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Regional bombs and public labour obligations

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Abstract

This study examines the long-term effects of wartime experiences on individual contributions to local public labour obligations, seen as a form of self-provision of public services. Analysing data from one of the most intensive regional bombing campaigns in history during the Vietnam War and six national census waves, I identify a U-shaped pattern in the causal relationships using an instrumental variable. These findings indicate that individuals with wartime exposure initially contribute less to public labour obligations. Their contributions increase when they endure high-intensity regional bombings. This pattern is particularly evident in Northern Vietnam, rural regions, and among people born before 1975. The findings make a novel contribution to our understanding of the long-term effects of early-life adversities on public service activities.

CGR WORKING PAPER SERIES

Regional bombs and public labour obligations

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This study examines the long-term effects of wartime experiences on individual contributions to local public labour obligations, seen as a form of self-provision of public services. Analysing data from one of the most intensive regional bombing campaigns in history during the Vietnam War and six national census waves, I identify a U-shaped pattern in the causal relationships using an instrumental variable. These findings indicate that individuals with wartime exposure initially contribute less to public labour obligations. Their contributions increase when they endure high-intensity regional bombings. This pattern is particularly evident in Northern Vietnam, rural regions, and among people born before 1975. The findings make a novel contribution to our understanding of the long-term effects of early-life adversities on public service activities.

Keywords: regional bombs; prosocial behaviour; public labour obligation; Vietnam

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INTRODUCTION

Wars and conflicts threaten development and regional management. Notably, the world is witnessing major conflicts like the Russia Ukraine war and attacks in Israel. Living in fragile, conflict-affected areas profoundly impacts life quality and long-term behaviour. The Russian invasion of Ukraine on 24 February 2022 and the Hamas attack on Israeli citizens on 7 October 2023 painfully remind us of war's devastating impact, deeply affecting socio-economic landscapes and lingering in societal memory. Ukraine's shattered infrastructure, like Vietnam's decade-long bombardment (1965-1975), speaks volumes. North and South Vietnam, with differing economic and political systems, endured the brunt of this conflict differently. This study examines the long-term effects of early war exposure on public labour obligations in regional management. In early childhood, the developing brain is particularly susceptible to prolonged exposure to high cortisol levels, a condition known as toxic stress. This exposure can cause permanent changes in brain structure that reduce the ability to regulate stress and fear responses. Therefore, I hypothesise that individuals exposed to war in formative years are less likely to engage in public service (Danese and McEwen 2012).

Building on regional management theories of self-provision of public services (Mizrahi et al. 2012) and individual traits in new public and regional management (Katzenelson and Weingast 2005; Haynes 2015; Cepiku and Mastrodascio 2021; Slavíková and Jílková 2011), I use a unique dataset of 91,220 observations from six waves of Vietnam's national census. The analysis of these data clearly illustrate the U-shaped relationship between the number of bombs (a proxy for early wartime exposure) and public labour obligations. *Public labour obligations* here refers to a hybrid of compulsory and voluntary individual decisions. I also study two potential mechanisms behind this relationship. First, individuals from Northern Vietnam, who are more inclined towards collectivist norms, tend to exhibit a U-shaped pattern in their contributions to public labour obligations. Second, rural residents in high bombing areas increase their public labour contributions after the U-shaped pattern's peak. Third, the effects are stronger in those who experienced wartime, especially individuals aged 35 or older. These people were born during the Vietnam War, significantly influencing their later behaviour towards public contributions.

This study significantly contributes to the literature on the nexus between New Public Management (NPM) and the political economy of quasi-experimental events, specifically the Vietnam War. While studies like Miguel and Roland (2011) found bombings did not affect poverty rates, individual-level effects may differ, especially across population segments (e.g., younger vs. older, rural vs. urban). Thus, this study examines the real-life impacts of the Vietnam War on public service activities.

This study examines the Vietnam War's real-life impacts on public service. Despite being considered a voluntary choice, these obligations contravene the ILO's minimum standards as they require a minimum contribution equivalent to 10 working days. While individuals could contribute more, this 10-day threshold was a mandatory minimum, highlighting the tension between voluntary participation and regulatory requirements.

The remainder of this paper is structured as follows. The next section offers a concise literature review. I then describe the data and empirical strategies employed in this study. Subsequently, I present the main findings and robustness analysis. I end the article with a discussion of the results and main conclusions.

LITERATURE REVIEW

Co-production Within Public Administration and Management

Co-production precisely links voluntary prosocial behaviour and public labour obligations, defined as voluntary or involuntary involvement of public service users in design, management, delivery, and evaluation (Osborne, Radnor, and Strokosch 2016). This scope is crucial, as service management views co-production as an essential, inalienable component of service delivery that occurs regardless of user awareness, willingness, or coercion (Osborne et al. 2016; Kellogg and Nie 1995). Unwilling or coerced consumers, common in public services like social justice or child protection services, distinguish these services from the for-profit sector and demand reevaluating voluntary agencies' role in value creation (Osborne 2018). In extreme cases, resistance from unwilling service users is seen as co-production (Osborne et al. 2016). Therefore, linking citizen compliance with mandated duties (public labour obligations)to prosocial motivation engages directly with the tension in public administration between the necessary degree of voluntary citizen involvement, whether voluntary (aligning with prosocial motivation) or imposed (aligning with civic duty).

To enhance conceptual precision, the literature advocates moving beyond co-production toward the dynamic concept of value co-creation (Osborne et al. 2016;

Osborne, Nasi, and Powell 2021). This shift, mentioned in the public service logic concept, indicates that co-production is only one explicit production process within a larger system of value creation situated alongside co-design (Osborne et al. 2016; Osborne 2018). Accordingly, public service logic emphasises that public service organisations only offer services, and the citizen or service user creates value by integrating this offering with their needs, abilities, and life experiences, resulting in value-in-use and value-in-context (Grönroos and Voima 2013; Osborne 2018). This approach links the user's dual role as public service recipient and citizen to broader societal outcomes (Osborne 2018; Pestoff 2013). Thus, analysing compliance with public labour obligations as an indirect measure of prosocial activities situates research within the public administration management examination of how citizen resources, motivation, and mandatory duties interact to co-create public value (Osborne and Strokosch 2013; Alford 2016).

Prosocial Behaviour

Analysing compliance with public labour obligations as an indirect measure of prosocial activities situates research examining how citizen resources, motivation, and duties co-create public value (Osborne and Strokosch 2013; Alford 2016). While contemporary economic studies concentrate on incentives (Bénabou and Tirole 2006), social norms (Rössler, Rusch, and Friehe 2019), trust and happiness (Carattini and Roesti 2025), significant early-life events such as natural disasters (Méon and Verwimp 2022) or other adverse life experiences (Rao et al. in 2011) as external factors May encourage prosocial behaviour. Although anecdotal evidence suggests a link between early-life shocks and prosocial behaviour, the specific impact of wartime experiences, such as the total number of bombs dropped during the Vietnam War, remains unclear. This study aims to bridge this research gap using an indirect measurement of prosocial behaviour through public labour obligations.

Midlarsky, Kahana, and Belser (2015) find a U-shaped relationship between volunteer hours and psychological well-being. Current research shows behavioural responses either mitigate or amplify early-life shocks (Yi et al. 2015). This study, motivated by evidence suggesting that early-life shocks like exposure to wartime conditions and bombings influence prosocial behaviour, reflected in monetary contributions to public services (Black et al. 2021). Although the literature links prosocial behaviour to motivation for public services (Esteve et al. 2016), such behaviour usually appears through volunteering, helping strangers, voting, contributing to organisations, donating blood, joining rescue squads, or sacrificing one’s life (Bénabou and Tirole 2016).

Psychological and Behavioural Pathways from Conflict to Public Labour Obligations

Early wartime exposure shapes later civic behaviour via known psychological and social mechanisms. These pathways predict both lower and higher contributions to public labour obligations, which reconciles the non-monotonic patterns I test in hypotheses 01 and 02. They also challenge the common *assumption of resilience* that individuals simply bounce back from hardship unchanged (Almond, Currie, and Duque 2018; Barceló 2021; Singhal 2019; Vickers and Kouzmin 2001).

Exposure to violence induces chronic stress and trauma that limit individuals' capacity for demanding social interactions and civic participation (Kasl 1984; Danese and McEwen 2012; Singhal 2019), plausibly reducing willingness to engage in discretionary public tasks or make above-minimum contributions to public labour funds. Economic factors reinforce this; early-life shocks and health adversity raise the opportunity cost of time and money, reducing prosocial transfers (Almond et al. 2018; Yi et al. 2015). In public service, vulnerability and secondary traumatisation trigger defensive, cautious, or avoidant behaviours that hinder constructive co-production with citizens (Davidovitz 2025; Miller, Trochmann, and Drury 2022). Similarly, *conflict contagion* highlights how actors carry negative experiences as heuristics from high-conflict settings into other forums, reducing cooperation (McLaughlin, Mewhirter, and Lubell 2022). These channels make individuals less likely to volunteer or exceed mandated contributions, consistent with a decline in low-to-moderate exposure. Adversity can foster prosocial behaviour *altruism born of suffering* via meaning-making, empathy, and local reciprocity (Rao et al. 2011; Black et al. 2021; Méon and Verwimp 2022; Barceló 2021). Empathy underlies cooperation in social dilemmas (Rumble, Van Lange, and Parks 2010; Parks, Joireman, and Van Lange 2013). Repeated coordination under threat can create *collective efficacy,* lowering co-production costs post-conflict. Vietnam shows durable local cooperation norms and institutions (Dell, Lane, and Querubin 2018; Ho, Martinsson, and Olsson 2022). Where institutions direct efforts to public tasks (e.g. workdays, village funds), extreme-exposure groups may increase their public labour contributions. These mechanisms predict rising participation at higher exposure, explaining the U-shape's right side.

Public labour contribution behaviours lie between co-production and value co-creation; citizen effort and discretion are vital, even for mandatory tasks (Osborne and Strokosch 2013; Osborne et al. 2016; Osborne 2018; Alford 2016; Grönroos and Voima 2013; Mizrahi 2012). Conflict exposure alters citizens' preferences (motivation, trust, identity) and capabilities (psychological bandwidth, time/income constraints) at this interface. The net effect can change signs as exposure intensifies: negative at low-to-moderate levels (trauma, distrust, crowding-out) and positive at high levels (empathy, solidarity, collective efficacy), implying a U-shape consistent with my empirical approach (Lind and Mehlum 2010).

