local area. Whilst this data source (the Global Database on Events, Language and Tone, or GDELT) has been used in existing research in political science and economics, its use in research on violence against women remains unexplored. By combining these data, I am able to quantify the effect of violence in one's local area or district on labor supply decisions. To eliminate potential bias from local area specific unobservables as well as state specific time (quarter-year) shocks, I include local area and state-time fixed effects in the estimations. I find that a σ increase in lagged reports of sexual assaults in the local area of a woman reduces the probability that she is employed outside her home by 0.44 percentage points (or 3.6% of the sample average). This effect is robust to changes in the estimation sample, empirical specification, and variable definitions. Consistent with a model in which women make investments to overcome fear in the presence of economic incentives (Becker & Rubinstein 2011), I find evidence that the effect of local violence on labor supply is weaker among women from poorer households. I also find this effect to be weaker among high caste Hindu women, but strong among Muslim women.

The rest of the paper is organised as follows: section 2 lays out the framework and estimation methods employed in the study; section 3 describes the data sets used as well as features of the estimation sample; section 4 discusses the estimation results and section 5 concludes.

2 Framework and Estimation methods

A large literature examines the determinants of female labor supply using both unitary and collective models of decision making. The empirical literature has examined the effects of education, wages and non-labor income on female labor supply, as well as the effects of fertility and spouse

incomes on the labor supply of married women. Finally, differences in labor supply across demographic covariates such as race and ethnicity continue to be of interest. Most of these determinants are endogenous when estimating standard labor supply equations, so empirical studies use some source of exogenous variation in these potential determinants and/or use a structural modelling approach. There is also some evidence that suggests that women may be strongly deterred from going out to work due to sexual harassment they face outside of their homes (Chakraborty et al. 2018). Over and above such effects, media reporting of physical or sexual assaults is likely to make the consequences of becoming an assault victim a salient phenomenon for women. This is likely to generate fear, consequently women might form subjective beliefs about becoming a victim of such assaults when they go outside for work which are very different from the objective probability of becoming a victim, and this may also influence whether or not they decide to work.

I examine the relationship between media reported violence and labor supply by estimating variations of the following reduced form labor force participation equation which incorporates lagged media reported assaults in one's own local area as additional regressors:

$$L_{idsr} = \beta_0 + \beta_1 X_{idsr} + \beta_2 PA_{ds,r-1} + \beta_3 SA_{ds,r-1} + \gamma_d + \gamma_{s \times r} + u_{idsr} \quad (1)$$

The dependent variable L_{idsr} is a labor force participation measure for woman i from an urban household who resides in district d , state s and interviews in NSS sub-round r . I use a measure which captures whether or not a woman *works outside her home*; L_{idsr} is an indicator taking the value one if a woman spends a positive fraction over the past seven days in either regular or casual employment based on daily activity status.⁴

A parsimonious set of covariates are used as the controls X_{idsr} in equation (1) which are plausibly exogenous, or uncorrelated with the error term u_{idsr} . These include a quadratic in own age, and a set of household social group (religion and caste) indicator variables.

The regressors of particular interest in equation (1) are $PA_{ds,r-1}$ and $SA_{ds,r-1}$. $PA_{ds,r-1}$ is the

⁴The advantage of this measure is that it captures the effects of media reporting of violence over the recent past. It is also possible to use alternative labor supply measures that are constructed from principal activity status over the past year. Two such measures are 1) whether or not a woman is employed in regular or casual employment over the past year according to usual principal activity status and 2) whether or not a woman is employed according to usual principal activity status *and* the location of her workplace is not within or adjacent to her dwelling place. The main findings continue to hold when these two alternative labor supply measures are used. These results are available on request.

number of physical assault media reports in a woman’s own district and state in the three months preceding NSS sub-round r in which labor force participation is elicited. Similarly, $SA_{ds,r-1}$ is the number of local sexual assault media reports in the previous time period. The coefficients on these regressors (β_2 and β_3) capture the effect of local interpersonal violence (in the form of media reported physical and sexual assaults) on the probability that a woman works outside her home. By including lagged physical and sexual assaults separately, it is possible to examine the differential effect of these two kinds of violence on female labor supply. The coefficient on $S_{ds,r-1}$ (or β_3) quantifies the effect of an additional local sexual assault media report in the previous time period on labor force participation today, while holding the number of local physical assault reports in the previous period constant. Media reporting of violence makes the possibility of being a victim of such assault incidents a salient phenomenon, and by estimating equation (1) we can quantify the impact such reports might have on women’s behaviors.

To rule out potential bias from unobserved heterogeneity which is local area (or district) specific, and state-time (quarter-year) specific, I also include district fixed effects (γ_d), and state times NSS sub-round fixed effects ($\gamma_{s \times r}$). These sources of unobserved heterogeneity can be important in this context. For instance, districts with a high population density might have a large number of assault incidents reported in the media but might also provide more employment opportunities for women. Provided population density changed slowly between 2009 and 2012 (a reasonable assumption), this kind of an omitted variable will be captured by district fixed effects. District fixed effects also allow me to rule out potential bias due to region specific cultural factors which may be correlated with both female labor supply and media reported assaults. Another source of bias is from state and time (quarter-year) specific macroeconomic shocks that influence labor supply and are likely correlated with the regressors; to rule these out state-time fixed effects are also included in all regressions. Finally, standard errors are adjusted for clustering at the district level.

Given that some groups of women might have greater incentives than others to invest in overcoming fear, we can expect that the effect of sexual assault media reports would be weaker among such women. For instance, women from poorer households will have strong economic incentives to continue going out of their homes for work despite increases in local sexual assault media reports. To investigate this kind of heterogeneity, the following regressions are estimated:

$$L_{idsr} = \alpha_0 + \alpha_1 X_{idsr} + \alpha_2 G_{idsr} + \alpha_3 PA_{ds,r-1} + \alpha_4 SA_{ds,r-1} + \alpha_5 (SA_{ds,r-1} \times G_{idsr}) + \gamma_d + \gamma_{s \times r} + \epsilon_{idsr} \quad (2)$$

All variables are as defined in equation (1). Additionally, G_{idsr} is an indicator variable which takes the value one if female i from district d , state s and NSS sub-round r belongs to group G and zero otherwise. Within these regressions the coefficients on the interaction term ($SA_{ds,r-l} \times G_{idsr}$) (or α_5) capture the *differential effect* of sexual assault reports on labor supply for women belonging to group G compared to everyone else. The overall effect of lagged sexual assault reports is $(\alpha_4 + \alpha_5)$ for women belonging to group G .

