Paving the Path to Safety: Rural Roads and Intimate Partner Violence in India *

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Abstract

Programs to enhance rural connectivity are often driven by the goal of promoting economic growth and improving access to markets and services. However, their potential social externalities, particularly those operating within households, remain underexplored. Using a regression discontinuity design, I show that in India rural road construction reduced intimate partner violence against women. I find improved rural connectivity leads to a significant decline in the likelihood of both sexual and physical violence against women in connected villages by 6 and 5.9 percentage points respectively. I find rural roads improve women's mobility, educational attainment, financial autonomy, and intra-household agency, which strengthens women's bargaining power within the household. At the same time, improved connectivity enhances men's economic status by shifting toward more skilled occupations and increasing educational attainment. These findings do not provide support to a male backlash. In this way, roads affect both women and men through distinct but mutually reinforcing pathways, jointly contributing to a less violent and more cooperative and equitable household environment.

JEL Classification: J12, J16, O12, O18, R42

Keywords: Gender, Intimate partner violence, Rural roads, PMGSY, India

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1 Introduction

Nearly one in three ever-partnered women worldwide have experienced intimate partner violence (IPV) during their lifetime (Sardinha et al., 2022; World Health Organization, 2026). Studies have found IPV generates substantial economic and social costs for victims and society, including direct financial burdens, productivity losses, and adverse health outcomes (Bhuller et al., 2022; Bindler et al., 2020; Bindler and Ketel, 2022; Hoeffler, 2017; Karimi et al., 2023; Ornstein, 2022). Given its widespread prevalence and far reaching consequences, IPV is increasingly recognized as a critical development issue (Michau et al., 2015; UN Women, 2015; World Health Organization, 2014). The Sustainable Development Goals explicitly call for the "elimination of all forms of violence against women and girls" (UN Women, 2015), highlighting the global policy priority of reducing IPV.

As a result, IPV has received much attention in the economics literature. Several programs and policies have been introduced to either directly or indirectly reduce the prevalence and severity of IPV. Interventions such as cash transfers (Angelucci, 2008; Bobonis et al., 2013; Buller et al., 2018; Haushofer et al., 2019; Hidrobo et al., 2016), economic transfers with behavioral training (Kim et al., 2007; Pronyk et al., 2006; Roy et al., 2019), and edutainment programs targeting social norms (Banerjee et al., 2019; Green et al., 2020; Hoff et al., 2020) have been introduced to reduce the prevalence and severity of IPV by improving women's economic or social resources and transforming discriminatory social norms. However, much less is known about whether large-scale development programs that are not explicitly designed to address IPV can improve women's safety within the household.

I address this gap by studying whether a large-scale rural infrastructure program generates improvements in women's safety as a social externality. Specifically, I study the Indian government's flagship rural road program called the Pradhan Mantri Gram Sadak Yojana (PMGSY), the Prime Minister's Village Road Program aimed at improving connectivity across villages in India. Although rural connectivity programs are typically designed to stimulate economic growth and improve access to markets and essential services,

their social externalities, particularly within households, remain largely unexplored. My study examines whether rural road construction influences the prevalence of IPV and how these effects vary across various subpopulations. Specifically, I examine whether access to a new rural road causally reduces the likelihood of women experiencing different forms of IPV, namely sexual, emotional or physical violence. I also investigate if exposure to a new rural road mitigates the severity of physical violence, particularly, less severe physical or severe physical violence. Finally, I explore the underlying pathways through which rural roads may bring about these changes for both men and women by shifting intrahousehold bargaining power.

Estimating causal impacts of new roads is challenging because road placement is endogenous: infrastructure investments are costly and generate potentially large benefits, and are therefore often targeted based on economic or political considerations, making road construction correlated with economic and political characteristics of location (Blimpo et al., 2013; Brueckner, 2014; Burgess et al., 2015; Lehne et al., 2018). If roads are systematically allocated to either wealthier or poorer areas, simple comparisons between villages with and without roads will be biased. To overcome this bias, I use a regression discontinuity (RD) design, which takes advantage of a specific policy rule: roads are constructed based on whether pre-existing village population sizes cross certain thresholds. This creates a natural experiment, allowing me to compare domestic violence in areas just above and below these thresholds, isolating the effect of roads from other confounding factors (Asher and Novosad, 2020).

I find that access to rural roads significantly reduces women's exposure to sexual and physical violence. Women living in eligible villages are less likely to experience sexual and physical violence in the last 12 months compared to women living in ineligible villages. The Intent-to-treat (ITT) estimates show that having access to paved road lowers the probability of experiencing sexual and physical violence by 6 and 5.9 percentage points respectively. Next, I find that in addition to reducing the prevalence of IPV, rural roads also mitigate the severity of physical violence. Rural road connectivity significantly reduces the likelihood of experiencing severe physical violence in the last 12 months among women

in eligible villages by 4.3 percentage points relative to women in ineligible villages. I also find a 5.3 percentage point reduction in the probability of experiencing less severe physical violence.

Rural road eligibility reduced the overall IPV by 0.19 standard deviation. To understand the pathways through which rural roads reduced IPV, I explore several potential mechanisms. Rural roads impacted both women and men simultaneously, generating complementary effects that converge to a reduction in IPV. For women, rural roads act as a catalyst for multi-dimensional empowerment by expanding their physical mobility, enhancing financial autonomy, increasing educational attainment, and strengthening intra-household agency. Collectively, these advancements enhanced women's household bargaining power. For men, rural road construction improved their economic status by providing better employment opportunities, higher income and increased educational attainment. The intersection of these gender-specific gains yields an overall expansion of household wealth, an accumulation of pooled resources, and a significant decline in sole male decision-making. In this way, roads affect both genders through distinct but mutually reinforcing pathways, jointly contributing to a more equitable and less violent household environment. Taken together, these findings document a shift towards a cooperative household equilibrium and provide robust evidence of the absence of a male backlash.

These findings add to the existing literature in many ways. First, this paper adds to the broader literature on the economic and social effects of large-scale infrastructure program.[1] Within this broader literature, studies on India's PMGSY program have documented a wide range of economic and social impacts of rural roads. Improved road connectivity has lowered price disparities and strengthened market integration (Aggarwal, 2018), while also encouraging the adoption of modern agricultural technologies (Shamdasani, 2021) and enhancing crop and dietary diversity (Aggarwal, 2018). Roads con-

[1]A large body of research demonstrates that transport infrastructure plays a crucial role in promoting economic growth and social development (Alder, 2016; Asturias et al., 2019; Banerjee et al., 2020; Donaldson, 2018; Faber, 2014; Ghani et al., 2016; Maitra and Yu, 2022). Improved connectivity has been shown to reduce poverty (Khandker et al., 2009; Lokshin and Yemtsov, 2005), enhance educational attainment (Chaudhary and Fenske, 2023), expand employment opportunities (Roberts et al., 2018), facilitate structural transformation (Mu and Van de Walle, 2011), and adopt markets inputs and strengthen market orientation (Nakamura et al., 2020).

struction has increased middle-school enrollment and improved examination performance (Adukia et al., 2020), although Chandra (2024) finds reductions in children's mathematics and reading test scores. Enhanced connectivity has also improved children's health outcomes (Dasgupta et al., 2024), and contributed to declines in infant mortality rates (Garg et al., 2024). Within this broader literature, a smaller body of research examines the gender-specific effects of rural roads. Roads have expanded non-agricultural employment opportunities for men (Asher and Novosad, 2020), increased middle-school enrollment for both boys and girls (Adukia et al., 2020), and improved women's access to healthcare services and health outcomes (Aggarwal, 2021).

I contribute to this literature by examining the causal impact of rural road construction on the prevalence of IPV and severity of physical violence. While large-scale public infrastructure investments often generate positive externalities for women by increasing ease for physical mobility, earning opportunities, better health care, however, their implications for women's safety, remain largely unexplored. Nandwani and Roychowdhury (2025) studies the impact of rural road construction on women empowerment and social norms around domestic violence in India. Their study focuses on attitudes and community-level norms around domestic violence rather than the actual prevalence of IPV and identifies the effects using a two-way fixed effects framework. My paper complements and extends this line of research by providing evidence on how improved rural connectivity affects women's experiences of violence within households, by employing a village-level fuzzy regression discontinuity design that compares villages immediately above and below the PMGSY population thresholds. This approach provides a cleaner source of causal identification by relying on local variation around the eligibility thresholds rather than comparisons across locations and over time.

Second, my study contributes to the literature on policy interventions and IPV. Existing research highlights different interventions undertaken to protect women by alleviating poverty and improving household welfare, such as cash transfers, non- cash transfer income, employment initiatives, and life skills or vocational training programs. I contribute to this literature by showing that such benefits for women's safety can extend beyond such tra-

ditional social protection interventions. The objective of rural road construction program under PMGSY was to provide all-weather paved road to unconnected villages, improve connectivity and promote rural development. In my study, I find that this program also generated a positive externality by reducing male-to-female violence within the household. My finding highlights the range of policy interventions that may reduce IPV and identifies women's safety as an additional social benefit of rural infrastructure investment.

Third, my study contributes to the literature on the determinants of IPV by examining potential mechanisms through which rural roads construction can affect male-to-female violence within the household. Existing studies face data constraints that can limit the range of pathways examined and the ability to investigate mechanisms operating through both partners (Peterman et al., 2022). By merging the rich individual- level data from the demographic and health surveys with village-level data on rural road construction from SHRUG, I empirically examine a broad set of potential mechanisms for both men and women. For women, I show how rural road construction affects their mobility, financial autonomy, educational attainment, migration, and intrahousehold decision making and bargaining power. For men, I examined the impact of rural roads on educational attainment and the shift towards more skilled occupations. In my study, evidence across multiple mechanisms provides an integrated account of how rural road construction reduces IPV, which strengthens the causal findings.

The rest of the paper is organized as follows: section 2 provides a brief background on the program and presents the theoretical framework; section 3 describes the data used for the analysis and construction of variables; section 4 describes the empirical methodology; section 5 provides the RD design validity checks; section 6 presents the main results; section 7 postulates the mechanisms driving the results; section 8 provides heterogeneity checks; section 9 presents robustness checks; and section 10 provides discussion and conclusion.

2 Background

2.1 PMGSY

PMGSY is a centrally funded initiative launched in 2000. The objective of the program was to provide all-weather paved roads to habitations that previously lacked access by linking them to the nearest market center through an all-weather road. The unit of implementation under PMGSY was the habitation, which was considered connected if it was located within 500 meters of an all-weather road or another connected habitation. A typical village comprises one to three habitations. Since the data from multiple sources used in this analysis are available at the village level, the treatment is defined at the village level. Following prior literature (Asher and Novosad, 2020; Shamdasani, 2021), I use the terms village and habitation interchangeably throughout the paper. Although PMGSY also aimed to upgrade existing roads, to measure exposure to the program I restrict my analysis to newly constructed roads only (PMGSY, 2012).

In 2000, India had more than 600,000 villages, approximately half of which lacked a paved road. To prioritize implementation, the program adopted a population-based rule: villages with population greater than 1,000 were given the highest priority, followed by those with population exceeding 500, and a cutoff of 250 was applied in hilly and tribal areas. While the program was financed and supervised by the Ministry of Rural Development at the national level, implementation was carried out by the respective state governments. Each state compiled a list of all unconnected villages within the state, ranking them in descending order of population size as recorded in the 2001 Population Census (Asher and Novosad, 2020; PMGSY, 2005, 2012; Shamdasani, 2021). Some states did not strictly adhere to the population-based prioritization criteria of 1,000 and 500, resulting in smaller villages receiving road connections before larger ones. Additionally, states with relatively few unconnected villages often applied the 500-population threshold directly, bypassing the initial 1,000-population cutoff (Asher and Novosad, 2020). As of 2024-2025, the program has connected 170,875 villages and built approximately 777,768 kilometers of roads.

2.2 Theoretical Framework

The gender identity model developed by Akerlof and Kranton (2000, 2010) shows that individuals' choices are driven not only by economic incentives, but also by a desire to protect their self-image and fit societal expectations. Society assigns individual to social categories such as "man" or "woman" which are associated with particular behavioral prescriptions and social status. Following these gender-specific prescriptions affirms one's self-image, or identity, whereas violating them can generate psychological costs such as guilt, anxiety, and discomfort as well as social disapproval from others. Thus, people continuously trade off economic gains against psychological and social costs of deviating from prescribed gender roles.

Conversely, a standard bargaining model shows how two spouses with different preferences bargain over resource allocation and family decisions (Lundberg and Pollak, 1993; Manser and Brown, 1980). Each spouse bargaining power depends partly on their threat point (the utility they could derive if cooperation within the marriage ends). Economic opportunities, resources and outside/exit options could shift these threat points and alter the relative bargaining power within the household.

Bargaining models that explicitly incorporate IPV, extend this framework by allowing changes in spouses' economic positions, outside options and relative economic positions to affect violence within the household (Bloch and Rao, 2002; Farmer and Tiefenthaler, 1997; Tauchen et al., 1991). Improvements in women's economic opportunities and outside options can raise their threat point, strengthen their bargaining power and reduce the violence they are willing to tolerate. However, when women's economic position improves relative to men's, the resulting shift in household power may threaten men's traditional authority and potentially generating male backlash. For instance, Clerici and Tripodi (2023) find increased IPV when male partners lost employment during the COVID-19 pandemic while Erten and Keskin (2024) find higher IPV when trade liberalization increased women's employment opportunities while reducing men's employment. Together, this literature suggests that the effect of women's economic advancement on IPV may depend importantly on what happens simultaneously to men's economic position.

Rural roads provide a distinct setting in which women's empowerment can increase without a corresponding decline in men's economic position. Women's empowerment is a multidimensional concept (Janssens, 2010; Kabeer, 1999; Moghadam, 1996). It is not limited to employment, income, education and ownership of assets, but also includes decision-making, mobility, access to institutions, and broader social and political participation (Golla et al., 2011; Kabeer et al., 2011). Studies show that rural roads can improve several of these dimensions by increasing women's physical mobility, increase earnings, improve education attainment and participation in household decisions, which strengthen their bargaining position within the household (Nandwani and Roychowdhury, 2025). Rural road construction has the potential to improve men's economic outcomes, including greater employment opportunities (Roberts et al., 2018), non-farm employment opportunities (Asher and Novosad, 2020), and increased educational attainment (Chaudhary and Fenske, 2023). These improvements strengthen men's economic position can increase household resources and reduce poverty in the household (Khandker et al., 2009). Together, these improvements enhance women's bargaining power and overall improvements in men's economic position, and greater overall household resources.

This can lead to two hypotheses. The first, the male-backlash hypothesis, is rooted in the gender identity model (Akerlof and Kranton, 2000; Bertrand et al., 2015) where an increase in women's autonomy and bargaining position may challenge traditional gender roles and threaten men's identity, status, or authority within the household. Men may respond to this perceived challenge by using violence to reassert control. Under this hypothesis, greater female empowerment following rural road construction could increase the prevalence or severity of IPV.

The second, the bargaining and household-welfare hypothesis, relates to economic models of household bargaining, IPV and family stress theories (Bloch and Rao, 2002; Conger et al., 1992; Farmer and Tiefenthaler, 1997; Lundberg and Pollak, 1993; Manser and Brown, 1980; Tauchen et al., 1991). Improvements in women's economic opportunities can strengthen their bargaining power and reduce the violence they are willing to tolerate. At the same time, improvement in men's economic status and overall household resources can

reduce financial stress and weaken the extent to which women's gains represent a zero-sum challenge to men's economic status. When both women and men benefit from improved connectivity, women's bargaining power may therefore increase without a corresponding deterioration in men's economic position, reducing both the incentives for male backlash and the use of violence within the household. In this way, both genders can contribute to a more equitable and less violent household environment. These two competing hypotheses imply that the overall effect of rural roads on prevalence and severity of IPV is theoretically ambiguous and is an empirical question that warrants the analysis presented in this paper.

3 Data

For my primary analysis I combined information on village-level rural road construction under PMGSY with individual-level data on IPV.