A critical theoretical question is why opposing mechanisms dominate at different exposure levels. Trauma, distrust, and prosocial solidarity coexist at all wartime exposure levels, with varying relative strengths. At low-to-moderate exposure, individuals face disruption and psychological stress without forming strong collective coping mechanisms. In such contexts, trauma-related responses like withdrawing from social activities or reduced trust in institutions likely dominate behaviour. However, extreme exposure fundamentally changes the social environment. Communities facing persistent severe threats rely on collective coordination for survival and reconstruction. Repeated cooperation under shared-risk conditions strengthens social bonds, generates collective efficacy, and reinforces mutual aid norms. Studies of disasters and armed conflict show extreme adversity fosters altruism born of suffering and durable cooperative norms; thus, at high wartime exposure, prosocial mechanisms may outweigh trauma's negative effects, creating the proposed U-shaped relationship.

Regional Public Labour Obligations in Vietnam

Improving public service delivery effectiveness and public perceptions thereof are key NPM goals (Fazekas and Czibik 2021). Public labour obligations are a collective system harnessing individual capabilities for societal benefit. Unlike earlier models mandating such contributions by the government (Morcom, 2016), the contemporary approach lacks state control over production. As Wallerstein (1995) notes, it encourages voluntary contributions to public labour funds, shifting towards a mix of obligatory and voluntary citizen participation. Ordinance No. 15/1999/PL-UBTVQH10 3 September 1999) states that each citizen must contribute at least 10 annual public labour days, regardless of actual labour form. Citizens could pay instead of engaging in public service activities, and they could contribute more than 10 working days. Therefore, public labour obligations could be a new public service (Lapuente and Van de Walle, 2020). The existing literature focuses on NPM theories from doctrinal beliefs (Barzelay, 2000).

NPM theory involves diverse, sometimes contradictory reforms (Dunleavy et al., 2006); public labour obligations include compulsory contributions and citizens' voluntary willingness. This study builds on the established body of literature in NPM theory, which focuses on integrating *management ideas from the business and private sector into public services*, (Haynes 2015). The systematic review by Cepiku and Mastrodascio (2021) makes clear that NPM can lead to equitable outcomes through representative bureaucracy. This approach improves public services by fostering active representation and ensuring equity.

These mechanisms' strengths may also depend on local institutional and social contexts. In Vietnam, historical and regional differences shaped communities' responses to wartime shocks. Northern Vietnam's strong collectivist norms and village-level cooperation (Dell et al. 2018; Ho et al. 2022) suggest that extreme wartime exposure may prompt coordinated rebuilding and collective public service, reinforcing the U-shaped relationship's positive side. By contrast, regions with weaker collective governance traditions may experience the negative effects of trauma for longer periods before cooperative responses emerge.

Rural environments may amplify these dynamics. Rural districts faced more bombing and relied more heavily on community cooperation for local public goods like roads, irrigation, and infrastructure. Severe destruction may intensify local coordination and mutual assistance for collective reconstruction. Thus, the shift from trauma-driven withdrawal to solidarity-based cooperation may be clearer in rural areas, causing the U-shaped pattern in public labour obligations.

Hypothesis Development

Although the literature recognises the shift from traditional to new public management (Dunleavy and Hood 1994), the underlying mechanisms are unclear. Public management is the cornerstone of political science (Kettl 2022). According to Kettl (2022), political science and public administration are closely intertwined, with wartime experiences potentially undermining or bolstering public administration systems.

The Vietnam War is known for controversial practices like the use of body counts, greatly skewed perceptions of actual events. By examining the Vietnam War as a unique context for early traumatic experiences, this study explores citizens' reactions to public service after experiencing political shocks. Public services self-provision theory states that citizens provide services when demand is strong but public sector quality is poor, prompting alternative strategies (Mizrahi et al. 2012). Another perspective explains public service behaviour through differences in imputed and induced preferences (Katzenelson and Weingast 2005). Inherent (or imputed) preferences, rooted in personality, explain how early shocks like wartime exposure relate to public service engagement. Based on this discussion, I propose the following hypothesis:

H_{01}: Individuals with wartime exposure are less likely to participate in public service activities.

Drawing on prosocial behaviour theory, extreme early-life shocks could lead to significantly different decisions. Specifically, Bernile, Bhagwat, and Rau (2017) show a non-linear relationship between the intensity of early-life exposure to fatal disasters and risk-taking behaviour, indicating that people may become more extreme in their actions following life-altering shocks. Almond et al. (2018) highlight that shocks, investments, and interventions can have complex and still-unclear interactions. Consequently, wartime shocks in early life could also encourage public service behaviour. Thus, I propose a second hypothesis:

H_{02}: The relationship between wartime exposure and contributions to public service activities is non-monotonic.

The theoretical rationale for a non-linear relationship, like a U-shaped or more commonly an inverted U-shape concerning social interaction effects, arises from the tension between competing behavioural or economic mechanisms as contextual factors change. In the context of repeated public goods provision, a non-monotonic group size effect emerges because of the interaction of two contrasting forces under higher group size: the standard free-riding effect and the novel large-scale effect (Wang and Zudenkova 2016). Therefore, the role of household size as well as regional capacity could matter. In dynamic political contests, non-linear institutional evolution is driven by strategic delegation resolving conflicts from citizen heterogeneity, acting as a commitment device to improve private decision efficiency, yielding monotonic non-linear political succession paths; class conflict from wealth heterogeneity causes downward succession toward lower wealth, while ideological conflict from public good valuation differences causes upward succession toward higher valuation (Jack and Lagunoff 2006). The context of identity creates non-linear effects. Empirical tests show conflict effort rises significantly only when a real identity, like race, is salient, not with minimal classification identity, which indicates non-monotonic salience effects (Chowdhury, Jeon, and Ramalingam 2016). Moreover, the interaction structure is crucial: public goods contributions are higher in dynamic multi-round than static one-shot games, suggesting trust-building via gradual history-dependent contributions matters, even with constant payoffs. Finally, epidemiological modelling often uses a non-monotonic incidence function to capture psychological effects on susceptibility, with transmission rising then falling as protective behaviours increase (Prem Kumar et al. 2021). Similarly, early-life bombing exposure affects civic contributions oppositely: low-to-moderate exposure reduces willingness due to trauma, stress, and economic strain limiting the resources for public tasks (Almond et al. 2018; Danese and McEwen 2012; Singhal 2019); extreme exposure triggers altruism, threat-induced reciprocity, collective efficacy from repeated coordination, and strong local governance. Specifically in Vietnam's north, this response translated cohesion into public tasks (Barceló 2021; Black et al. 2021; Méon and Verwimp 2022; Dell et al. 2018). The net effect is non-monotonic: negative at low/moderate exposure due to trauma, distrust, and crowding-out, and positive at high exposure due to solidarity, collective efficacy, and institutional channelling, producing a U-shaped relationship with stronger right tail recovery where institutions and norms support coordination, for example, in northern and rural areas.

DATA AND EMPIRICAL STRATEGY

Data

The first empirical dataset consists of bombing data sourced from Miguel and Roland (2011) originating from the Defence Security Cooperation Agency (DSCA) archives within the United States National Archives under Record Group 218, titled "Records of the U.S. Joint Chiefs of Staff." The dataset encompasses comprehensive records of all ordnances deployed by the U.S. and allied aircraft and helicopters, as well as naval artillery fire, in Vietnam from 1965 to 1975. While the dataset contains gaps because of missing reports, it remains a widely recognised resource for analysing the impact of war on various social and economic aspects, including entrepreneurship

(Churchill et al. 2021), mental health shocks (Singhal 2019), and education (Cornelissen and Dang 2022). In summary, to assess the impact of wartime exposure, as indicated by bombings during the war between the U.S. and Vietnam, I employ a measure of district-level bombing intensity to match an individual in this area. This is quantified by the total volume of bombs, missiles, and rockets deployed per square kilometre by the U.S. military in Vietnam between 1965 and 1975. The data for this variable are sourced from Miguel and Roland (2011).

The second dataset is the Vietnam Household Living Standards Survey (VHLSS). Utilising six waves of the VHLSS conducted by the General Statistics Office (GSO) of Vietnam, this study seeks to leverage nationally representative data with a 12-month recall period. The survey waves cover 2010/2011 (wave 1), 2012/2013 (wave 2), 2014/2015 (wave 3), 2016/2017 (wave 4), 2018/2019 (wave 5), and 2020/2021 (wave 6). A significant advantage of the VHLSS is its repeated cross-sectional design. This study aims to include as much panel data as possible to observe repeated patterns in individual behaviours. Throughout all six waves of the survey, participants were asked, "How much do you contribute to public labour obligations?" This question falls under the household expenditure category. Notably, 2021 is the last year that the VHLSS questionnaire includes a question related to the public labour obligations fund, as mandated by the Vietnamese Law (Ordinance No. 15/1999/PL-UBTVQH10, issued on 3 September 1999), since Vietnam must follow the Forced Labour Convention, 1930 (No. 29) and the Forced Labour Convention, 1957 (No. 105) to stop public labour obligations. This legislation explicitly stipulates that Vietnamese citizens are obliged to dedicate a minimum of 10 working days annually to public activities. Alternatively, they could pay a monetary amount. Furthermore, the law allows for contributions that exceed the government-mandated minimum. According to the written law, the funds collected for public labour obligations are allocated towards enhancing social development. Contributions above the required amount for public labour obligations can be viewed as a form of prosocial behaviour, demonstrating support for social development. Overall, the VHLSS offers a comprehensive dataset for capturing individual variations in public labour contributions, particularly in monetary terms, for those who opt out of actual work activities. In addition to the primary variables of interest, the VHLSS database also includes socio-economic factors such as marital status, age, personal income, and gender. These variables are constructed at the individual level and aligned with the amount of money that each person contributes to public labour obligations. Control variables for external factors, such as geographic and climate controls (soil type and latitude), were obtained from Miguel and Roland (2011). Therefore, the complete dataset includes 91,220 observations for the six survey waves within 564 districts of 63 provinces. Figure 1 illustrates the geographic differences between areas heavily bombed by the U.S. during the Vietnam War and regions with public labour obligations.