I investigate heterogeneity in the effect of sexual violence on female labor supply across two dimensions; one is across poor vs non-poor households (based on household per capita consumption), the second across different social groups. For the first, G is an indicator variable which takes the value one if the household a woman belongs to has per capita consumption less than or equal to the twenty fifth percentile of the per capita household consumption distribution (= 11,359 rupees). This allows me to examine whether the effect of local sexual violence on female labor supply is weaker for these women (ie whether the coefficient on the interaction term or α_5 is positive). Second, I examine whether the effect of local sexual violence on female labor supply is different for Muslim women and for high caste Hindu women. Women belonging to these two social groups have the lowest levels of labor force participation in India, due to stronger status considerations or stronger restrictions on women's interactions with outsiders within these two social groups. It is important to note that while high caste Hindu women have higher socioeconomic status in Indian society, this is not necessarily the case for Muslim women. When examining heterogeneity for Muslim and high caste Hindu women, the vector of control variables in equation (2) only includes a quadratic in age and not the set of social indicator variables. Due to this, the coefficient on G_{idsr} in this case is interpreted as the difference in labor force participation for Muslim (high caste Hindu) women compared to women from all other social groups (SCST, OBC, Other religion).

3 Data and estimation samples

3.1 Data on the labor market

Data on the Indian labor market is taken from the Employment and Unemployment schedules of the Indian National Sample Survey (NSS). I use the two most recent ‘thick’ rounds of the NSS: round 66 which was fielded between July 2009 and June 2010, and round 68 which was fielded between July 2011 and June 2012. There are four quarters, also referred to as sub-rounds, within each round. These data include a wealth of individual and household variables, and are the most widely used source of information on the Indian labour market.

The dependent variable of interest is whether or not a female respondent to the survey *works outside her home*. I construct a measure of this dependent variable based on questions on daily activity status over the past week. Each survey respondent is asked about her activity particulars over the last seven days which includes questions on daily activity status. These questions reveal information on whether the respondent spent any time in regular salaried employment or casual employment over the last week. Since either of these two activities are highly likely to involve work outside the home, I use this information to construct the labor supply measure L . L is then an indicator variable taking the value one if the respondent spent a positive fraction of the past seven days in either regular salaried or casual employment. Note that the NSS also queries respondents about their usual principal activity status over the past year, with an accompanying question on location of the workplace.

Amongst the variables whose relationship with labor force participation is examined are age and social group. Social groups include religious and caste groups in India. A set of indicator variables indicating the respondents religious and caste affiliation are used as controls when estimating equation (1). I include indicator variables for whether a respondent belongs to the historically disadvantaged Scheduled Caste (SC) or Scheduled Tribe (ST) groups; whether a respondent is non-SCST and belongs to the Muslim religion; whether a respondent is non-SCST and belongs to the Other religion⁵; and whether a respondent is non-SCST and belongs to the low caste Hindu group referred to as Other Backward Caste (OBC). The omitted category when estimating equation (1)

⁵Other religion includes Christian, Sikh, Jain, Buddhist, Zoroastrian or Other.

is Other Hindu, which consists primarily of high caste Hindus.⁶

3.2 Data on media reported violence

Data on media reports of different kinds of assaults is extracted from the Global Database of Events, Language and Tone (GDELT). This is a very large, open source database which collects information on political events in the area of verbal and physical mediation and conflict based on an automated textual analysis of newswires.⁷ GDELT includes over a quarter-billion event records in over 300 categories across the globe, from 1979 to the present. Events in the database are sourced from digitalised newspapers, news agencies and web based news aggregators such as GoogleNews. Data is extracted from these sources using an open source coding algorithm TABARI (Text Analysis by Augmented Replacement Instructions) that searches through news articles using CAMEO (Conflict and Mediation Coding System), a widely used coding system in political science.

The database includes information on the type of event which was reported in the media, the day and location of the event, as well as the number of articles in which the event was reported.⁸ Of the different event categories, I extracted data on physical assault events or ‘physical assaults, not specified below,’ which are defined as ‘attack physical well-being of individuals without the use of weaponry, not otherwise specified’; this event category consists primarily of beatings. To these incidents I also add events involving ‘torture’ and ‘kill by physical assault.’ Sexual assault incidents are a separate event category, and are defined as ‘sexually abuse, assault sexual integrity of individuals.’

Data on physical and sexual assault incidents is matched to individual districts using the 2011 Census administrative boundaries.⁹ Incidents and the number of articles in which they are reported (or assault reports) are then aggregated at the district level over the three months preceding each quarter or NSS sub-round in the estimation sample. The aggregated district-NSS sub-round data on assaults is then merged with the individual level NSS data.

⁶These dummy variables are constructed from two questions, the first asking respondents their social group (SC, ST, OBC, Other) and the second asking respondents their religion.

⁷Data available from <https://www.gdeltproject.org>.

⁸For location the latitude and longitude of the landmark-centroid are provided.

⁹I only keep incidents that have been identified by the database at the level of a city or landmark outside the US, which is 91.86% of all events over the respective time frame.

3.3 Estimation sample and summary statistics

The estimation sample consists of women from urban households age 18-50. These women are likely to be active in the labor market, and to be aware of media reporting on assaults taking place in their local area.

The dependent variable of interest is employment outside the home. Figure A1 shows the time allocation of men and women age 18-50 in the past week. A woman is taken to be employed outside her home if she spends a non-zero fraction of time in the past seven days in either regular salaried or casual employment according to daily activity status. From Figure A1, most of the time in the previous week is spent by women outside of the labor force, and there is little change in this pattern over time. This provides a striking contrast with men who spend a far higher fraction of time in regular salaried or casual employment, as well as in self employment.

Figure A2 shows the fraction of men and women age 18-50 from urban households who indicate their workplace is not within or adjacent to their dwelling by type of work *based on principal activity status over the past year*. This fraction is highest among regular salaried workers and among casual workers for women. This provides support for considering regular salaried and casually employed women as being employed outside the home. Note that for men the fraction indicating their workplace is not within or adjacent to their dwelling is high among regular salaried and casual workers, but also among the self employed and unpaid family workers (at close to or greater than 70%).

Table 1 gives the descriptive statistics of the variables used in the empirical analysis. The average age of women in the estimation sample, at 33 years, is very similar over time (or across rounds). Women from disadvantaged caste groups such as Hindu OBC and SCST form 30% and 22% of the estimation sample. Women from Hindu Other or high caste form 29% of the estimation sample. Women from Muslim households form 15% and from Other religion form just 4% of the estimation sample. Figure A3 gives the labor force participation rates for women by social group. Labor force participation rates are highest among low caste women (Hindu OBC and SCST) and among women who belong to the Other religion category. Labor force participation rates are lowest among Muslim women, followed by high caste Hindu women.

Descriptive statistics for the merged data on assaults are given in Panel B of Table 1. Physical

assaults occur more than twice as frequently as sexual assaults, on average. While there is a small increase in both physical and sexual assaults over time (see also Figure 1), there is far more variation in assaults across districts as indicated by the large standard errors.

The distribution of physical and sexual assault incidents aggregated to Indian states is given in Figures 2 and 3. The states Maharashtra and Uttar Pradesh tend to have more physical and sexual assault incidents than other states. The distribution of physical and sexual assault reports aggregated to Indian states is given in Figures 4 and 5. As with the distribution of assault incidents, physical and sexual incident reports are also higher in Maharashtra and Uttar Pradesh compared with other Indian states. It is important to note that the number of physical and sexual assault incidents/reports taking place in the city of Delhi, which is also the capital, is very high. The numbers of assault incidents/reports in Delhi is comparable to those occurring over the whole of Maharashtra and Uttar Pradesh.