3.1 Data on Rural Roads

I draw on the Socioeconomic High-Resolution Rural-Urban Geographic Dataset (SHRUG) to obtain information on rural road construction at the village level under PMGSY (Asher et al., 2021). The SHRUG database contains information on details of road construction, such as completion date, approved project cost, project approval (sanction) year, road length, etc. For my analysis, I used the completion date to create the treatment variable.

Following Asher and Novosad (2020), I focus on states that adhered to the population priority criteria (in parentheses) set by the national government: Chhattisgarh (500; 1,000), Gujarat (500), Madhya Pradesh (500; 1,000), Maharashtra (500), Orissa (500), and Rajasthan (500). My analysis sample consists of 2202 villages that meet two conditions: (i) they lacked a paved road in 2001, and (ii) had populations within the optimal bandwidth from a treatment threshold.

I also use the data on village characteristics from the 2001 Indian Population Census (PC) for control variables. The variables include village amenities (primary school, medical center and electrification); agricultural characteristics, including the total agricultural land

area; log transformed share of irrigated agricultural land; share of workers in agriculture; and village-level measures of socioeconomic status and connectivity, such as literacy rates, share of inhabitants belonging to a scheduled caste, share of households that own agricultural land, share of households who are subsistence farmers, share of households earning over INR 250 cash per month (approximately US$4), and distance in kilometers from the nearest census town.

3.2 Data on Intimate Partner Violence

I use rich, micro-level data on the prevalence and intensity of IPV, derived from the domestic violence module of the 2015 Demographic and Health Survey (DHS) dataset. The DHS Program is a global initiative that collects information on health, education, and demographics through more than 400 surveys conducted across 90 countries. In India, it is the only large-scale national survey that provides information on three forms of spousal violence: physical, sexual, and emotional. The individual women's questionnaire is administered to all women aged 15 to 49 in sampled households with a standardized domestic violence module includes in a randomly selected subset of households. To ensure respondent safety and confidentiality, only one eligible woman per household is interviewed for this module.

The domestic violence module of the Indian DHS collected information from a subsample of women aged 15–49 who were married or living with a partner. These women were asked 13 questions about their experiences of domestic violence perpetrated by their current or former husband/partner, including whether they had ever experienced each act and, if so, how often it had occurred during the last 12 months. The module comprises direct questions on seven acts of physical violence, three acts of sexual violence, and three acts of emotional violence. Physical violence is measured based on whether a husband has perpetrated any of the following acts against his wife: (i) pushed/shook/threw an object at her, (ii) slapped her, (iii) twisted her arm or pulled her hair, (iv) punched her with a fist or hit her with something that could hurt, (v) kicked, dragged, or beat her up, (vi) attempted to choke or burn her, or (vii) threatened or attacked her with a knife, gun, or

any other weapon. Emotional violence is measured based on whether a husband has ever: (i) said or done anything to humiliate his wife in front of others, (ii) threatened to harm her or someone close to her, or (iii) insulted her or made her feel bad about herself. Sexual violence is measured based on whether a husband has ever: (i) physically forced his wife to have sexual intercourse, (ii) physically forced her to perform other sexual acts, or (iii) coerced her through threats or other means to perform sexual acts.

To analyze IPV and its types, I constructed three dummy variables capturing physical, sexual, and emotional violence experienced in the last 12 months. Each variable takes the value 1 if a woman responded "yes" to any of the corresponding questions and 0 otherwise. I then created a composite dependent variable that takes the value 1 if in last 12 months a woman has experienced at least one form of violence— physical, sexual, or emotional and 0 otherwise. This resulted in four binary variables representing IPV and its types: (i) Any type of violence by a partner (IPV), (ii) Any physical violence by a partner, (iii) Any sexual violence by a partner, and (iv) Any emotional violence by a partner.

3.3 Study Sample

I construct a novel dataset by merging village-level data on rural road construction under PMGSY with individual-level measures of IPV, using village shapefiles (Meiyappan et al., 2017, 2018). Following the methodology of Garg et al. (2024), I identify all DHS clusters (villages) located within a 50-kilometer radius of each PMGSY village to estimate IPV outcomes in the matched DHS villages. The final analytic sample comprises 2,202 villages; 1,149 from the control group and 1,053 from the treatment group, with a total of 12,076 respondents, including 6,270 from control villages and 5,806 from treatment villages.

4 Empirical Strategy

The main challenge in estimating the causal impact of new roads is that road placement is not random. Political favoritism, economic potential, and pro-poor targeting schemes could influence the placement of roads. As a result, road placement is correlated with

other government programs and with local economic growth, making simple comparison of domestic violence between areas that received new roads and those that did not will be biased. To overcome this bias, I use a regression discontinuity (RD) design, which takes advantage of a specific policy rule: roads are constructed based on whether pre-existing village population sizes cross certain thresholds. This creates a natural experiment, allowing me to compare domestic violence in areas just above and below these thresholds, isolating the effect of roads from other confounding factors (Asher and Novosad, 2020).

To uncover the effect of rural road construction on prevalence of IPV, I leverage the 2001 village population in a regression discontinuity design (RDD). First, I estimate the following linear regression model with outcome specific bandwidth (Calonico et al., 2020, 2017) defined as follows:

$$\begin{aligned} Y_{ivds} = \gamma_0 + \gamma_1 I(pop_{vds} \geq T) + \gamma_2 (pop_{vds} - T) + \gamma_3 (pop_{vds} - T) \\ \times I(pop_{vds} \geq T) + \delta^{'} X_{ivds} + \eta_{dh} + \rho_m + \delta_t + \epsilon_{ivds} \end{aligned} \tag{1}$$

where Y_{ivds} denotes IPV experienced by woman i in village v, district d and state s. The population of the village in 2001 is denoted as pop_{vds}, and T represents the treatment threshold, which is either 500 or 1000 depending on the state. $I(pop_{vds} \geq T)$ is an indicator variable that takes the value of 1 if population of the village in 2001 is greater than or equal to the treatment threshold T, and 0 otherwise. The interaction term $(pop_{vds} - T) \times I(pop_{vds} \geq T)$ allows the slope of the running variable to differ on each side of the cutoff. X_{ivds} represents a vector of baseline (2001) village characteristics and individual level characteristics included as controls. I control for village amenities: primary school, medical center, and electrification; agricultural characteristics, including total agricultural land area, log-transformed share of irrigated agricultural land, share of workers in agriculture, and village-level measures of socioeconomic status and connectivity, such as literacy rates, share of inhabitants belonging to a scheduled caste, share of households owning agricultural land, share of households who are subsistence farmers, share of households earning over

INR 250 cash per month (approximately US$4), and distance in kilometers from the nearest census town. The individual level controls include age, religion and caste of the respondent. In equation (1), I included three sets of fixed effects: district-population threshold fixed effects represented by η_{dh} so that the regression discontinuity (RD) estimates compare IPV for villages within the same district but on opposite sides of the PMGSY population threshold, survey month fixed effects denoted by ρ_m to account for seasonality and lastly δ_t which reflect time of the day fixed effects to account for any variation in respondent's reporting due to time of the day (Theiss, 2026).

I estimate equation (1) using MSE-optimal bandwidth with robust bias-corrected inference (Calonico et al., 2020, 2017), a first-order polynomial of the assignment variable and a triangular kernel, which assigns higher weights to observations closer to the threshold. Standard errors are clustered at the village level. The coefficient γ_1 in equation (1) captures the intent-to-treat effect of the treatment, i.e., effect of being eligible to receive a new road on the likelihood of experiencing IPV.

Next, due to imperfect compliance of rural road construction with the policy rules, I use a fuzzy RD design where population-based eligibility is used as an instrument for actual PMGSY road construction (Lee and Lemieux, 2010), with outcome specific optimal bandwidth (Calonico et al., 2020, 2017). In particular, I estimate the following set of instrumental variable (IV) regressions:

$$\begin{aligned} Road_{vds} = \gamma_0 + \gamma_1 I(pop_{vds} \geq T) + \gamma_2 (pop_{vds} - T) + \gamma_3 (pop_{vds} - T) \\ \times I(pop_{vds} \geq T) + \theta^{'} X_{vds} + \mu_{dh} + \nu_{vds} \end{aligned} \tag{2}$$

$$\begin{aligned} Y_{ivds} = \beta_0 + \beta_1 Road_{vds} + \beta_2 (pop_{vds} - T) + \beta_3 (pop_{vds} - T) \\ \times Road_{vds} + \delta^{'} X_{ivds} + \eta_{dh} + \rho_m + \delta_t + \epsilon_{ivds} \end{aligned} \tag{3}$$

In equation (2) the variable $Road_{vds}$ equals one if village v in district d of state

s received a PMGSY road by 2014. X_{vds} represents a vector of baseline (2001) village characteristics included as controls. I included district-population threshold fixed effects represented by μ_{dh}.

In equation (3) the outcome of interest, Y_{ivds} represents IPV experienced by woman i in village v, district d and state s. In addition to controlling for baseline (2001) village level characteristics; I also included individual level characteristics as controls represented by X_{ivds}. As explained in equation (1), I control for the following three types of fixed effects: district-population threshold fixed effects, survey month fixed effects and time of the day fixed effects.

I estimate equation (2) and (3) using MSE-optimal bandwidth with robust bias-corrected inference method (Calonico et al., 2020, 2017), a first-order polynomial of the assignment variable and a triangular kernel, which assigns higher weights to observations closer to the threshold. Standard errors are clustered at the village level. The coefficient β_1 in equation (3) captures the local average treatment effect of a new road on IPV.

5 Validity of the RD Design

The validity of the RD design rests on two key assumptions: (i) there is no manipulation of the assignment variable around the cutoff, an implication of which is that predetermined characteristics must be as good as randomly assigned around the cutoff and (ii) the probability of being eligible to receive a new rural road is discontinuous at the cutoff. To verify the first assumption, I conducted a McCrary density test (McCrary, 2008). The reported test statistic is -0.4278 with a p-value 0.67, indicating no evidence of manipulation in the assignment variable. Figure 2 presents the corresponding density plot, showing a smooth distribution of village populations around the cutoff.

Next, I performed the balance tests to confirm that predetermined characteristics are balanced across the threshold. Specifically, I examined both individual-level and village-level predetermined variables.

At the village-level, I estimated the following reduced-form regression:

$$X_{vds} = \gamma_0 + \gamma_1 I(pop_{vds} \geq T) + \gamma_2 (pop_{vds} - T) + \gamma_3 (pop_{vds} - T) \times I(pop_{vds} \geq T) + \mu_{dh} + \nu_{vds} \quad (4)$$

where X_{vds} denotes the village-level predetermined characteristics such as presence of primary schools, electrification, distance to the nearest town, share of irrigated agricultural land and literacy rates. The right hand side variables in equation (4) are defined as in equation (2).

Similarly, for individual-level predetermined variables, I estimated the following specification:

$$X_{ivds} = \gamma_0 + \gamma_1 I(pop_{vds} \geq T) + \gamma_2 (pop_{vds} - T) + \gamma_3 (pop_{vds} - T) \times I(pop_{vds} \geq T) + \eta_{dh} + \rho_m + \delta_t + \epsilon_{ivds} \quad (5)$$

where X_{ivds} denotes the individual-level predetermined characteristics such as respondents' age, religion, caste. The right hand side variables in equation (5) are defined as in equation (1).

The results from the balance tests are presented in Table 1. I find that the treatment indicator, i.e., eligibility to receive a new rural road, has no statistically significant effect on any predetermined characteristics at the village and individual levels. This ensures the sample is as good as random around the cutoff, i.e., villages just below and just above the cutoff do not differ systematically in observed characteristics. Figure A1 and Figure A2 present the graphical representation of balance check tests on village-level and individual-level controls respectively.

Next, I check if the probability of being eligible to receive a new rural road is discontinuous at the cutoff. Specifically, I estimate the first-stage relationship between actual road construction and eligibility status. Table 2 presents the first-stage results. I find that on average, villages that are above the threshold are 18.3 percentage points more likely to

receive a new road than those who just missed the cutoff. The first-stage coefficient is statistically significant at the 1 percent significance level, showing strong correlation between eligibility and the actual receipt of a road. Figure 3 presents the corresponding graphical representation of the first-stage relationship between the assignment variable and the probability of receiving a new road.

6 Results

Table 3 presents summary statistics for the main outcome and individual-level control variables. My final study sample comprises 12,076 currently married women aged 15 to 49. About 27% of the respondents in my sample reported experiencing at least one act of physical, sexual, or emotional violence in the last 12 months. Disaggregating male-to-female IPV by type, 5% of women reported experiencing sexual violence, 9% emotional violence, and 24% physical violence. Physical violence is further categorized into less severe and severe physical violence. Approximately 23% of women reported experiencing less severe physical violence and 6% reported severe physical violence. The average age of respondent in the sample is 32 years, with 92% identifying as hindu and 5% as muslim. About 23% belong to scheduled tribes, 18% to scheduled castes, and 43% to other backward classes.

Table 4 presents summary statistics for the village-level control variables. At the village level (in the baseline year 2001), 94% of villages had a primary school and 18% had a medical center. Roughly 44% of villages were electrified, with an average distance of 26 kilometers from the nearest town. On average, 27% of village land was irrigated, and the mean (log) land area was 5.11. The average literacy rate was 47%, and 15% of the population belonged to scheduled castes. About 76% of households owned land, and 44% primarily depended on subsistence agriculture. Approximately three-fourths of households reported a monthly income above INR 250.[2]

[2]This threshold is extremely low: adjusting for inflation, INR 250 in 2002 is equivalent to approximately INR 1,050 in 2026 prices. The 2002 BPL Census recorded respondent-reported average monthly household income in broad categories, and its instructions do not specify whether home-produced consumption, in-kind compensation, or irregular and seasonal earnings should be included. The measure may therefore understate the total resources available to households engaged in subsistence agriculture or informal employment and should be interpreted as a proxy for baseline socioeconomic conditions rather than as a

Table 5 presents the reduced-form estimates of the effect of village road eligibility on IPV in the last 12 months using equation (1), also illustrated in Figure 4. The results suggest that the likelihood of women in villages just above the population threshold to experience sexual and physical violence compared to women in villages just below the population threshold reduces by 6 and 5.9 percentage points respectively. Table 6 presents the reduced-form estimates for the severity of physical violence in the last 12 months using equation (1). I find that women residing in villages eligible to receive a new road are 5.3 percentage points less likely to experience less severe physical violence and 4.3 percentage points less likely to experience severe physical violence by their partners compared to women in ineligible villages. Figure 5 illustrates the reduced-form estimates for severity of physical violence in the last 12 months.

Table 7 shows the reduced-form estimates for lifetime prevalence of IPV using equation (1). I find that women in eligible villages are 6 percentage points less likely to experience sexual violence compared to their counterparts in ineligible villages. Finally, Table 8 shows the reduced-form estimates for the severity of physical violence over women's lifetime using equation (1). I find that women in eligible villages are 5.4 percentage points less likely to experience severe physical violence compared to their counterparts in ineligible villages. This shows that access to roads reduce the prevalence of IPV and severity of physical violence.

Table 9 presents the instrumental variable (IV) or local average treatment effects (LATE) using equation (2), where I use PMGSY population threshold as an instrument for access to rural roads. I find that women in the last 12 months experienced a decline in sexual and physical violence by 32.7 and 44.8 percentage points, respectively, in villages with access to road compared to those without. Table 10 reports the LATE estimates for the severity of physical violence in the last 12 months using equation (2). The results indicate that women in treated villages experience 40.1 percentage points decline in less severe physical violence and 26.1 percentage points decline in severe physical violence than women in untreated villages.

comprehensive measure of household income or consumption.

7 Mechanisms

In this section, I explore several potential gendered channels that could explain the main findings through which men and women may reach a more equitable partnership and stress-free home environment.

7.1 Women's Empowerment and Agency

In this section, I examine whether rural roads improve women's empowerment. Women's empowerment is a multidimensional concept (Janssens, 2010; Kabeer, 1999; Moghadam, 1996). Using equation (1), I examine several dimensions of women's empowerment including, women's mobility, financial autonomy, education, migration and intra-household agency which are widely recognized as key indicators of women's empowerment.

