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Srinivas Raghavendra, Nata Duvvury & Sinéad Ashe

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ABSTRACT

Violence against women (VAW) is now acknowledged as a global problem with substantial economic costs. However, the current estimates of costs in the literature provide the aggregate loss of income, but not the macroeconomic loss in terms of output and demand insofar as they fail to consider the structural interlinkages of the economy. Focusing on Vietnam, this study proposes an approach based on the social accounting matrix (SAM) to estimate the macroeconomic loss due to violence. Using Vietnam's 2011 SAM, the study estimates the income and multiplier loss due to VAW. From a policy point of view, the study argues that the macroeconomic loss due to VAW renders a permanent invisible leakage to the circular flow that can potentially destabilize, weaken, or neutralize the positive gains from government expenditure on welfare programs.

KEYWORDS

Violence against women, social accounting matrix (SAM), Vietnam, macroeconomic loss, multiplier loss, macroeconomic policy

JEL Codes: J16, E19, E00

INTRODUCTION

Violence against women (VAW) is now recognized as a global issue that is prevalent in all societies at all levels of development. Globally, the leading form of VAW is intimate partner violence (IPV), with more than one in three women reporting experiencing it in their lifetime (WHO 2013). A widely accepted definition of IPV is "physical violence, sexual violence, stalking and psychological aggression (including coercive acts) by a current or former intimate partner" (Breiding et al. 2015: 11). Available research suggests that different types of violence can occur simultaneously, are often interconnected, and can have cumulative impact (Coker et al. 2011). For example, psychological aggression often co-occurs with physical or sexual

violence; additionally, it is often considered a predictor for physical or sexual violence (O'Leary 2000; Heise 2012).

Even though VAW (and thus IPV) is widely accepted as a fundamental human rights and public health issue, there has been considerable inertia in acknowledging it as a development issue. The recent (2015) UN declaration on the new Sustainable Developmental Goals (the 2030 Agenda for Sustainable Development) is the first time that the issue has been explicitly incorporated into global development policy agenda. However, carrying through the expressed commitment to concrete policy action on VAW remains a challenge, particularly in a context where economic reasoning weighs more than other considerations in policymaking. Despite the growing evidence of economic costs associated with VAW, the economic impact of VAW is neither acknowledged nor considered in economic policy deliberations. A main reason for this is the lack of quantitative translation of the individual-specific micro-level costs that arise in incidents of violence to the macroeconomic level.

In the literature, the approach for estimating the economic cost of VAW is one of aggregating the specific monetary costs arising at an individual level. This approach provides an aggregate estimate of the loss of income for the victim, for example due to lost time in paid work. These individual-level cost estimates do not reflect the *macroeconomic loss* due to VAW insofar as they fail to take into account the consequent loss of output and demand in the economy due to the interlinkages of the economy. The aim of this paper is to provide an approach to estimate the overall loss to the economy, that is, macroeconomic loss, by taking into account these interlinkages as described by a social accounting matrix (SAM). We apply our approach to the case of the Vietnamese economy using the 2011 SAM for Vietnam (Central Institute of Economic Management-World Institute for Development Economics Research [CIEM-WIDER] 2014). We show that our approach provides a way to estimate both the direct loss in the *level* of aggregate income and the indirect loss due to intersectoral linkages – that is, the multiplier effect (henceforth, *multiplier loss*).

Although multiplier loss as a concept is recognized in the VAW literature, to our knowledge this is the first paper to propose a method for estimating such a loss. Furthermore, including in the estimation the intersectoral linkages of production in the economy provides a way to estimate the loss of income, output, and demand due to VAW in a macroeconomic setting. In other words, the SAM framework provides a way to estimate the *leakage* due to VAW in the circular flow of income in the economy. We argue that the estimates reported in this paper, based on the missed days of work due to violence, abstracting from other issues such as the loss of productivity, provide a compelling argument for considering the issue of VAW in macroeconomic policy deliberations.