4 Estimation results and discussion

4.1 Baseline estimation results

The results from estimating equation (1) are reported in Table 2. The results reported in column (I) include controls for a quadratic in age and a set of indicators for social group. With only this parsimonious set of controls included, reports of physical assaults have a positive statistically significant effect on labor force participation and there is no effect of sexual assault reports. Inclusion of district fixed effects in column (II) changes the results dramatically. There is no longer a statistically significant positive effect of physical assault reports on labor force participation, and sexual assault reports now have a negative statistically significant effect. Further addition of State \times NSS sub-round fixed effects in column (III) only has a minor impact on results. In the preferred specification (as reported in column (III)), physical assault reports in the media during the past quarter do not have a statistically significant effect on female labor force participation. Reports of sexual assaults in the media during the past quarter have a statistically significant negative effect on female labor force participation. A σ increase in the number of sexual assault reports in the previous quarter (= 64 incidents) reduces the probability that a woman works outside her home by 0.44 percentage points. This effect is 3.6% of the sample average of labor supply.

The effect of age and social group affiliation on female labor supply is consistent with existing research. Estimates reported in Table 2 indicate a quadratic effect of age on female labor supply, with labor force participation first increasing (with a positive coefficient on Age) and then decreasing (with a negative coefficient on Age^2) as age increases. Labor force participation is lowest among Muslim women, who are 4.4 – 4.7 percentage points less likely to be working outside the home compared to high caste Hindu women (the omitted category). The lowest caste group of SCST has higher labor force participation in comparison with high caste Hindu women. Women belonging to the SCST social group are 6.5 – 7.0 percentage points more likely to be working outside the home compared to high caste Hindu women.

These results provide an interesting contrast with those from estimating equation (1) on a sample of men from urban households who are also 18-50 years old as reported in Table 3. For men, the relationship between violence and labor supply is weaker. Reports of physical assaults in the media during the past quarter have no to some positive effect on whether or not men are working in regular or casual employment. The coefficient is positive and statistically significant at the 5% level in the preferred specification reported in column (III). I also estimate (1) for an additional labor supply measure L^{ALT} . This is an indicator variable taking the value one if men are in regular employment, casual employment, self-employment, or unpaid family work based on daily activity status. For this broader measures of employment there is no effect of lagged physical assaults on labor supply or the coefficient on lagged physical assaults is statistically insignificant (column (VI)). Note that given a large fraction of men who are self employed or unpaid family workers work outside the home (see Figure A2) the measures L^{ALT} is more likely to capture employment outside the home than L . There is no effect of lagged sexual assaults reported in the media on male labor supply for either labor supply measure. While there is no consistent and strong relationship between interpersonal violence and male labor supply, it does seem that there is some positive effect of physical assaults on whether or not men are working in *regular or casual employment*. There is also a strong quadratic relationship of age with labor supply for urban men. Men who belong to low caste groups such as SCST and OBC are more likely to be working outside the home compared to high caste Hindu men.

4.2 Heterogeneity results

To examine the mechanisms behind the relationship between lagged sexual assault reports and female labor supply, I estimate and report results for equation (2). This allows me to explore whether and how this effect is stronger among some groups of women compared to others.

Media reports of sexual assaults are likely to generate feelings of anxiety and fear among women. It is possible that fear leads women to magnify the subjective probability that they might become a victim, despite little to no change in the objective probability of this happening. Such fear could then explain why women become less likely to work outside their homes in response to higher media reports of sexual assaults in the previous time period. It is also possible that some groups of women have the economic incentives to overcome this fear and work outside their homes. One such group may be women from poor households. I examine whether the effect of violence on labor supply is weaker for these women by estimating equation (2), where G is an indicator variable taking the value one if a woman belongs to a household with per capita consumption less than or equal to the twenty fifth percentile of the household per capita consumption distribution (see Figure A4 for the distribution of household consumption per capita across NSS rounds). The results are reported in Table 4. The positive and statistically significant coefficient on G shows that these women are more likely to be working outside the home compared to women who belong to wealthier households. The coefficient on the interaction term α_5^j is positive and statistically significant at the 5% level for the preferred specification reported in column (III). This provides evidence indicating that the relationship between violence and labor supply is *weaker* for women from poorer households who have the economic incentives to invest in overcoming their fear.

Two groups of women who have the lowest labor force participation rates are Muslim and high caste Hindu women. I examine whether these two groups of women also have a relationship between violence and labor supply that differs from other women. I estimate equation (2) separately for Muslim and high caste Hindu women. The results are reported in columns (I)-(III) of Table 5 for Muslim women and in columns (IV)-(VI) of Table 5 for high caste Hindu women. The negative and statistically insignificant coefficient on G indicates that both Muslim and high caste Hindu women are *less likely* to work outside the home than other women, which is consistent with existing research. However, the coefficient on the interaction term is negative (although statistically insignificant) for

Muslim women (column (III)) but positive for high caste Hindu women (columns (VI)). In other words, while the relationship between violence and labor supply continues to be strong among Muslim women, it is actually *weaker* among high caste Hindu women compared to non-high caste Hindu women. This might be due to the higher socioeconomic status of high caste Hindu women, for instance they may have the means to use safer modes of transport to work such as private cars rather than having to use public transport or walking to work.

4.3 Robustness checks

In this sub-section I report robustness checks to examine whether the negative relationship between lagged reports of sexual assaults and married women’s labor supply persists after alterations of the estimation sample, empirical specification and variable definitions. I find the negative relationship to be robust to alterations across all of these dimensions.

A very large number of sexual assault reports over this time period are from the city of Delhi.¹⁰ As a first robustness check, I drop Delhi and other small Indian states from the estimation sample and re-estimate equation (1). The results are reported in columns (I)-(III) of Table 6. The estimation sample in this case is the twenty largest states of India, excluding Jammu and Kashmir. The negative relationship between lagged sexual assaults and female labor supply persists in this reduced sample, if anything the coefficients are slightly larger than in Table 2.

As another robustness check, I drop women who are currently studying in an educational institution from the estimation sample and re-estimate equation (1). The results are reported in columns (IV)-(VI) of Table 6. The relationship between lagged sexual assaults and labor supply is very similar to before (as reported in Table 2).

