The Lasting Effect of War on Female Labour Market Outcomes: Evidence from Vietnam

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Abstract

War results in sex imbalance, which in turn, has been shown to increase female labour force participation (FLFP). Existing evidence on the nexus between conflict and FLFP predominantly stems from developed nations which may not fully capture the dynamics in developing contexts. This paper examines the impact of the Vietnam War on Vietnamese women's labour market outcomes 14 to 44 years after its conclusion. To this end, I match comprehensive historical data on ordnance deployed by the United States in Vietnam to microdata. I find that war-induced demographic shocks contributed to increasing FLFP rates in South Vietnam, but not North Vietnam where Socialist ideology may have played a larger role in promoting FLFP. In terms of mechanism, I find that war widows increased their labour supply to compensate for the negative income shock caused by the loss of their husbands. I also find that daughters of widows are more likely to work than daughters of non-widows. However, I find a lack of support for demand-side mechanisms, namely, substitution towards female labour.

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1 Introduction

Women's decision to participate in the labour market is shaped by cultural norms, which in itself, are shaped by historical events (Alesina et al., 2013). One such event is war. Through a variety of mechanisms, but primarily through demographic shocks, war can suspend norms and enable women to enter the labour force. These war-induced changes in norms do not simply revert back to their *antebellum* states at the conclusion of the war, but can persist as the new cultural norm even after the sex ratio has recovered (Teso, 2019; Boehnke and Gay, 2022; Gay, 2023). The majority of evidence establishing the nexus between war-induced demographic shocks and female labour force participation (FLFP) originate from developed countries and stress that the manufacturing sector played a pivotal role in the creation of jobs for women (Goldin and Olivetti, 2013; Rose, 2018). This leaves the question of how demographic shocks alter the labour market outcomes of women in economies which are characterised by lower levels of industrialisation underexplored (Teso, 2019; Fenske et al., 2022; Rogall and Zárate-Barrera, 2020).

In this paper, I investigate the effect of war-induced demographic shocks on FLFP in the context of Vietnam. Vietnam presents an interesting case study since the country's current FLFP rate of 75 percent far surpasses the global average of 53 percent. Separately, US intervention in Vietnam between 1965 and 1975, in which the US attempted to prevent South Vietnam from reuniting with the Communist North Vietnam, represents one of the most intense episodes of warfare in human history.¹ The US' approach of using "overwhelming firepower" resulted in a severe sex imbalance where there were 94 men for every 100 women in 1979 (Hirschman et al., 1995). Observational studies have connected these two phenomenon to speculate that Vietnam's high FLFP may stem from a shortage of male workers throughout the Vietnam War, and which helped increase demand for female labour ("missing men effect") (Banerji et al., 2018). However, there is a lack of empirical evidence establishing that the Vietnam War led to higher FLFP and its underlying mechanisms. In showing that the Vietnam War led to higher FLFP, I find a lack of evidence for the "missing men" effect. Instead, I highlight an often overlooked explanation. Namely, that the Vietnam War left many women widowed, most of whom had lost their primary breadwinner and were compelled to enter the labour market out of to economic necessity.

To examine the effect of war-induced demographic shocks on FLFP in Vietnam, I take advantage of the Theatre History of Operations Reports (THOR) which record the

¹After Vietnamese independence from France in 1954 until the conclusion of the Vietnam War in 1975, Vietnam was split along the 17th Parallel into the Democratic Republic of Vietnam ("North Vietnam") and the Republic of Vietnam ("South Vietnam"). North Vietnam was governed by the Communist Party of Vietnam (CPV) which promoted central government planning and Socialist ideology. Conversely, South Vietnam was governed by Prime Minister Ngo Dinh Diem, who had the backing of the US, and who advocated for a Capitalist market-oriented economy.

geolocation of every bomb, missile and rocket ("ordnance") deployed by the US since WW2. In total, I have information of over 900,000 bombing missions by the US in Vietnam between 1965 and 1975. Although I am unable to directly observe the death rate by region as Boehnke and Gay (2022) and Gay (2023) have done, I am able to calculate to the number of ordnance deployed on each district in Vietnam, and which I use as a proxy for demographic shock. To this end, I rely on Fixed Effect models where I exploit districtlevel variation in the number of bombs dropped throughout the Vietnam War, as well as a Difference-in-Differences model which additionally takes into account timing in exposure to conflict. My results reveal large regional heterogeneity in the impact of bombing intensity on FLFP. In what was South Vietnam, a one standard deviation increase in historical bombing intensity increases the probability that a woman is working by 1.49 percentage points 34 years after the war's conclusion. Similar estimates are obtained even after 44 years. For North Vietnam, I find that women residing in districts that were more heavily bombed were not more likely to be working. My DiD estimates show that the labour market effects of the Vietnam War is largest for Southern women who were aged 21 to 30 at the time of reunification in 1975, the same group for which there is the largest sex imbalance.

One might expect the FE and DiD estimates to be biased due to the strategic nature of bombing targets. Disproportionately bombed in the South were poorer districts which the US believed to be hubs of insurgent activity or were perceived to be densely populated by sympathisers towards the Communist government in the North (Littauer and Uphoff, 1972; Miguel and Roland, 2011). This may lead the true effect to be underestimated by the FE and DiD models. To address endogeneity concerns, I employ an instrumental variables (IV) strategy using two different instruments. The first instrument used is the distance to the a network of secretive trails and underground tunnels which the People's Army of Vietnam in the North took advantage of to support insurgent activity in the South, but which the US failed to correctly identify and dismantle ("Ho Chi Minh Trail") (Riano and Valencia Caicedo, 2024). The second is the distance of the 17th Parallel which was the official border between North and South Vietnam during the Vietnam War, and which was arbitrarily placed (Miguel and Roland, 2011). I obtain larger estimates in my IV models where a one standard deviation increase in historical bombing increases the probability of Southern women working by 2.36 percentage points 34 years after reunification, and 1.94 percentage points after 44 years. For Northern women, I continue to obtain insignificant estimates using an IV strategy.

The large heterogeneity in the effect of the Vietnam War on FLFP is interesting in the light of the socio-economic differences between North and South Vietnam. The separation of the country in 1954 deepened pre-existing differences between the two regions, especially with regards to the role of women in society. In espousing Socialist ideology, the Communisty Party of Vietnam (CPV) in the North emphasised that "women are equal to men in all respects" in their 1949 constitution, and encouraged women to actively participate in the labour market throughout the war. By contrast, the Diem administration in the South did not promote such policies, and multiple contemporary accounts note that Southern Vietnamese women lived under significantly more patriarchal structures (Turley, 1972). Today, North Vietnam has a higher rate of FLFP and North Vietnamese women also report more egalitarian views (Do et al., 2023; Huynh and Ku, 2024). The results in this paper suggests that, although South Vietnam still lags behind its Northern counterpart, demographic shocks played a role in narrowing the FLFP gap between the two regions.

This paper contributes to the body of literature which documents the impact of demographic shocks on FLFP. There exists an extensive body of work which establishes a causal relationship between war mobilisation, male fatalities and FLFP in developed countries. It is widely accepted that married women and widows in France, Germany and the United States increased their labour supply during WW1 and WW2 to smooth their household consumption (Goldin and Olivetti, 2013; Gay, 2023; Braun and Stuhler, 2024). There is also evidence that scarcity of male workers due to conscription and fatalities can cause firms to substitute towards female labour (Acemoglu et al., 2004; Boehnke and Gay, 2022). As for why demographic shocks can have a lasting impact on female labor market outcomes even after sex ratios have normalised, increased FLFP can help shift societal norms and enable greater acceptance for future generations of women to work. For example, Gay (2023) show that daughters and daughters-in-law of women who experienced higher WW1 casualties were more likely to be working. Of the few studies to examine evidence from developing countries, Teso (2019) show that descendants of women who experienced female-biased sex ratios due to the transatlantic slave trade have a more positive attitude towards women working outside the home and are also more likely to be working two centuries later.

Within this field also exists a growing body of research which challenges the consensus that demographic shocks can have enduring impacts on FLFP. For example, Rose (2018) show that the rise in demand for female labour in the US due to the exigences of WW2 reversed once male soldiers returned. Moreover, Goldin and Olivetti (2013) find that only highly educated women remained in the labour force. To what extent women were induced to enter the labour market and occupy jobs in male-intensive sectors in developing countries remain under explored, and one which this paper empirically examines.