[Figure 1 here]

Identification Strategy

The VHLSS contains a question regarding the individual's annual compulsory contribution to public labour obligations. All waves from 2010 to 2020 included this question. To examine the possibility of a U-shaped correlation between bombing intensity and public labour obligations, I define the model as follows:

$$\mathrm{PLO}_{\mathrm{i,t,p,d}} = \alpha + \beta \mathrm{Total}_{\mathrm{bomb}_{\mathrm{per}_{\mathrm{km2}_{\mathrm{i,p,d}}}}} + \gamma \mathrm{Total}_{\mathrm{bomb}_{\mathrm{per}_{\mathrm{km2sq}_{\mathrm{i,p,d}}}}} + \delta \mathrm{I}_{\mathrm{i,t,p,d}} + \vartheta \mathrm{X}_{\mathrm{p,d}} + \mu \mathrm{FE}_{\mathrm{p,t}} + \varepsilon. \quad (1)$$

Here, $PSC_{i,t,p,d}$ represent the contributions to the public labour fund made by individual *i* in year *t*, in district *d* of province *p*. $\mathrm{Total\_bomb\_per\_km2}_{i,p,d}$ and $\mathrm{Total\_bomb\_per\_km2\_sq}_{i,p,d}$ are the total counts of U.S. bombs, missiles, and rockets per square kilometre dropped in Vietnam between 1965 and 1975 from Miguel and Roland (2024), representing bombing intensity during the Vietnam War. These variables measure the intensity of individual *i*'s exposure in district *d* of province *p* in the past; therefore, I do not have any variation in year *t* (2010-2020) in the VHLSS. β and γ capture the effect of bombing on public labour obligations, and are expected to have negative and positive signs, respectively. The study includes two sets of control variables. (1) Individual characteristics, denoted as $I_{i,t,p,d}$, which vary for each individual *i* at each surveyed time *t* in district *d* of province *p* and encompass factors such as marital status, age, gender, and income. (2) Geographic and climatic characteristics, represented as $X_{p,d}$, and cover aspects such as district soil type (divided into nine distinct soil categories), district demographics, and geographic features. These geographic controls are defined by the proportion of land area at varying altitudes (250–500 m, 500–1000 m, and over 1000 m) and the latitude in degrees north (°N). The model considers consistent differences across provinces over time, as well as changes that affect all districts and provinces in a similar manner over time. Consequently, the model includes fixed effects terms for province *p*, denoted as FE (province *p*). Furthermore, with six waves of the VHLSS conducted in 2010, 2012, 2014, 2016, 2018, and 2020, I include time-fixed effects to account for temporal variations.

The main estimation issue is the non-random U.S. bombing distribution, driven by military strategies and possibly local economic conditions. A key identification challenge is endogeneity bias from unobserved confounders and/or inaccuracies in measuring bombs, missiles, and rockets per $^{km^2}$ in estimation (1). Many district or province specific factors could not be identified or included in the regression analysis. To the extent that both variables, $\text{Total\_bomb\_per\_km2}_{i,p,d}$ and $\text{Total\_bomb\_per\_km2\_sq}_{i,p,d}$ are correlated with unobserved confounders relevant for explaining individual differences in contributing to public labour obligations, the main results can be biased and inconsistent. Miguel and Roland (2024) used the North Vietnam–South Vietnam border at the 17th parallel as an instrumental variable. However, this instrumental variable applies only to the single endogenous variable $\text{Total\_bomb\_per\_km2}_{i,p,d}$ when considering the effects of bombs and local poverty in the first-stage estimation:

$$\text{Total}_{\text{bomb}_{\text{per}_{\text{km2}_{\text{i,p,d}}}}} = \alpha + \tau \text{Distance}_{17_{\text{i,p,d}}} \times \text{Year}_t + \delta \text{I}_{\text{i,t,p,d}} + \vartheta \text{X}_{\text{p,d}} \varphi + \text{FE}_{\text{d}} + \varepsilon. \quad (2)$$

The first-stage relationship relates bombing intensity ($\text{Total\_bomb\_per\_km2}_{i,p,d}$) of individual *i* with war exposure in district *d* of province *p* to the district's distance from the border ($\text{Distance\_17}_{\text{i,p,d}}$). To account for the unobserved factors specific to each district, district fixed effects were incorporated in the first stage of the analysis. The first stage includes controls carried to the second stage to ensure consistent, unbiased estimates from the fitted values and structural equation. Wooldridge (2010) also discussed the predicted variables $\widehat{\text{Total\_bomb\_per\_km2}}_{i,p,d}$ and $\widehat{\text{Total\_bomb\_per\_km2\_sq}}_{i,p,d}$ in Equation (2) to deal with the endogenous variables in Equation (1). The 17th parallel demilitarised zone served as an exogenous source of bombing intensity variation. Quang Tri Province, near the 17th parallel in central Vietnam, was the most intensely bombed area during the war, once dividing North and South Vietnam. Provinces north and south of Quang Tri also faced significant U.S. bombing, though less than Quang Tri. Coastal North Vietnam, parts of Hanoi, and areas near Saigon by Cambodia were heavily bombarded. The region was strategic due to frequent North Vietnamese Army and Viet Cong incursions into South Vietnam via the Ho Chi Minh Trail through Laos and Cambodia. This evidence supports the robustness of excluding Quang Tri Province, the current capital (Hanoi), and the former capital of the south (previously Saigon, now Ho Chi Minh City).

MAIN FINDINGS

Descriptive Statistics

Table 1 presents the descriptive statistics for the comprehensive data used in this study. Noteworthy points regarding the representative sample include nearly equal proportions of males and females among the 91,220 observations (with a gender mean of 0.506). The average age of the sample was approximately 33 years, ranging from newborns to elderly, with a broad age distribution. This age distribution is pivotal for testing the hypothesis that individuals exposed to wartime conditions may exhibit different behaviours than other groups in the sample. Most individuals are classified, on average, just above the '*single*' status, suggesting a predominance of married individuals. The average logarithm of income was incorporated as a control variable in previous models. Regarding *public labour obligations*, the average contribution is 84,151 VND (about 3.46 USD), with the minimum value at zero, indicating that some individuals do not contribute monetarily to this public fund, and the maximum value reaching approximately 11 million Vietnam Dong (479.31 USD). Additionally, each district in Vietnam experiences an average of 35 bombs per square kilometre, although significant regional variations are likely. The other variables were used as control factors in the model.

[Table 1 here]

Ordinary Least Squares (OLS) Estimates

The baseline results are presented in Table 2. The first column shows the OLS estimates from a linear regression without quadratic terms for *Total bomb per km2*. The subsequent columns illustrate the outcomes of the quadratic regressions.

Column (1) displays a negative coefficient for *Total bomb per km2* (β = -0.1519), which is statistically significant at the 1% level. This suggests that an increase of one bomb per square kilometre is associated with a decrease in contributions to the public labour fund by 151.9 VND. The primary findings remain consistent when factoring in different geographical characteristics at the district level and addressing potential selection bias due to unobserved factors as per the coefficient stability test (Oster 2019). In the analysis in Column 1, I employ the coefficient stability test (Oster 2019) to evaluate the extent of selection bias arising from unobservable factors. Oster (2019) showed that the traditional method of addressing concerns about omitted variable bias by including observed control variables in a regression analysis might not yield reliable results, especially when these observed confounders are imperfect proxies for the actual unobserved covariates. In this context, it is possible to argue that various geographical factors, excluding the squared term *Total bomb per km2*, of included in Equation (1) may serve as incomplete representations of the true variation in geographic and economic characteristics across Vietnamese districts. Consequently, following Oster's methodology, I ascertained whether my results would be significantly influenced or invalidated by unobserved selection biases. The δ statistic is crucial as it measures the relative significance of unobserved confounders compared to observed control variables in potentially negating the core findings. The symbol β^*represents the adjusted coefficient, calculated under the assumption that δ equals 1 and R_{max} (in this case 0.1597 × 1.3 = 0.2076) is 1.3 times R (where R is the R-squared value of the model containing all observed controls, and R_{max} is the R-squared of a hypothetical model that includes both observed and unobserved control variables, assumed to be 30% higher than the former). In essence, β^* aims to estimate the impact of total bombs per square kilometre on public labour obligations, assuming complete accounting for all unobserved confounders. The result indicates that $\delta = 7.7037$ with bound for $(\beta, \beta^*) = [-0.1518, -0.0768]$. This clearly indicates that for unobserved confounders to negate the primary relationship between *Total bomb per km2* and public labour obligations, their correlation with *Total bomb per km2* would have to be implausibly stronger than the correlation between observed controls and *Total bomb per km2*. In line with Oster's (2019) recommendation, a value of δ greater than 1 suggests that my findings are not readily susceptible to being confounded by selection based on unobservable factors.

In summary, my research indicates that higher bombing rates are associated with lower contributions to public labour obligations. A series of comprehensive tests supported these results, effectively diminishing the likelihood that they were solely influenced by unobserved confounding factors.

[Table 2 here]

The Quadratic Term for Total Bomb Per Km2

Columns (2) to (4) in Table 2 present the quadratic term for the key variable of interest, *Total bomb per km2*. The estimated coefficients in the table strongly support a U-shaped association between total bomb exposure and contributions to public labour obligations. This finding is in line with my previous hypothesis that individuals are likely to reduce their contributions after experiencing traumatic events in early life, but this trend reverses, leading to increased support for social development when these traumatic experiences are exceptionally severe. This suggests that people living in areas with the highest bomb intensity percentile may contribute more to public labour funds. The coefficients across the three estimations, ranging from models with no controls to those with full controls, were precisely estimated and showed consistent signs and levels of significance. To further validate this finding, I conduct Lind and Mehlum’s (2010) test for U-shaped relationships. The test statistics and associated p-values presented in Table

2 firmly reject the hypothesis of a monotonic or U-shaped relationship at the 1% significance level in Columns 2, 3, and 4, confirming the identified U-shaped pattern.

Given the non-linear nature of the fitted relationship, the effect of an increase in bombing on public labour obligation contributions varies depending on the initial bombing level. Interpreting Column 4 for the standardised beta coefficients, the relationship can be understood as follows: As the number of bombs increases by one standard deviation, the amount contributed to public labour obligations decreases by approximately 0.095 standard deviations for the non-quadratic term. Meanwhile, for the squared term, there was an increase of approximately 0.060 standard deviation.