As a further check I estimate the following equation:

$$L_{idsr}^j = \beta_0^j + \beta_1^j X_{idsr} + \sum_{l=-1}^{+1} \beta_{2,l}^j PA_{ds,r+l} + \sum_{l=-1}^{+1} \beta_{3,l}^j SA_{ds,r+l} + \gamma_d + \gamma_{s \times r} + u_{idsr}^j \quad (3)$$

This empirical specification adds contemporaneous physical and sexual assault reports as well as

¹⁰Despite covering a small area, there are as many as 160 cases of sexual assaults and 1200 reports of such cases in Delhi over the time period under study. Only the states of Uttar Pradesh, West Bengal and Maharashtra have higher sexual assault reports, all spread over a much larger number of districts. For reference there are 8 districts in Delhi, compared to 71 in Uttar Pradesh, 19 in West Bengal and 34 in Maharashtra. The number of physical assault incidents and their reports in Delhi is similarly high.

one period leads of physical and sexual assault reports to the set of regressors in equation (1). Inclusion of one period leads of physical and sexual assault reports provide a useful placebo test. The estimation results for equation (3) are reported in Table 7. Reassuringly, the coefficients on the one period leads or $PA_{ds,r+1}$ and $SA_{ds,r+1}$ are statistically insignificant. The coefficients on contemporaneous physical or sexual assault reports are statistically insignificant in the preferred specification reported in column (III), indicating that the effect of violence on labor supply takes place with a one period (or quarter) lag. Lagged sexual assault reports continue to have a strong negative relationship with female labor supply.

As a final check, I modify the definition of physical assault (violence) incidents so that these exclude the more extreme cases of ‘torture’ and ‘kill by physical assault.’ I then re-estimate equation (3). The results are given in Table 8. The relationship between lagged sexual assault reports and female labor supply continues to be negative and statistically significant, with slightly larger coefficients than before.

5 Conclusion

I find that the labor force participation of urban women in India is reduced following increased media reporting of sexual assaults in one’s local area. These effects are found despite ruling out several sources of unobserved heterogeneity, and are robust to a number of checks. The results highlight the importance of addressing safety concerns of women in India. Some interventions which might be adopted include special transport facilities for women, self defence training for women and the strengthening of a policing and legal framework that protects women from sexual assaults.

The benefits of increased female labor force participation above and beyond increases in economic output have been documented in a number of studies. Besides increasing overall productivity of the economy (Bloom et al. 2009), increased participation improves women’s status within the household (Anderson & Eswaran 2009, Atkin 2009) and delays women’s marriage and childbearing decisions (Jensen 2012, Heath & Mobarak 2015). While increased female labor force participation can reduce leisure and potentially increase domestic violence due to a backlash effect, the alternative of low participation rates and high sexual assaults is likely to lead to a cycle of low productivity and

low bargaining power of women within their households. This underscores the importance of implementing changes and adopting interventions that enable women to become productive members of the economy.

Tables

TABLE 1
Descriptive statistics

	Round 66	Round 68	Total
Panel A: Demographic and labor market characteristics			
Employed in salaried or casual work last week	0.1215	0.1246	0.1231
Age	32.5831	32.7181	32.6504
Hindu Other	0.3046	0.2874	0.2960
SCST	0.2128	0.2148	0.2138
Hindu OBC	0.2822	0.2897	0.2859
Muslim	0.1557	0.1635	0.1596
Other Religion	0.0448	0.0446	0.0447
Observations	43297	43022	86319
	Round 66	Round 68	Total
Panel B: Assault incidents and reports			
Physical assault incidents in own district over past quarter	2.9954	2.9915	2.9935
	(9.0534)	(9.8047)	(9.4353)
Physical assault reports in own district over past quarter	19.8939	20.2515	20.0722
	(69.6184)	(73.5502)	(71.6048)
Sexual assault incidents in own district over past quarter	1.7700	2.1333	1.9511
	(8.9451)	(9.2506)	(9.1004)
Sexual assault reports in own district over past quarter	11.9138	13.1675	12.5387
	(64.0261)	(64.8648)	(64.4482)
Observations	43297	43022	86319

Notes: Each cell gives the average value of a variable in the respective sub-sample with the standard deviation given in parentheses.

Source: Data on demographics and labor market characteristics (Panel A) is from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample is restricted to women from urban households who are 18-50 years of age. Data on incidents and reports of assaults (Panel B) is extracted from the Global Database of Events, Language, and Tone (GDELT), aggregated at the district level and matched with individual level NSS data; see sub-section 3.2 for details.

TABLE 2
Violence and female labor supply

	(I)	(II)	(III)
$PA_{ds,r-1}$	0.0109*** (0.0031)	-0.0025 (0.0031)	-0.0025 (0.0029)
$SA_{ds,r-1}$	0.0058 (0.0051)	-0.0054*** (0.0013)	-0.0068*** (0.0019)
SCST	6.5198*** (0.6467)	6.9042*** (0.5293)	6.9357*** (0.5372)
Hindu OBC	1.6453*** (0.6188)	0.6079 (0.4392)	0.6861 (0.4369)
Muslim	-4.4156*** (0.5087)	-4.6876*** (0.6243)	-4.6328*** (0.6225)
Other Religion	6.6325*** (1.1019)	4.0287*** (0.8977)	3.8563*** (0.8936)
Age	1.9009*** (0.1133)	1.9101*** (0.1095)	1.9106*** (0.1097)
Age ²	-0.0247*** (0.0017)	-0.0250*** (0.0016)	-0.0250*** (0.0016)
Controls	Yes	Yes	Yes
District FE	No	Yes	Yes
State \times NSS sub-round FE	No	No	Yes
N	86319	86319	86319

Notes: Results reported from estimating equation (1) in section 2. The dependent variable is $(L \times 100)$. Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05, ** p-value < 0.025, *** p-value < 0.01.

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample is restricted to women from urban households who are 18-50 years of age. Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELDT).

TABLE 3
Violence and male labor supply

	(I)	(II)	(III)	(IV)	(V)	(VI)
$PA_{ds,r-1}$	0.0234*** (0.0055)	0.0017 (0.0031)	0.0071* (0.0034)	0.0041 (0.0023)	0.0015 (0.0020)	0.0013 (0.0020)
$SA_{ds,r-1}$	0.0122 (0.0072)	0.0007 (0.0028)	-0.0004 (0.0029)	0.0042 (0.0030)	0.0003 (0.0014)	0.0021 (0.0022)
SCST	13.8977*** (0.9889)	15.4692*** (0.8312)	15.4738*** (0.8121)	2.9581*** (0.6385)	4.7113*** (0.4632)	4.7178*** (0.4505)
Hindu OBC	3.3176*** (1.0202)	3.5024*** (0.6230)	3.5932*** (0.6108)	3.0880*** (0.4035)	3.8993*** (0.3912)	3.9246*** (0.3886)
Muslim	-4.2189*** (1.0636)	-1.9198** (0.8369)	-1.7665* (0.8369)	6.1214*** (0.9589)	7.9370*** (0.5185)	7.9730*** (0.5186)
Other Religion	-1.0209 (1.5825)	-4.7411*** (1.2488)	-4.8181*** (1.2482)	-0.3676 (0.8051)	-0.8943 (0.7462)	-0.8926 (0.7203)
Age	6.0807*** (0.2158)	5.8993*** (0.2032)	5.9102*** (0.2012)	11.8976*** (0.1314)	11.8627*** (0.1310)	11.8565*** (0.1305)
Age ²	-0.0791*** (0.0032)	-0.0764*** (0.0030)	-0.0765*** (0.0029)	-0.1512*** (0.0017)	-0.1504*** (0.0017)	-0.1503*** (0.0017)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	No	Yes	Yes	No	Yes	Yes
State \times NSS sub-round FE	No	No	Yes	No	No	Yes
N	89618	89618	89618	89618	89618	89618

Notes: Results reported from estimating equation (1) in section 2. The dependent variable is ($L \times 100$) for columns (I)-(III). An alternative measure of labor supply is used as the dependent variable for columns (IV)-(VI); see section 2 and sub-section 4.1 for details. Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05, ** p-value < 0.025, *** p-value < 0.01.