A priori, it is not clear that demand for female labour would have increased in Vietnam as it did in France, Germany and the US during the two World Wars. Although the traditionally male-intensive manufacturing and construction sector grew at an average annual rate of 8 percent throughout the war, Vietnam was predominantly a "peasant society" (CIA, 1960). Unlike in the US during WW2 where over 3 million (mainly auto) manufacturing firms were relied upon to produce high-tech goods (e.g. ordnance, rubber and aircraft), Vietnam's manufacturing sector was controlled by a handful of firms which mainly produced textiles and paper in the South, and processed chemicals in the North (Gropman, 1996; CIA, 1960). Factories in Vietnam also had significantly less technical capabilities and had to rely on importing weapon systems from foreign allies (i.e. USSR and China for the North, and the US for the South). Due to this, demand for female labour may not have increased as anticipated. Even if there was a surge in demand for female labour, it is questionable as to whether this was sustained during peacetime as occupational segregation of men and women became more pronounced since the 1980s (Goodkind, 1995; Huynh and Ku, 2024). For example, while there were 98 male workers for every 100 female workers in the manufacturing sector in 1979, this ratio increased to 132 male workers to 100 female workers in 1989 (Goodkind, 1995). Similarly to how Indian districts with higher mortality rates due to the 1921 pandemic saw increased FLFP primarily in the femaleintensive services sector, I also find that women in districts which experienced greater intensity of bombing increased their labour supply in the female-intensive services sector rather than the male-intensive manufacturing sector (Fenske et al., 2022).

The paper closest to this is by Kreibaum and Klasen (2015) who also examined the effect of the Vietnam War on FLFP. This paper differs from theirs in two distinct ways. First, I extend the timeline of analysis by employing the newly released Population and Housing Census of 2019, allowing me to look at the impact of the Vietnam War on FLFP 44 years after its conclusion. Second, this paper also uses a higher level of disaggregation (i.e. districts rather than province), providing a more precise understanding of the effect of the Vietnam War as I am able to compare the effect of war-induced demographic shocks on female labour market outcomes even *within provinces*.

More broadly, this paper speaks to the literature on the long-term impact of the Indochina Wars. Examining the presence of a "Conflict Trap" as a result of the Vietnam War, Miguel and Roland (2011) find no impact on consumption and poverty 23 years after reunification. On the other hand, Riano and Valencia Caicedo (2024) show that unexploded mines due to the Laotian Civil War, and which the US was also heavily involved in, still negatively impacts the country's economic development and human capital. Separately, Singhal (2019) investigates the long-term effect of early year exposure to conflict on mental health to find that early-life exposure to the Vietnam War negatively affects mental health in adulthood. This paper revisits the question of how US foreign policy in Southeast Asia still affects the economic development of the region today by incorporating a gender dimension. This an important question to study because understanding the role women play in post-war economic reconstruction has important policy implications.

The rest of this paper proceeds as follows: Section 2 provides an overview of the Vietnam War, Section 3 details my sources of data, Section 4 outlines my empirical strategy, Section 5 analyses the results, and Section 6 explores the mechanisms. Finally, Section 7 concludes.

2 Overview of the Vietnam War

2.1 The Vietnam War

Vietnam was under French colonial rule from 1858 until 1954 when the French Union were ousted by the Viet Minh communist revolutionaries. Following independence from France, Vietnam was split along the 17th Parallel pursuant to the Geneva Conference where the North was designated a Communist state led by Ho Chi Minh, and the South as a Capitalist state under US-backed President Ngo Dinh Diem. Although the country was split into two, the CPV sought to reunite the two regions under Communist rule. Pursuant to the "Road to the South" plan, the CPV sent support in the form of manpower and materials to Southern Viet Cong (VC) revolutionaries (Daddis, 2015). This was achieved through the development of a secret network of roads and trails (dubbed the "Ho Chi Minh Trail") which connected the North and the South, and which the CPV exploited to send troops and arms to VC insurgents (Figure 1).

The primary objective of US intervention in Vietnam was to prevent the South from capitulating to the Communist government in the North. President Kennedy initially opposed military intervention, but the backdrop of the Cold War and the Diem administration's incompetence in addressing communist insurgency ultimately led to the deployment of 200,000 troops in South Vietnam in 1965. After President Kennedy's assassination, President Johnson and President Nixon continued their predecessor's policy towards involvement in Southeast Asian geopolitics. By 1973, there were over 500,000 troops in South Vietnam which ended with US defeat and subsequent withdrawal in 1973 (Dell and Querubin, 2018).

It is worth noting that the war occurred against a backdrop of large cultural and economic differences between North and South Vietnam. Specifically, North Vietnam had a higher level of industrialisation at the onset of the war thanks to its endowment in natural resources (especially coal) and French investment in the manufacturing sector under its colonial rule (Cima, 1989). However, the government of the North also discouraged private enterprise, emphasising instead the role of central planning in economic development. By contrast, South Vietnam had a relatively nascent industrial capacity and instead expanded and traded rice and rubber (CIA, 1960). In contrast to the North, South Vietnam operated under a market-oriented economy until 1975. By the time the country reunified in 1975 with the Fall of Saigon, the two economies did not converge and the initial differences were amplified further as the new CPV failed to contain private enterprises in the South (Cima, 1989).

Figure 1: Summary of district-level bombing intensity



Source: Author's calculations using THOR.

The scale and chaotic nature of the Vietnam War cannot be understated. Throughout the war, Vietnam experienced the most intense bombing in history with a combined tonnage of ordnance dropped equalling three times as much by weight as the European and Pacific theatre in WW2 combined (Miguel and Roland, 2011). As shown in Figure 1 and Table 1, US efforts were primarily directed towards the Southern regions and concentrated along the 17th Parallel, reflecting the US' emphasis on quelling insurgent activities in the South over addressing communist presence in the North (Daddis, 2015; Dell and Querubin, 2018). In total, approximately 4 times more bombs were dropped on South Vietnam compared to North Vietnam. Also targeted were regions that were close to the Ho Chi Minh Trail, notably as part of "Operation Barrel Roll" and "Operation Steel Tiger". US counterinsurgency (COIN) in South Vietnam has also been characterised as favouring an approach of "overwhelming firepower" (Dell and Querubin, 2018).

	North	South
Agriculture	0	107
Civilian	34649	810840
Infrastructure	468053	156051
Industry	17914	4321

Table 1: Summary of ordnance targets, by region

Source: Author's calculations using THOR.

Agricultural targets are targets labelled "agricultural area". Civilian targets include civilian population centres, villages, huts, islands and buildings (excluding factories). Industrial targets include construction sites, factory sites, and electrical power plants. Infrastructure targets include roads, bridges, railroads, ferry crossings, piers, ports, and ship-yards.

2.2 Vietnamese demography after the Vietnam War

Not only was this an expensive war to fight, it was also extremely costly in terms of lives lost. One conservative estimate puts North and South Vietnamese casualties at 791,000, of which 655,000 were males above the age of 15 (Hirschman et al., 1995). Figure 2 below shows the sex ratio of North and South Vietnam 14 years after the war and reveals that disproportionately killed were men of prime working age (i.e. 25 to 54) (Merli, 1998). More specifically, although the sex ratio for those born after reunification is above 100 (i.e. more men than women), a sharp drop can be seen for those born before 1975. For those aged 25 to 42 in 1975, there were approximately 80 men per 100 women, highlighting the "missing men" phenomenon. This sex imbalance is particularly pronounced for those aged 32 in 1975 where there were only 61 men for every 100 women.

One possible reason for the differential effect of the war on the demography of North and South Vietnam lies in the roles the respective women played. North Vietnamese women were galvanised by the CPV to actively fight whereas Southern Vietnamese women were given no such mandate by their government. For example, Turner and Hao (2002) report that young women comprised 70 percent of the youth unions responsible for guarding the Ho Chi Minh Trail. Additionally, over 1 million women were recruited by the People's Army of Vietnam (PAV), the military force of the CPV, in local self-defence and militia units. By contrast, the National Liberation Front of South Vietnam (NLF), a largely guerrilla unit which received directions from the PAV, had a female membership of only 30 percent.



Figure 2: Sex ratio by birth cohort

Source: Author's calculations using the 1989 Census.

Another contributing factor to the difference in how the war manifested in Northern and Southern demography is the difference in mission functions by the US Air Force (USAF). As shown in Figure 3, the most frequent mission flown by the USAF in South Vietnam was (close or direct) air support and air interdiction. These operations likely led to higher male casualties since they primarily occurred at the frontline where the majority of combatants were men. On the other hand, the most frequent missions in the North were armed reconnaissance and strikes. Armed reconnaissance, a military tactic focused on locating and destroying enemy targets, often targeted areas which the US believed to be hubs of the Ho Chi Minh Trail and which were occupied by both men and women. Strikes in the North were also disproportionately directed at strategic infrastructure or logistical hubs rather than direct combat zones, potentially resulting in fewer genderspecific casualties.