ECONOMIC COSTS OF VAW

The social and economic impacts of violence against women and girls manifest as multiple impacts at the individual and household level. The immediate impacts are missing work (paid and unpaid), poor physical and mental health status, poor reproductive outcomes, out-of-pocket expenditures for accessing services, and replacement costs for lost property. VAW also has long-term impacts on outcomes such as accumulation of education, expanding skills, experience, and upward mobility within the workforce, chronic disability, and the stability of family life. Research on health impacts provides evidence of increased risk of mortality and morbidity, HIV, chronic pain, and a range of physical disorders (Jewkes et al. 2008; Rees, Zweigenthal, and Joyner 2014). The economic impacts highlighted in the literature include lower labor force participation in the long run, employment instability, and lowered earnings (Moe and Bell 2004; Crowne et al. 2011; Agüero 2012). Trauma and poor mental health seem to be the mediating pathways for both health and work impacts (Sabia, Dills, and DeSimone 2013).

In addition to these multiple impacts at the individual and household level, VAW also has costs for communities including low community cohesion, loss of economic output for businesses, and expenditures incurred by national and local NGOs. Governments incur costs in both providing services to survivors (and, to varying degrees, to perpetrators) of violence, investing in programs to prevent violence, as well as incurring loss of taxes due to lower income for households and lower economic output for businesses (Envall and Eriksson 2006).

Many of these consequences of VAW can be classified into distinct categories of costs, and a common classification is direct tangible, indirect tangible, direct intangible, and indirect intangible (Day, McKenna, and Bowlus 2005). Several meta reviews of costing studies have identified some distinct approaches or methodologies to cost VAW such as direct accounting methodology, human capital approaches including propensity score matching, willingness to pay/contingent valuation, disability-adjusted life years, and gender-responsive budgeting (Duvvury, Grown, and Redner 2004; Morrison and Orlando 2004; Day, McKenna, and Bowlus 2005; Willman 2009). Over forty studies have used one or more methodologies to establish direct and intangible costs and also direct intangible costs of pain, suffering, and loss of quality of life in high-, middle-, and low-income countries.

The majority of the studies focus on industrialized countries, and estimates vary widely depending on the specific costs included in the analysis (see Duvvury et al. [2013] for a detailed review). One comprehensive study on costs undertaken by Access Economics in Australia (2004) suggests that the annual cost of domestic violence in Australia was

Au$8.1 billion in 2002–3. A subsequent study projected that the cost would rise to Au$15.6 billion by 2021–22 if no action is taken (National Council 2009).

In the case of low- and middle-income countries, the studies on the direct costs are rare because women often do not seek help for IPV or health and law enforcement officials commonly underrecord IPV cases. Indirect costs, particularly the costs of missed work and lower productivity, have been estimated in several countries. An early study by Andrew Morrison and Maria Beatriz Orlando (1999) estimated that the loss of earning capacity of women experiencing IPV was approximately 2 percent of GDP in Chile. Using data from the Tanzania National Panel Survey, Seema Vyas (2013) found that weekly income was 29 percent lower among currently abused women compared to women who had never been abused – a figure that rose to over 40 percent when considering severe abuse. A household survey in Vietnam undertaken in 2012 estimated that missed paid and unpaid work amounted to 0.94 percent of GDP. The study also found reduced earnings for women experiencing domestic violence amounting to US$2.26 billion or about 1.78 percent of 2011 GDP (Duvvury, Nguyen, and Carney 2012). A Peruvian study by Aristides Vara Horna (2013) estimated that the productivity loss (due to absenteeism and presenteeism) for businesses was equivalent to 3.7 percent of GDP.

However, most of these studies provide an aggregate estimate of the loss of income, but not the *macroeconomic loss* in terms of output and demand insofar as they fail to consider the structural interlinkages of the economy. The loss of income at an individual level has both direct and indirect effects due to the structural interlinkages of the economy, which translates the micro-level loss to the level of the macroeconomy. Therefore, the consideration of the structure of production in the estimation of loss due to violence would not only bring out the level of loss in individual sectors but would also help to quantify the impact of loss in one sector on the other sectors of the economy through the multiplier effect. This idea is not new, and it has been recognized in the literature that loss estimates should have multiplier effects (for example, Myra Buvinic and Andrew Morrison [1999]), but, to our knowledge, no one has explicitly provided comprehensive estimates that take into account both sectoral and intersectoral categories of loss due to violence. In an earlier paper, Duvvury et al. (2013) attempted the first iteration of estimating the sectoral loss of output due to violence but were constrained in drawing robust conclusions given the lack of specification of intersectoral linkages. In this paper, we attempt to estimate the loss in the level of income and the multiplier loss using the framework of the SAM, which allows us to consider the intersectoral linkages in a direct manner.