Instrumental Variable Estimates

The identification strategies section discusses, a significant challenge in estimating Equation (1) arises because the current and historical districts in Vietnam differ considerably in terms of socio-economic development. Identifying and incorporating all potential confounding factors into regression models is unfeasible. While I employed fixed-effects estimators to account for variations, capturing cross-individual, cross-district, and/or cross-province variations in public labour obligations can be prone to measurement errors. These errors could potentially render the basis for the statistical inference invalid. Table 3 reports the 2SLS-IV estimation with the difference from the 17^{th} parallel as the instrumental variable. In accordance with the approach used by Miguel and Roland (2011), I employed the distance from the centroid of each district to the 17th parallel north latitude, the region where bombing was most intense, as an instrumental variable for bombing density in that district. This method is widely applied in recent studies (Singhal 2019; Yamada and Yamada 2021; Barceló 2021).

[Table 3 here]

The initial stage results in Table 3 show that proximity to the 17th parallel (interacting with the surveyed year to have a time variation) had a negative and statistically significant impact on the number of bombs per km². This indicates that areas farther from the north–south border during the Vietnam War experienced a reduced incidence of bombings from 1965 to 1975. The first stage involves calculating the predicted values of Total bomb per km² and its squared terms for use in the second-stage regression. Following the methodology outlined by Wooldridge (2010), I treat these predicted values (denoted as $\widehat{\text{Total\_bomb\_per\_km2}}_{i,p,d}$ and $\widehat{\text{Total\_bomb\_per\_km2\_sq}}_{i,p,d}$) as instrumental variables for quadratic terms. The F-test for the excluded instruments yielded a value of 47,000,000, indicating that the predicted variables were not weak. Additionally, I included Anderson-Rubin (AR) test statistics for the Two-Stage Least Squares (2SLS) model with clustered standard errors at the household level. This approach provides a valid inference of the coefficient of the endogenous variable, even if the instrument is weak (Finlay and Magnusson 2009). According to the AR tests, the null hypothesis that bombing intensity has no effect on public labour obligation contributions is rejected at the one percent level with a p-value of 0.002, which is less than or equal to 0.01. This strengthens the evidence that bombing intensity significantly influences public labour obligation. Column (2) of Table 3 illustrates the U-shaped causal relationship between the number of bombs and public labour obligation contributions. The coefficients here are estimated precisely, which is consistent with the previous regressions presented in Table 2. Importantly, the instrumental variable (IV) results retain their signs and statistical precision in most cases. This consistency helps address and at least partially alleviate concerns regarding potential deviations from exclusion restrictions.

In summary, the findings indicate that individuals who experience early-life shocks related to wartime events tend to reduce their contributions to public labour obligations. However, when these shocks are extreme, characterised by a high number of bombs and an increased probability of mortality, individuals are more likely to increase their contributions to public funds, demonstrating an increase in prosocial behaviour. This pattern suggests a complex interaction between the severity of wartime experience and subsequent social contributions.

U-shape and Turning Point

Figure 2 illustrates the U-shaped relationship between bombing intensity and the outcome variable. At low bombing levels, the marginal effects are negative, indicating adverse impacts; however, they become positive beyond the estimated turning point for both the OLS and IV estimates. Approximately 83% of the observations fell below this point, and 17% of the samples were larger than the turning point. The IV curve is steeper than the OLS curve, suggesting that the OLS underestimates the negative effects at low exposure levels. Overall, the results confirm a non-linear effect with stronger initial damage and partial recovery at higher bombing intensities.

[Figure 2 here]

To assess the sensitivity of my non-linear estimates to the sample imbalance in bombing exposure, I conducted a Monte Carlo balanced sampling exercise. In each iteration, I retain all communes with bombing intensity above the turning-point threshold (*Total bomb per km2* ≥ 308.3) and randomly draw an equal number of communes from those below the threshold, yielding a balanced matched sample. I then re-estimate the baseline specification (Table 2) with clustered standard errors, the full set of controls, and fixed effects. I repeat this procedure 500 times and report the empirical distributions of the linear and quadratic coefficients on bombing intensity, as well as the implied turning point ($-\beta_1/(2\beta_2)$). Figure 3 shows the sampling distributions of the estimated coefficients using the balanced matched samples. Panel A indicates that the linear term (*Total bomb per km2*) is consistently negative, while Panel B shows that the quadratic term (*Total bomb per km2 squared*) is predominantly positive. Together, these results confirm a stable U-shaped relationship between bombing intensity and the outcome variable across repeated random samples. The resulting histograms characterised the stability of the U-shaped relationship and robustness of the estimated turning point to random variations in the composition of the low-exposure group.

[Figure 3 here]

To validate my previous findings without relying on the instrumental variable (the distance to the 17th parallel during the Vietnam War), I estimate a quadratic difference-in-differences model that captures how the treatment effect evolved relative to 2014, the year in which the Vietnam National Mine Action Centre (VNMAC) was established. The marginal effects are shown in Figure 4. Before 2014 ($\tau < 0$), treated and control individuals show no significant differences, supporting the parallel pre-trend assumption. Following the 2014 policy shock, the estimated marginal effects become sharply negative, around 60–80 units, over the next two periods, indicating a substantial short-run decline in public labour obligations in more war-contaminated communes. The positive quadratic term (τ^2) suggests that this negative gap gradually narrows over time, becoming smaller and eventually positive by the later years ($\tau \geq 5$), consistent with partial recovery as mine action efforts expanded nationwide. These results reinforce and validate my earlier findings on the relationship between bombing intensity and public labour obligations.

[Figure 4 here]

ROBUSTNESS TEST AND SENSITIVITY

Table 4 presents the results of various robustness tests conducted to verify the stability of the main findings. Initially, I excluded data from Quang Tri Province, the most heavily bombed province, as shown in Column 1. Additionally, in Column 2, I exclude data from both the current and former capitals of Vietnam, Hanoi City and Ho Chi Minh City, which are considered megalopolies. Despite these exclusions, the coefficients remain precisely estimated, and the U-shaped relationship identified in the main analysis is consistently maintained. This reinforces the reliability of the findings across different data subsets. I also tested the mechanism by interacting the bombing intensity with region (south versus north) and rural status, including all lower-order terms

(Appendix A.2)[1]. In the full sample, the bombing–public labour obligations relationship is U-shaped. The interactions reveal clear heterogeneity: the south shifts toward an inverted U, whereas rural districts in the south exhibit only a weak inverted U (a flatter curve). The triple interactions (total bombs per km2 × south × rural) and (total bombs per km2 squared × south × rural) are statistically significant, indicating that rurality further modifies the south–north difference in slope and curvature. I also ran the F-test for (Total bombs per km² × South × Rural) with $F(1, 25) = 11.69$ ($p<0.01$) and (Total bombs per km² squared × South × Rural) with $F(1, 25) = 7.74$ ($p<0.05$); jointly, I obtained $F(2, 25) = 8.81$ ($p=0.0013$). These results show that there are differences in the relationship between bombs and public labour obligations across regions.

[Table 4 here]

In this section, I extend individual-level analyses to investigate the mechanisms behind regional divergence. Columns (3) and (4) of Table 4 estimate separate curvatures for North and South. The north exhibits a clear U-shape, whereas the south displays the opposite curvature (inverse-U) and statistically weaker effects in several specifications. I now explain this divergence in terms of institutional legacies: Areas more deeply shaped by the Dai Viet State developed durable village governance and civic cooperation that could translate extreme shocks into coordinated rebuilding, consistent with a rising right tail in the north (Dell et al. 2018). Complementing this deep-roots channel, recent quasi-experimental evidence shows that positive export shocks reduce women's labour force

[1] I thank the first reviewer for suggesting this valid test to examine the differences.

participation more in the south than in the north, indicating persistent regional differences in gender role attitudes and market attachment that can rationalise earlier withdrawal at high shock levels in the south (Huynh and Ku 2025). In summary, the collectivist norms of Dell et al. (2018), Ho et al. (2022), and Huynh and Ku (2025) explain these differences. In Appendix A.1. with a balanced test, the North and South differ markedly across most baseline covariates: public labour obligations, bombing intensity (and its square), age, income, latitude, and marital status all show statistically significant gaps. Only the gender share was balanced (both 50.7%; p = 0.860). Soil composition also differed substantially across regions, reinforcing that the two samples came from distinct environments and socio-economic backgrounds.

Consequently, the baseline results appeared to be predominantly driven by responses from the northern region. Following the methodology of Miguel and Roland (2011), I distinguish between rural and urban areas during wartime to further understand contextual differences. Columns (5) and (6) of Table 4. It appears that the main results of this study were predominantly influenced by responses from rural areas. This inference is drawn from the fact that the coefficients for urban areas are not precisely estimated, suggesting a lesser or different impact of bombing on public labour obligations in these regions. Thus, the rural context seems to play a crucial role in shaping the patterns observed in the data. other individual characteristics and external factors with fixed effects terms. While conducting the analysis, I did not observe a U-shaped relationship in the rural areas. Using a linear estimation approach, I found that the coefficient for *Total bomb per km2* remains negative ($\beta = -0.3513$) and is statistically significant at the 1%

level. This result is consistent even after accounting for other individual characteristics and external factors, and incorporating fixed effects terms. This indicates a persistent negative association between bombing intensity and public labour obligations in rural areas, reinforcing the distinct impacts of wartime experiences in these regions. In Table 5, the coefficients for *Total bomb per km2* and *Total bomb per km2 squared* in Column 3 are larger compared to those in Column 2, indicating that the effects of bombing are more pronounced in the older generation. This suggests that the impact of the bombing during the Vietnam War had a more substantial influence on the behaviour and attitudes of the elderly, particularly in terms of their contribution to public labour obligations.

[Table 5]

Selective migration is a key concern in conflict research. Accordingly, individuals may have moved away from or into heavily bombed areas since the war (Marbach 2024). To mitigate this concern, I re-estimate the main specification on the subsample of "non-movers," defined as individuals whose current district of residence equals their place of birth. This variable, available in several survey waves, serves as a proxy for respondents who have remained in the same locality since birth and were, therefore, plausibly exposed to the wartime environment of that district. The results in Table 7 indicate that the estimated effects of the bombing on compulsory public labour obligations remain negative and statistically significant among non-movers. The OLS coefficient of total bombs per km2 was -0.4607 (S.E. = 0.1353) and the 2SLS estimate was -0.4972 (S.E. = 0.1426), both significant at the 1% level. The squared term remains positive and significant, indicating a concavity similar to that of the full-sample pattern. The similarity in magnitude between the non-mover and full-sample results suggests that selective migration is unlikely to have driven the findings[2].