7.1.1 Physical Mobility

Improved rural road connectivity is expected to increase women's mobility for employment, visiting health center or visiting family. Greater mobility exposes women to broader social norms that discourage the acceptance of violence. As women gain work opportunities and earnings, their self-confidence and household bargaining power strengthen, reducing their risk of IPV. Hirsch (1981) shows that individuals' social and physical mobility shapes their ability to build personal networks, which in turn supports coping with stress and adversity. These networks provide emotional support, practical help, and guidance, helping individuals navigate crises. Table 11 shows that rural road construction significantly increased women's mobility, i.e., expanding their access to economic, social and health related opportunities. I find that eligiblity for rural road construction increased women's mobility by 6.9 percentage points relative to women in ineligible villages.

7.1.2 Financial Autonomy

Enhanced financial autonomy can mitigate IPV in two ways. First, greater financial independence strengthens woman's bargaining power and reduces their financial dependence

on partners, lowering their acceptance of IPV (Angelucci, 2008; Farmer and Tiefenthaler, 1997). Second, increased earnings can enable women to purchase their own personal assets, such as mobile phones, which provides the confidence and means to seek help when needed. I find evidence for both channels. Table 12 shows that rural road construction enhances women's financial autonomy. The coefficient of cash earnings is positive but statistically insignificant while likelihood of receiving in-kind earnings increases significantly by 1.3 percentage points. I find that women in eligible villages experience a statistically significant increase in ownership of personal phones by 14.1 percentage points, and own bank accounts by 13.1 percentage points relative to women in ineligible villages. Overall, the financial autonomy index shows increase in financial autonomy of women in villages with population above population threshold by 7.5 percentage points in comparison to their counterparts in ineligible villages. These indicators highlight access to rural roads expands women's earning opportunities ownership of assets.

7.1.3 Educational Attainment

Education can increase awareness of individual rights and improve decision making abilities, strengthening women's bargaining power within the household and reducing acceptance of violence. Additional years of schooling also expand access to better job opportunities and higher earnings, which may reduce economic stress and lower the likelihood of violence between partners. Similarly, additional years of schooling can shift attitudes toward gender equality and decrease the social acceptance of violence. Stöckl et al. (2021) shows that higher levels of education for both men and women are associated with lower risk of IPV. Table 13 shows that villages with population above threshold experience significant increase in years of schooling for women.

7.1.4 Intrahousehold Agency

Mavisakalyan and Rammohan (2021) show that women's autonomy in household decision-making significantly reduces the risk of IPV, highlighting intrahousehold power dynamics as a critical factor in IPV prevention. The change in intrahousehold agency from men to

women or both sharing equal power can shift relative power dynamics and reduce both the acceptability and prevalence of violence at home. Table 14 show how rural roads can improve women's economic and social agency. I find that women in eligible villages are more likely to report greater involvement in household decisions related to own earnings, own health, household purchases, family visits, spouse's earnings, suggesting enhanced bargaining power. Two out of five indicators for intrahousehold agency are statistically significant at the 5 percent significance level.

7.2 Men's Economic and Human Capital Status

I examine whether rural roads improve men's economic status through occupational transitions and higher educational attainment, which serve as key indicators of economic advancement.

7.2.1 Occupational Transition

Higher household earnings accompanied by shifts toward higher-return occupation can reduce economic stress and lower the prevalence of IPV, as financial hardship and low income are key determinants of domestic conflict (Jewkes, 2002). Table 15 shows that rural road construction facilitated men's occupational transition from low-skilled or manual jobs to more skilled and technical occupations. The variable *occupation* is coded in a way that lower values indicate low-skill or manual jobs, and higher values denote technical or skilled work. I find that rural road construction increases the occupational ranking of men by approximately five points, a result that is statistically significant at the 5 percent significance level. This upward occupational mobility reflects improved access to better employment opportunities made possible by enhanced connectivity. These results are consistent with Asher and Novosad (2020), who show that rural road construction leads to the movement of workers out of agriculture.

7.2.2 Educational Attainment

Table 13 shows that villages with population above threshold experience significant increase in years of schooling for men. Additional years of schooling could lead to better employment opportunities, and higher income, which strengthens men's economic status. In addition increased schooling can shift gender attitudes and decrease acceptance of violence (Stöckl et al., 2021).

7.3 Household Welfare, Resource Pools, and Social Norms

In this section, I examine how rural road construction impacted household welfare, resources availability and social norms around IPV. These channels serve as direct empirical tests for welfare and resource-pooling hypothesis outlined in the theoretical framework section earlier in the paper.

7.3.1 Household Wealth

Poverty is widely recognized as an important determinant of IPV, as financial hardship generates economic stress and conflict between partners (Jewkes, 2002). Improved road connectivity can expand employment opportunities, raise household income, and enhance asset accumulation, thereby reducing economic stress and, in turn, the likelihood of violence within households. Stöckl et al. (2021) shows that higher household wealth is associated with lower risk of IPV. Table 16 presents the intent-to-treat effect of rural road construction on household wealth, measured using both wealth quintiles and a continuous wealth index constructed through principal component analysis. The results show that women in eligible villages are 0.53 wealth quintiles higher than those in ineligible villages. The positive and statistically significant coefficient on the wealth factor score further corroborates the finding that rural road construction leads to increases in household wealth. This is an important channel through which roads can reduce male-to-female IPV.

7.3.2 Social Norms around IPV

Improved road connectivity can increase exposure to markets, health centres and community networks which can introduce alternative gender norms to women and reduce the tolerance of male dominance and acceptability of violence by partner at home. Rural roads can contribute in reshaping the social norms that justify IPV. Clark et al. (2024) shows improved social norms can reduce violence against women. Nandwani and Roychowdhury (2025) shows rural road construction program under PMGSY improved norms around domestic violence. In my paper, I find similar results for improvement in social norms. Table 17 reports the impact of rural road construction on social norms around IPV using five attitudinal statements. To capture the overall measure, I construct a binary variable *violence* that takes the value of 1 if any of the five norms were reported "yes" and 0 otherwise. The coefficient on *violence* is negative and statistically significant at 5 percent level, suggesting an improvement in perceptions among women living in villages above the population threshold compared to those in villages below the population threshold. Specifically, the likelihood of reporting acceptance of IPV declines by 8 percentage points.

7.3.3 Sole Decision Making

While the male backlash hypothesis predicts that men will reassert their intra-household position using violence when they perceive a threat to their tradition roles and status, the cooperative bargaining framework suggests as women's resources or outside options increases, their intrahousehold bargaining power will also increase causing a shift in decision making within the household from unilateral decisions by men to mutual decisions by both spouses. In this framework, women empowerment will not lead to male backlash but an equal distribution of decision making power within the household. Table 18 shows how access to rural road not just increase women's intrahousehold agency, but also decreased men's sole decision making. The results show that women in eligible villages are significantly less likely to report that their husbands make decisions alone across various domains of household. This suggest that rural road construction not only helped increase women's participation in decision making but also weakened male dominance. A decline in sole

male decision making represents more cooperative behavior by men toward women and provides evidence of the absence of male backlash.

8 Heterogeneity Checks

Next, I explore heterogeneity in the treatment effects of rural road construction on the prevalence and severity of physical violence by marriage timing and spousal age gap, following Calonico et al. (2025).

8.1 Marriage Timing

Since the rural road construction program really took off in 2002, I construct an indicator *Marriage* that takes the value one if a woman married in 2002 or later and zero if she married before 2002. As a validity check, I first examine whether treatment affected marriage timing using the following specification:

$$\begin{aligned} Y_{ivds} = \gamma_0 + \gamma_1 I(pop_{vds} \geq T) + \gamma_2 (pop_{vds} - T) + \gamma_3 (pop_{vds} - T) \\ \times I(pop_{vds} \geq T) + \delta^{'} X_{ivds} + \eta_{dh} + \rho_m + \delta_t + \epsilon_{ivds} \end{aligned} \tag{6}$$

where $Marriage_{ivds}$ is an indicator that takes the value one if a woman married in 2002 or later and zero if she married before 2002. The right hand side variables in equation (6) are defined as in equation (1). The results, reported in Table 19, show no evidence of a discontinuity in marriage timing at the treatment threshold, suggesting that treatment did not systematically affect the likelihood of marriage timing.

Next, I examine heterogeneity in the reduced form effects of rural road eligibility on IPV outcomes by marriage timing. I estimate equation (1) separately for women who married before 2002 and those who married in 2002 or later. I also conducted a formal test of equality of the treatment effects across the two groups. Table 20 reports the results. Columns (1) and (2) report the local-polynomial point estimates for women married before 2002 and women married in 2002 or later, respectively. Column (3) reports the p-value

from the formal test of equality of the RD treatment effects across the two marriage-timing groups. Overall, I find no evidence of heterogeneous treatment effects by marriage timing. For all IPV outcomes, I fail to reject the null hypothesis that the treatment effects are equal across women who married before 2002 and those who married in 2002 or later.

8.2 Spousal Age Gap

Further, I examine how the effects of rural road construction on IPV outcomes vary by spousal age gap. For this, I divide the sample at the median spousal age gap of four years. I construct an indicator for spousal age gap that takes the value one if the difference between the husband's and wife's ages is greater than four years and zero if the difference is less than or equal to four years. As a validity check, I first examine whether treatment affected the likelihood of having a spousal age gap greater than four years using the following specification:

$$\begin{aligned} Y_{ivds} = \gamma_0 + \gamma_1 I(pop_{vds} \geq T) + \gamma_2 (pop_{vds} - T) + \gamma_3 (pop_{vds} - T) \\ \times I(pop_{vds} \geq T) + \delta' X_{ivds} + \eta_{dh} + \rho_m + \delta_t + \epsilon_{ivds} \end{aligned} \tag{7}$$

where Y_{ivds} is an indicator for spousal age gap that takes the value one if the difference between the husband's and wife's ages is greater than four years and zero if the difference is less than or equal to four years. The right hand side variables in equation (7) are defined as in equation (1), except that the respondent's age is excluded from the set of controls. The results, reported in Table 21, show no evidence of a discontinuity in the likelihood of having a spousal age gap greater than four years at the treatment threshold, suggesting that treatment did not systematically affect assignment to the two spousal age gap groups.

Next, I examine heterogeneity in the reduced-form effects of rural road eligibility on IPV outcomes by spousal age gap. I estimate equation (1) separately for women with a spousal age gap of four years or less and those with a spousal age gap greater than four years. I also conduct a formal test of equality of the treatment effects across the two groups. Table 22 reports the results. Columns (1) and (2) report the local-polynomial

point estimates for women with a spousal age gap of four years or less and those with a spousal age gap greater than four years, respectively. Column (3) reports the p-value from the formal test of equality of the RD treatment effects across the two spousal age gap groups. The results provide evidence of heterogeneous treatment effects for severe physical violence. The reduction in severe physical violence is larger among women with a spousal age gap greater than four years, and the formal test of equality rejects the null hypothesis of equal treatment effects across the two groups at the 5 percent level. For the remaining IPV outcomes, I fail to reject the null hypothesis of equal treatment effects across the two spousal age gap groups.

9 Robustness Checks

RD estimates can be sensitive to alternative model specifications. First, the functional form of the running variable may lead to misspecification bias if the true relationship is nonlinear. Second, the choice of bandwidth as including observations too far from the cutoff may increase bias while a narrow bandwidth may inflate the variance. Third, the choice of kernel function, which assigns the non-negative weights to each observation based on the distance between the observation and the cutoff and may affect the estimate. Each of these can potentially distort the estimated effects, I re-estimate the models using alternative polynomial orders, bandwidth selectors, and kernel functions to examine the robustness of my findings. In Figure A3, I show that the main estimates are not sensitive to the different choice of polynomial order used for local polynomial estimation. Table A1 shows that the main findings on reduction of sexual violence are insensitive to using a higher-order polynomial (quadratic), although the estimate for physical violence is no longer significant. This suggests that while the effect is not sensitive to model specification overall, the estimated impact on physical violence may be more local and less stable to higher-order approximations. Figure A4 and Table A2 present similar robustness checks for the severity of physical violence during the last 12 months. The estimated effect on severe physical violence remains robust. In Figure A5, I show that my estimates are not sensitive to the choice of

kernel used for local polynomial estimation. In the main analysis, I use a triangular kernel, under which weights decline linearly and symmetrically as running variables take values away from the threshold and are maximized at the cutoff. Table A3 shows that the result for sexual violence remain robust when using a uniform kernel, which assigns equal weight to all observations within the optimal bandwidth, although the statistical significance for physical violence disappears. In Table A3, I also use an Epanechnikov kernel which assigns quadratically decreasing weights as observations move away from the cutoff. The results remain robust for both sexual and physical violence. Figure A6 and Table A4 present the similar robustness check for severity of physical violence during the last 12 months and show similar conclusions.

In Figure A7, I show that main estimates are not sensitive to the choice of bandwidths used for local polynomial estimation. In Table A5, I use twice the bandwidth selected through the mean squared error (MSE)-optimal bandwidth, the coverage error rate (CER)-optimal bandwidth and twice the bandwidth selected through the CER-optimal bandwidth method as different robustness checks. The MSE-optimal bandwidth minimizes the mean squared error of the point estimate and the CER-optimal bandwidth instead minimizes coverage error and provides valid confidence interval inference. The results for prevalence of sexual violence remain robust under different bandwidths, and the estimated effect on IPV becomes marginally significant under the CER-optimal bandwidth. Figure A8 and Table A6 present similar robustness checks for severity of physical violence during the last 12 months. The estimated effect on severe physical violence remains robust and significant at the 5 percent level. Finally, to account for multiple hypothesis testing and alleviate the concerns that the main findings are driven by Type I error, I estimate and report sharpened False Discovery Rate (FDR) q-values following Benjamini et al. (2006) and Anderson (2008) for the main results presented in Table 5 and Table 7. These reported q-values represent the minimum false discovery rate (FDR) threshold (α) at which the null hypothesis would be rejected, thus accounting for the multiplicity of hypotheses tested. The reported q-values show that the estimated reductions in both the prevalence of male-to-female IPV and severity of physical violence remain robust, confirming the precision of the estimated

effects of rural road construction among women living in villages that were eligible to receive a road.

The consistency of the results across these alternative model specifications and estimation methodologies, and multiple hypothesis testing strengthens the validity of the RD design and suggests that the findings reflect a true causal effect rather than artefacts of specification choices or statistical inference.

10 Discussion & Conclusion

Infrastructure development has the potential to address gender disparities by reducing spatial isolation and increasing access to economic and social opportunities. In rural areas, improved connectivity is particularly important for women, increasing their mobility and expanding access to employment, education and financial resources. This paper shows that these benefits extend beyond conventional economic outcomes to an important dimension of women's well-being, that is, their exposure to IPV. In this paper, I employ an RD design that leverages a fuzzy increase in the likelihood of rural road construction at population thresholds in India.

I find that access to rural roads decrease the likelihood of experiencing sexual and physical violence by a woman in treated village by 6 and 5.9 percentage points respectively. Beyond prevalence, I also find rural roads mitigate the severity of physical violence. These effect sizes are comparable to those of IPV-relevant interventions. For example, a multifaceted female empowerment program in urban Liberia produced larger reductions, decreasing emotional, physical, and sexual violence by 10–26 percentage points (Park and Kumar, 2023). Particularly, in context of India, a multidimensional women's empowerment program decreased physical and emotional violence by 3 and 2 percentage points respectively (Chatterjee and Poddar, 2024). In Northern Ecuador, a randomized cash, voucher, and food transfer program reduced physical and/or sexual violence by 6–7 percentage points (Hidrobo et al., 2016). Similarly, a cash transfer program in Mali reduced IPV in polygamous households, with physical violence declining by about 7 percentage

points and emotional violence by approximately 12 percentage points (Heath et al., 2020).

To understand the pathways through which rural roads reduced IPV, I explore several potential mechanisms. Rural roads affected both men and women simultaneously, leading to a reduction in the prevalence of IPV. For women, roads improved a range of outcomes that collectively capture empowerment (e.g. mobility, educational attainment, financial autonomy, intra-household agency), which strengthened their household bargaining power. For men, rural roads improved economic outcomes by facilitating a shift from less-skilled to more-skilled employment opportunities and enhanced educational attainment. The intersection of these gender-specific improvements lead to an increase in household wealth and significantly reduced sole male decision making. In this way, roads affect both genders through distinct but mutually reinforcing pathways, jointly contributing to a more equitable and less violent household environment. Taken together, these findings document a shift toward a cooperative household equilibrium and provide supporting evidence for the absence of a male backlash.