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample is restricted to men from urban households who are 18-50 years of age. Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELT).

TABLE 4
Heterogeneity by HH consumption

	(I)	(II)	(III)
$G_{ids,r}$	7.2227*** (0.6016)	8.4546*** (0.5445)	8.7523*** (0.5514)
$SA_{ds,r-1}$	0.0060 (0.0057)	-0.0058*** (0.0011)	-0.0073*** (0.0022)
$G_{ids,r} \times SA_{ds,r-1}$	0.0148 (0.0097)	0.0187* (0.0091)	0.0180* (0.0091)
Controls	Yes	Yes	Yes
District FE	No	Yes	Yes
State \times NSS sub-round FE	No	No	Yes
N	86319	86319	86319

Notes: Results reported from estimating equation (2) in section 2. The dependent variable is $(L \times 100)$. $G_{ids,r}$ is an indicator taking the value one if a woman belongs to a household where per capita consumption in the past month is less than or equal to the 25th percentile of the per capita consumption distribution. Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05 , ** p-value < 0.025 , *** p-value < 0.01 .

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample restricted to women from urban households who are 18-50 years of age. Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELT).

TABLE 5
Heterogeneity by social group status

	$G = 1$ if Muslim			$G = 1$ if high caste Hindu		
	(I)	(II)	(III)	(IV)	(V)	(VI)
$G_{ids,r}$	-6.8490*** (0.4054)	-6.3809*** (0.5218)	-6.3711*** (0.5226)	-2.1762*** (0.5068)	-2.0579*** (0.3794)	-2.0776*** (0.3813)
$SA_{ds,r-1}$	0.0063 (0.0061)	-0.0035** (0.0015)	-0.0047* (0.0022)	0.0019 (0.0038)	-0.0100*** (0.0024)	-0.0109*** (0.0024)
$G_{ids,r} \times SA_{ds,r-1}$	-0.0107 (0.0072)	-0.0136 (0.0072)	-0.0128 (0.0072)	0.0077 (0.0040)	0.0091*** (0.0035)	0.0084** (0.0034)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	No	Yes	Yes	No	Yes	Yes
State \times NSS sub-round FE	No	No	Yes	No	No	Yes
N	86319	86319	86319	86319	86319	86319

Notes: Results reported from estimating equation (2) in section 2. The dependent variable is $(L \times 100)$. $G_{ids,r}$ is an indicator taking the value one if a woman belongs to a Muslim household in columns (I)-(III) and a high caste Hindu household in columns (IV)-(VI). Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05 , ** p-value < 0.025 , *** p-value < 0.01 .

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample restricted to women from urban households who are 18-50 years of age. Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELT).

TABLE 6
Robustness check: Alternative samples

	excluding Delhi and small Indian states			excluding students		
	(I)	(II)	(III)	(IV)	(V)	(VI)
$PA_{ds,r-1}$	0.0122*** (0.0031)	-0.0023 (0.0031)	-0.0017 (0.0027)	0.0123*** (0.0032)	-0.0027 (0.0030)	-0.0031 (0.0028)
$SA_{ds,r-1}$	0.0062 (0.0052)	-0.0053*** (0.0013)	-0.0072*** (0.0017)	0.0061 (0.0057)	-0.0059*** (0.0014)	-0.0070*** (0.0019)
SCST	7.6945*** (0.5916)	7.3817*** (0.5482)	7.4168*** (0.5499)	6.8122*** (0.7210)	7.0405*** (0.5919)	7.0645*** (0.6028)
Hindu OBC	2.2707*** (0.5535)	0.5898 (0.4431)	0.6407 (0.4410)	1.4981* (0.6813)	0.3970 (0.4829)	0.4806 (0.4818)
Muslim	-4.1296*** (0.5474)	-4.8790*** (0.6403)	-4.8450*** (0.6372)	-5.3591*** (0.5854)	-5.6706*** (0.7026)	-5.6023*** (0.6991)
Other Religion	6.2092*** (1.1485)	3.4832*** (0.8717)	3.4845*** (0.8670)	7.5686*** (1.2436)	4.6171*** (1.0006)	4.4276*** (0.9915)
Age	1.8749*** (0.1148)	1.8735*** (0.1135)	1.8755*** (0.1139)	0.8755*** (0.1398)	0.8743*** (0.1370)	0.8837*** (0.1371)
Age ²	-0.0244*** (0.0017)	-0.0246*** (0.0017)	-0.0246*** (0.0017)	-0.0115*** (0.0019)	-0.0117*** (0.0019)	-0.0118*** (0.0019)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	No	Yes	Yes	No	Yes	Yes
State \times NSS sub-round FE	No	No	Yes	No	No	Yes
N	71746	71746	71746	78542	78542	78542

Notes: Results reported from estimating equation (1) in section 2. The dependent variable is $(L \times 100)$. Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05, ** p-value < 0.025, *** p-value < 0.01.
Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample restricted to women from urban households who are 18-50 years of age and 1) from the twenty largest Indian states excluding Jammu and Kashmir in columns (I)-(III), 2) not currently enrolled in education in columns (IV)-(VI). Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELT).

TABLE 7
Robustness check: Alternative specification

	(I)	(II)	(III)
$PA_{ds,r-1}$	0.0055 (0.0038)	-0.0028 (0.0034)	-0.0031 (0.0025)
$PA_{ds,r}$	0.0087*** (0.0020)	-0.0005 (0.0029)	-0.0019 (0.0030)
$PA_{ds,r+1}$	0.0028 (0.0029)	-0.0002 (0.0028)	0.0020 (0.0028)
$SA_{ds,r-1}$	-0.0027 (0.0033)	-0.0052*** (0.0018)	-0.0065*** (0.0022)
$SA_{ds,r}$	0.0023 (0.0029)	-0.0011 (0.0038)	-0.0027 (0.0021)
$SA_{ds,r+1}$	0.0051 (0.0032)	0.0004 (0.0054)	-0.0005 (0.0041)
SCST	6.5819*** (0.6447)	6.9031*** (0.5283)	6.9317*** (0.5375)
Hindu OBC	1.6744*** (0.6108)	0.6077 (0.4386)	0.6841 (0.4369)
Muslim	-4.4458*** (0.5132)	-4.6861*** (0.6220)	-4.6329*** (0.6226)
Other Religion	6.6531*** (1.0998)	4.0280*** (0.8965)	3.8572*** (0.8931)
Age	1.9022*** (0.1126)	1.9097*** (0.1095)	1.9101*** (0.1099)
Age ²	-0.0248*** (0.0016)	-0.0250*** (0.0016)	-0.0250*** (0.0016)
Controls	Yes	Yes	Yes
District FE	No	Yes	Yes
State \times NSS sub-round FE	No	No	Yes
N	86319	86319	86319

Notes: Results reported from estimating equation (3) in section 4.3. The dependent variable is $(L \times 100)$. Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05, ** p-value < 0.025, *** p-value < 0.01.