As a consequence of the significant male mortality, many Vietnamese women were left widowed. As evidenced by Figure 4, the gap in the share of widowed women between the North and South is especially apparent for women between the ages of 21 and 54 in 1975, further corroborating the evidence that male mortality was concentrated among Southern men who were of prime working age. That the Vietnam War left many women widowed, especially those of prime working age, is especially pertinent in the examination of the impact of demographic shocks on FLFP since the death of a husband often concurrently meant to death of the main breadwinner. It is thus plausible that one way in which the Vietnam War led to higher FLFP is through the creation of widows where, due the economic hardship of losing their husband, these women were especially compelled to enter



Figure 3: Mission types, by region

Source: Author's calculations using THOR.

the labour market to compensate for the loss of income (Gay, 2023; Braun and Stuhler, 2024).

2.3 Women during the Vietnam War

Anecdotal evidence from the Vietnam War era is abundant with stories of how women filled in for men (Turley, 1972; Banister, 1985; Cima, 1989). However, the majority of these stories emerge from the North of Vietnam, with the evidence from South Vietnam being parsimonious in comparison.

Building on the growing public debate for equal women's rights from the 1930s, the government of the DRV mobilised women into the workforce by arguing that the fight for gender equality was tantamount to the emancipation of the peasants. In 1966, the Central Committee of the North issued Directive 99/CT-TU which explicitly stated that women would be inducted into management roles. Throughout the war, the DRV emphasised that women had 'three responsibilities': (1) replace men to free them to join the front line, (2) encourage husbands and sons to enlist, and (3) participate in combat if required. The success of the pro-female propaganda is evident as by 1967, 15 percent of village administrative council presidencies were occupied by women (compared to 0.5 percent in 1962) (Turley, 1972). More broadly, FLFP in the North grew from close to zero during the pre-war era to 80 percent in 1966 (Turley, 1972).



Figure 4: Share of women widowed, by birth cohort

Source: Author's calculations using Census of 1989.

Unlike their Northern counterparts, Southern women were less exposed to Socialist ideology and policies which promoted FLFP. Contemporary reports highlight that Southern women enjoyed less economic and social freedoms than Northern women (Turley, 1972). Without mobilisation, Confucian ideology which asserted the subordinate role of women prevailed (Nguyen and Tran, 1980). In modern times, Southern women report more conservative attitudes towards gender equality and have a lower FLFP rate (Do et al., 2023).

3 Data

3.1 Historical data

Data on ordnance dropped by the US in Vietnam between 1965 and 1975 comes from the Theatre History of Operations Reports (THOR). THOR was collated under the guidance of Lieutenant Colonel Jenns Robertson and combines raw data on ordnance dropped in Vietnam from the Combat Air Activities Files (CACTA), the Southeast Asia Database (SEADAB), and Strategic Air Command Combat Activities Report (SACOACT) which are housed at the US National Archives.² THOR thus represents the most comprehensive source of data on ordnance dropped on Vietnam during the Vietnam War, not only recording the geolocation of bombs, missiles and rockets jettisoned, but also the quantity and load weight. In total, I have information relating to over 900,000 missions flown in Vietnam between 1965 and 1975. Since THOR contains the geolocation of sorties, I am able to match ordnance activity to contemporary subnational administrative boundaries and calculate historical exposure of districts and provinces.

To calculate the distance between a district's centroid to the nearest part of the Ho Chi Minh Trail, I rely on historical maps which were georeferenced by Riano and Valencia Caicedo (2024).

3.2 Microdata

My main sources of individual-level data comes from the cross-sectional Population and Housing Census of Vietnam, downloaded from the IPUMS International website. The currently available waves of the Census are from 1989, 1999, 2009, and 2019. The Censuses contains rich information including demography, employment status and sector of employment. To assess the impact of the Vietnam War on female labour market outcomes closer to the time of reunification, I rely on the 1989 and 1999 Census which provides data for labour market outcomes 14 and 24 years after the war respectively. The 1989 Census captures 5 percent of the population (N = 2, 626, 985), and the 1999 Census captures 3 percent of the population (N = 2, 368, 167). To assess longer-term impacts at a higher level of disaggregation, I employ the 2009 and 2019 Census which represents outcomes 34 and 44 years after the war respectively. The 2009 Census captures 15 percent of the

²CACTA contains monthly data on air combat missions flown in Southeast Asia by the US and allied forces between 1 October 1965 and January 31 1971. The SEADAB is the successor to the CACTA and records air combat missions flown in Southeast Asia by US and allied forces between January 1971 and June 1975. SACOACT contains data on air combat missions flown in Southeast Asia by the Strategic Air Command between 6 January 1965 and 31 October 1975.

country's population (N = 14, 177, 590), and the 2019 Census captures 8.5 percent of the country's population (N = 8, 236, 773).

The 2009 Census covers 679 districts and the 2019 Census covers 702 districts out of 713, both of which are representative at the district-level. The 1989 and 1999 Census covers all provinces in Vietnam, and are representative at the province-level.³ Since the 1989 and 1999 Census do not record the district of residence, I perform analyses at the province-level when employing these waves of the Census.

As a robustness check, I employ the Vietnam Household Living Standards Survey (VHLSS) of 2014 and 2016. The VHLSS is conducted biennially by the General Statistics Office of Vietnam, and is primarily cross-sectional. The VHLSS contains rich individuallevel information pertaining to demography, employment status, sector of employment, and type of employer (i.e. state enterprise, collectives, domestic or foreign firms). The VHLSS of 2014 and 2016 are representative at the province-level and contains over 175,000 observations from 45,000 households.⁴ The VHLSS can be thought of as a complement to the Census as the province of birth is recorded, allowing me to bypass concerns regarding internal migration.

In my analyses, I restrict my observations to women aged 16 to 64, corresponding to the legal working age in Vietnam.

4 Empirical Strategy

Before outlining the empirical strategies used in this paper, I will begin by discussing the challenges to uncovering the causal effect of the Vietnam War on FLFP.

One challenge to uncovering the causal effect of the Vietnam War comes from the non-random nature of bombing targets. For instance, estimates may be biased upwards if the initial level of economical development of a district is correlated with its bombing intensity. If more economically developed districts were more likely to be targeted, higher FLFP might reflect not the demographic shock caused by the war but rather the economic opportunities present in those districts. Instead, war historians have documented that poorer areas were more likely to be targeted due to its proximity to peasants who the VC actively targeted in their efforts to recruit insurgents (Littauer and Uphoff, 1972; Daddis, 2015). This is reflected in the THOR data where Ho Chi Minh City and Da Nang City, the commercial hubs of the South, received only one-tenth of the bombings

³There were 44 provinces in 1989, 61 provinces in 1999, and 63 provinces since 2003.

 $^{^4\}mathrm{Although}$ the first VHLSS dates back to 1998, the first year in which the province of birth is collected is in 2014.

experienced by Quang Tri Province, the most heavily bombed province. Similarly for Northern megalopolises, 20,000 bombs were dropped on Hanoi and Hai Phong compared to Quang Tri Province which was the target of over 1 million bombs. Miguel and Roland (2011) also find in both their main paper and in its corrigendum that bombing had no impact on the prosperity of districts 23 years after its conclusion. Thus, I do not expect my estimates to be confounded by the initial level of economic development of the district.

Internal migration poses another threat to identification. If, for example, districts that were less heavily bombed became a refuge for migrants from heavily bombed districts, the change in composition of residents could bias results. Unfortunately, the Census only records the migration status of individuals based on their district or province of residence in the last 5 years. However, I show in Figure 5 that districts that were less heavily bombed in both North and South Vietnam did not have a higher share of migrants in 2009 and 2019. Additionally, Singhal (2019) show using the Vietnam Living Standards Survey of 97-98 and the Vietnam Access to Resources Household Survey of 2016 that bombing intensity did not have an effect on birth cohort size at the district-level, alleviating concerns regarding selective mortality.

Although my sources of data do not allow me to observe which district individuals likely resided in during the Vietnam War, the Census provides insight into the key differences between migrant and non-migrant women. The age, educational attainment and labour force participation of migrant and non-migrant women aged 15 to 64 is summarised in Table 2 below. Migrant women are significantly younger and have higher educational attainment than non-migrant women. In spite of this, their labor force participation rate is substantially lower, with a gap ranging from 5 to 13 percentage points between 1989 and 2019. Phan and Coxhead (2010) also reveal that migrants typically moved from low income (high bombing intensity) to high income (low bombing intensity) provinces in search of better economic opportunities.⁵ Given the lower labor force participation of migrant women and the direction of migration, this may lead my estimates to be downwards biased.