My paper contributes to several literatures. First, this paper adds to the broader literature on the economic and social effects of large-scale infrastructure programs, particularly rural roads, where I study their implications for women's safety which is largely unexplored. Second, my study contributes to the literature on policy interventions and IPV. I contribute to this literature by showing that policies that enhance women's safety within a household can extend beyond traditional social protection interventions such as cash transfers, non-cash transfer income etc. Policies in other realms may have significant unintended effects on women's safety. Third, my study contributes to the literature on the determinants of IPV by identifying the impacts of rural roads construction and examining mechanisms in detail. In particular, I examine pathways operating through both partners. Earlier studies faced data constraints that limited the range of pathways under consideration, and in particular the ability to investigate mechanisms operating through both partners (Peterman et al., 2022).

These pathways suggest some potential policy implications. First, my results indicate that rural road construction increased women's mobility, availability of affordable and

high frequency rural public transportation can complement road construction and provide connectivity to markets, health centres and outside village areas. Second, I find rural roads increased education attainment for women. Education has the potential to provide better employment opportunities, create awareness about unacceptability of gender-based violence, increase financial autonomy which together can strengthen women's bargaining power within the household. Policymakers should support continued education by increasing schools and colleges in rural areas and rural public transportation to attend schools and colleges outside the villages. Third, I find rural roads improved women's financial autonomy and facilitated a shift from less-skilled to more-skilled employment for men, policies targeting rural employment can complement these infrastructure investments. These programs can increase women's access to employment opportunities and thereby improving their bargaining power within the household. In conclusion, my results highlight an important social externality of rural infrastructure investments: policies designed to improve rural connectivity and promote economic development can also contribute to reducing prevalence of male-to-female violence.

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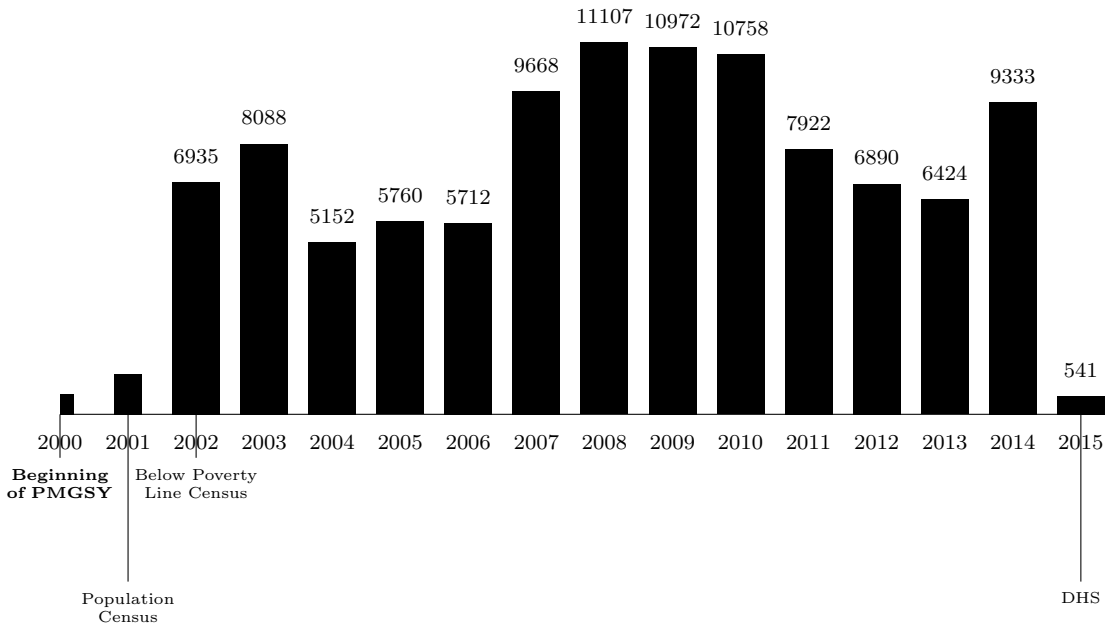
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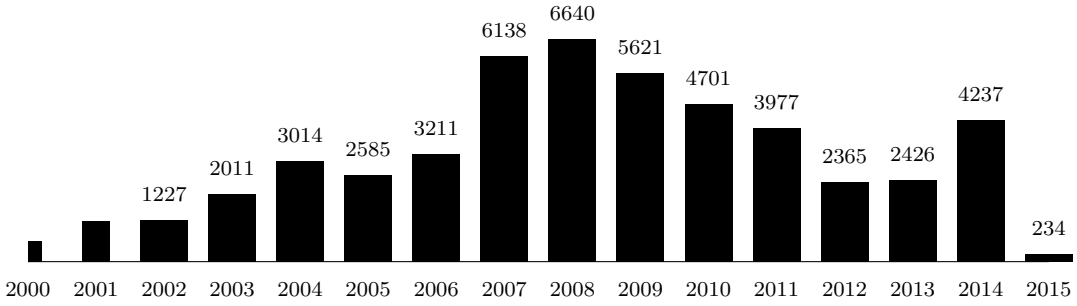
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Figure 1: Time Line of Data Sources
with Count of Roads Completed under PMGSY by Year



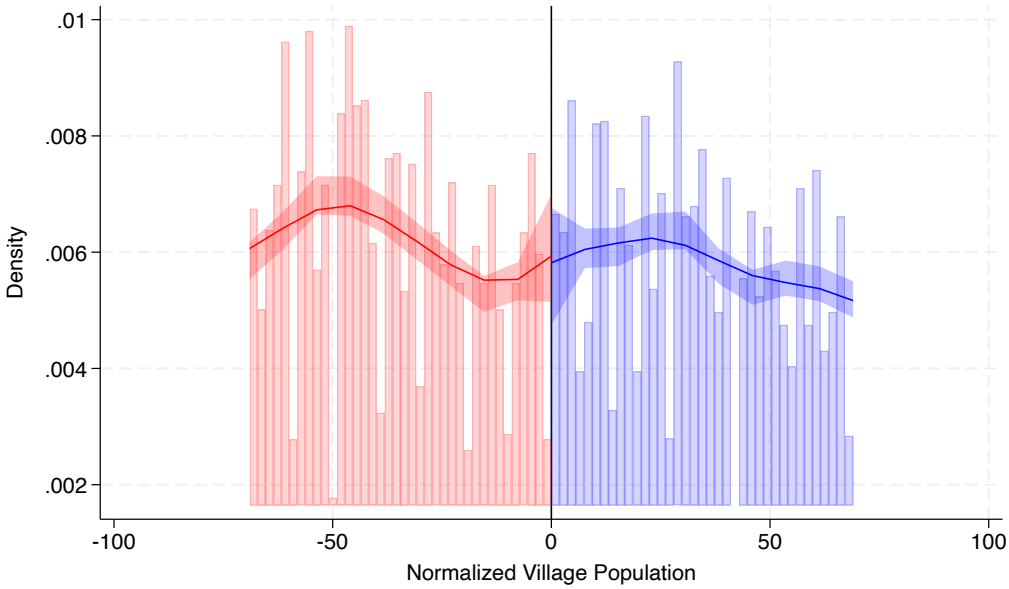
(a) All States



(b) Sample States

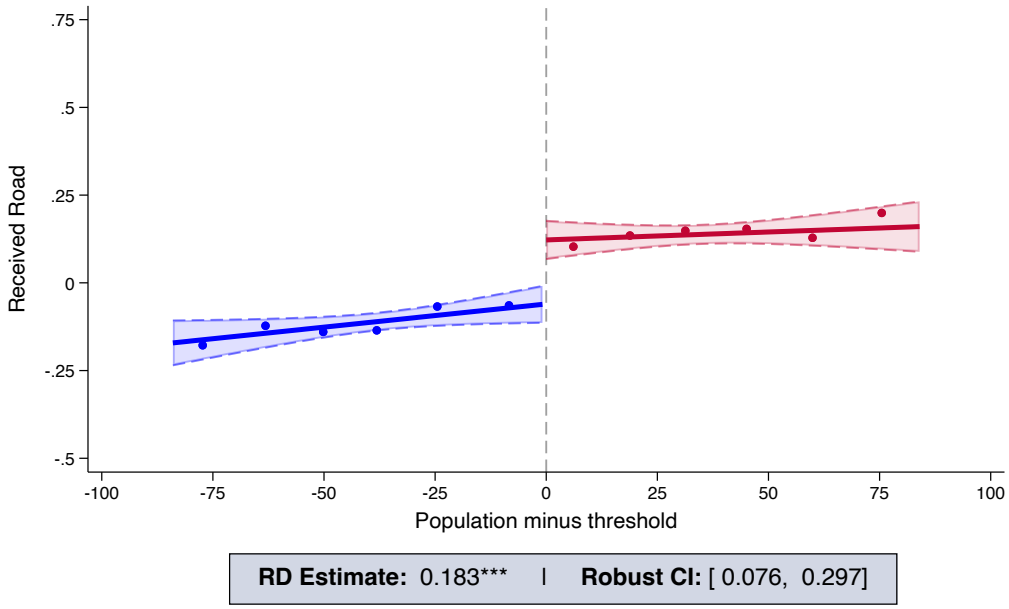
Notes: Panel (a) shows the annual number of roads constructed under the PMGSY across all Indian states. The figure also highlights the timing of the PMGSY launch, the Population Census of India, the Below Poverty Line (BPL) Census, and the Demographic Health Survey (DHS). Panel (b) shows the annual number of roads constructed in the sample states. Road construction data is drawn from Asher et al. (2021) and Asher and Novosad (2020).

Figure 2: McCrary Density Test



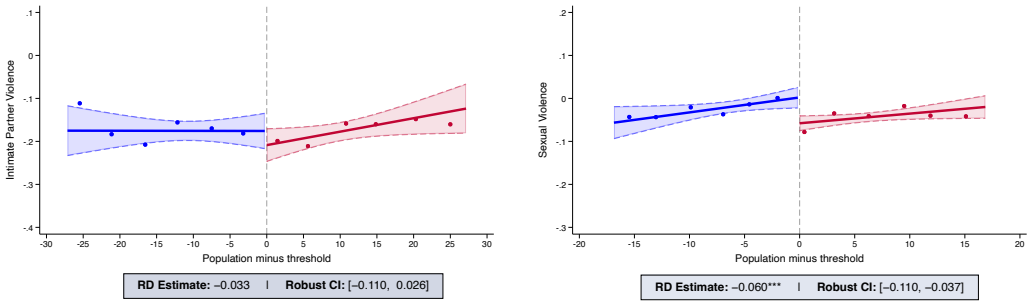
Notes: The figure uses the normalized village population (reported population minus the threshold, either 500 or 1,000). It plots a non-parametric regression on each half of the distribution following McCrary (2008), testing for a discontinuity at zero. The point estimate for the discontinuity is −0.4278 with p-value 0.67.

Figure 3: Effect of Road Eligibility on Road Receipt



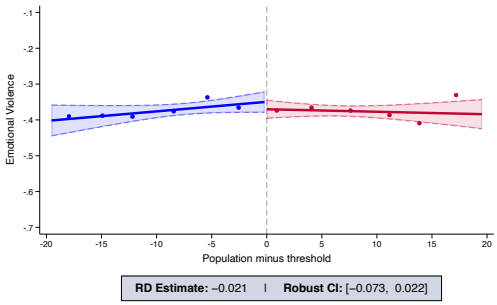
Notes: This figure presents the first-stage RD estimate by plotting the residualized values of probability of a village receiving a new rural road between 2002 and 2014, after controlling for all variables in the main specification other than population, as a function of the normalized 2001 village population relative to the eligibility threshold. Each point represents the mean of all villages in a given population bin. The regression control for district-threshold fixed effects and village characteristics measured in 2001 (baseline). Population is normalized by subtracting the state-specific eligibility threshold (500 or 1,000). Standard errors are clustered at the village level. Shaded areas represent 95% confidence intervals.

Figure 4: Impact of Rural Roads on Intimate Partner Violence

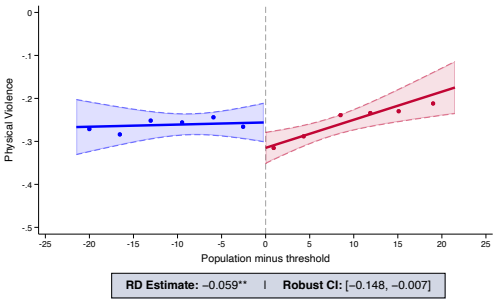


(a) IPV

(b) Sexual



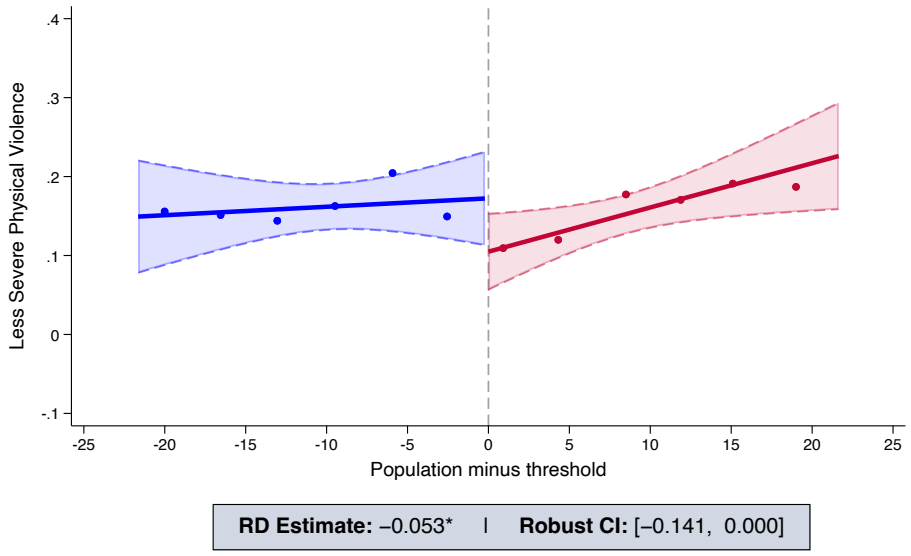
(c) Emotional



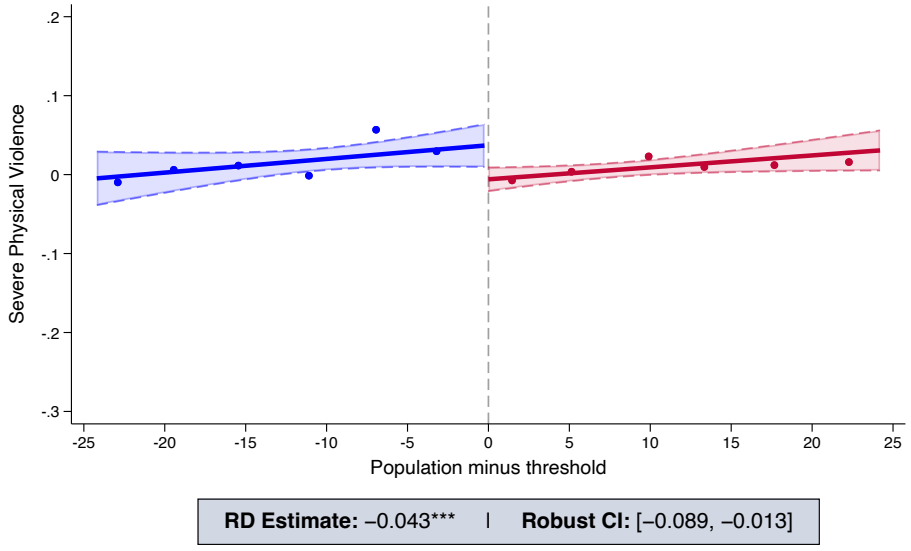
(d) Physical

Notes: This figure presents the reduced-form RD estimate by plotting the residualized values of intimate partner violence during the last 12 months, after controlling for all variables in the main specification other than population, as a function of the normalized 2001 village population relative to the eligibility threshold. Each point represents the mean of all villages in a given population bin. The regression control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level (baseline) and individual-level controls. Population is normalized by subtracting the state-specific eligibility threshold (500 or 1,000). Standard errors are clustered at the village level. Shaded areas represent 95% confidence intervals.