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample restricted to women from urban households who are 18-50 years of age. Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELT).

TABLE 8

Robustness check: Alternative variable definition

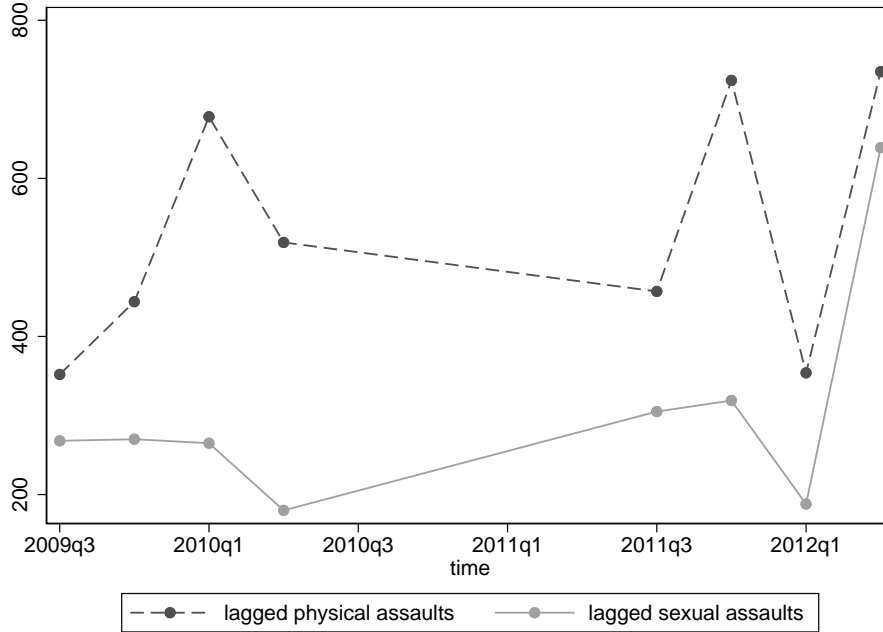
	<i>PA</i> excludes torture, deaths		
	(I)	(II)	(III)
<i>PA</i> _{<i>ds,r-1</i>}	0.0122*** (0.0044)	-0.0051 (0.0041)	-0.0039 (0.0038)
<i>SA</i> _{<i>ds,r-1</i>}	0.0075 (0.0054)	-0.0054*** (0.0013)	-0.0069*** (0.0018)
SCST	6.5161*** (0.6467)	6.9059*** (0.5294)	6.9361*** (0.5372)
Hindu OBC	1.6521*** (0.6190)	0.6095 (0.4394)	0.6861 (0.4369)
Muslim	-4.4225*** (0.5126)	-4.6855*** (0.6245)	-4.6316*** (0.6228)
Other Religion	6.6412*** (1.1010)	4.0301*** (0.8979)	3.8570*** (0.8938)
Age	1.9008*** (0.1134)	1.9101*** (0.1096)	1.9105*** (0.1097)
Age ²	-0.0247*** (0.0017)	-0.0250*** (0.0016)	-0.0250*** (0.0016)
Controls	Yes	Yes	Yes
District FE	No	Yes	Yes
State × NSS sub-round FE	No	No	Yes
N	86319	86319	86319

Notes: Results reported from estimating equation (1) in section 2. The dependent variable is $(L \times 100)$. Standard errors are clustered at the district level, and reported in parentheses; * p-value < 0.05, ** p-value < 0.025, *** p-value < 0.01.

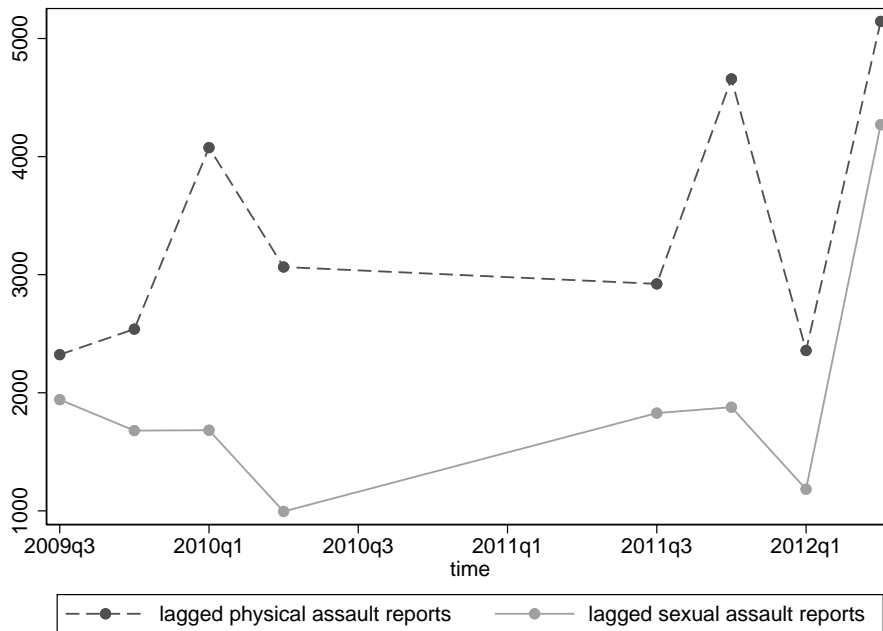
Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample restricted to women from urban households who are 18-50 years of age. Data on reports of assaults is extracted from the Global Database of Events, Language, and Tone (GDELT).

Figures

Figure 1
Media reporting of assaults over time



(a) Incidents of physical and sexual assaults

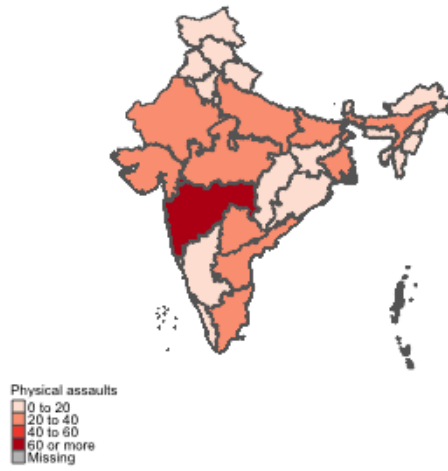


(b) Reports of physical and sexual assaults

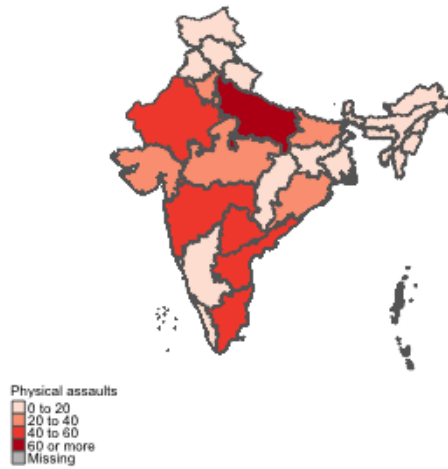
Source: Data on incidents and reports of assaults is extracted from the Global Database of Events, Language and Tone (GDELT), aggregated at the district level and matched with individual level NSS data.