Guided by the fact that North and South Vietnam experienced different economic systems between 1954 and 1975, and that South Vietnam experienced a larger demographic shock than the North, I implement all models below separately for the North and South.

⁵The share of observations who had been living in the same district for the last 5 years was 81.8 percent in 1989, 86.3 percent in 1999, 85.4 percent in 2009 and 87.5 percent in 2019. By comparison, the share of observations who had been living in the same province but different district was 1.68 percent in 1989, 1.49 percent in 1999, 1.99 percent in 2009 and 1.25 percent in 2019.

Figure 5: District-level bombing intensity versus share of population who are migrants



Source: Author's calculations using the 2009 and 2019 Census.

4.1 Fixed-Effect Model

As the first step in my empirical analysis, I explore the relationship between historical exposure to the Vietnam War and FLFP 34 to 44 years after the conclusion of the Vietnam War by exploiting district-level variation in historical bombing intensity. To this end, I implement the following Fixed Effect (FE) model using the 2009 and 2019 Census:

$$Work_{id} = \beta BMR_d + \mathbf{X}_{id} + \delta_p + \varepsilon_{id} \tag{1}$$

where $Work_i$ takes the value of 1 if individual *i* in district *d* has worked in the past 7 days, and 0 otherwise. The BMR_d is the number of bombs, missiles and rockets jettisoned

	М	igrant	Non-	Migrant	
	Mean	Std. Dev.	Mean	Std. Dev	Difference
1989					
Age	29.28	11.08	32.75	13.54	-3.48^{***}
Educational Attainment	7.49	3.67	5.79	3.66	1.70^{***}
Work	0.75	0.47	0.87	0.42	-0.12^{***}
1999					
Age	27.65	10.47	33.34	13.04	-5.69^{***}
Educational Attainment	6.53	3.41	5.45	3.41	1.07^{***}
Work	0.75	0.47	0.87	0.42	-0.13^{***}
2009					
Age	26.26	9.27	35.45	13.26	-9.19^{***}
Educational Attainment	8.36	3.35	7	3.41	1.36^{***}
Work	0.78	0.46	0.88	0.41	-0.10^{***}
2019					
Age	38.2	10.51	46.46	13.56	-8.26^{***}
Educational Attainment	9.27	4	7.77	4.30	1.50^{***}
Work	0.75	0.45	0.80	0.42	-0.05^{***}

Table 2: Summary of Female Migrants and Non-Migrants

Source: Author's calculations using 1989, 1999, 2009, and 2019 Census. Observations are restricted to women aged 15 to 64.

between 1965 and 1975 on district d. For ease of interpretation, I have standardised the variable BMR_d . \mathbf{X}_{id} contains a vector of individual-level controls which include age and its square, educational attainment, marital status, number of children, a dummy for ethnic minority status, a dummy for urban-dwelling, and a dummy for migration status. Province fixed effects (δ_p) are included to control for time-invariant characteristics at the province-level, and which also allows me to exploit within-province variation in bombing intensity. The coefficient of interest, β , gives the conditional effect of district-level ordnance on women's labour market outcomes 34 or 44 years after the war. Standard errors are clustered at the district level.

4.2 Difference in Differences Model

As an alternative identification strategy, I exploit a combination of variation in timing and spatial exposure to ordnance by implementing a difference-in-differences (DiD) model. One advantage of the DiD estimation strategy is that it allows me to partially address endogeneity concerns arising from the fact that ordnance were not randomly distributed across districts. Using the 2009 and 2019 Census, I implement the following DiD model separately for women in the North and South:

$$Work_{idc} = \sum_{c} \gamma_c (BMR_d \times Age1975_{idc}) + \mathbf{X}_{idc} + \delta_p + \phi_c + \varepsilon_{idc}$$
(2)

where $Work_{icp}$ takes the value of 1 if individual *i* in district *d* in age cohort *c* in 1975 has worked in the past 7 days, and 0 if they did not. $Age1975_{icd}$ is a set of dummy variables which takes the value of 1 if individual *i* resides in district *d* and belongs to age cohort *c* in 1975, and 0 otherwise. ϕ_c is the age cohort fixed effect. Individual-level controls include the same set as that in equation (1), excluding age and its square. Other variables are as in equation (1). Standard errors are clustered by district and age cohort.

4.3 Instrumental Variables Model

The FE and DiD models may suffer from bias since bombs were not randomly dropped across Vietnam. Districts that were heavily bombed in the North were districts which were more industrialised and had higher access to infrastructure. On the other hand, districts that were more targeted in the South tended to be poorer since they had a higher share of peasants who the VC were actively recruiting from (Dell and Querubin, 2018). The FE and DiD estimates may therefore be overestimated for the North, and underestimated for the South.

To address the potential endogeneity of bombing, I leverage the fact that the exact location of the Ho Chi Minh Trail was unknown by the US throughout the war. Efforts to dismantle the secretive network of trails which the VC used to launch attacks against the US were in vain despite operations which sought to identify its location. Although referred to as the Ho Chi Minh Trail, the bulk of these trails in fact crossed through Laos and Cambodia. Tracks and roads which constituted the Ho Chi Minh Trail in the South meandered across rugged mountains and dense rainforests, making it unlikely for the trail to have influenced FLFP other than through increasing a district's exposure to bombing campaigns. Given the asymmetry of information on the location of the trails, and following Riano and Valencia Caicedo (2024), I employ the distance to the Ho Chi Minh Trail as an instrument.

Another potential instrument comes in the form of the distance of the district centroid to the 17th parallel, as first used by Miguel and Roland (2011) and subsequently employed by Singhal (2019). The decision to separate North and South Vietnam along the 17th parallel can be thought of as producing quasi-random variation in bombing intensity since its placement was arbitrarily chosen and arose as a result of negotiations between the US and the USSR (Miguel and Roland, 2011). As Vietnam was excluded from discussions pertaining to the placement of the border, it is unlikely that the exclusion restriction is violated since the 17th Parallel did not reflect the initial level of economic development or access to natural resources. Moreover, Miguel and Roland (2011) show that the distance to the 17th parallel is uncorrelated with a district's poverty levels 20 years after reunification.

The first-stage of the 2 stage least squares regression thus takes the following form:

$$BMR_d = \rho \cdot f(Z_d) + X_{id} + \delta_p + \epsilon_{id} \tag{3}$$

where Z_d is the distance between a district's centroid to the nearest part of the Ho Chi Minh Trail or the 17th parallel. As can be seen in Figure A.5 in the Appendix, the relationship between distance and bombing is non-linear. Therefore, I also include a squared term per Riano and Valencia Caicedo (2024). Other variables are as in equation (1).

4.4 OLS Model

To assess the impact of the Vietnam War on labour market outcomes closer to time of reunification, I employ a regression model that is analogous to my FE model. Here, I exploit provincial variation in historical exposure to the Vietnam War and utilise all available waves of the Census to implement the following OLS model:

$$Work_{ip} = \theta BMR_p + \mathbf{X}_{ip} + \varepsilon_{ip} \tag{4}$$

where $Work_{ip}$ takes the value of 1 if individual *i* in province *p* has worked in the past 7 days or 12 months, and 0 otherwise.⁶ BMR_p is the total number of ordnance dropped on province *p* between 1965 and 1975, and which has also been standardised for ease of interpretation. Individual controls are the same as in equation 1, and standard errors are clustered at the province-level.

Although this model explores the relationship between historical exposure to conflict and FLFP at a more aggregated level than the aforementioned models, one advantage this model has is that it partially mitigates biases that stem from internal migration across

 $^{^6{\}rm The}$ reference period for employment was the last 7 days for the 2009 and 2019 Census, and last 12 months for the 1989 and 1999 Census.

districts. As explained above, my estimates may be biased if the composition of districts changed due to reasons that are not exogenous to bombing intensity. By contrast, this model allows for intra-provincial migration, a requirement that is more easily met since inter-provincial migration is relatively low (Pincus and Sender, 2008; McCaig et al., 2022).

As a robustness check, and to explore the extent to which migrants are confounding estimates, I re-implement the OLS model above using the VHLSS. As the 2014 and 2016 waves of the VHLSS record the province of birth, I replace BMR_p with the total number of ordnance jettisoned on the *province of birth*. The dependent variable takes the value of 1 if individual *i* has worked in the last 12 months.