Figure 5: Impact of Rural Roads on Severity of Physical Violence



(a) Less Severe Physical Violence



(b) Severe Physical Violence

Notes: This figure presents the reduced-form RD estimate by plotting the residualized values of severity of physical violence during the last 12 months, after controlling for all variables in the main specification other than population, as a function of the normalized 2001 village population relative to the eligibility threshold. Each point represents the mean of all villages in a given population bin. The regression control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level (baseline) and individual-level controls. Population is normalized by subtracting the state-specific eligibility threshold (500 or 1,000). Standard errors are clustered at the village level. Shaded areas represent 95% confidence intervals.

Table 1: Balance Check

Variable	Full Sample (1)
Panel A: Individual-Level	
Age	−0.412
	(0.435)
Hindu	0.032
	(0.027)
Muslim	−0.012
	(0.021)
Scheduled Tribe	−0.001
	(0.045)
Scheduled Caste	0.021
	(0.028)
Other Backward Class	−0.029
	(0.042)
Observations	12,076
Panel B: Village-Level	
Primary School	0.000
	(0.025)
Electrified	−0.009
	(0.055)
Scheduled Caste (Share)	0.018
	(0.022)
Land Irrigated (Share)	0.036
	(0.029)
Literate (Share)	0.013
	(0.015)
Observations	2,202

Notes: This table reports the balance check for predetermined individual-level and village-level characteristics. Panel A presents the RD estimates for individual-level variables from 2015-16 DHS, using district-population threshold fixed effects, survey-month fixed effects and time-of-day fixed effects, and standard errors clustered at the village level. Panel B reports the RD estimates of the effect of being above the treatment threshold on the baseline village-level variables using district-population threshold fixed effects and heteroskedasticity-robust standard errors. Standard errors are reported in the parantheses.

Table 2: Impact of Road Eligibility on Road Receipt

	New Road (1)
Eligible	0.183***
	(0.056)
District-Threshold FE	Yes
Baseline Controls	Yes
Observations	12,076

Notes: This table presents the first-stage effect of road eligibility on the probability of receiving a new rural road, using MSE-optimal bandwidth with robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. 'Eligible' is an indicator that takes the value of one if the village population is above the treatment threshold. The dependent variable 'New Road' takes the value one if the village received a new road during 2002-2014 and 0 otherwise. Standard errors in parentheses are clustered at the village level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Individual-Level Summary Statistics

	Full Sample (1)
Outcome Variables	
IPV	0.27
	(0.44)
Sexual	0.05
	(0.22)
Emotional	0.09
	(0.29)
Physical	0.24
	(0.42)
Less Severe Physical	0.23
	(0.42)
Severe Physical	0.06
	(0.24)
Individual-Level Controls	
Age	32.25
	(7.80)
Hindu	0.92
	(0.28)
Muslim	0.05
	(0.23)
Scheduled Tribe	0.23
	(0.42)
Scheduled Caste	0.18
	(0.38)
Other Backward Class	0.43
	(0.50)
Observations	12,076

Notes: This table reports the summary statistics for the individual-level sample used in the analysis. Outcome variables are based on women's self-reports of intimate partner violence during the last 12 months. *IPV* is a composite indicator equal to one if a woman experienced at least one form of male-to-female violence — sexual, emotional or physical during the last 12 months, and zero otherwise. Individual-level controls presents the mean values for individual characteristics from DHS 2015-16. Standard deviations are reported in the parentheses.

Table 4: Village-Level Summary Statistics

	Full Sample (1)
Village-Level Controls	
Primary School	0.94
	(0.23)
Medical Center	0.18
	(0.38)
Electrified	0.44
	(0.50)
Distance to Nearest Town (km)	26.38
	(21.73)
Land Irrigated (Share)	0.27
	(0.29)
Log Land Area	5.11
	(0.82)
Literate (Share)	0.47
	(0.15)
Scheduled Caste (Share)	0.15
	(0.18)
Land Ownership (Share)	0.76
	(0.22)
Subsistence Agriculture (Share)	0.44
	(0.26)
Household Income > INR 250 (Share)	0.76
	(0.27)
Observations	2,202

Notes: This table reports the summary statistics for the village-level controls used in the analysis. Village-level controls presents the mean values for village characteristics measured at baseline. The first eight variables come from the 2001 Population Census, the next three (below the first line) come from the 2002 Below Poverty Line Census (Asher et al., 2021). Standard deviations are reported in the parenthese.

Table 5: Intent-to-Treat Effects of Rural Roads on IPV

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
Eligible	−0.033	−0.060***	−0.021	−0.059**
	(0.035)	(0.019)	(0.024)	(0.036)
Control Mean	0.27	0.06	0.10	0.22
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sharpened q-values	0.208	0.001	0.208	0.051
Observations	3,851	2,359	2,722	2,968

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months, using MSE-optimal bandwidth with robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Column (1) reports the composite indictor *IPV*, which equals one if a woman experienced at least one form of intimate partner violence – sexual, emotional, or physical, perpetrated by her partner during the last 12 months, and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 6: Intent-to-Treat Effects of Rural Roads on the Severity of Physical Violence

	Less Severe Physical Violence (1)	Severe Physical Violence (2)
Eligible	-0.053^{*}	-0.043^{***}
	(0.036)	(0.019)
Control Mean	0.22	0.06
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Sharpened q-values	0.027	0.017
Observations	2,968	3,438

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on the severity of physical violence in the last 12 months, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 7: Intent-to-Treat Effects of Rural Roads on Lifetime IPV

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
Eligible	−0.049	−0.060***	−0.021	−0.044
	(0.037)	(0.020)	(0.027)	(0.036)
Control Mean	0.34	0.07	0.12	0.30
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sharpened q-values	0.217	0.003	0.289	0.217
Observations	4,039	2,481	2,839	4,039

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on lifetime IPV, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Column (1) reports the composite indictor *IPV*, which equals one if a woman experienced at least one form of intimate partner violence – sexual, emotional, or physical, perpetrated by her partner during her lifetime, and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 8: Intent-to-Treat Effects of Rural Roads on the Severity of Lifetime Physical Violence

	Less Severe Physical Violence (1)	Severe Physical Violence (2)
Eligible	−0.038	−0.054***
	(0.036)	(0.023)
Control Mean	0.30	0.08
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Sharpened q-values	0.154	0.014
Observations	4,252	3,182

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on the severity of lifetime physical violence, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 9: Local Average Treatment Effects of Rural Roads on IPV

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
New Road	−0.185	−0.327**	−0.150	−0.448**
	(0.197)	(0.168)	(0.181)	(0.326)
Control Mean	0.27	0.06	0.10	0.22
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sharpened q-values	0.199	0.092	0.199	0.092
Observations	3,851	2,359	2,722	2,968

Notes: This table presents the local average treatment effects of receiving a new rural road on IPV in the last 12 months, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Column (1) reports the composite indictor *IPV*, which equals one if a woman experienced at least one form of intimate partner violence – sexual, emotional, or physical, perpetrated by her partner during the last 12 months, and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 10: Local Average Treatment Effects of Rural Roads on the Severity of Physical Violence

	Less Severe Physical Violence (1)	Severe Physical Violence (2)
New Road	-0.401^{*}	-0.261^{**}
	(0.307)	(0.150)
Control Mean	0.22	0.06
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Sharpened q-values	0.062	0.062
Observations	2,968	3,438

Notes: This table presents the local average treatment effects of receiving a new rural road on the severity of physical violence in the last 12 months, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 11: Intent-to-Treat Effects of Rural Roads on Mobility

	Market (1)	Health Center (2)	Outside Village (3)	Mobility (4)
Eligible	0.069***	0.068***	0.029	0.069***
	(0.026)	(0.023)	(0.022)	(0.022)
Control Mean	0.91	0.94	0.91	0.95
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sharpened q-values	0.006	0.003	0.170	0.002
Observations	2,631	2,631	3,569	2,481

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on women's mobility, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Columns (1)–(3) examine whether a woman is allowed to go alone to the market, a health center, and places outside the village, respectively. Column (4) reports the composite indicator *Mobility*, which equals one if a woman is allowed to go alone to at least one of these three locations and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 12: Intent-to-Treat Effects of Rural Roads on Financial Autonomy

	Cash Earnings (1)	In-Kind Earnings (2)	Bank Account (3)	House Paper (4)	Personal Phone (5)	Financial Autonomy (6)
Eligible	0.013	0.013*	0.131***	0.058	0.141***	0.075***
	(0.033)	(0.008)	(0.044)	(0.046)	(0.044)	(0.029)
Control Mean	0.25	0.01	0.50	0.40	0.36	0.84
District-Threshold FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sharpened q-values	0.352	0.085	0.002	0.146	0.002	0.006
Observations	4,252	3,182	2,079	2,722	2,481	2,631

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on women's financial autonomy, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Columns (1)–(5) examine indicators equal to one if a woman receives cash earnings, receives in-kind earnings, owns a bank account, owns a house either solely or jointly with her husband, and owns a personal phone, respectively. Column (6) reports the composite indicator *Financial Autonomy*, which equals one if a woman owns at least one physical or financial asset, and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 13: Intent-to-Treat Effects of Rural Roads on Educational Attainment

	Female (1)	Male (2)
Eligible	2.109***	1.166***
	(0.543)	(0.467)
Control Mean	5.19	7.17
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Sharpened q-values	0.001	0.005
Observations	2,079	2,481

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on years of education, using MSE-optimal bandwidth with robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 14: Intent-to-Treat Effects of Rural Roads on Intrahousehold Agency

	Own Earnings (1)	Own Health (2)	Household Purchases (3)	Family Visits (4)	Spouse's Earnings (5)	Agency (6)
Eligible	0.021	0.078**	0.031	0.097***	0.029	0.035*
	(0.038)	(0.039)	(0.034)	(0.036)	(0.039)	(0.024)
Control Mean	0.26	0.76	0.75	0.75	0.76	0.88
District-Threshold FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sharpened q-values	0.290	0.023	0.225	0.005	0.225	0.094
Observations	2,839	2,839	3,182	2,481	2,943	3,851

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on women's intrahousehold agency, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Columns (1)–(5) examine indicators equal to one if a woman reports that decisions regarding her own earnings, her own health care, household purchases, family visits, and her spouse's earnings, respectively, are made either by herself alone or jointly with her husband, and zero if they are made by her husband alone. Column (6) reports the composite indicator *Agency*, which equals one if a woman participates, either alone or jointly with her husband, in at least one of the decision making domains, and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 15: Intent-to-Treat Effects of Rural Roads on Occupational Transition

	Occupation (1)
Eligible	3.507**
	(1.920)
Control Mean	32.27
District-Threshold FE	Yes
Survey-Month FE	Yes
Time of Day FE	Yes
Controls	Yes
Sharpened q-values	0.026
Observations	3,438

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on occupational transition, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). 'Occupation' ranges from 0 to 99, where 0 denotes not working, lower values correspond to low-skill or manual occupations, and higher values correspond to technical or skilled occupations. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 16: Intent-to-Treat Effects of Rural Roads on Wealth and Wealth Factor Score

	Wealth (1)	Wealth Factor Score (2)
Eligible	0.530***	0.382***
	(0.145)	(0.106)
Control Mean	2.79	−0.06
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Sharpened q-values	0.001	0.001
Observations	2,206	2,206

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on wealth and the wealth factor score, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). 'Wealth' classifies households into quintiles ranging from 1 (poorest) to 5 (richest) based on asset ownership and housing characteristics. The 'Wealth Factor Score' is a continuous index constructed using principal component analysis (PCA) of the same household characteristics. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 17: Intent-to-Treat Effects of Rural Roads on Norms around IPV

	Leaves w/o Permission (1)	Neglects Children (2)	Argues with Husband (3)	Refuses Sex (4)	Bad Cooking (5)	Violence (6)
Eligible	−0.006	−0.008	−0.082**	−0.029	−0.045*	−0.080**
	(0.033)	(0.037)	(0.041)	(0.028)	(0.034)	(0.045)
Control Mean	0.19	0.24	0.25	0.13	0.18	0.36
District-Threshold FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sharpened q-values	0.016	0.046	0.006	1.000	0.170	0.026
Observations	4,039	4,395	2,481	2,631	2,968	2,481

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on norms around intimate partner violence , using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Columns (1)–(5) examine whether a woman reports that a husband is justified in beating his wife if she leaves home without permission, neglects the children, argues with him, refuses to have sex with him, or does bad cooking, respectively. Column (6) reports the composite indicator *Violence*, which equals one if a woman justifies wife beating under at least one of these circumstances, and zero otherwise. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 18: Intent-to-Treat Effects of Rural Roads on Decision-Making

Decision	Alone (1)	Both (2)	Husband (3)
Own Earnings	0.001	−0.001	−0.074***
	(0.014)	(0.037)	(0.024)
Control Mean	0.04	0.22	0.05
Sharpened q-values	1.000	1.000	0.002
Observations	4,395	2,839	1,752
Own Health	0.022	0.055	−0.067**
	(0.023)	(0.047)	(0.042)
Control Mean	0.07	0.67	0.22
Sharpened q-values	0.225	0.135	0.048
Observations	2,631	2,631	2,839
Household Purchases	0.026**	0.006	−0.050*
	(0.014)	(0.037)	(0.032)
Control Mean	0.03	0.71	0.21
Sharpened q-values	0.026	1.000	0.076
Observations	2,631	2,968	3,569
Family Visits	0.017	0.092***	−0.111***
	(0.021)	(0.040)	(0.035)
Control Mean	0.07	0.68	0.21
Sharpened q-values	0.170	0.012	0.002
Observations	2,481	2,631	2,631
Spouse's Earnings	0.001	0.000	−0.050*
	(0.015)	(0.041)	(0.040)
Control Mean	0.04	0.70	0.21
Sharpened q-values	0.998	1.000	0.085
Observations	4,395	3,569	2,631
District-Threshold FE	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on women's decision-making, using an MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. For each decision domain, columns (1)–(3) report the effects on whether decisions are made by the woman alone, jointly with her spouse, or by her husband alone, respectively. Sharpened q-values are computed following the procedure proposed by Benjamini et al. (2006) and described in Anderson (2008). Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 19: Marriage Timing

Variable	(1)
Marriage timing	0.003
	(0.019)
District-Threshold FE	Yes
Survey-Month FE	Yes
Time of Day FE	Yes
Controls	Yes
Observations	12,076

Notes: This table reports the RD estimates for marriage timing. Standard errors (in parentheses) are clustered at the village level.

Table 20: Heterogeneous Effects of Rural Roads on IPV by Marriage Timing

	Married Before 2002 (1)	Married in 2002 or Later (2)	p-value for Difference (3)
Panel A: Prevalence			
IPV	−0.027	−0.048	0.985
	(0.093)	(0.081)	
Observations	1,574	1,542	
Sexual Violence	−0.055	−0.036	0.755
	(0.067)	(0.035)	
Observations	1,073	2,025	
Emotional Violence	−0.039	−0.008	0.921
	(0.083)	(0.037)	
Observations	1,248	2,378	
Physical Violence	−0.038	−0.054	0.761
	(0.088)	(0.078)	
Observations	1,574	1,474	
Panel B: Severity			
Less Severe Physical Violence	−0.034	−0.052	0.752
	(0.087)	(0.078)	
Observations	1,632	1,474	
Severe Physical Violence	−0.005	−0.067**	0.368
	(0.045)	(0.032)	
Observations	1,948	2,092	
District-Threshold FE	Yes	Yes	
Survey-Month FE	Yes	Yes	
Time of Day FE	Yes	Yes	
Controls	Yes	Yes	

Notes: This table presents heterogeneous intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months by marriage timing, using MSE-optimal bandwidths with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Women are classified as married before 2002 if they were married before the year 2002 and as married in 2002 or later if they were married in 2002 or later. Columns (1) and (2) report local-polynomial point estimates. Column (3) reports the p-value from the formal test of equality of the RD treatment effects across the two marriage-timing groups. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 21: Spousal Age Gap

Variable	(1)
Spousal Age Gap	−0.015
	(0.029)
District-Threshold FE	Yes
Survey-Month FE	Yes
Time of Day FE	Yes
Controls	Yes
Observations	12,076

Notes: This table reports the RD estimates for spousal age gap. Respondent's age is excluded from the set of controls. Standard errors (in parentheses) are clustered at the village level.