DATA

This paper employs two sources of data. First, we use the primary data on prevalence, such as incidence of types of violence and missed days of work, drawn from the Vietnam field study of Duvvury, Nguyen, and Carney (2012).[1] Second, we use the secondary data on sectoral employment patterns in Vietnam and the Vietnam 2011 SAM to estimate the macroeconomic loss due to VAW.

Vietnam field study on IPV

We draw on survey data from a study on the costs of domestic violence in Vietnam to estimate the prevalence and incidence of violence. The Vietnam study conducted by Duvvury, Nguyen, and Carney (2012) surveyed 1,053 women across both urban and rural regions and collected detailed information on incidents of IPV reported by women in the past fifteen months.[2] Each woman was asked how many incidents of violence she had experienced in the previous fifteen months, followed by detailed questions on the most recent incidents that she recalled. There were three key types of violence considered within the study: psychological (verbal abuse, humiliation and intimidation, or threat of violence), physical (such as slapping, beating, hitting, and kicking), and sexual (forced or other forms of coerced sex when the women did not want it or did not like the way it was done) suffered by women during the last twelve months (to obtain current prevalence) and also during their lifetime (to obtain lifetime prevalence). Of the 1,053 women surveyed, 63.7 percent (or 671) of women reported experiencing at least one incident of psychological, physical, or sexual violence ever in their lifetime, with 39 percent (or 414) of women experiencing at least one type of event in the last twelve months. Many women reported multiple incidents of violence: 436 women reported a total of 9,815 incidents of IPV in the last fifteen months and provided detailed information on 1,041 of the most recent incidents.[3]

To estimate the income loss at the individual level, the study estimates days *both* women and men took off from work. As Duvvury, Nguyen, and Carney (2012) stated, domestic violence impacts the family causing disruption in the daily lives of women, men, and children. As a result, the study explored detailed questions on the impact of violence on women's *as well as* men's paid work. Of the total number of incidents reported by women, 14 percent of incidents (or 148 incidents) required women to take time off work, with an average of 5.5 days taken off work per incident across all reported incidents. Women also reported that in 7 percent of incidents (or 74 incidents), their husbands or partners also missed paid work, with an average of 6.5 days taken off per incident.[4]

With the empirical data available from the Vietnam study, there are some caveats to the analysis that should be noted. First, we are not able

to establish the effects by type of violence as the majority of women experienced multiple forms in an incident, making detailed analysis by type problematic due to the small sample size. Second, women reported men missing paid or unpaid work, and thus we cannot assure with certainty that men did so because of the violence per se. Third, the study was a follow-up to a study on the national prevalence of violence to gather additional information on costs incurred by women and thus had limited representativeness.

General structure of the Vietnamese economy

Employment pattern

We analyzed the employment distribution, percentage share of women and men in various sectors, and the daily wage distribution of women in Vietnam for the year 2011. Vietnam has high women's workforce participation with about 73 percent of women (ages 15 and above) engaged in economic activity (World Bank 2011). As shown in Figure 1, women's employment is distributed across both agricultural and nonagricultural sectors. In terms of the distribution, about 51.6 percent of women are in agriculture, with another 15 percent in manufacturing and 14 percent in retail and wholesale. Together these sectors account for more than three quarters of women's employment in Vietnam, that is, 80.6 percent of the