5 Main Results

5.1 FE Model Results

Table 3 reports the FE estimates as given by equation 1. Panel A presents the results for Northern women and reveal that historical bombing intensity is largely unassociated with women's labour market outcomes in the North. My estimates with and without individual controls using the 2009 Census, while negative, are statistically insignificant at the conventional levels. Using the 2019 Census yields larger estimates, although the coefficient for the effect of bombing on women's probability of working is only significant at the 10 percent level with the inclusion of individual controls.

On the other hand, the results in Panel B show that Vietnam War-era bombing intensity is positively associated with the probability of working for Southern women. With the inclusion of province fixed effects and conditional on individual controls, a one-SD increase (an extra 25369.58 of ordnance jettisoned or 39.12 percent increase) in bombing intensity increases women's probability of working in the South by 1.49 percentage points in 2009 and 1.02 percentage points in 2019. These estimates are also significant at the 1 percent level. Overall, the results in Table 3 point towards an increase in the labour supply of Southern women in response to war-induced demographic shocks.

5.2 DiD Model Results

As an alternative empirical strategy and to examine the effect of historical bombing intensity across birth cohorts and districts, but within the same province, I employ a DiD model as specified by equation (2) using the 2009 and 2019 Census. The results using the 2009 Census are presented in panel (a) of Figure 6, while panel (b) presents the results using the 2019 Census.

		D	1 /	• 1 1 1 1 1 1						
	Dependent variable: work									
		2009			2019					
Model:	(1)	(2)	(3)	(4)	(5)	(6)				
Panel A. North										
BMR	-0.0055 (0.0073)	-0.0040 (0.0161)	-0.0040 (0.0079)	-0.0134^{**} (0.0052)	-0.0120 (0.0099)	-0.0104^{*} (0.0060)				
$\begin{array}{l} {\rm Mean} \\ {\rm Observations} \\ {\rm R}^2 \end{array}$	$\begin{array}{c} 0.8053 \\ 2,216,446 \\ 7.39 \times 10^{-5} \end{array}$	0.8053 2,216,446 0.03191	0.8053 2,216,446 0.25993	$0.8072 \\ 1,233,069 \\ 0.00040$	0.8072 1,233,069 0.02831	0.8072 1,233,069 0.20565				
		Panel B	8. South							
BMR	$\begin{array}{c} 0.0394^{***} \\ (0.0074) \end{array}$	$\begin{array}{c} 0.0295^{***} \\ (0.0052) \end{array}$	$\begin{array}{c} 0.0149^{***} \\ (0.0031) \end{array}$	$\begin{array}{c} 0.0314^{***} \\ (0.0063) \end{array}$	$\begin{array}{c} 0.0196^{***} \\ (0.0048) \end{array}$	$\begin{array}{c} 0.0102^{***} \\ (0.0037) \end{array}$				
Mean Observations R ²	0.7127 2,329,351 0.00740	0.7127 2,329,351 0.03462	0.7127 2,329,351 0.12564	$0.6976 \\ 1,416,209 \\ 0.00456$	$0.6976 \\ 1,416,209 \\ 0.03872$	$0.6976 \\ 1,416,209 \\ 0.14066$				
Province FE Individual Controls	No No	Yes No	Yes Yes	No No	Yes No	Yes Yes				

Table 3: FE model results: Bombing intensity and labour force participation

Notes: Clustered (district) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include age and its square, educational attainment, number of children, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy.

Starting with the estimates obtained for Northern women in 2009, bombing has a heterogeneous effect on women's probability of working by birth cohort. For women born before reunification in 1975, I obtain progressively larger coefficients which also becomes more statistically significant as I move up the birth cohort. The largest coefficients are obtained for women who were 20 to 31 at the end of the Vietnam War where a one-SD increase in bombing increases the probability of working by 1.1 percentage points on average. Although I have obtained insignificant results for Northern women aged 20 to 31 here reveal that although most of the fighting occurred in South Vietnam, demographic shocks also induced women of prime working age in 1975 to enter the labour market in the North. For women born after reunification, bombing has a negative effect on the probability of working. Specifically, a one-SD increase in bombing reduces the probability of working for this age cohort by 1.26 percentage points.

Similar patterns are observed for Northern women when using the 2019 Census in which bombing is associated with an increase in the probability of working for birth cohorts born before reunification, but the reverse is true for birth cohorts born after reunification. The strongest negative effects are concentrated among women born 15 to 25 years after

reunification (i.e. 19 to 29 in 2019) where a one-SD increase in bombing reduces the probability of working by 4.79 percentage points. Not only is this effect statistically significant at the 5 percent level, it is also economically significant.

Focusing now on the DiD estimates for Southern women, Figure 6 shows that bombing is positively associated with the probability of working for women across the vast majority of working age women in both 2009 and 2019. As with the North, among women born before reunification, the impact of bombing was strongest for women aged 20 to 30 in 1975 where a one-SD increase in bombing increases the probability of working by 3.51 percentage points on average – more than treble the estimate obtained for Northern women in the same birth cohort. Notably, the pre-1975 birth cohorts for which the DiD estimates are largest in 2009 and 2019 corresponds with the birth cohort which experienced the largest sex imbalance in the South, supporting the hypothesis that war-induced demographic shocks led prime working-age women to take up work. Moreover, that I recover positive and statistically significant estimates for women in both North and South Vietnam who born before reunification 34 and 44 years after the war provides evidence of persistent effects, contrasting the finding by Rose (2018) and Goldin and Olivetti (2013) that any such effect may be short-lived.

For the birth cohorts born after 1975, I also obtain predominantly positive and statistically significant estimates although the magnitude is smaller compared to women born before 1975. The exception to this is women who were 22 to 24 in 2009 (i.e. born 12 to 14 years after reunification) and 19 to 22 in 2019 (i.e. born 22 to 25 years after reunification) where I obtain similar or larger estimates to women of prime working age in 1975. This may point towards intergenerational effects, and which I explore in sections below.

5.3 IV Model Results

As explained above, districts that were more heavily targeted by the US in the South tended to be more agrarian whereas industrialised districts in the North were more susceptible to being bombed (Dell and Querubin, 2018). This may lead the FE and DiD estimates to suffer from downwards bias in the South and upwards bias in the North. To address endogeneity concerns, I employ an IV strategy as specified by equation (3). To this end, I exploit two variables as an instrument to the district-level bombing intensity: distance of the district centroid to the nearest part of the Ho Chi Minh Trail, and district of the district centroid to the 17th Parallel.

The IV estimates may additionally be thought of as the local average treatment effect (LATE) as opposed to the (potentially biased) average treatment effect (ATE) provided

by the FE model. In this instance, the IV estimate captures the effect of bombing on compliers (i.e. districts which became more intensely bombed primarily due to their proximity to the Ho Chi Minh Trail or the 17th Parallel).

Starting first with the second-stage results for the distance to the Ho Chi Minh Trail as an instrument for bombing intensity, the F-statistics in Table 4 are far above the threshold set by Stock and Yogo (2002) in their test for weak instruments.

As suspected, the IV estimates in Table 4 reveal that the FE and DiD estimates were upwards biased for the North and downwards biased for the South. Still, I obtain insignificant results for the impact of bombing on the probability of Northern women working using both the 2009 and 2019 Census. I also continue to obtain estimates that are positive and significant at the 1 percent level, even with the inclusion of FE and individual controls. As can be seen in panel B, the IV estimates for Southern women are approximately twice as large as the FE estimates with a one-SD increase in bombing being associated with an increase in the probability of working by 2.36 percentage points in 2009 and 1.94 percentage points in 2019.

	Dependent variable: Work										
		2009			2019						
Model:	(1) (2) (3)			(4)	(5)	(6)					
Panel A. North											
BMR	$0.0063 \\ (0.0224)$	-0.0385 (0.0268)	-0.0202 (0.0504)	$0.0143 \\ (0.0145)$	-0.0165 (0.0155)	$\begin{array}{c} 0.0079 \ (0.0385) \end{array}$					
$\begin{array}{l} {\rm F-statistic}\\ {\rm Observations}\\ {\rm R}^2 \end{array}$	1,908,586.8 2,216,446 -0.00070	1,578,493.1 2,216,446 -0.01776	$\begin{array}{c} 143,\!593\\ 2,\!216,\!446\\ 0.25915\end{array}$	$\begin{array}{c} 1,039,213.1\\ 1,233,069\\ 0.00033\end{array}$	851,151.7 1,233,069 -0.00127	76,509.6 1,233,069 0.20559					
		Pane	l B. South								
BMR	$\begin{array}{c} 0.1003^{***} \\ (0.0220) \end{array}$	$\begin{array}{c} 0.0732^{***} \\ (0.0274) \end{array}$	0.0236^{**} (0.0116)	$\begin{array}{c} 0.1208^{***} \\ (0.0288) \end{array}$	$\begin{array}{c} 0.0836^{***} \\ (0.0322) \end{array}$	$\begin{array}{c} 0.0194^{**} \\ (0.0099) \end{array}$					
F-statistic Observations R ²	381,905.5 2,329,351 -0.02655	68,542.7 2,329,351 -0.10643	$\begin{array}{c} 136,\!256.1 \\ 2,\!329,\!351 \\ 0.12166 \end{array}$	211,994.5 1,416,209 -0.04999	38,251.6 1,416,209 -0.05853	96,604.2 1,416,209 0.13971					
Province FE Indv. controls	No No	Yes No	Yes Yes	No No	Yes No	Yes Yes					

Table 4: IV model results: Bombing intensity and labour force participation, instrumented by distance to Ho Chi Minh Trail

Clustered (district) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include age and its square, educational attainment, number of children, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy.