Table 22: Heterogeneous Effects of Rural Roads on IPV by Spousal Age Gap

	Spousal Age Gap $\leq$ 4 Years (1)	Spousal Age Gap $>$ 4 Years (2)	p-value for Difference (3)
Panel A: Prevalence			
IPV	−0.009	−0.137	0.264
	(0.074)	(0.098)	
Observations	2,046	1,088	
Sexual Violence	−0.024*	−0.092	0.968
	(0.045)	(0.055)	
Observations	1,495	1,088	
Emotional Violence	−0.011	−0.028	0.284
	(0.051)	(0.064)	
Observations	1,582	1,143	
Physical Violence	0.009	−0.162	0.130
	(0.067)	(0.092)	
Observations	2,390	1,088	
Panel B: Severity			
Less Severe Physical Violence	0.003	−0.136	0.223
	(0.068)	(0.092)	
Observations	2,288	1,088	
Severe Physical Violence	0.003	−0.108*	0.048
	(0.037)	(0.055)	
Observations	1,766	1,088	
District-Threshold FE	Yes	Yes	
Survey-Month FE	Yes	Yes	
Time of Day FE	Yes	Yes	
Controls	Yes	Yes	

Notes: This table presents heterogeneous intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months by spousal age gap, using MSE-optimal bandwidths with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. The Spousal age gap indicator takes the value one if the difference between the husband's and wife's ages is greater than four years and zero if the difference is less than or equal to four years. Columns (1) and (2) report local-polynomial point estimates. Column (3) reports the p-value from the formal test of equality of the RD treatment effects across the two spousal age gap groups. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Appendix

Table A1: Intent-to-Treat Effects of Rural Roads on IPV
(Alternate Polynomial Order = 2)

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
Eligible	−0.037	−0.048**	−0.004	−0.039
	(0.051)	(0.023)	(0.032)	(0.050)
Control Mean	0.26	0.06	0.10	0.22
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	3,329	4,252	3,569	3,329

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a second-order polynomial of the assignment variable, and a triangular kernel. Column (1) reports the composite indicator *IPV*, which equals one if a woman experienced at least one form of intimate partner violence–sexual, emotional, or physical–perpetrated by her partner during the last 12 months, and zero otherwise. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A2: Intent-to-Treat Effects of
Rural Roads on Severity of Physical Violence
(Alternate Polynomial Order = 2)

	Less Severe (1)	Severe (2)
Eligible	−0.027	−0.048*
	(0.050)	(0.028)
Control Mean	0.22	0.06
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Observations	3,329	3,438

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on the severity of physical violence in the last 12 months, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a second-order polynomial of the assignment variable, and a triangular kernel. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A3: Intent-to-Treat Effects of Rural Roads on IPV
(Alternate Kernels)

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
Panel A: Uniform				
Eligible	−0.018	−0.043**	0.005	−0.023
	(0.044)	(0.019)	(0.028)	(0.035)
Observations	2,206	2,359	2,206	3,329
Control Mean	0.27	0.06	0.10	0.22
Panel B: Epanechnikov				
Eligible	−0.052*	−0.055***	−0.022	−0.062**
	(0.038)	(0.020)	(0.026)	(0.038)
Observations	2,968	2,359	2,631	2,722
Control Mean	0.27	0.06	0.10	0.23
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months, using the MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and alternative kernel functions. Column (1) reports the composite indicator IPV, which equals one if a woman experienced at least one form of intimate partner violence—physical, sexual, or emotional—perpetrated by her partner during the last 12 months, and zero otherwise. Panel A reports estimates using the uniform kernel, while Panel B reports estimates using the Epanechnikov kernel. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A4: Intent-to-Treat Effects of
Rural Roads on Severity of Physical Violence
(Alternate Kernels)

	Less	Severe
	(1)	(2)
Panel A: Uniform		
Eligible	−0.014	−0.034**
	(0.034)	(0.023)
Observations	3,182	2,206
Control Mean	0.22	0.07
Panel B: Epanechnikov		
Eligible	−0.057**	−0.045**
	(0.038)	(0.021)
Observations	2,722	2,839
Control Mean	0.22	0.07
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on the severity of physical violence in the last 12 months, using the MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and alternative kernel functions. Column (1) reports the composite indicator *IPV*, which equals one if a woman experienced at least one form of intimate partner violence—physical, sexual, or emotional—perpetrated by her partner during the last 12 months, and zero otherwise. Panel A reports estimates using the uniform kernel, while Panel B reports estimates using the Epanechnikov kernel. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A5: Intent-to-Treat Effects of Rural Roads on IPV
(Alternate Bandwidths)

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
Panel A: 2*MSE				
Eligible	−0.013	−0.024*	−0.008	−0.007
	(0.027)	(0.016)	(0.020)	(0.029)
Observations	7,945	4,887	5,737	6,161
Control Mean	0.28	0.06	0.10	0.23
Panel B: CER				
Eligible	−0.056*	−0.101***	−0.010	−0.056*
	(0.034)	(0.018)	(0.023)	(0.036)
Observations	2,631	1,601	1,934	2,079
Control Mean	0.27	0.06	0.10	0.23
Panel C: 2*CER				
Eligible	−0.016	−0.041***	−0.007	−0.025
	(0.028)	(0.016)	(0.020)	(0.029)
Observations	5,309	3,182	3,729	4,252
Control Mean	0.27	0.06	0.10	0.23
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months, using alternative bandwidths with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Column (1) reports the composite indicator *IPV*, which equals one if a woman experienced at least one form of intimate partner violence—physical, sexual, or emotional—perpetrated by her partner during the last 12 months, and zero otherwise. Panel A reports estimates using twice the MSE-optimal bandwidth, Panel B reports estimates using the CER-optimal bandwidth, and Panel C reports estimates using twice the CER-optimal bandwidth. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A6: Intent-to-Treat Effects of Rural Roads on Severity of Physical Violence (Alternate Bandwidths)

	Less (1)	Severe (2)
Panel A: 2*MSE		
Eligible	−0.004	−0.028**
	(0.029)	(0.015)
Observations	6,333	7,134
Control Mean	0.23	0.06
Panel B: CER		
Eligible	−0.047	−0.041**
	(0.036)	(0.020)
Observations	2,079	2,359
Control Mean	0.22	0.07
Panel C: 2*CER		
Eligible	−0.021	−0.031**
	(0.029)	(0.016)
Observations	4,252	4,743
Control Mean	0.22	0.06
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on the severity of physical violence in the last 12 months, using alternative bandwidths with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, and a triangular kernel. Column (1) reports the composite indicator *IPV*, which equals one if a woman experienced at least one form of intimate partner violence—physical, sexual, or emotional—perpetrated by her partner during the last 12 months, and zero otherwise. Panel A reports estimates using twice the MSE-optimal bandwidth, Panel B reports estimates using the CER-optimal bandwidth, and Panel C reports estimates using twice the CER-optimal bandwidth. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A7: Intent-to-Treat Effects of Rural Roads on IPV

	IPV	Sexual	Emotional	Physical
	(1)	(2)	(3)	(4)
Eligible	−0.052*	−0.046***	−0.014	−0.057**
	(0.037)	(0.017)	(0.024)	(0.036)
Control Mean	0.27	0.06	0.10	0.23
District-Threshold FE	Yes	Yes	Yes	Yes
Survey-Month FE	Yes	Yes	Yes	Yes
Time of Day FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	2,968	2,968	2,968	2,968

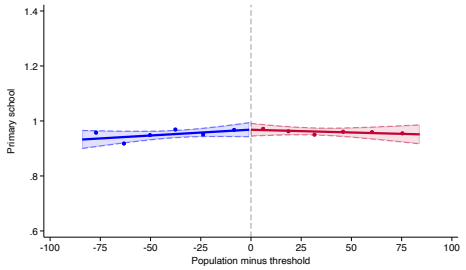
Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on IPV in the last 12 months, using MSE-optimal bandwidth with robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, a triangular kernel, and same number of observations across all outcome variables. Column (1) reports the composite indictor IPV, which equals one if a woman experienced at least one form of intimate partner violence – sexual, emotional, or physical, perpetrated by her partner during the last 12 months, and zero otherwise. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A8: Intent-to-Treat Effects of Rural Roads on the Severity of Physical Violence

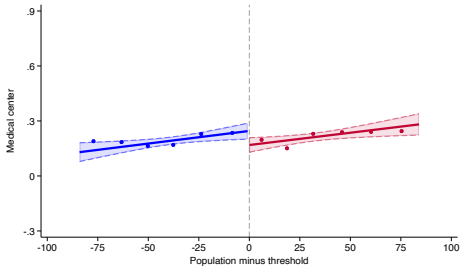
	Less Severe Physical Violence (1)	Severe Physical Violence (2)
Eligible	-0.052^{*}	-0.045^{***}
	(0.036)	(0.020)
Control Mean	0.22	0.06
District-Threshold FE	Yes	Yes
Survey-Month FE	Yes	Yes
Time of Day FE	Yes	Yes
Controls	Yes	Yes
Observations	2,968	2,968

Notes: This table presents the intent-to-treat effects of being eligible to receive new roads on the severity of physical violence in the last 12 months, using MSE-optimal bandwidth with a robust bias-corrected inference method (Calonico et al., 2020), a first-order polynomial of the assignment variable, a triangular kernel, and same number of observations across all outcome variables. Standard errors (in parentheses) are clustered at the village level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

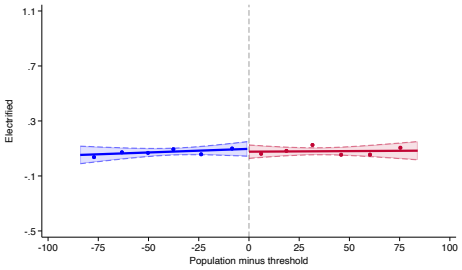
Figure A1: Balance Check on Village-Level Variables



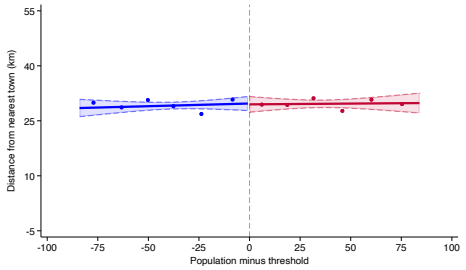
(a) Primary school



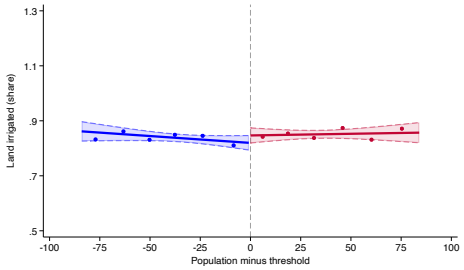
(b) Medical center



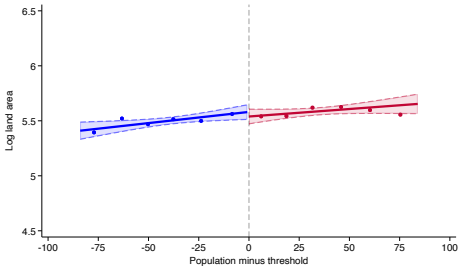
(c) Electrified



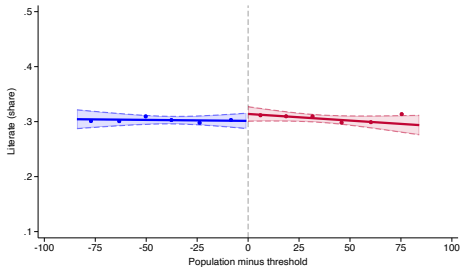
(d) Distance from nearest town (km)



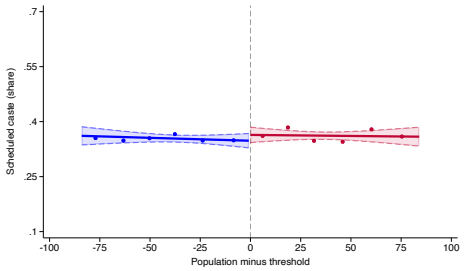
(e) Land irrigated (share)



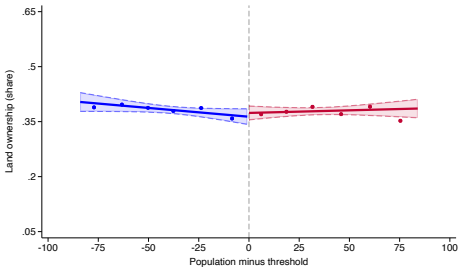
(f) Log land area



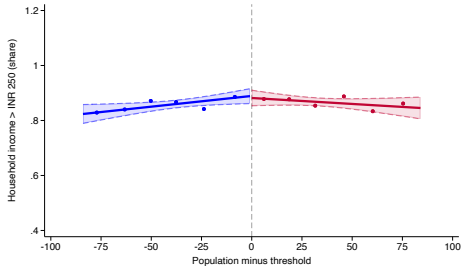
(g) Literate (share)



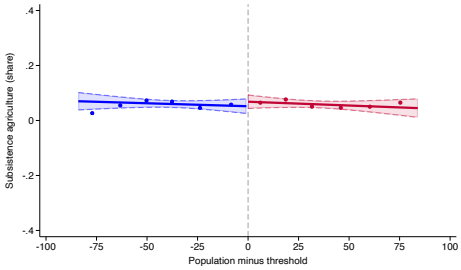
(h) Scheduled caste (share)



(i) Land ownership (share)



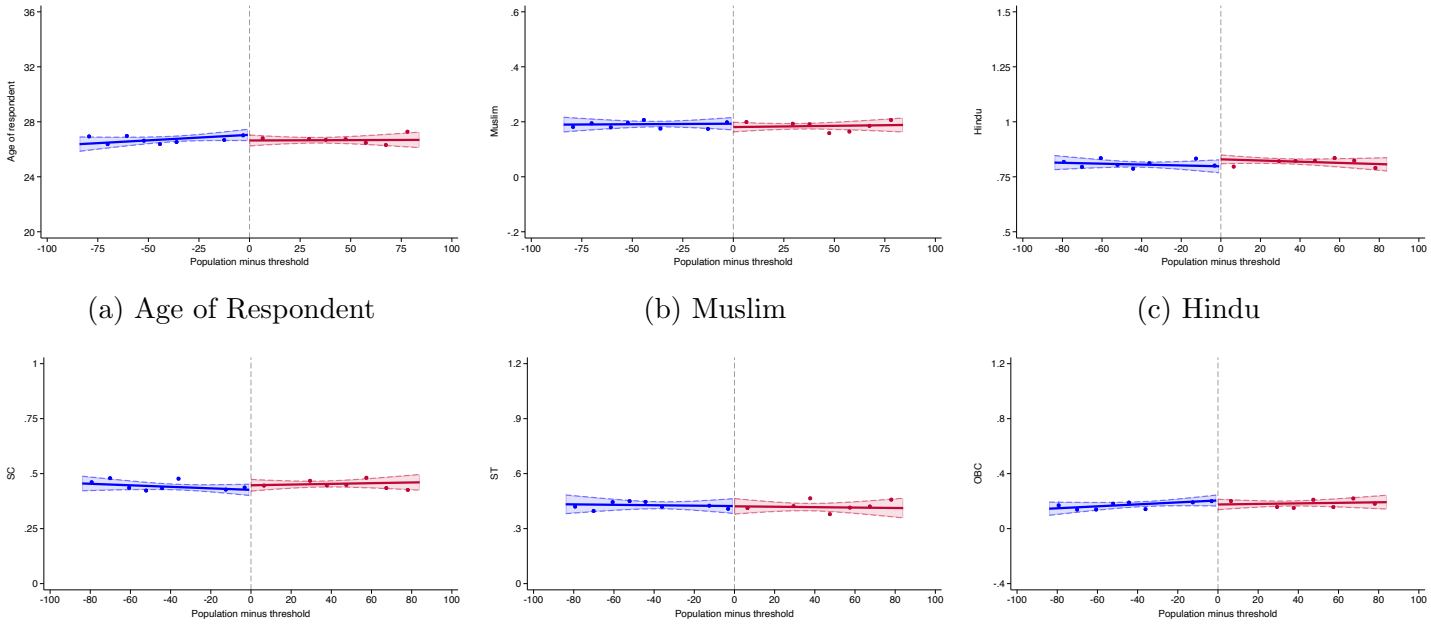
(j) Household income > INR 250 (share)



(k) Subsistence agriculture (share)

Notes: Panels A-K present regression discontinuity estimates for predetermined vilage-level characteristics by plotting the residualized values of the outcomes as a function of the normalized 2001 village population relative to the eligibility threshold. Each point represents the mean outcome within a population bin. All regressions control for district-threshold fixed effects and use heteroskedasticity-robust standard errors. Population is normalized by subtracting the state-specific eligibility threshold (500 or 1,000). Shaded areas represent 95% confidence intervals.