Figure 2

Incidents of physical assaults across states



(a) April 2009 to March 2010

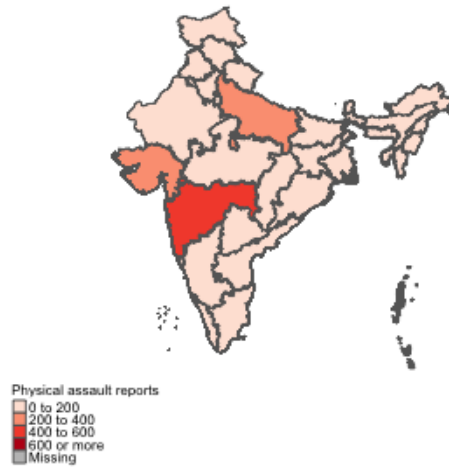


(b) April 2011 to March 2012

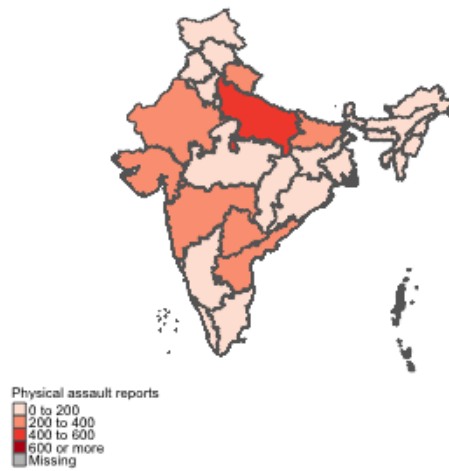
Source: Data on incidents and reports of assaults is extracted from the Global Database of Events, Language and Tone (GDELT).

Figure 4

Media reports of physical assaults across states



(a) April 2009 to March 2010

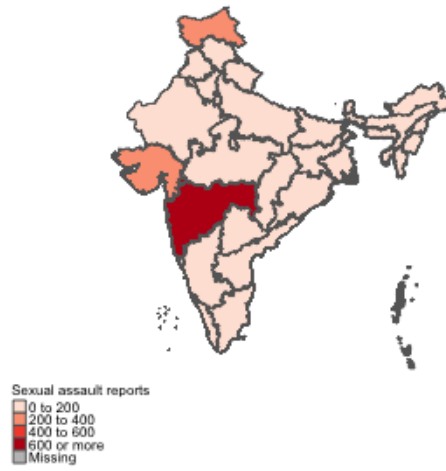


(b) April 2011 to March 2012

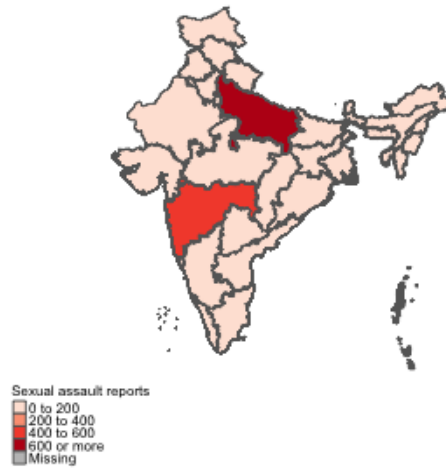
Source: Data on incidents and reports of assaults is extracted from the Global Database of Events, Language and Tone (GDELT).

Figure 5

Media reports of sexual assaults across states



(a) April 2009 to March 2010



(b) April 2011 to March 2012

Source: Data on incidents and reports of assaults is extracted from the Global Database of Events, Language and Tone (GDELT).

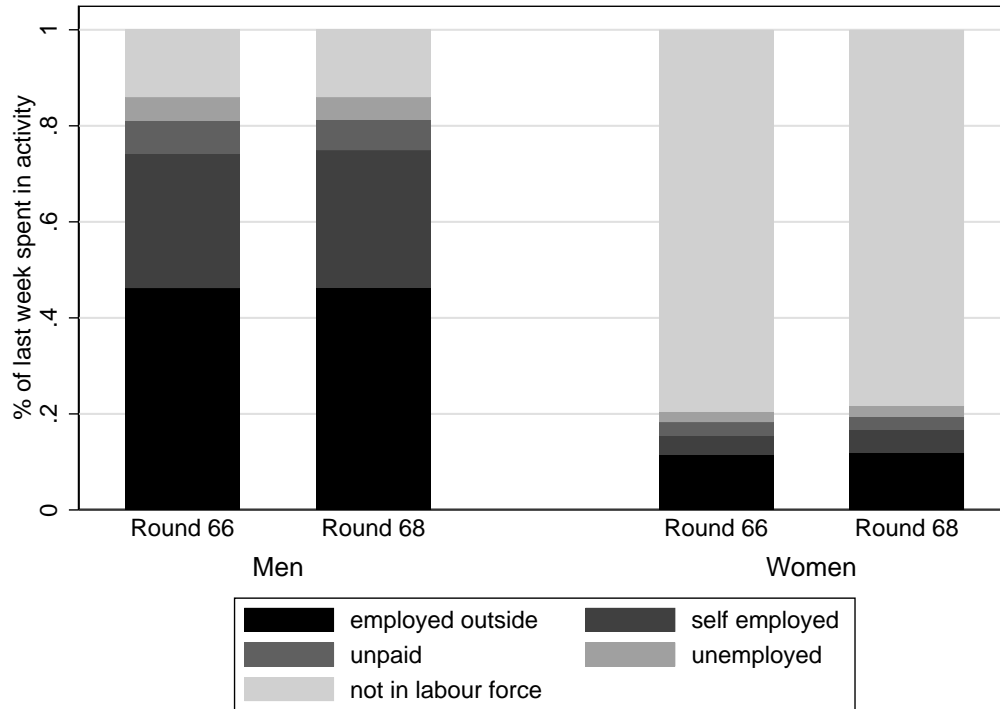
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Appendix Tables and Figures