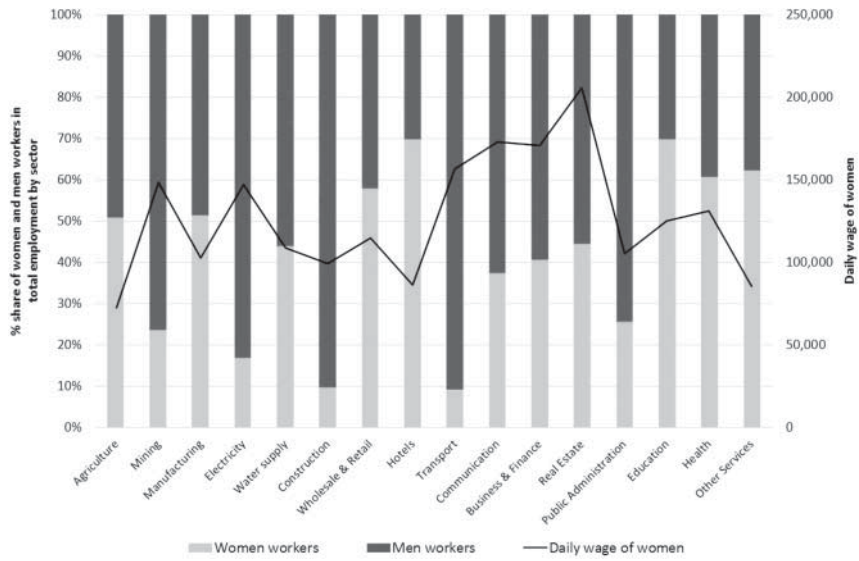

Figure 1 Employment distribution and daily wages (VND)
Source: General Statistics Office of Vietnam (2013).

total number of women employed. In terms of public sector employment (such as sectors of public administration, education, and health), the three sectors together account for about 7.8 percent of women's total employment (see supplemental online Table A).

In terms of the concentration of women workers in the total number of people (both men and women) employed, seven sectors stand out in Figure 1. We note that these sectors are agriculture, manufacturing, retail and wholesale, hotel, education, health, and other services, where the percentage share of women in the total employed is above 50 percent. Among these, the education and hotel sectors have the highest concentration of women; for instance, in education it is about 69.7 percent, and in hotels it is 69.8 percent.[5]

Overall, Vietnam is a low-wage economy as both women and men are concentrated in low-wage sectors. Women are concentrated in low-wage sectors such as agriculture, wholesale and retail, hotels, and other services. Men are equally concentrated in low-wage sectors such as agriculture, construction, water, and public administration. However, in the few sectors where the wages of women are high (such as communication, finance, and real estate), men account for higher wages and share of employment. Overall, this would suggest that men's incomes are likely to be higher than women's incomes generally, which could impact the level of loss of income due to violence.

Vietnam 2011 SAM

Vietnam's 2011 SAM is a square data matrix of 169 rows and 169 columns (CIEM-WIDER 2014). It broadly follows the basic structure of a SAM presented in Table 1. Its structure can be described by three main categories: sectoral production and foreign trade, factor income generation and distribution, and household expenditure. In the case of Vietnam's 2011 SAM, the activities column (the first column in Table 1) is disaggregated into sixty-three subsectors, which are aggregated from Vietnam's 2011 Supply-Use Table (SUT). Of these sixty-three sectors, thirteen relate to agriculture (including for example, paddy rice, sugarcane, poultry, and coffee), thirty-seven relate to industry (including, for example, manufacturing, mining, and utilities), and thirteen relate to services (including, for example, transportation, education, and financial services). The factor account (F in Table 1) – that is, the factors of production – is disaggregated into eleven factors of production, including six types of labor (which are classified by geography [urban/rural] and education levels [primary, secondary, and tertiary]), and two types of capital (agricultural and nonagricultural), land, livestock, and fisheries capital. The household account (H) is disaggregated into twenty types of households, which are classified by three criteria, urban/rural,

Table 1 Basic structure of a SAM

	Activities	*Commodities*	*Factors*	*Households*	*Government*	*Saving and investment*	*Rest of world*	*Total*
Activities		Domestic supply						Activity income
Commodities	Intermediate demand			Consumption spending (C)	Recurrent spending (G)	Investment demand (I)	Exports earnings (E)	Total demand
Factors	Value-added							Total factor income
Households			Factor payments to households		Social transfers		Foreign remittances	Total household income
Government		Sales and import tariffs					Foreign loans and grants	Government income
Saving and investment				Private savings	Fiscal surplus		Current account balance	Total savings
Rest of world		Import payments (M)						Foreign exchange outflow
Total	Gross output	Total supply	Total factor spending	Total household spending	Government expenditure	Total investment spending	Foreign exchange inflow	

agricultural and nonagricultural, and five income quintiles (from the poorest [quintile 1] to the richest [quintile 5]).