As a further robustness check, I employ the distance to the 17th Parallel as an instrument where I also obtain F-statistics that far surpasses the threshold of 10 as seen in Table 5. First, the estimates obtained using the distance to the 17th parallel as an instrument are similar in magnitude to those using the distance to the Ho Chi Minh Trail as an instrument. However, once I control for individual characteristics and include province FE, my estimates are not statistically significant.

		Dependent variable: Work								
		2009			2019					
Model:	(1)	(2)	(3)	(4)	(5)	(6)				
		Pane	el A. North	'n						
BMR	$0.0036 \\ (0.0155)$	-0.0301 (0.0186)	-0.0143 (0.0308)	$0.0036 \\ (0.0111)$	-0.0224^{*} (0.0117)	$0.0167 \\ (0.0235)$				
$\begin{array}{l} \text{F-statistic} \\ \text{Observations} \\ \text{R}^2 \end{array}$	918,214 2,216,446 -0.00013	557,084.1 2,216,446 0.00494	37,166.4 2,216,446 0.25985	518,317.6 1,233,069 -0.00024	308,883 1,233,069 0.00357	20,653.1 1,233,069 0.20514				
		Pane	el B. South	ı						
BMR	$\begin{array}{c} 0.0619^{***} \\ (0.0150) \end{array}$	-0.0038 (0.0246)	0.0156 (0.0192)	$\begin{array}{c} 0.0775^{***} \\ (0.0196) \end{array}$	-0.0053 (0.0228)	0.0274 (0.0174)				
$\begin{array}{l} \text{F-statistic} \\ \text{Observations} \\ \text{R}^2 \end{array}$	300,397.1 2,329,351 0.00501	$\begin{array}{c} 132,\!527.8\\ 2,\!329,\!351\\ 0.00556\end{array}$	$\begin{array}{c} 48,872.2\\ 2,329,351\\ 0.12564\end{array}$	160,718.2 1,416,209 -0.00523	68,884.2 1,416,209 0.00853	30,023.1 1,416,209 0.13990				
Province FE Indv. controls	No No	Yes No	Yes Yes	No No	Yes No	Yes Yes				

Table 5: IV model results: Bombing intensity and labour force participation, instrumented by distance to the 17th Parallel

Clustered (district) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include age and its square, educational attainment, number of children, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy.

5.4 OLS Model Results

To examine the effect of the Vietnam War on the labour market outcomes of women closer to the year of reunification, I rely on earlier waves of the Census and exploit provincial variation in historical bombing intensity. The results for the OLS model, given by equation (4), is shown in Table 6. As explained, the OLS models permit individuals to migrate within the same province and thus partially address concerns that internal migration may bias results. Reassuringly, the results here qualitatively mirror the FE estimates found in Table 3.

		Dependent variable: Work								
	19	1989 1999		999	2009		2019			
Model:	North (1)	South (2)	North (3)	South (4)	North (5)	South (6)	North (7)	South (8)		
BMR	-0.0120^{**} (0.0053)	$\begin{array}{c} 0.0279^{***} \\ (0.0083) \end{array}$	-0.0003 (0.0079)	$\begin{array}{c} 0.0379^{***} \\ (0.0102) \end{array}$	-0.0099 (0.0068)	$\begin{array}{c} 0.0288^{***} \\ (0.0057) \end{array}$	-0.0099 (0.0102)	$\begin{array}{c} 0.0258^{***} \\ (0.0081) \end{array}$		
$\begin{array}{l} {\rm Mean} \\ {\rm Observations} \\ {\rm R}^2 \end{array}$	$0.7680 \\ 319,074 \\ 0.23860$	$0.6323 \\ 415,621 \\ 0.09915$	0.7027 314,142 0.27433	$0.6942 \\ 386,817 \\ 0.10468$	0.8053 2,216,446 0.25433	0.7127 2,329,351 0.11093	$0.8072 \\ 1,205,067 \\ 0.19613$	$0.6976 \\ 1,416,209 \\ 0.11383$		

Table 6: OLS Model Results: Impact of historical bombing intensity on probability of working

Clustered (province) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include age and its square, educational attainment, number of children, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy.

The odd columns of Table 6 report the estimates for a one-SD increase (equivalent to an extra 184833.8 ordnance jettisoned, or 173.9 percent increase) in province-level bombing on the probability of working for Northern women. Much like in the results from Table 3, I obtain negative coefficients which are, for the most part, statistically insignificant. The exception to this is the estimate using the 1989 Census which is significant at the 5 percent level, and which shows that a one-SD increase in bombing corresponds to a 1.2 percentage point reduction in the probability of Northern women working.

Conversely, as can be seen from the even columns of Table 6, I continue to obtain positive estimates that are significant at the 1 percent level for women in the South. More specifically, a one-SD increase in a province's historical exposure to bombing increases the probability that a woman works by 2.79 percentage points in 1989, 3.79 percentage points in 1999, 2.88 percentage points in 2009 and 2.58 percentage points in 2019. That I recover similar estimates between 1989 to 2019 indicates also the presence of persistent effects of the Vietnam War on FLFP in the South. Compared to the results in Table 3, the results in Table 6 are approximately twice as large, possibly due to spillovers across districts within the same province.

To further explore the robustness of my results and to ascertain the extent to which internal migration introduced bias, I employ the 2014 and 2016 and exploit historical bombing intensity of the province of birth rather than of residence (i.e. BMR_p represents the total number of ordnance jettisoned on the province of birth of individual i). The results using the 2014 and 2016 VHLSS can be found in Table 7 and are qualitatively similar to the OLS estimates using the Census found in Table 6. Specifically, I fail to reject the null hypothesis that bombing had an impact on women's participation in the labour force for Northern-born women yet obtain positive and statistically significant estimates for Southern-born women. For women born in the South, a one-SD increase in bombing intensity of the province of birth increases the probability of working by 1.97 percentage points in 2014, and 1.94 percentage points in 2016.

	De	Dependent variable: Work							
	201	4	20	016					
Model:	North (1)	South (2)	North (3)	South (4)					
BMR	$\begin{array}{c} 2.74 \times 10^{-5} \\ (0.0039) \end{array}$	$\begin{array}{c} 0.0197^{***} \\ (0.0051) \end{array}$	-0.0003 (0.0026)	$\begin{array}{c} 0.0194^{***} \\ (0.0038) \end{array}$					
Mean Observations R ²	$0.8709 \\ 31,766 \\ 0.31163$	0.7774 28,781 0.20777	$0.8764 \\ 29,914 \\ 0.31425$	$0.7784 \\ 28,285 \\ 0.20078$					

Table 7: OLS Model Results: Impact of historical bombing intensity of province of birth on probability of working

 $Clustered \ (province) \ standard \ errors \ in \ parentheses.$

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include age and its square, educational attainment, household size, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy.

6 Mechanisms

Having established that women residing in districts and provinces which experienced greater exposure to the Vietnam War had higher level of FLFP in the short and longterm in the South, I now turn to investigating the demand and supply-side mechanisms. Three mechanisms have been highlighted in extant studies on war-induced demographic shocks and FLFP. On the supply side are widowhood and delayed marriage, whereas demand-side mechanisms refer to substitution towards female labour. In this section, I empirically test the aforementioned mechanisms in turn to explore whether they were also at play in Vietnam.