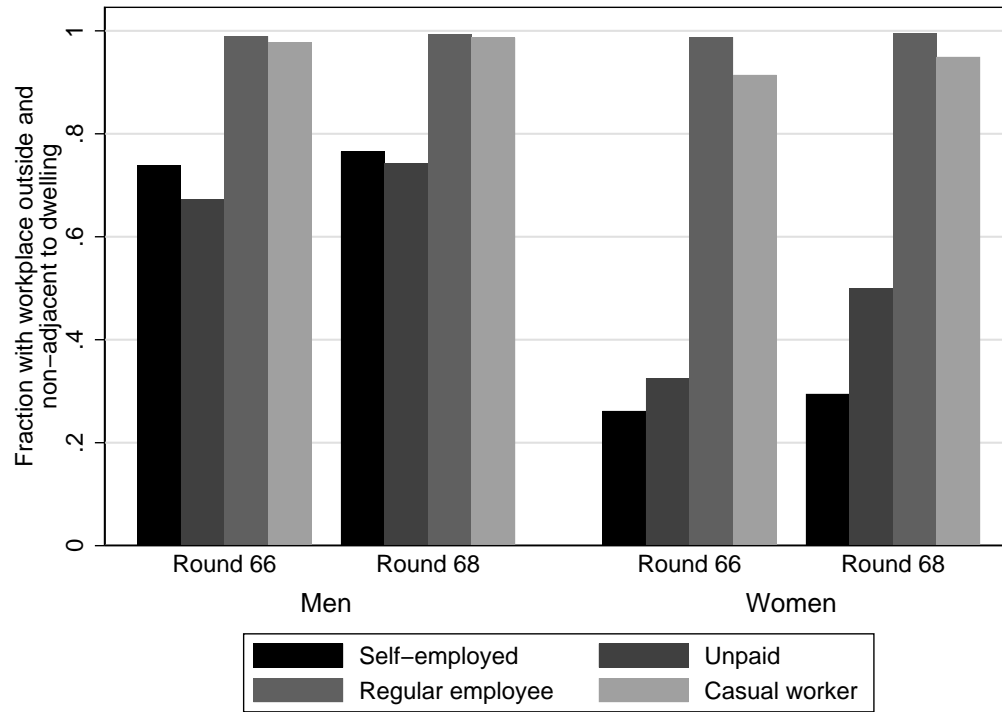
Figure A1
Time allocation in the past week



Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Sample is restricted to men and women from urban households who are 18-50 years of age.

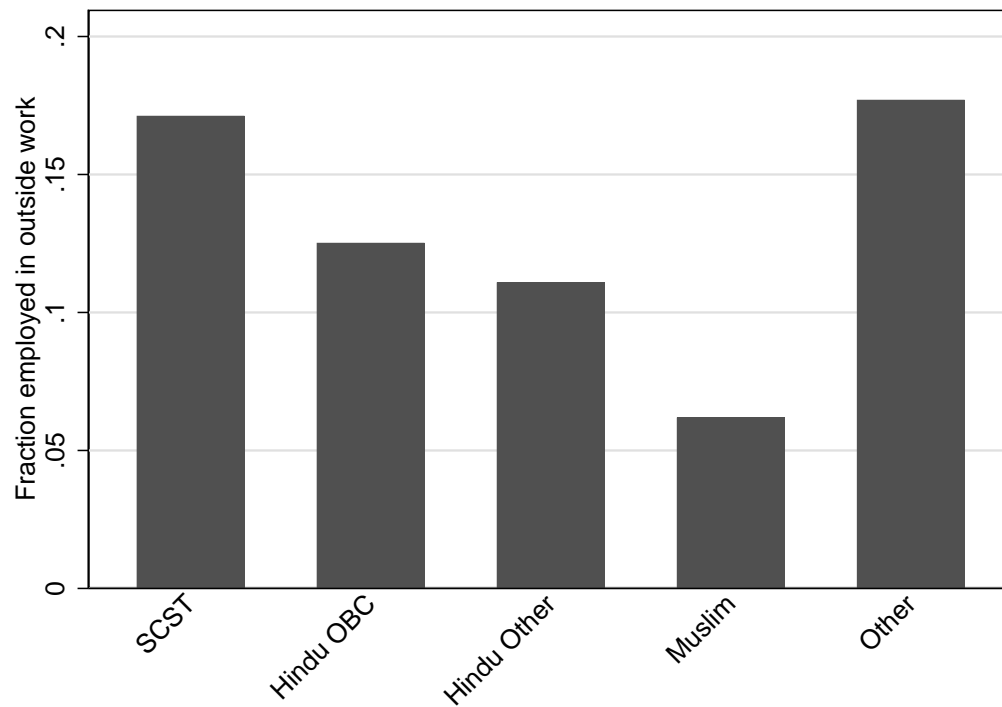
Figure A2

Location of workplace by type of work undertaken over the past year



Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Sample is restricted to men and women from urban households who are 18-50 years of age.

Figure A3
Labour supply of urban women by social group

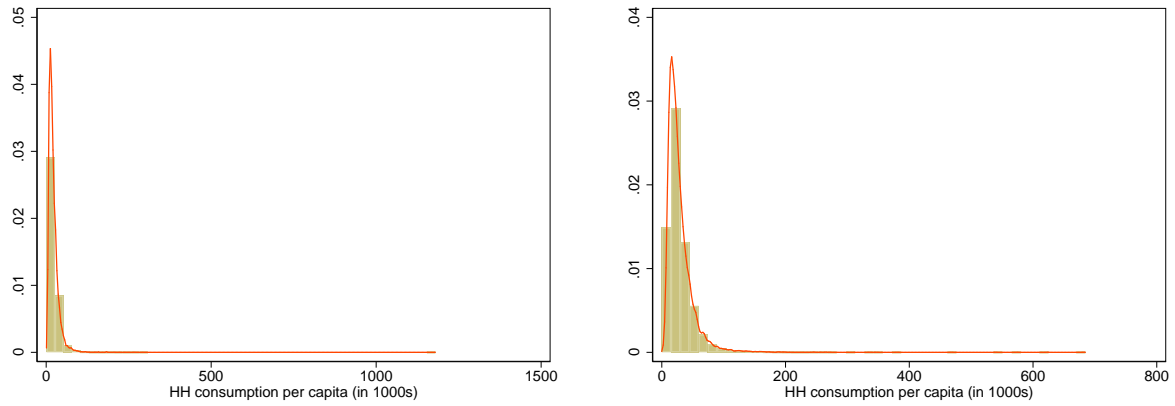


Notes: SCST refers to women belonging to Scheduled Caste or Scheduled Tribe households. Hindu OBC refers to women belonging to Hindu Other Backward Caste households. Hindu Other refers to women belonging to non-SCST, non-OBC (primarily high caste) Hindu households. Muslim refers to women belonging to Muslim households. Other refers to women belonging to Christian, Sikh, Jain, Buddhist, Zoroastrian or Other religion households.

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample is restricted to women from urban households who are 18-50 years of age.

Figure A4

Distribution of Household Consumption per capita by NSS round



(a) NSS round 66

(b) NSS round 68

Notes: Household Consumption per capita is the value of household consumption per capita over the last 30 days in rupees.

Source: Data from Rounds 66 (2009-10) and 68 (2011-12) of the Employment and Unemployment schedules, Indian National Sample Survey. Estimation sample is restricted to women from urban households who are 18-50 years of age.