METHODOLOGY

The framework of the SAM has been extensively used in macroeconomic policy analysis. SAM is a particular representation of a macroeconomic system that incorporates a considerable level of information about the transfers, transactions, and relationships between macro and meso level economic categories or accounts (Pyatt and Round 1985). There are three main reasons why SAM is particularly useful in macroeconomic policy analysis. First, disaggregated household groups as a distinct set of institutional accounts makes the use of SAM more distinctive since it allows one to study their interaction with other institutions, such as factors of production, across various production activities coordinated by product, and labor markets. Second, the structural interdependencies between macro and meso accounts in the context of highly interlinked production is highlighted by the SAM, which provides an accounting framework to study the consequences for income generation and distribution. Third, the accounting framework of SAM provides an analytical way to study how the impact of shocks percolate the system through direct and indirect linkages between various institutional accounts of the macroeconomy, which is pertinent for macroeconomic policymaking.

The general organization of a SAM can be described as follows: it is a square matrix that represents the transactions taking place in an economy during an accounting period, usually one year. The macroeconomy is usually divided into various institutions, production activities, consumption of commodities, factors of production, households, private corporate enterprises, government, rest of the world, and so on. Each account is represented twice; once as a row (showing receipts) and once as a column (showing payments). The entry in cell, say (T_{ij}), shows the payment flow from the j^{th} account to the i^{th} account as in the standard accounting convention of the input–output table. The transactions between accounts display their interconnections between the sectors in an explicit way. Since these transactions adhere to the accounting framework, where the row total and column total must be equal, the analysis is tractable.

In the literature on gender and macroeconomic policy, SAM has been used as an input to the "computable general equilibrium" (CGE) framework for macroeconomic policy analysis. In particular, one of the early papers that developed the "gendered SAM" (GSAM) extended the standard SAM by incorporating a monetized (market) and non-monetized (social reproduction and leisure) part of the economy and disaggregated variables by gender. Furthermore, GSAM was used to model a "gendered CGE" (GCGE) model for Pakistan to study the effect of macroeconomic

shocks such as trade liberalization on employment patterns, time allocation in market production and household work, and the gender gap in wages (Siddiqui 2004). In a recent study, a SAM-based analysis was developed to study the impact of economic growth on the deepening of gender inequalities through the process of the casualization of labor, particularly in the manufacturing sector in Kenya (Wanjala and Were 2009). The study, using simulation techniques, investigated the effect of exogenous injections in the subsectors that have high backward and forward linkages on compensation of employees, distribution of factor incomes across households, and employment creation.

However, to our knowledge, ours is the first attempt in using the SAM-based multiplier analysis to estimate the macroeconomic loss due to VAW. An obvious question that may arise would be of not extending this analysis to the CGE setting. One of the issues with the CGE framework is that in the context of violence, particularly in the case of IPV, the equilibrium characterization of the household production can be problematic. Even though there are extensions of CGE with "home production" (Fofana, Cockburn, and Décaluwé 2003), it is difficult to see how the equilibrium conditions regarding the marginal utility of time for each gender would hold under violence. Given that the underlying micro-behavioral approach of the CGE framework can be problematic in the context of VAW, the macro-structural SAM approach is explored in an attempt to estimate the macroeconomic loss due to violence. We believe that the proposed SAM-based multiplier method to quantify the multiplier loss due to violence is a novel contribution of this paper.

A stylized two-sector SAM

In what follows, we explain the method that is being adopted in this paper for the estimation, using a simple two-sector (production sectors) SAM (see Appendix A1 for the general model). A stylized SAM for an economy with two production sectors is given in Table 2. The production sectors are the activities A_1 and A_2, producing commodities C_1 and C_2, respectively. In this stylized version, we denote the factor account by F, and factors earn V_1 and V_2 in the production activities. We denote the household account by H and the households' consumption expenditure on the commodities is denoted as C_1 and C_2 as consumption expenditures. All the exogenous accounts, such as the government account, investment account, and rest of the world are grouped together for simplicity and denoted by E.