6.1 Widowhood

As explained in section 2.2 and as can be seen in Figure A.4 in the Appendix, the Vietnam War left many prime working age women in the South widowed in 1975. Widowed women in Vietnam may have been induced to enter the labour market out of economic necessity since the death of their husband would have represented the loss of the main breadwinner (Boehnke and Gay, 2022; Braun and Stuhler, 2024). This is coupled with reports that state support for widows after reunification was inadequately small (Friedman et al., 2003). To

examine whether the loss of a husband led women to enter the labour market, I compare the probability of working of widows versus married women who were within marriageable years (i.e. above the age of 16) in 1975. To this end, I restrict my observations to working-age women in the South who were within marriageable years in 1975 and replace the variable BMR_p in the OLS model with a dummy variable which takes the value of 1 if female *i* is a widow, and which takes the value 0 if they are currently married.⁷ I also include province FE, enabling me to compare the probability of work of widows versus non widows who likely experienced similar exposure to the Vietnam War.⁸

The results for the effect of widowhood on the probability of working are shown in Table 8. In 1989 and 1999, widows were more likely to work than comparable non-widows by 3.84 and 3.32 percentage points in 1989 and 1999 respectively. While widows were more likely to work than non-widows in the short-term, this trend did not persist as widows were approximately 6.27 percentage points less likely to be working than non-widows in 2009, and 1.58 percentage points in 2019. While counter-intuitive, these results are in line with those found by Braun and Stuhler (2024) who provided evidence that although WW1 widows in Germany initially increased their labour supply to smooth household consumption, they exited the labour market once their children became adults. This is also consistent with sociological studies which highlight that it is the norm in Vietnam for the elderly to co-reside with their children, irrespective of the marital status of sons or daughter (Anh et al., 1997; Bui et al., 1999; Friedman et al., 2003). Indeed, in 1999, 76.5 percent of women aged 60 and older co-resided with an adult child (Anh et al., 1997). To further examine the heterogeneous effect of widowhood, I rerun the FE model on women with and without children.

Table 9 summarises the widowhood effect on women with and without children. The coefficient in odd columns provide the difference in probability of working for widows versus non-widows without children. In the short-term widows without children were not discernibly different in terms of their labour market outcomes compared to married women without children, as can be seen from the statistically insignificant estimates. Intuitively, this is reasonable since women without children do not face the same economic pressure that women with children do – regardless of marital status. While I obtain negative estimates in 2009, this is only significant at the 10 percent level and translates to a 1

⁷Widows are women whose husbands have died and have not remarried. Aside from the 2019 Census, the year of marriage is not recorded. Therefore, I assume that my observations entered into marriage before reunification. I also assume that widows lost their husbands during the Vietnam War since the year which women became widowed is not recorded in the Census. This assumption is reasonable as the disparity in mortality rates between men and women begins to widen significantly only after the age of 70 – whereas my observations only include women up to the age of 64.

⁸Since I assume that individuals experienced the Vietnam War in the province which they currently reside in, in addition to restricting my observations to Southern women who were of marriageable years in 1975, I also restrict my observations to those who have not migrated in the last 5 years.

	Dependent variable: Work						
	1989	1999	2009	2019			
	(1)	(2)	(3)	(4)			
Widow	$\begin{array}{c} 0.0384^{***} \\ (0.0091) \end{array}$	$\begin{array}{c} 0.0332^{***} \\ (0.0091) \end{array}$	-0.0627^{***} (0.0049)	-0.0158^{***} (0.0046)			
$\begin{array}{l} \text{Observations} \\ \text{R}^2 \end{array}$	$186,\!379$ 0.14335	$107,\!603$ 0.15005	$77,425 \\ 0.14366$	$88,063 \\ 0.12446$			

 Table 8: FE Model Results: Impact of Vietnam War Widowhood on the Probability of Working

Clustered (province) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include age and its square, educational attainment, number of children, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy. Province fixed effects are included in all specifications.

percentage point difference in the probability of widows and non-widows without children working. On the other hand, it would appear that in the long-term, widows without children were more likely to be working than married women without children by 3.6 percentage points (significant at the 5 percent level). This may reflect the fact that widows without children typically lived alone in 2019 (average household size is 1.23) whereas married women without children lived together with their spouses (average household size is 2.16) and can therefore rely on their husbands for income.

By contrast, the even columns show that among women with children, widows were initially more likely to work than non-widows but did not remain in the labour market for long. Although in 1989 and in 1999, widows were 7.11 and 9.23 percentage points more likely to be working than married women without children, they were less likely to be working by approximately 3 percentage points in 2009 and 2019. The results in Table 9 provide additional evidence that, much like in Germany, war widows initially had to carry the double burden of working and childcare but exited the labour market once their children became economically self-sufficient. This finding is also unsurprising considering the trend that the most important source of financial support for the elderly in Vietnam is adult children (Friedman et al., 2003).

The effect of the Vietnam War on widows' labour market outcomes may have spilt over onto the next generation of women. For example, exposure to working women from a young age may normalise women's work outside the home such that daughters of widows may be more likely to be active in the labour force once they become adults. This was the case in France where in the aftermath of WW1, daughters and daughters-in-law of women who were exposed to higher mortality rates were more likely to be working in spite

Table 9: Impact of Vietnam War Widowhood on the Probability of Working, by Number of Children

	Dependent variable: Work									
	1989		1999		2009		2019			
	No children (1)	> 0 children (2)	No children (3)	> 0 children (4)	No children (5)	> 0 children (6)	No children (7)	> 0 children (8)		
Widow	-0.0134 (0.0273)	$\begin{array}{c} 0.0711^{***} \\ (0.0135) \end{array}$	$\begin{array}{c} 0.0111 \\ (0.0439) \end{array}$	$\begin{array}{c} 0.0923^{***} \\ (0.0113) \end{array}$	-0.0100^{*} (0.0058)	-0.0342^{***} (0.0085)	0.0360^{**} (0.0145)	-0.0324^{***} (0.0058)		
	$4,339 \\ 0.07866$	$120,946 \\ 0.08892$	$1,445 \\ 0.08229$	$58,160 \\ 0.08107$	68,397 0.11586	$297,119 \\ 0.15291$	$29,019 \\ 0.12690$	59,044 0.11572		

Clustered (province) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

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Controls include age and its square, educational attainment, number of children, marital status, ethnic minority dummy, and urban-dwelling dummy. Province fixed effects are included in all specifications.

of the recovery of the sex ratio (Gay, 2023). Conversely, daughters of widows may also be compelled to work out of economic necessity, much as their mothers had. As widows sought to exit the labour market, daughters of widows may enter the labour market to alleviate the burden of working for their mothers (Braun and Stuhler, 2024). To explore the intergenerational effects of widowhood on daughters, I replace the dummy variable for widowhood with a dummy variable which takes the value of 1 if the mother of child i is a widow and was within marriageable years in 1975, and 0 if their mother is married.

Table 10: Impact of having a widowed mother on the probability of daughters working

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• 1

	Ι	Dependent variable: Work							
	1989	1989 1999 2009 2019							
Model:	(1)	(2)	(3)	(4)					
Widowed mother	0.0055 (0.0062)	$\begin{array}{c} 0.0202^{***} \\ (0.0044) \end{array}$	$\begin{array}{c} 0.0124^{***} \\ (0.0032) \end{array}$	$\begin{array}{c} 0.0249^{***} \\ (0.0037) \end{array}$					
$\begin{array}{c} \text{Observations} \\ \text{R}^2 \end{array}$	$116,\!665 \\ 0.09014$	$89,334 \\ 0.12194$	$279,920\\0.10695$	$82,620 \\ 0.08491$					

Clustered (province) standard errors in parentheses. Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

 $WidowedMother_i$ takes the value of 1 if mother of female *i* was within marriageable years in 1975 and is widowed, and 0 if they are married or divorced. Observations therefore include daughters with mothers who were within marriageable years in 1975. Controls include age and its square, educational attainment, number of children, marital status, migration status, ethnic minority dummy, and urban-dwelling dummy. Province fixed effects are included in all specifications.

The results in Table 10 supports the explanation that the effect of the Vietnam War was not confined to women who were directly exposed to it, but spilt over to the next generation. Specifically, I recover positive estimates using all waves of the Census, with results using the 1999, 2009 and 2019 Census being statistically significant at the 1

percent level. While in 1989, daughters of widows were not more likely to be working than their counterparts, the respective labour market outcomes began to diverge thereafter. In subsequent waves of the Census, daughters of widows were 1.24 to 2.49 percentage points more likely to be working than daughters whose father did not die during the war. Although I am unable to disentangle whether daughters entered the labour market due to economic necessity or due to having more progressive norms, I show in Table A.1 in the Appendix that daughters of widows received between 8 to 12.43 months less of schooling, lending support to the argument that daughters may have been pressured to enter the labour market earlier than their counterparts.