[Table 6 here]

I agree that differential wartime mortality could induce the selection of unobservable (e.g. pro-sociality), potentially biasing estimates. I now provide a set of exercises to consider survival effects. To assess whether wartime mortality selection drives my results, I re-estimate the main specification of the subsample of former soldiers who survived and were observed in the VHLSS. This cohort faced the highest wartime mortality risk. If my baseline effects reflected the differential survivorship of prosocial types, the functional form and/or magnitude should change materially in this group. The specifications mirror the baseline, including province- and year-fixed effects, district soil and geographic controls, and individual controls. Table 7 shows that among former soldiers, the bombing effect on public labour obligations remains U-shaped. The point estimates are close to the full-sample estimates, suggesting that differential wartime survivorship is unlikely to explain the main findings.

[Table 7 her]

Mortality is also a potential threat. If wartime deaths were non-random, for instance, if more civic-minded individuals were more likely to undertake risky actions and die, then heavily bombed locations could appear less prosocial today simply because

[2] I thank the second reviewer for suggesting this robustness test to validate my results.

of compositional changes in those who survived. In this case, the observed cross-area gaps might partially capture mortality-driven selection rather than the effect of bombardment itself. To assess the potential magnitude of mortality selection, I conduct a conservative stress test following Barceló (2021). Specifically, I augment the realised sample with synthetic "non-survivor" observations that are oversampled from more heavily bombed areas and assigned low prosocial outcomes, thereby forming a worst-case counterfactual. Operationally, I added approximately 11% of the additional cases, drawing with probability increasing in local bombardment intensity, and set their prosocial score to the 5th percentile of the observed distribution. I then re-estimate the baseline model using OLS and 2SLS for this augmented sample. Table 8 shows that the OLS bombing effect remains negative and statistically significant at typical exposure levels and that the IV estimate using the time-variant distance to the 17^{th} parallel has a similar sign, magnitude, and precision. Thus, even under an extreme survivorship scenario that disproportionately removes high-prosocial types from heavily bombed areas, the main results were robust. Although no bound is dispositive, a survival bias of a plausible size is unlikely to overturn the main findings.

[Table 8 here]

To examine whether the non-linear relationship between bombing intensity and public labour obligations depends on the imposed quadratic specification, I estimate a flexible spline model and present a non-parametric visualisation in Appendix A.3. The figure plots the bin-averaged fitted values from the spline regression together with a Locally Weighted Scatterplot Smoothing (LOWESS) curve, allowing the relationship to be assessed without imposing a specific functional form. Consistent with the baseline results, the relationship initially declined with bombing intensity but became more positive at higher levels of exposure, suggesting that the negative effects of wartime exposure weakened in the most heavily bombed districts.

DISCUSSION

Although existing literature shows that prior experience may discourage citizens from embracing the self-provision of public services (Mizrahi 2011), this study found that the effect might U-shaped. People who experienced high-intensity bombing as a traumatic event lifetime could contribute more to public services. These findings could inform policymaking, particularly in post-conflict societies. Based on the available data, public officers could identify those who experienced war and offer proper interventions to engage them in public service activities. This study also explores an exogenous shock that causes people to engage in public labour obligations using a monetary scheme.

I explore how Vietnam’s history of foreign occupation fostered nationalism, which could be leveraged in public management to enhance community engagement and support for public services. Clearly, the war’s effects may be economically adverse. However, people exposed to wartime would have higher nationalism (Alesina et al. 2020). Therefore, public management also requires a theory based on nationalism. Addressing the potential challenges in ensuring equitable participation in public labour obligations, especially among those disproportionately affected by war, is also important (Cepiku and Mastrodascio 2021). I emphasise the importance of inclusive policy designs that consider the varied experiences of different societal groups.

The finding that traumatic wartime experience, as an exogenous shock, influences contributions to public labour obligations shows how personal context shapes citizen involvement, aligning with public service logic's value-in-context (Osborne, 2018; Osborne et al., 2021). Co-production covers voluntary or involuntary involvement in public services (Osborne et al., 2016); observed engagement, whether obligatory or internally motivated, falls within co-construction or co-experience, where public service interaction impacts the user's life experience (Osborne et al., 2021). Leveraging nationalism fosters public participation by reinforcing the citizen's dual role as a service user and a societal stakeholder (Osborne, 2018; Pestoff, 2006). This focus on maximising collective interest contributes directly to the creation of societal value, which is fundamental for achieving systemic societal objectives (Osborne et al., 2021). However, translating this shock-induced motivation into sustainable public service engagement requires inclusive policy designs that acknowledge the varied and subjective experiences of different societal groups (Osborne et al., 2021). Failure to address challenges in equitable participation could lead to the co-destruction of value (Osborne et al., 2021) or impose high costs on democratisation, where citizens lose trust if their input is not valued (Bryer, 2011; McNutt, 2014). Successful public management interventions in post-conflict societies, therefore require public managers with the requisite skills to listen to community groups and mobilise collective resources (Sicilia et al. 2016) and actively create capacity for future change rather than enduring dependency (Osborne et al. 2021).

CONCLUSION

This study explored the long-term effects of early-life adversities on public service activities. By analysing the context of the American bombing campaign in Vietnam from 1965 to 1975, I discover that individuals who did not experience the high-intensity bombing are less inclined to contribute to public labour obligations voluntarily. These results imply that the costs of war in the NPM sense are greater than previously estimated. Accordingly, policymakers must implement policies to encourage people who experienced wartime exposure. The disproportionate effect could be a problem for equal contributions to the public labour obligations fund, which will be used to improve public spaces for everyone. Vietnam's emergence from war followed a prolonged struggle for national liberation from foreign occupiers, primarily China, France, and later the U.S. This experience cultivated a robust sense of nationalism, which proved instrumental in mobilising efforts for post-war reconstruction. Therefore, public managers should consider nationalist features when encouraging public service activities. A deeper understanding of diverse groups of individuals can lead to the development of more effective policies that engage citizens in public service activities. Given the distinct nature of each society's institutions, political landscapes, and histories, I believe that accumulating more empirical evidence across various cases is essential before making general assertions regarding the long-term effects of war on public management.

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FIGURES

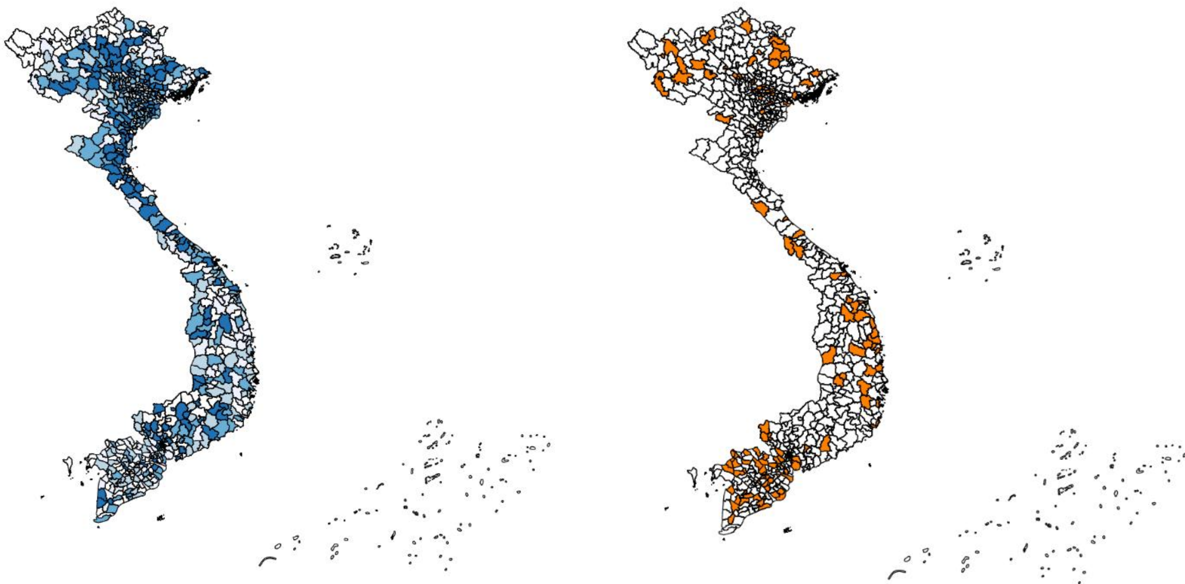


Figure A

Figure B

Figure 1. Geographic distribution of public labour obligations and total U.S. bombs

Notes: Figure A depicts the geographic distribution of the average amount of money contributed to public labour obligations by individuals surveyed in each district from 2010 to 2020 from the VHLSS. Figure B shows the geographic distribution of the total bombings per district (shaded to represent the density of U.S. bombs, missiles, and rockets per square kilometre) between 1965 and 1975 from Miguel and Roland (2024).