The total demand Z for the two-sector economy is given by

$$Z_1 = a_{11}X_1 + a_{12}X_2 + c_1Y + E_1 \tag{1}$$

$$Z_2 = a_{21}X_1 + a_{22}X_2 + c_2Y + E_2 \tag{2}$$

Table 2 A stylized two-sector SAM

	Activities		Commodities		Factors	Households	Exogenous demand		
	A1	A2	C1	C2	F	H	E	**Total**	
A1			X_1					$\mathbf{X_1}$	**Activity income**
A2				X_2				$\mathbf{X_2}$	
C1	Z_{11}	Z_{12}				C_1	E_1	$\mathbf{Z_1}$	**Total demand**
C2	Z_{21}	Z_{22}				C_2	E_2	$\mathbf{Z_2}$	
F	V_1	V_2						**V**	**Total factor income**
H					V_1 V_2			**Y**	**Total household income**
E			l_1	l_2		S		**E**	**Total exogenous income**
Total	$\mathbf{X_1}$	$\mathbf{X_2}$	$\mathbf{Z_1}$	$\mathbf{Z_2}$	**V**	**Y**	**E**		
	Gross output		**Total supply**		**Total factor spending**	**Total household expenditure**	**Total exogenous expenditure**		

where a is the technical coefficient (that is, input or intermediate shares in production), (X) is gross output, and c is the share of household consumption expenditures in total household expenditure (Y).

The gross output (X) is only part of total demand (Z) and we can express it as,

$$X_1 = b_1 Z_1; X_2 = b_2 Z_2 \tag{3}$$

where b is the share of domestic output in total demand.

The total household income depends on the share of factors' earnings in each sector, that is

$$Y = v_1 X_1 + v_2 X_2 \tag{4}$$

where v_1 and v_2 are the share of value added or factor income in gross output.

Here we propose the modification of accounting for the loss of factor income due to violence in different sectors. In order to estimate the lost factor income due to violence, we need to estimate the total days lost by women in various sectors of the economy. To calculate the total days lost by women and men after violent episodes, we draw on several key facts obtained from Duvvury, Nguyen, and Carney (2012). One of the most revealing facts is that men too seem to lose work after violent episodes that they inflict on their intimate partners.[6] Other studies estimating costs, for example in Peru and Papua New Guinea, corroborate this finding (Vara Horna 2013 and Darko, Smith and Walker 2015). The main reasons for men missing work includes distress or trauma, depression, and attending to legal matters related to the incident. The Vietnam study reported that the proportion of total incidents that resulted in missed work is 14 percent for women and 7 percent for men. Using the information on the labor force participation in each sector, the proportion of incidents that lead to loss of work, the prevalence and incidence of violence, and the days lost after violent episodes, we estimate the total days lost (TDL_i) by women and men in sector (i) as:

$$TDL_i = (W_i * IR * a_W * DL_W) + (M_i * IR * a_M * DL_M) \tag{5}$$

where W_i and M_i is the total number of women and men working in sector i, IR is the number of incidents per women, a_W and a_M is the proportion of violent incidents out of total incidents that resulted in missed work for women and men respectively, and $DL_W$and DL_M is the average number of days missed per incident for women and men (5.5 days for women and 6.5 days for men).[7]

The loss of income, due to violence, for both women and men in each sector is calculated by multiplying the total workdays lost due to violence with their respective wage rates (wg_i^m) for women and (wg_i^m) for men, and is estimated as

$$TIL_i = (TDL_i^W * wg_i^W) + (TDL_i^M * wg_i^M) \tag{6}$$

where wg_i^W and wg_i^M is the daily wage for women and men working in sector i and is obtained, by sector, from the 2011 Vietnam Labor Force Survey 2011 (General Statistics Office of Vietnam 2013).[8]

Returning to our two-sector model, based on equation (6) we can now modify the factor income earned by labor, both women and men, to account for the lost income due to violence in each sector as,

$$W_1 = [V_1 + (TIL_1)] \text{ and } W_2 = [V_2 + (TIL_2)] \tag{7}$$

where $TIL_1$is the total income lost by women in the two sectors, and TIL_2 is the total income lost by men in the two sectors.

Let

$$w_1 = \frac{W_1}{X_1} \text{ and } w_2 = \frac{W_2}{X_2} \tag{8}$$

be the *violence accounted factor income* shares in gross output.