Figure A2: Balance Check on Individual-Level Variables

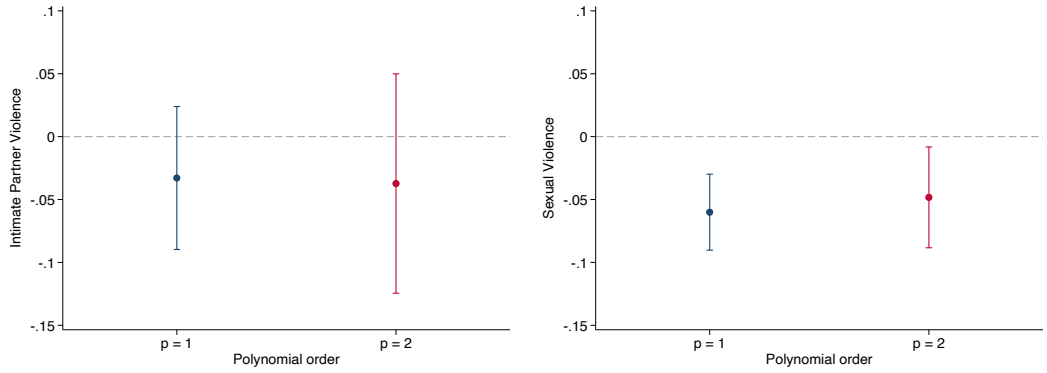


(a) Age of Respondent (b) Muslim (c) Hindu

(d) SC (e) ST (f) OBC

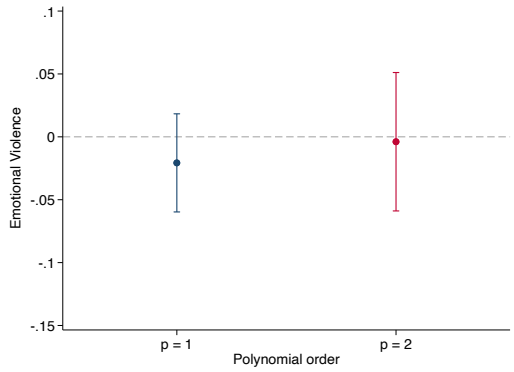
Notes: Panels A-F present regression discontinuity estimates for predetermined individual-level characteristics by plotting the residualized values of the outcomes as a function of the normalized 2001 village population relative to the eligibility threshold. Each point represents the mean outcome within a population bin. All regressions control for district-threshold fixed effects, survey-month fixed effects and time-of-day fixed effects. Population is normalized by subtracting the state-specific eligibility threshold (500 or 1,000). Standard errors are clustered at the village level. Shaded areas represent 95% confidence intervals.

Figure A3: Alternative Polynomial Orders

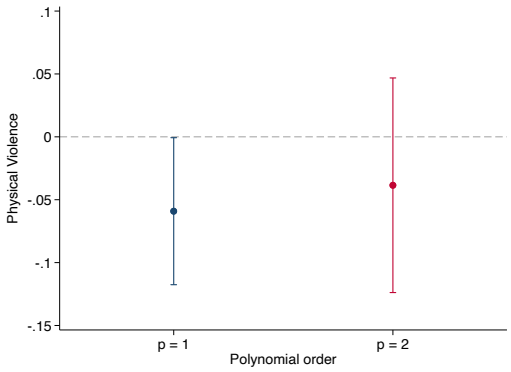


(a) IPV

(b) Sexual



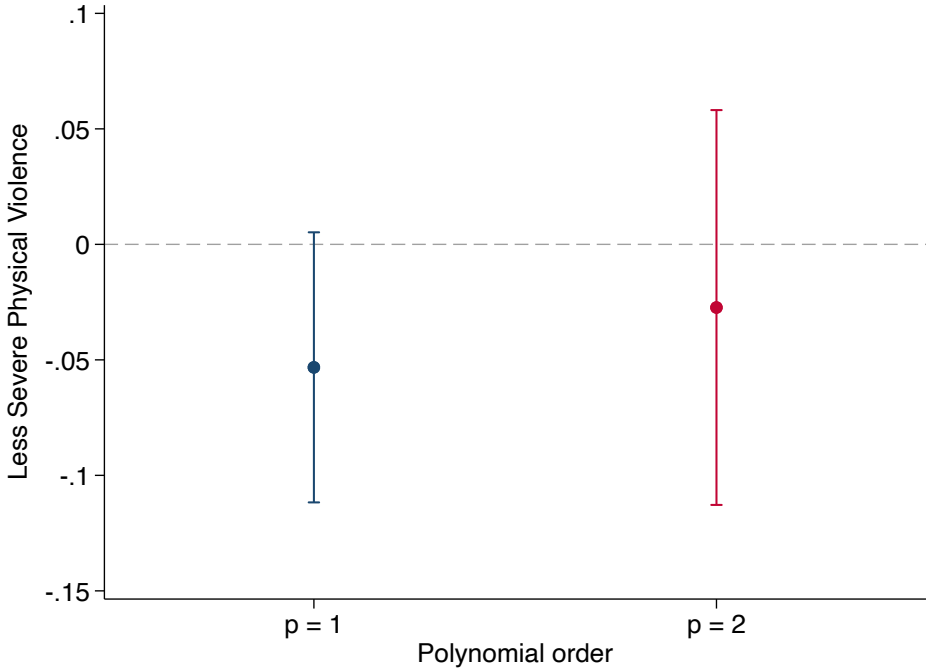
(c) Emotional



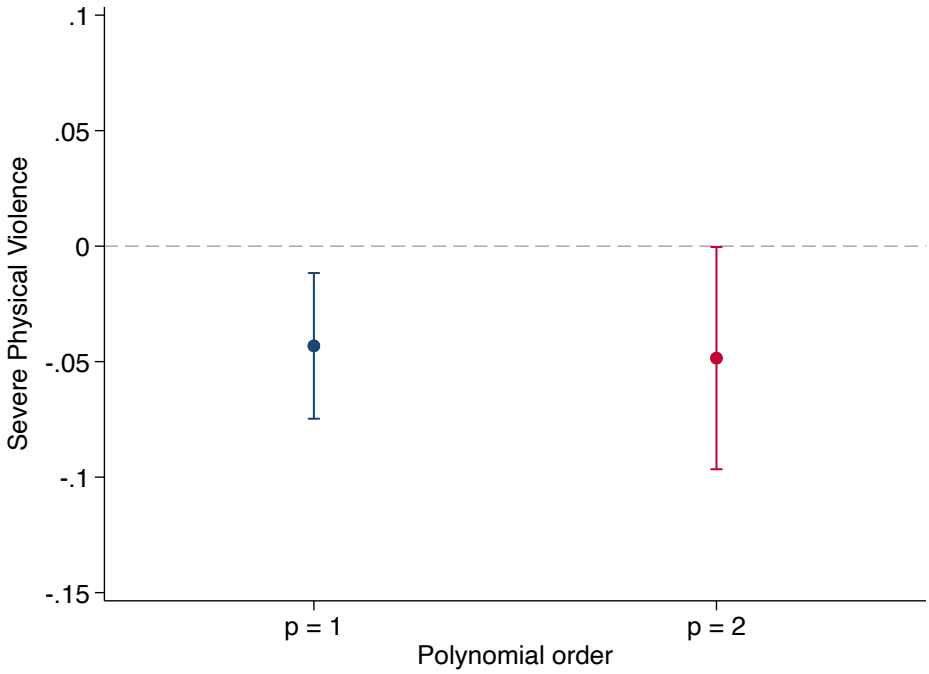
(d) Physical

Notes: This figure presents robustness checks for the reduced-form estimates of the effect of eligibility to receive a new road on the prevalence of intimate partner violence in the last 12 months using alternative polynomial orders. Panels A–D report estimates for IPV, sexual violence, emotional violence, and physical violence, respectively. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 95% confidence intervals are reported.

Figure A4: Alternative Polynomial Orders



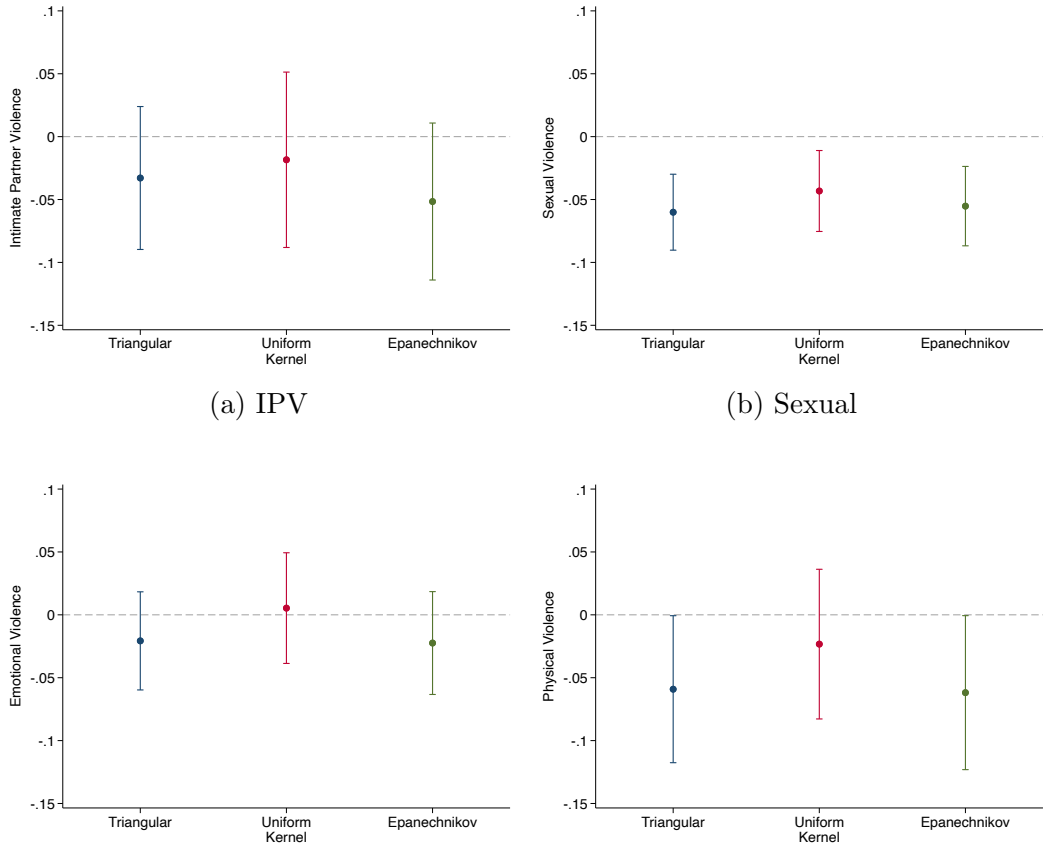
(a) Less Severe



(b) Severe

Notes: This figure presents robustness checks for the reduced-form estimates of the effect of eligibility to receive a new road on the severity of physical violence in the last 12 months using alternative polynomial orders. Panels A and B report estimates for less severe physical violence and severe physical violence, respectively. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 95% confidence intervals are reported.

Figure A5: Alternative Kernels

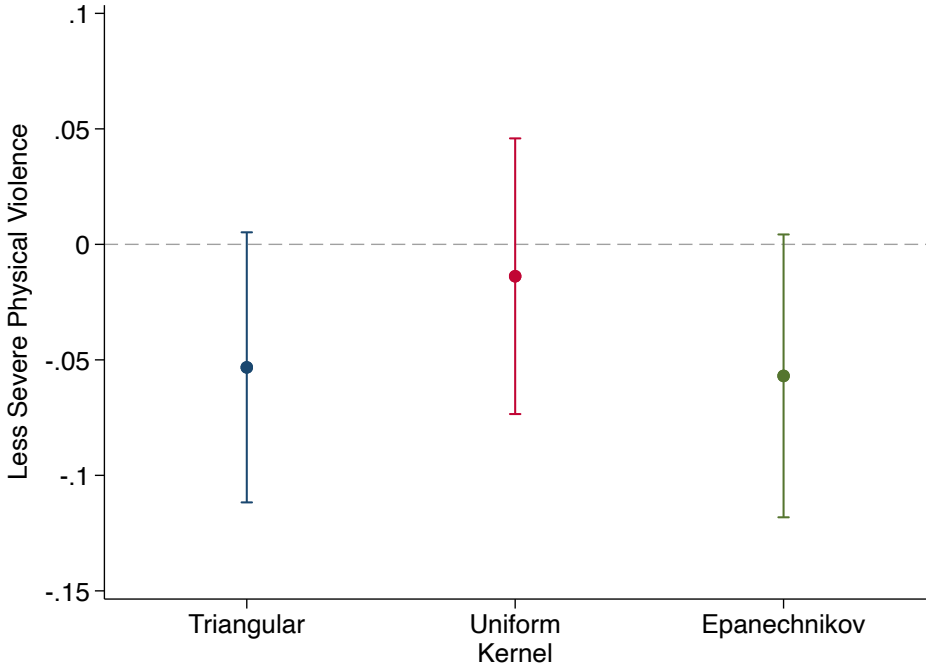


(a) IPV (b) Sexual

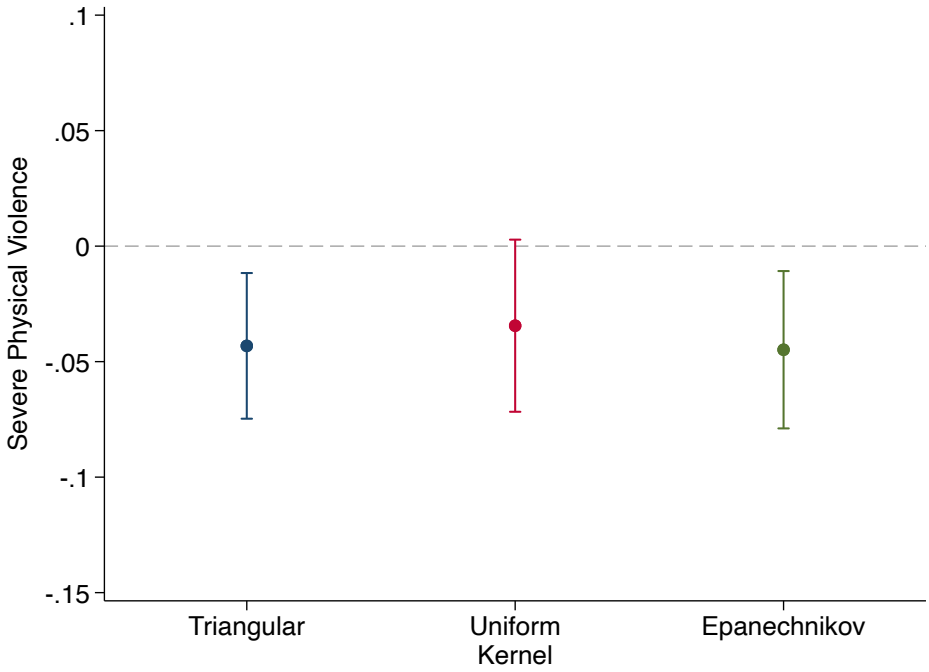
(c) Emotional (d) Physical

Notes: This figure presents robustness checks for the reduced-form estimates of the effect of eligibility to receive a new road on the prevalence of intimate partner violence in the last 12 months using alternative kernel functions. Panels A–D report estimates for IPV, sexual violence, emotional violence, and physical violence, respectively. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 95% confidence intervals are reported.