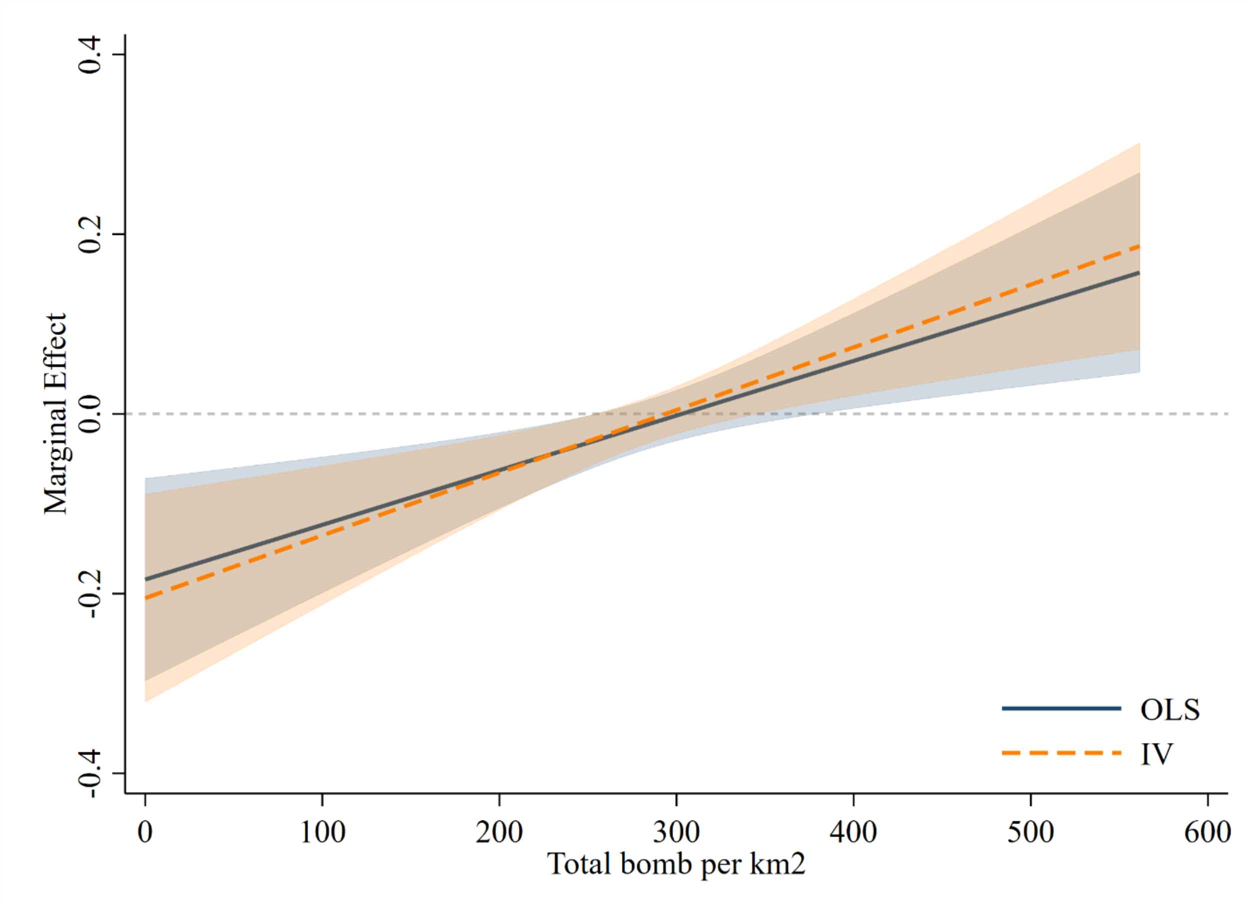
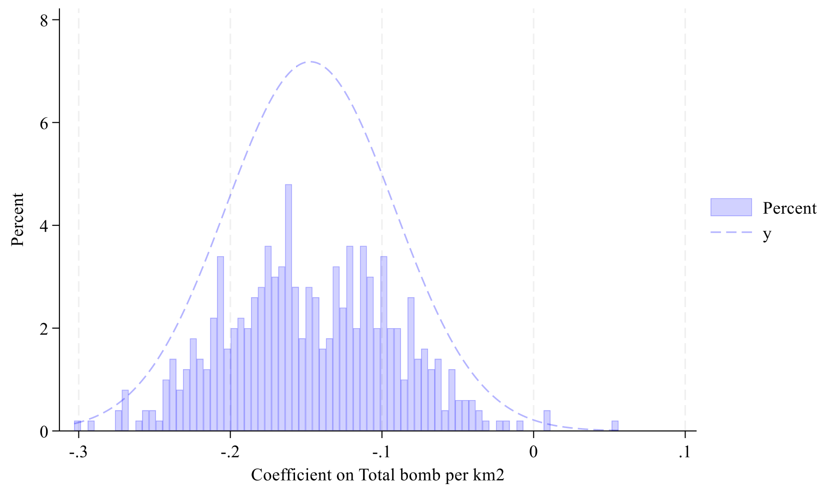


Figure 2. Marginal effects of the functional form analysis: OLS vs. IV

Notes: This figure provides the marginal effect across the different values of the main independent variables *Total bombs per km2* and *Total bomb per km2 squared*. The estimated extremum points are listed in Table 2. Approximately 17% of the observations (17,737) are above the turning point, whereas approximately 83% (89,454) are below.

Panel A: Coefficient estimates for Total bomb per km2



Panel A: Coefficient estimates: Total bomb per km2 squared

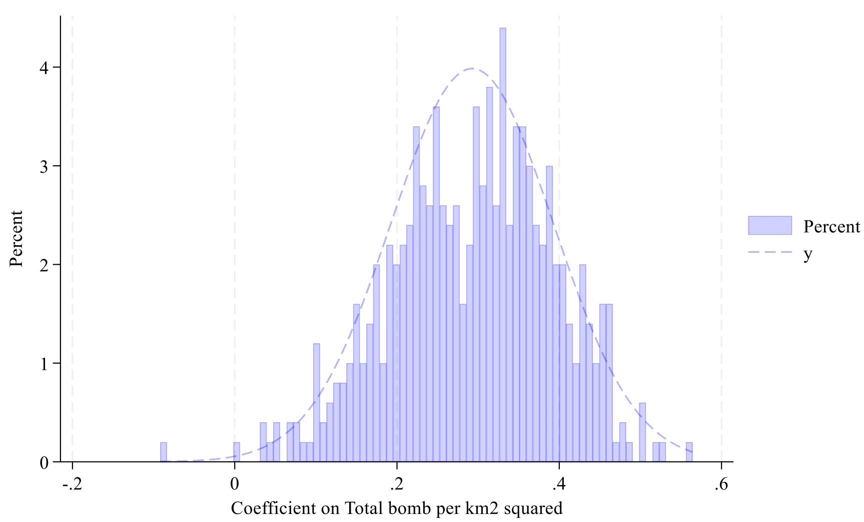


Figure 3. Coefficient plots from a Monte Carlo simulation (500 replications) using the matched sample

Notes: I test the robustness of the non-linear estimates using a Monte Carlo balanced sampling exercise. In each of 500 iterations, I keep all high-exposure communes (Total bomb per km² ≥ 308.3) and randomly select an equal number of low-exposure ones, then re-estimate the baseline model. I use the resulting coefficient and turning-point distributions to assess the stability of the U-shaped relationship.

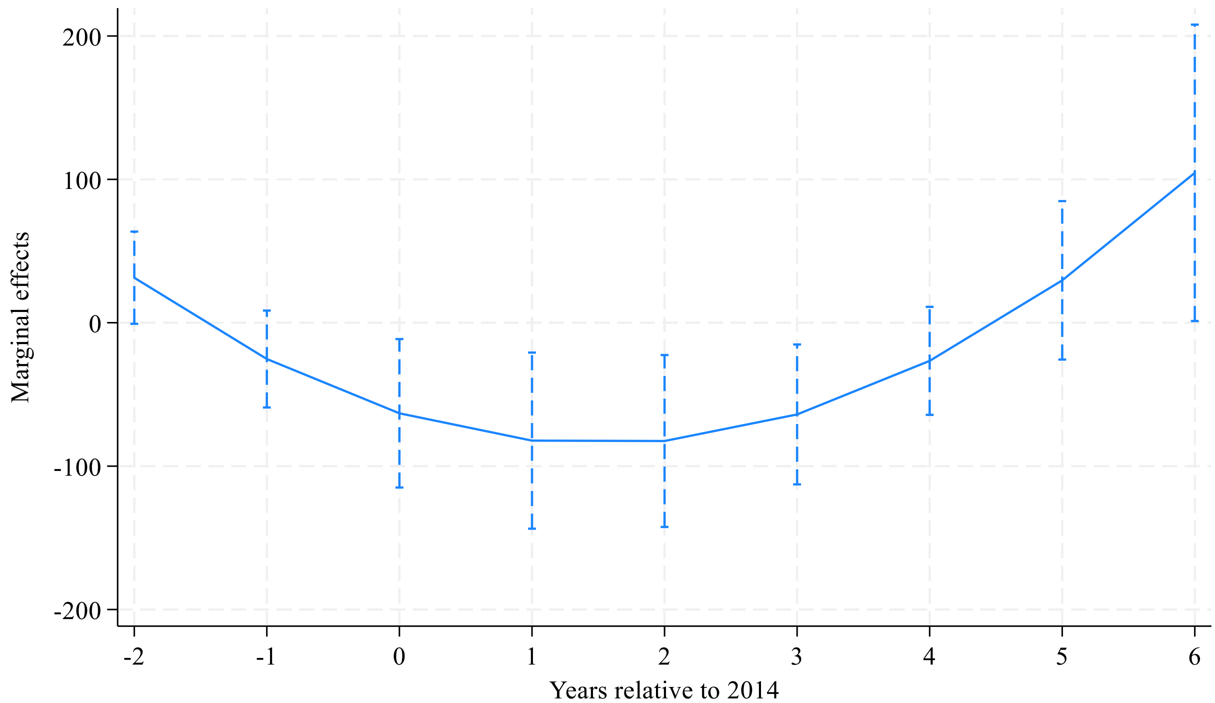


Figure 4. Quadratic differences-in-differences

Notes: This figure plots the estimated marginal effects of the treatment on the linear prediction of the quadratic difference-in-differences model. The regression allows for group-specific linear and quadratic time trends (τ and τ^2, centred at 2014). The points show the estimated treatment effects at each value of τ, with dashed bars indicating 95% confidence intervals. Accordingly, the difference-in-differences framework exploits the policy shock generated by the March 2014 establishment of the VNMAC under Prime Minister's Decision No. 319/QĐ-TTg. This event represented a major institutional milestone in coordinating nationwide efforts for unexploded ordnance (UXO) clearance and post-war remediation. The analysis designates 2014 as the intervention year, comparing changes in outcomes for communes with higher versus lower wartime contamination before and after the VNMAC's creation, to identify the causal effects of the national mine action policy on public labour obligation outcomes.