6.2 Marriage Market

War can also affect unmarried women by deteriorating the conditions of the marriage market, which in turn, may affect women's propensity to work. Assortative marriage models predict that female-biased sex ratios can deteriorate marriage market conditions for women such that single women may delay getting married (Chiappori et al., 2002; Abramitzky et al., 2011). The decision to delay marriage may cause women to enter the labour market earlier, or remain working for longer while they search for a husband (Boehnke and Gay, 2022).

Unfortunately, due to unavailability of data, I am unable to investigate the age at which women entered and exited the labour market. Despite this, the 2019 Census contains information about the age of first marriage for observations born after 1979, allowing me to speculate on the effect of the Vietnam War on women's marriage market outcomes. In order to explore whether women in districts which was more intensely bombed delayed getting married, possibly due to deteriorated marriage market conditions, I modify the DiD model given by equation (2) by replacing the dependent variable with the age of first marriage. I also including marriage-year fixed effects to control for any macro shocks that affected the couple in the year which they got married. This DiD model therefore compares the age of first marriage of women in the same birth cohort and province, and who got married in the same year, but across districts.

Although I am unable to observe the age of first marriage for birth cohorts who were of marriageable years in 1975, the Figure 7 provides some suggestive evidence that the Vietnam War may have had an impact on women's marriage market outcomes, albeit small. While I find that cohorts which were born closer to reunification and who reside in more intensely bombed districts delayed marriage, the point estimate for the birth cohort born 5 to 10 years after reunification translates to a delay of a mere 2 weeks. As I move down the birth cohort, the estimate becomes smaller and less statistically significant. This may be reflective of the fact that, for these cohorts, the sex ratio had recovered such that the marriage market was not as unfavourable for single women. The small estimates obtained may also be reflective of the social norm in Vietnam which places importance on women's early marriage, and which may have prevailed despite the sex imbalance and rise of FLFP (Goodkind, 1995).

6.3 Substitution Towards Female Labour

The rise of FLFP may also have been in response to increased demand in female labour as male-intensive industries struggled to find male workers. While earlier evidence has highlighted this as an important mechanism, recent work by Goldin and Olivetti (2013), Rose (2018) and Boehnke and Gay (2022) have explained that women almost entirely disappeared from the manufacturing sector once men returned from the battlefields. As explained, although the CPV made strides in increasing the share of women in the manufacturing, construction and local administration sector *before* the war, these efforts did not continue after reunification (Turley, 1972; Goodkind, 1995). Importantly, since South Vietnam was not exposed to the CPV's efforts to recruit women in male-intensive sectors throughout the Vietnam War, it is dubious as to whether FLFP rose not as a response to economic necessity, but due to increased demand.

To investigate whether demand for female workers increased, particularly among male-intensive sectors such as manufacturing and construction in provinces which were more heavily bombed, I implement the following FE model:

$$SexRatio_d = BMR_d + X_d + \delta_p + \epsilon_d \tag{5}$$

where $SexRatio_d$ is the ratio of male to female workers in Southern district d in 2009 or 2019, and X_d are district-level controls including share of ethnic minority, share of migrants, share in urban, share with secondary school degree, and share with university degree. Other variables are as in equation (1).⁹

Table 11 reports the effect of historical bombing and the sex ratio of workers in 2009 and 2019. Column 1 includes workers across all sectors and although I obtain negative coefficients, indicating female-biased sex ratio of workers across all sectors in districts that were more heavily targeted during the Vietnam War, this estimate is also statistically insignificant. When I disaggregate by sector, I also find a lack of effect of historical bombing on agriculture nor male-intensive sectors such as manufacturing and construction 34 to 44 years on. Therefore, much like Rose (2018) and Fenske et al. (2022), I find a

 $^{^{9}}$ Workers are male and female workers of legal working age (i.e. between 16 and 64).

lack of evidence towards sustained demand for female labour. I do, however, find that the ratio of male to female workers in the services sector are smaller in districts that were more intensely bombed in 2009, although this estimate is only significant at the 10 percent level. Moreover, this estimate is economically small where a one-SD increase in bombing translates to a 0.41 less male workers per 100 female workers in the services sector. By 2019, this effect is statistically insignificant and the estimate has also reduced, lending support for the argument that female labour supply increased without concomitant increase in demand.

Table 11: Impact of Bombing on the Ratio of Male to Female Workers

	Dependent Variable: Sex Ratio of Workers									
	All		All Agriculture		Manufacturing		Construction		Services	
Model:	2009 (1)	2019 (2)	2009 (3)	2019 (4)	2009 (5)	2019 (6)	2009 (7)	2019 (8)	2009 (9)	2019 (10)
BMR	-0.0083 (0.0059)	-0.0063 (0.0041)	-0.0479 (0.0452)	-0.0728 (0.0611)	-0.0123 (0.0277)	$\begin{array}{c} 0.0043 \\ (0.0297) \end{array}$	-2.342 (2.192)	-1.058 (1.174)	-0.0041^{*} (0.0023)	-0.0037 (0.0026)
$\begin{array}{c} \text{Observations} \\ \text{R}^2 \end{array}$	$351 \\ 0.48722$	$365 \\ 0.66869$	$351 \\ 0.31087$	$363 \\ 0.41748$	$350 \\ 0.58512$	$365 \\ 0.60663$	348 0.26009	359 0.30692	$\begin{array}{c} 351 \\ 0.60433 \end{array}$	$365 \\ 0.72629$

Clustered (district) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

Controls include the share of ethnic minorities, share of migrants, share with a secondary school degree, and share with a university degree. All specifications include province fixed effects.

Figure 6: DiD model results: Bombing intensity and labour force participation, by birth cohort



31

Figure 7: Impact of district-level bombing on age of first marriage



7 Conclusion

In this paper, I examine how the Vietnam War, one of the most intense episodes of bombing, affected women's labour market outcomes 14 to 44 years after its conclusion. I use comprehensive data on US sorties in Vietnam between 1965 and 1975 and exploit variation in historical exposure to bombing. First, I find that women residing in districts which experienced greater exposure to US ordnance were more likely to work in the South even 44 years after reunification. However, I find a lack of effect of the Vietnam War on Northern women's labour force participation. This may be explained by the fact that South Vietnam suffered a far greater demographic shock than the North, with the South experiencing 4 times as much ordnance activity. I also find that the effect of the Vietnam War is strongest for Southern women aged 21 to 30 when the war ended – the same age group which experienced the largest demographic shock. In terms of mechanisms, I explore both demand and supply-side explanations for why FLFP may have increased in areas which saw greater exposure to ordnance. I find a lack of support for the demandside argument, namely, that a shortage of male workers caused female workers to step in. I also find a lack of evidence for the Vietnam War causing women to delay entering in the labour market, possibly encouraging them to take up work. However, I find that war widows significantly increased their labour supply given the loss of the breadwinner and the lack of financial support from the government. I also find that daughters of widows were more likely to work than daughters of non-widows, shedding light on the intergenerational effects of the Vietnam War on female labour market outcomes.

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A.1 Descriptive Statistics





Source: Author's calculations using THOR.



Figure A.2: Provincial bombing intensity versus provincial sex ratio



Figure A.3: Bombing intensity versus FLFP





Figure A.4: Bombing intensity versus share of women widowed

2009

Source: Author's calculations using the 2009 and 2019 Census.

Figure A.5: Distance to Ho Chi Minh Trail versus bombing intensity





Figure A.6: Industry composition of the male and female workers in 1989





Figure A.7: Industry composition of the male and female workers in 1999

Source: Author's calculations using the 1999 Census.



Figure A.8: Industry composition of the male and female workers in 2009





Figure A.9: Industry composition of the male and female workers in 2019

Source: Author's calculations using the 2019 Census.





Source: Author's calculations using the 2002 VHLSS.

	Dependent variable: Years of schooling			
	1989	1999	2009	2019
Model:	(1)	(2)	(3)	(4)
Widowed mother	-0.8598^{***} (0.0535)	-1.209^{***} (0.0403)	-1.165^{***} (0.0629)	-1.193^{***} (0.0568)
$\begin{array}{l} \text{Observations} \\ \text{R}^2 \end{array}$	297,324 0.29199	157,839 0.22931	$319,384 \\ 0.14920$	$85,536 \\ 0.21286$

Table A.1: Impact of having a widowed mother on years of schooling

Clustered (province) standard errors in parentheses.

Significance Codes: ***: 0.01, **: 0.05, *: 0.1.

 $WidowedMother_i$ takes the value of 1 if mother of female i was within marriageable years in 1975 and is widowed, and 0 if they are married or divorced. Observations therefore include daughters with mothers who were within marriageable years in 1975. Controls include age, migration status, ethnic minority dummy, and urban-dwelling dummy. Province fixed effects are included in all specifications.