Figure A6: Alternative Kernels



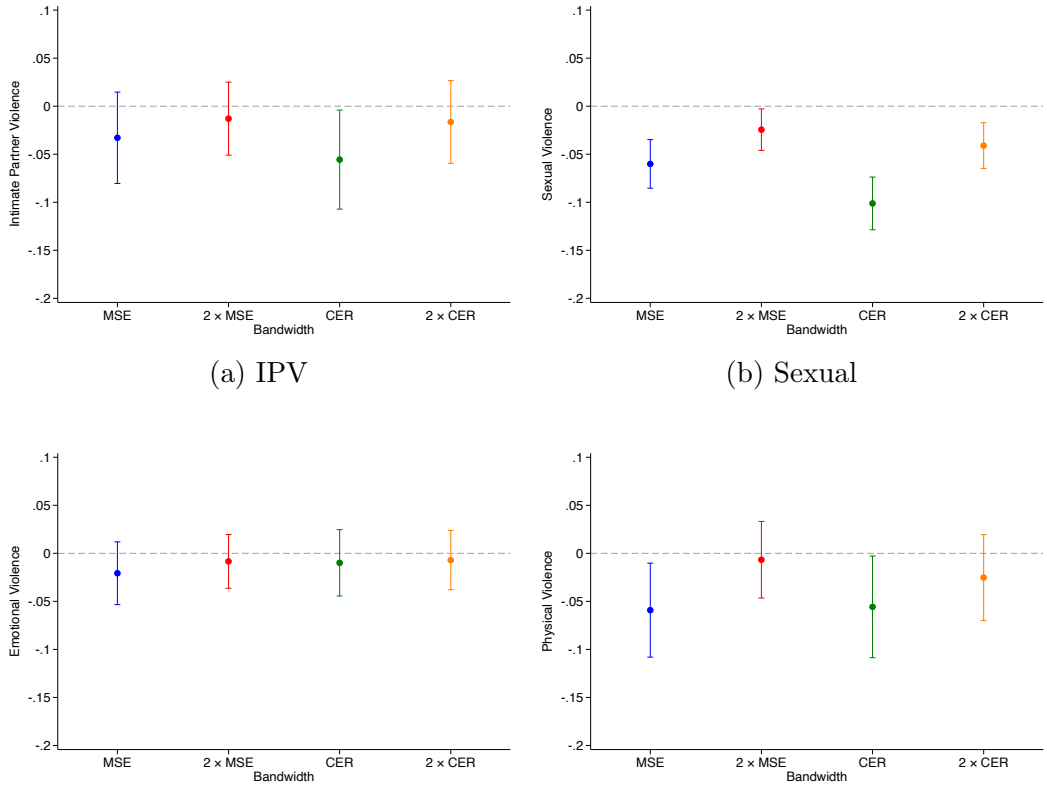
(a) Less Severe Physical Violence



(b) Severe Physical Violence

Notes: This figure presents robustness checks for the reduced-form estimates of the effect of eligibility to receive a new road on the severity of physical violence in the last 12 months using alternative kernel functions. Panels A and B report estimates for less severe physical violence and severe physical violence, respectively. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 95% confidence intervals are reported.

Figure A7: Alternative Bandwidths

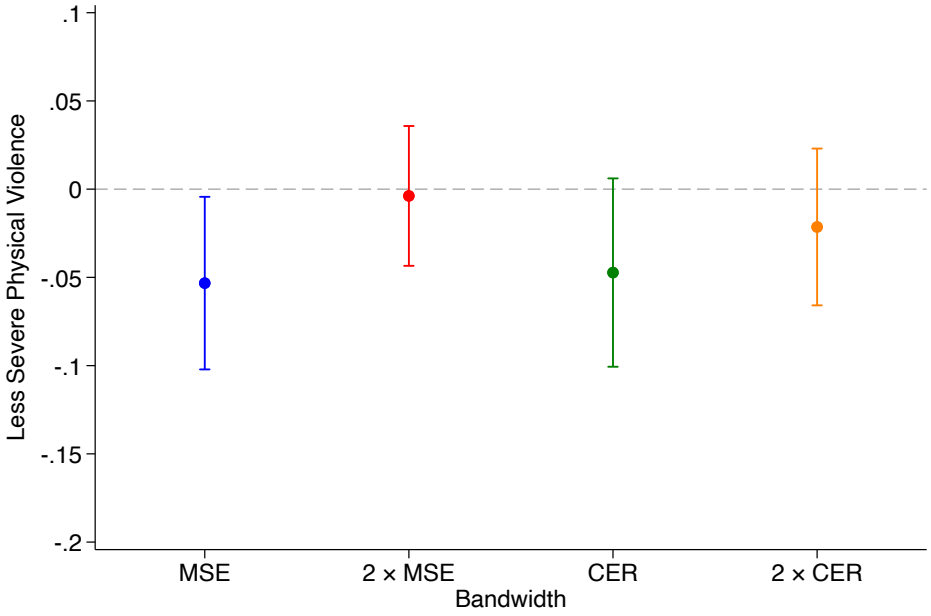


(a) IPV (b) Sexual

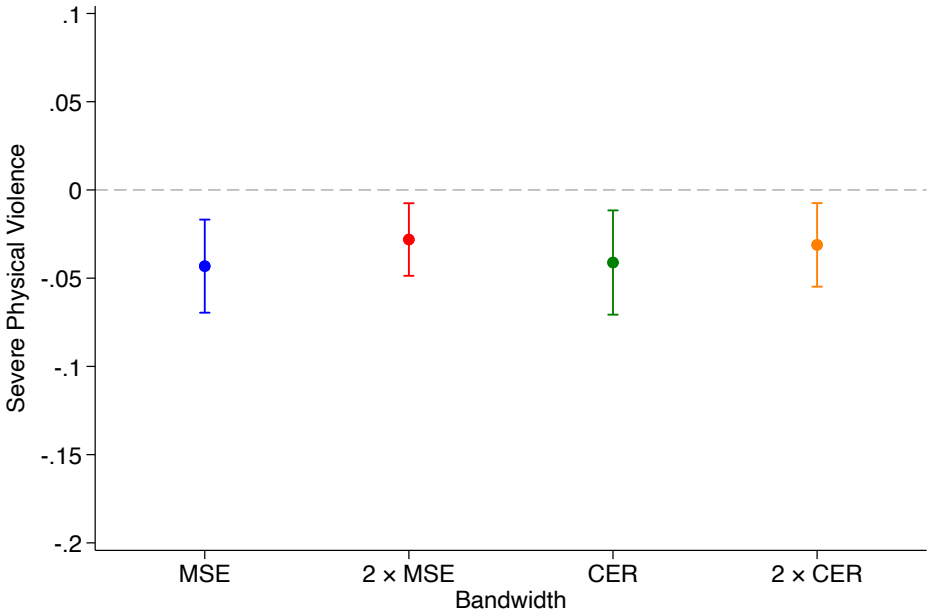
(c) Emotional (d) Physical

Notes: This figure presents robustness checks for the reduced-form estimates of the effect of eligibility to receive a new road on the prevalence of intimate partner violence in the last 12 months using alternative bandwidths. Panels A–D report estimates for IPV, sexual violence, emotional violence, and physical violence, respectively. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 90% confidence intervals are reported.

Figure A8: Alternative Bandwidths



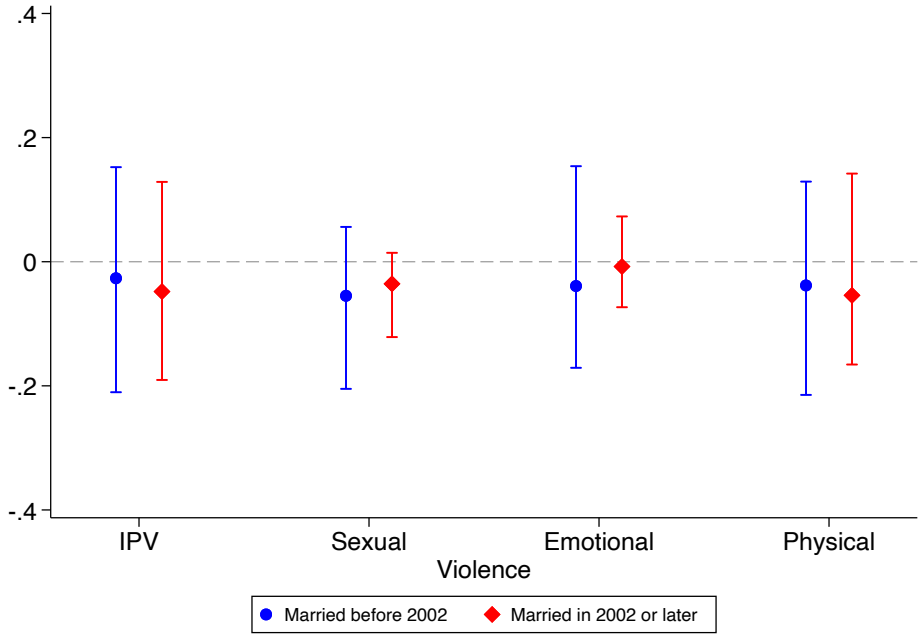
(a) Less Severe Physical Violence



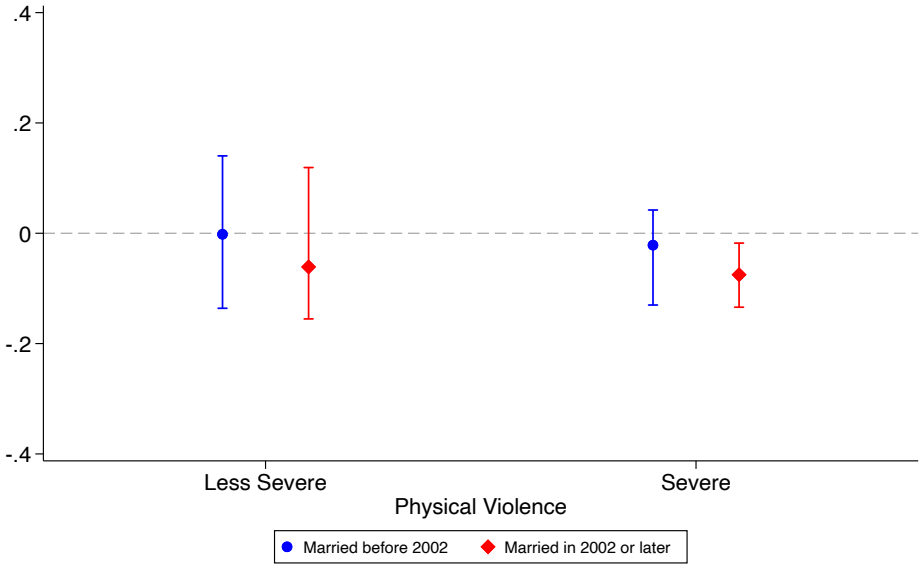
(b) Severe Physical Violence

Notes: This figure presents robustness checks for the reduced-form estimates of the effect of eligibility to receive a new road on the severity of physical violence in the last 12 months using alternative bandwidths. Panels A and B report estimates for less severe physical violence and severe physical violence, respectively. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 90% confidence intervals are reported.

Figure A9: Heterogeneous Effects of Rural Roads on IPV by Marriage Timing



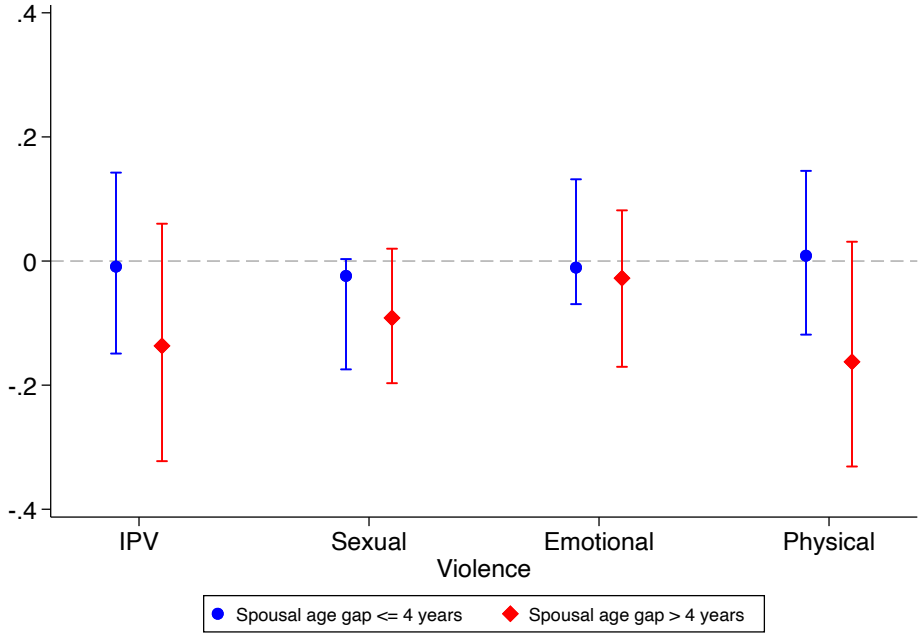
(a) Prevalence of IPV



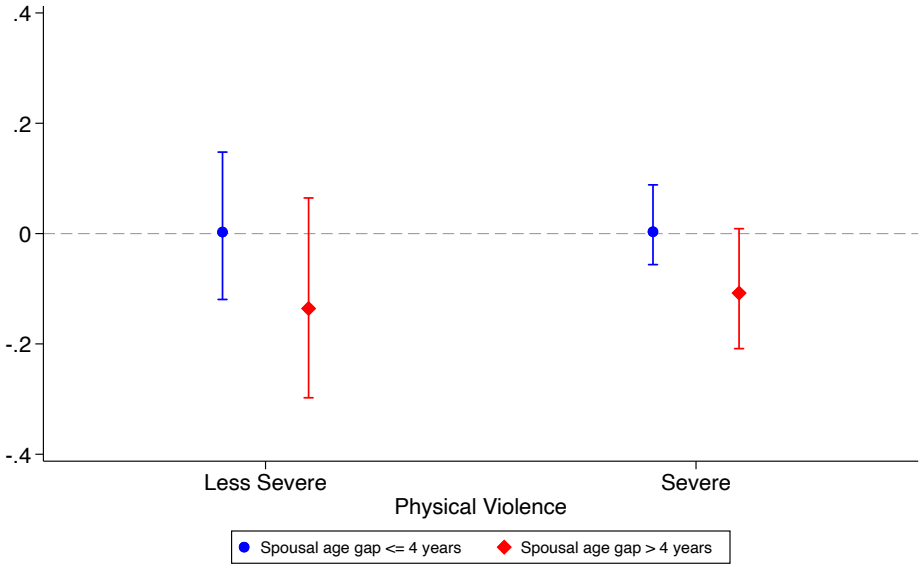
(b) Severity of Physical Violence

Notes: This figure presents heterogeneous reduced-form estimates of the effect of eligibility to receive a new road on intimate partner violence by marriage timing. Women are classified as married before 2002 if they were married before the year 2002 and as married in 2002 or later if they were married in 2002 or later. Panel A reports estimates for the prevalence of IPV in the last 12 months, and Panel B reports estimates for the severity of physical violence in the last 12 months. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 95% confidence intervals are reported.

Figure A10: Heterogeneous Effects of Rural Roads on IPV by Spousal Age Gap



(a) Prevalence of IPV



(b) Severity of Physical Violence

Notes: This figure presents heterogeneous reduced-form estimates of the effect of eligibility to receive a new road on intimate partner violence by spousal age gap. The Spousal age gap is an indicator that takes the value one if the difference between the husband's and wife's ages is greater than four years and zero if the difference is less than or equal to four years. Panel A reports estimates for the prevalence of IPV in the last 12 months, and Panel B reports estimates for the severity of physical violence in the last 12 months. Each estimate is obtained from a separate regression. All regressions control for district-threshold fixed effects, survey-month fixed effects, time-of-day fixed effects, and village-level and individual-level controls. Standard errors are clustered at the village level. 95% confidence intervals are reported.