TABLES

Table 1. Descriptive statistics of key variables

Variable	N	Mean	Std. Dev.	Min	Max
Panel A: VHLSS					
Gender	91,220	0.506	0.4999	0.000	1.000
Year of birth	91,220	1980.153	21.102	1908.000	2020.000
Age	91,220	32.582	21.017	0.000	110.000
Marital status	72,464	1.828	0.629	1.000	5.000
Logarithm of income	72,556	12.033	0.834	1.000	9.000
Public labour obligations	91,220	84.151	287.908	0.000	11,664.000
Panel B: Bombing data from Miguel and Roland (2011)					
Total bomb per km2	91,220	35.185	73.710	0.000	561.487
Total bomb per km2 squared	91,220	6671.302	30549.970	0.000	315,268.000
Area 251 500m	91,220	0.090	0.169	0.000	0.995
Area 501 1000m	91,220	0.098	0.208	0.000	1.000
Area over 1000m	91,220	0.031	0.115	0.000	1.000
North latitude	91,220	18.053	5.140	9.696	25.378
Soil 1	91,220	1.418	6.250	0.000	75.317
Soil 3	91,220	1.254	4.920	0.000	41.793
Soil 6	91,220	5.138	16.225	0.000	100.000
Soil 7	91,220	1.895	8.289	0.000	92.444
Soil 8	91,220	5.237	15.193	0.000	96.932
Soil 9	91,220	8.410	20.202	0.000	100.000
Soil 10	91,220	6.388	14.650	0.000	91.949
Soil 11	91,220	7.352	14.671	0.000	96.320
Soil 12	91,220	3.920	12.966	0.000	95.246

Notes: Panel A presents data from the Vietnam Household Living Standards Survey (VHLSS), including the following variables: *Gender* (binary: woman – 1; man – 0); *Year of Birth* (the year the surveyed person was born), *Age* (age of the individual at the survey wave), *Marital Status*, (1 – Single; 2 – Married; 3 – Widower; 4 – Divorce; 5 – Legal separation), *Logarithm of Income* constructed from all income data in the VHLSS survey; and *Public Labour Obligations* as the amount of money an individual contributes to public labour funds (unit '000 VND dong). Panel B includes data from Miguel and Roland (2011), including *Total Bomb per km2* and *Total Bomb per km2 sq*, which refer to the total number of U.S. bombs, missiles, and rockets per square kilometre and its squared value, respectively. *Area_251_500m*, *area_501_1000m*, and *area_over_1000m* indicate the proportions of land area at elevations of 250–500 metres, 500–1000 metres, and over 1000 metres, respectively. *North Latitude* is the actual latitude of the district. Includes control for district soil type across nine distinct soil categories (Miguel and Roland 2011).

Table 2. Local bombing and the public labour obligations

Dependent variable: Public labour obligations	(1) PLO	(2) PLO	(3) PLO	(4) PLO
Total bomb per km2	-0.1519***	-0.3301***	-0.3913***	-0.3270***
	(0.0402)	(0.0748)	(0.0734)	(0.0669)
Total bomb per km2 squared		0.0005***	0.0006***	0.0005***
		(0.0001)	(0.0001)	(0.0001)
Logarithm of income			23.2235***	21.6324***
			(4.5880)	(4.6613)
Constant	19.1291**	21.3724**	-271.0590***	-267.7910***
	(8.4996)	(8.2829)	(61.1921)	(46.8337)
Observations	91,220	91,220	57,545	57,545
R-squared	0.1597	0.1600	0.1668	0.1747
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Individual Control	No	No	Yes	Yes
District soil controls	No	No	No	Yes
District geographic controls	No	No	No	Yes
U-test		4.41	4.12	2.90
[p-value]		[0.0001]	[0.0002]	[0.003]
Extremum point		308.3018	321.1299	345.4026

Notes: Province Fixed Effects (FEs) represent provincial dummies that encompass all authoritative provinces in Vietnam. Year FEs are temporal dummies corresponding to each VHLSS, specifically for 2010, 2012, 2014, 2016, 2018, and 2020. Individual controls include variables such as age, sex, and marital status. Controls for district soil type are represented by the proportion of district land across the nine distinct soil categories. District demographic and geographic controls are characterised by the proportion of land area at altitudes of 250–500 m, 500–1000 m, and over 1000 m, as well as by latitude in degrees north (°N). The U-test was used for the U-shaped estimations (Lind and Mehlum 2010). *Extremum point* is the implied turning-point total bomb per km2. Robust standard errors are indicated in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, and * p<0.1.

Table 3. Effects of bombing on the public labour obligations

Dependent variable	(1) Total bomb per km2	(2) Public labour obligations
|Latitude - 17°N| × Year	-0.0057***	
	(0.0013)	
Total bomb per km2		-0.2050***
		(0.0590)
Total bomb per km2 squared		0.0003***
		(0.0001)
Logarithm of income	-0.0004	14.6022***
	(0.0003)	(2.6579)
Constant	-70.6842	280.6892***
	(54.8250)	(97.2232)
Observations	42,610	42,610
R-squared		0.1537
District FE	Yes	No
Province FE	No	Yes
Year FE	Yes	Yes
Individual Control	Yes	Yes
District soil controls	Yes	Yes
District geographic controls	Yes	Yes
Kleibergen-Paap rk LM statistic [p-value]		4.415
		[0.035]

Notes: District (Provincial) Fixed Effects (FEs), year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. I also incorporate within-district temporal variation into the instrument by interacting distance with time dummies to ensure that the estimate is not collinear with the fixed effects and can contribute to identification. Standard errors clustered at the household level are indicated in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, and * p<0.1.

Table 4. Robustness checks and extensions

Dependent variable: Public labour obligation	(1) Exc. Quang Tri	(2) Exc. present and former capital	(3) North Vietnam	(4) South Vietnam	(5) Rural area (1960-1961)	(6) Urban area (1960-1961)
Total bomb per km2	-0.3861***	-0.3338***	-0.4981***	0.1235	-0.4996***	0.0135
	(0.1052)	(0.0697)	(0.0988)	(0.1146)	(0.0928)	(0.0739)
Total bomb per km2 squared	0.0007**	0.0005***	0.0009***	-0.0013**	0.0005***	-0.0001
	(0.0003)	(0.0001)	(0.0002)	(0.0006)	(0.0001)	(0.0002)
Constant	-267.3543***	-231.7090***	1,863.8726***	-402.4966***	-356.5114***	-299.5537***
	(46.8166)	(46.4187)	(353.7396)	(73.0465)	(72.7396)	(76.2380)
Observations	56,724	54,203	31,924	25,621	38,529	19,016
R-squared	0.1743	0.1737	0.1776	0.1986	0.1804	0.1620
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Control	Yes	Yes	Yes	Yes	Yes	Yes
District soil controls	Yes	Yes	Yes	Yes	Yes	Yes
District geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
U-test	2.03	3.15	5.04	1.08	0.85	0.18
[p-value]	[0.0265]	[0.0021]	[0.00002]	[0.146]	[0.202]	[0.428]
Extremum point	276.0580	337.8345	267.5082	46.2150	494.4763	118.2223

Notes: District FEs, year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. The U-test was used for U-shaped estimations (Lind and Mehlum 2010). *Extremum point* is the implied turning-point total bomb per km2. Robust standard errors are in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, and * p<0.1.

Table 5. Sensitivity of the impact of bombing on public labour obligations by age interval

Dependent variable: Public labour obligations	(1) 18 ≤ Age ≤ 35	(2) 35 ≤ Age ≤ 60	(3) Age ≥ 60
Total bomb per km2	-0.3354***	-0.3176***	-0.3398***
	(0.0956)	(0.0704)	(0.1180)
Total bomb per km2 squared	0.0003*	0.0005***	0.0006***
	(0.0002)	(0.0001)	(0.0002)
Constant	-304.5437***	-268.5602***	-273.4328***
	(46.0807)	(66.8922)	(67.1756)
Observations	19,584	25,168	8,322
R-squared	0.1867	0.1686	0.1879
Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Individual Control	Yes	Yes	Yes
District soil controls	Yes	Yes	Yes
District geographic controls	Yes	Yes	Yes
U-test	0.21	3.81	2.75
[p-value]	[0.419]	[0.0004]	[0.0057]
Extremum point	525.2813	291.0894	292.7346

Notes: District FEs, year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. The U-test was used for the U-shaped estimations (Lind and Mehlum 2010). *Extremum point* is the implied turning-point total bomb per km2. Robust standard errors are in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, and * p<0.1.

Table 6. Effects of bombing on the public labour obligations for non-movers

	OLS	2SLS estimates	
	(1)	(2)	(3)
Dependent variable:	Public labour obligations	Total bomb per km2	Public labour obligations
Total bomb per km2	-0.4607***		-0.4972***
	(0.1353)		(0.1426)
Total bomb per km2 squared	0.0007**		0.0008***
	(0.0003)		(0.0003)
Logarithm of income	88.2281***	0.00006***	86.6475***
	(12.8713)	(0.0000)	(12.1381)
|Latitude - 17°N| × Year		0.00004*	
		(0.0000)	
Constant	-457.1801**	734.3697***	1,109.7094*
	(172.3769)	(0.0000)	(635.6418)
Observations	7,235	7,235	7,235
R-squared	0.1425		0.1438
Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Individual Control	Yes	Yes	Yes
District soil controls	Yes	Yes	Yes
District geographic controls	Yes	Yes	Yes
District FE	No	Yes	No
Kleibergen-Paap rk LM statistic [p-value]			4.801 [0.0284]

Notes: District FEs, year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. I incorporate within-district temporal variation in the instrument by interacting distance with time dummies to ensure that the estimation is not collinear with fixed effects and can contribute to identification. Standard errors clustered at household level are in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Effects of bombing on the survival-related public labour obligations of former soldiers

	OLS	2SLS estimates	
	(1)	(2)	(3)
Dependent variable:	Public labour obligations	Total bomb per km2	Public labour obligations
Total bomb per km2	-1.2916**		-1.3236***
	(0.5379)		(0.4952)
Total bomb per km2 squared	0.0020**		0.0021***
	(0.0009)		(0.0008)
Logarithm of income	88.6805***	0.00001	88.0355***
	(26.9002)	(0.0000)	(25.1522)
|Latitude - 17°N| × Year		-0.00007*	
		(0.0000)	
Constant	-1,167.6201	1.5556***	-751.2755
	(1,867.5249)	(0.0000)	(1,681.5939)
Observations	854	854	854
R-squared	0.2775		0.2762
Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Individual Control	Yes	Yes	Yes
District soil controls	Yes	Yes	Yes
District geographic controls	Yes	Yes	Yes
District FE	No	Yes	No
Kleibergen-Paap rk LM statistic [p-value]			7.498 [0.0062]

Notes: District FEs, year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. I incorporate within-district temporal variation in the instrument by interacting distance with time dummies to ensure that the estimation is not collinear with fixed effects and can contribute to identification. Standard errors clustered at household level are in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, * p<0.1.

Table 8. Baseline results and IV estimates with survival-bias simulation from Barceló (2021)

	OLS	2SLS estimates	
	(1)	(2)	(3)
Dependent variable	Public labour obligations	Total bomb per km2	Public labour obligations
Total bomb per km2	-0.1443**		-0.1631***
	(0.0521)		(0.0534)
Total bomb per km2 squared	0.0002*		0.0002**
	(0.0001)		(0.0001)
Logarithm of income	14.6722***	-0.0001	14.5905***
	(2.8627)	(0.0002)	(2.7791)
|Latitude - 17°N| × Year		-0.0055***	
		(0.0013)	
Constant	-122.4879***	-60.9631	277.4880***
	(30.8852)	(51.7804)	(95.1763)
Observations	89,072	89,072	89,072
R-squared	0.1519		0.1524
Province FE	Yes	No	Yes
Year FE	Yes	Yes	Yes
Individual Control	Yes	Yes	Yes
District soil controls	Yes	Yes	Yes
District geographic controls	Yes	Yes	Yes
District FE	No	Yes	No
Kleibergen-Paap rk LM statistic [p-value]			3.537
			[0.060]

Notes: This specification replicates the main model after augmenting the sample to mimic selective non-response/survivorship. Following Barceló (2021), I add roughly 11% synthetic observations drawn with probability increasing in local bombing intensity and fix their outcome at the 5th percentile of the observed prosocial index. I then re-estimate both OLS and IV on this augmented dataset. District FEs, year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. In addition, I include the number of martyr graveyards per district and its squared term, collected manually from http://thongtinlietsi.gov.vn/ban-do, to examine whether the relationship with public labour obligations follows a U-shaped or inverted U-shaped pattern. I incorporate within-district temporal variation in the instrument by interacting distance with time dummies to ensure that the estimation is not collinear with fixed effects and can contribute to identification. Standard errors clustered at household level are in parentheses, with significance levels denoted as *** p<0.01, ** p<0.05, * p<0.1.

Appendix A.1. Balance of main variables based on North and South Vietnam

Variable	**North**	**South**	**Total**	**p-value**
	48,963 (53.7%)	*42,273 (46.3%)*	*91,236 (100.0%)*	
Panel A: Socio-economic characteristics				
Public Labour Obligations	107.24 (357.03)	57.41 (172.97)	84.15 (287.91)	<0.001
Total bombs per km2	37.75 (90.71)	32.26 (45.16)	35.21 (73.26)	<0.001
Total bombs per km2 squared	9,652.62 (40,662.31)	3,079.91 (8,486.78)	6,607.24 (30,519.45)	<0.001
Age	32.81 (21.34)	32.31 (20.63)	32.58 (21.02)	<0.001
Age squared	1,532.21 (1,666.95)	1,469.79 (1,592.67)	1,503.29 (1,633.24)	<0.001
Logarithm of income	11.92 (0.81)	12.18 (0.84)	12.03 (0.83)	<0.001
Degrees north latitude	22.54 (1.64)	12.90 (2.04)	18.08 (5.15)	<0.001
Gender (1=Male)	24,831 (50.7%)	21,412 (50.7%)	46,243 (50.7%)	0.860
Marital status	1.68 (0.63)	1.74 (0.68)	1.71 (0.65)	<0.001

Panel B: Soil characteristics

soil_1	1.13 (5.56)	1.69 (6.90)	1.39 (6.22)	<0.001
soil_3	1.58 (6.01)	0.91 (3.34)	1.27 (4.96)	<0.001
soil_6	2.75 (12.56)	8.37 (19.23)	5.35 (16.24)	<0.001
soil_7	0.33 (1.88)	3.93 (11.94)	2.00 (8.43)	<0.001
soil_8	2.18 (9.81)	8.77 (18.78)	5.23 (15.03)	<0.001
soil_9	13.00 (24.85)	2.09 (8.26)	7.94 (19.82)	<0.001
soil_10	8.66 (17.46)	3.79 (9.43)	6.40 (14.51)	<0.001
soil_11	7.39 (15.72)	6.20 (12.39)	6.84 (14.28)	<0.001
soil_12	2.01 (7.83)	7.95 (18.57)	4.76 (14.19)	<0.001

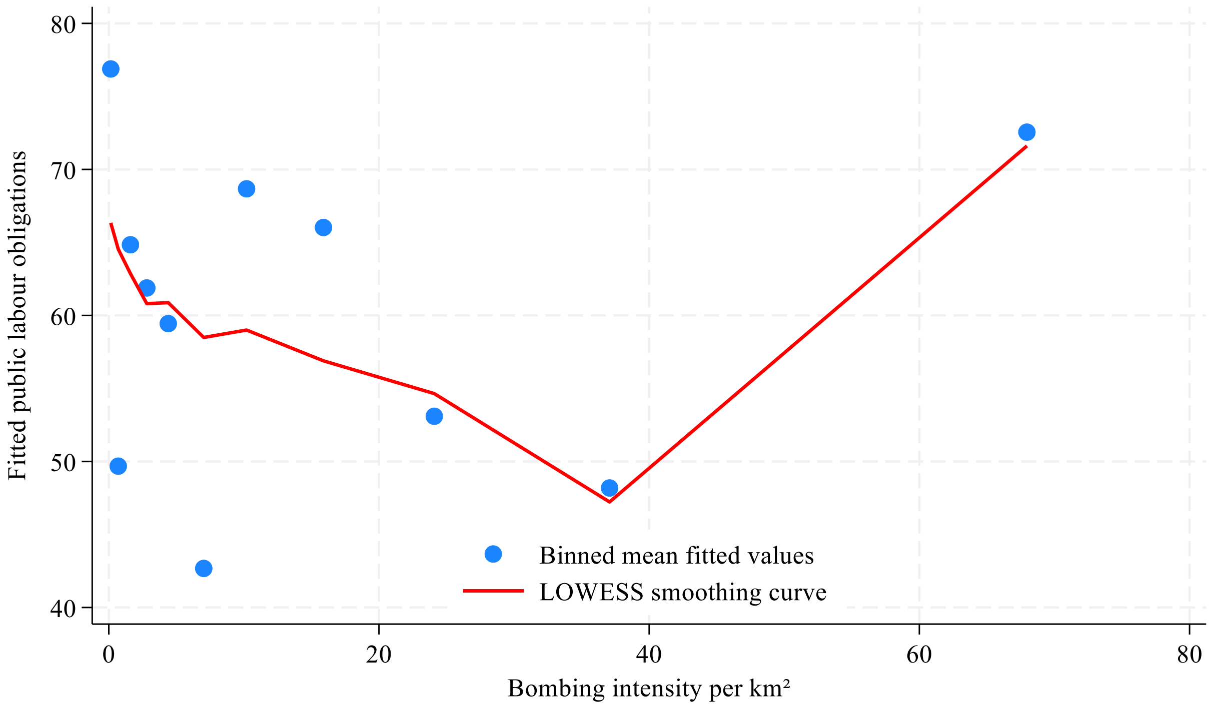
Notes: This table reports the value of mean (standard deviation in parentheses); p-values from pooled t-tests for continuous variables and χ^2 tests for categorical variables. Significance levels denoted as *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Appendix A.2. Interaction of Total Bombs With South Vietnam and Rural Areas

Dependent variable:	(1) Public labour obligation	(2) Public labour obligation	(3) Public labour obligation	(4) Public labour obligation
Total bomb per km2	-0.1629***	-0.2944***	-0.4162***	-0.6172***
	(0.0507)	(0.0620)	(0.1322)	(0.1415)
Total bomb per km2 squared	0.0003***	0.0006***	0.0015***	0.0021***
	(0.0001)	(0.0001)	(0.0005)	(0.0005)
Total bomb per km2 × South		0.3872***	0.4227***	1.3424***
		(0.1007)	(0.1046)	(0.3587)
Total bomb per km2 squared × South		-0.0018***	-0.0018***	-0.0135***
		(0.0006)	(0.0006)	(0.0047)
Total bomb per km2 × Rural			0.0964	0.3189**
			(0.1355)	(0.1373)
Total bomb per km2 squared × Rural			-0.0009*	-0.0016***
			(0.0005)	(0.0005)
Total bomb per km2 × South × Rural				-0.9842***
				(0.2879)
Total bomb per km2 squared × South × Rural				0.0120**
				(0.0043)
South		-226.3242***	-220.7186***	-186.5190***
		(57.8043)	(68.7179)	(60.6361)
Rural			15.5717	20.1553
			(18.3064)	(17.7763)
South × Rural			-8.1156	-42.4141***
			(20.2334)	(14.4333)
Logarithm of income	14.7465***	14.8141***	14.9498***	15.0733***
	(2.7310)	(2.7525)	(2.6587)	(2.7088)
Constant	-122.1716***	318.1255***	302.5855**	292.7588**
	(31.9061)	(105.4954)	(120.6302)	(119.6696)
Observations	42,610	42,610	42,610	42,610
R-squared	0.1532	0.1540	0.1541	0.1543
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Individual Control	Yes	Yes	Yes	Yes
District soil controls	Yes	Yes	Yes	Yes
District geographic controls	Yes	Yes	Yes	Yes

Notes: District FEs, year FEs, individual controls, district soil type controls, and district demographic and geographic controls are the same as in Table 2. Rural equals 1 for rural districts. Bombing intensity is measured as total bombs per km²; its square is included to allow for curvature. In interaction specifications, all lower-order terms with South, Rural, and (South × Rural) are included to respect the interaction hierarchy. Standard errors are clustered at the household level and reported in parentheses. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.1.

Appendix A.3. Non-parametric Estimations Between Bombing Intensity and Public Labour Obligations



Notes: This figure plots the relationship between bombing intensity and predicted public labour obligations using a non-parametric approach. The blue points represent the bin-averaged fitted values of public labour obligations obtained from the spline regression specification. Bombing intensity is divided into quantile bins and each point corresponds to the average fitted outcome within a bin. The red curve represents the locally weighted regression (LOWESS) smoothing of these bin averages. The horizontal axis represents bombing intensities below the 99^{th} percentile of the distribution. All fitted values are derived from regressions that include the full set of control variables and fixed effects used in the baseline specification. The figure illustrates the non-linear relationship between bombing exposure and public labour obligations without imposing a quadratic functional form.