Now using equations (3) and (8), we can rewrite (4), the total household income equation, by accounting for lost income due to violence as,

$$Y_v = w_1 b_1 Z_1 + w_2 b_2 Z_2 \tag{9}$$

Finally, using equations (3) and (9), we can rewrite the total demand equations in equations (1) and (2) to take into account the violence accounted income and income shares as,

$$Z_1 = a_{11} b_1 Z_1 + a_{12} b_2 Z_2 + c_1 w_1 b_1 Z_1 + c_1 w_2 b_2 Z_2 + E_1$$

$$Z_2 = a_{21} b_1 Z_1 + a_{22} b_2 Z_2 + c_2 w_1 b_1 Z_1 + c_2 w_2 b_2 Z_2 + E_2$$

Rewriting the above final demand equations in matrix form and deriving the multiplier yields

$$\begin{bmatrix} 1 - a_{11} b_1 - c_1 w_1 b_1 & -a_{12} b_2 - c_1 w_2 b_2 \\ -a_{21} b_1 - c_2 w_1 b_1 & 1 - a_{22} b_2 - c_2 w_2 b_2 \end{bmatrix} \begin{bmatrix} Z_1 \\ Z_2 \end{bmatrix} = \begin{bmatrix} E_1 \\ E_2 \end{bmatrix}$$

that is,

$$Z_v = [I - M]^{-1} E \tag{10}$$

Equation (10) yields the violence accounted total demand vector; that is, it is the total demand in the absence of violence, which can be thought of as the *potential* total demand (Z_v), and the corresponding multiplier provides the *potential* multiplier. The difference between the *potential* total demand and the *original* total demand, $Z^* = (Z_v - Z)$, yields the macroeconomic loss due to violence, and the corresponding multiplier provides the multiplier loss due to VAW.

RESULTS AND DISCUSSION

Economic loss of violence: Level of loss in factor incomes and in GDP

We estimated the loss of income for women and men employed in various sectors drawing on the employment distribution and using the estimates (see equations [5] and [6]) derived from the Vietnam field study (Duvvury, Nguyen, and Carney 2012). These estimates are given in Table 3.

The calculations show that the sectors where the income loss is higher are those that account for much of women's employment. For example, the loss of income in the agricultural sector accounts for 39.5 percent of the total loss followed by the manufacturing (16 percent) and wholesale

Table 3 Income loss in Vietnam due to VAW

	Women	*Men*	*Total*	*Women's share (%)*	*Sectoral loss (%)*
Agriculture	5,171	3,856	9,027	57.3	39.5
Mining	56	132	188	29.8	0.8
Manufacturing	2,115	1,536	3,651	57.9	16.0
Electricity	20	61	81	24.5	0.4
Water supply	29	28	57	51.4	0.2
Construction	178	1,085	1,263	14.1	5.5
Wholesale and retail	2,228	1,092	3,320	67.1	14.5
Hotels	692	251	943	73.4	4.1
Transport	118	672	790	15.0	3.5
Communication	100	106	206	48.5	0.9
Business and finance	296	257	553	53.5	2.4
Real estate	62	41	104	60.3	0.5
Public administration	239	454	693	34.5	3.0
Education	869	260	1,129	77.0	4.9
Health	220	99	319	68.9	1.4
Other services	341	198	540	66.3	2.4
Total	12,736	10,128	22,864	55.7[a]	6.3[a]

Source: Authors' calculations.
Notes: Income loss in VND. [a]Average share across sectors.

and retail (14.5 percent) sectors, respectively. However, two interesting counter observations emerge from the distribution of the loss of income across sectors. First, there are sectors with low women's employment that contribute more to the loss in the total income. For example, both the construction and the transport sectors, which have a low women's employment share at 9.7 and 9.3 percent, contribute almost 5.5 and 3.5 percent to the loss in total income, respectively. Second, in most of the sectors women's share in the loss of income in that sector is proportionately higher than their share in that sectors' total employment. For example, in the hotel sector, where it is dominated by the activities of accommodation and food services, women's share in the total loss of income is 73 percent, whereas their share in the total employment of that sector is 69.8 percent. Health is another sector where women's share in total employment is 60.6 percent, and their share in total income loss is 68.9 percent. The first pattern could be due to the loss of income for men, whose employment share is above 90 percent of total employment in both the sectors, due to missed work after incidents of violence. The second observation, although influenced to some extent by the loss of income for men due to missed work, could be due to the casualization of women's labor in those sectors where women may work in multiple businesses in that industry on the

same day, that is, the same women working in three different businesses would lose income from all three due to violence. However, these remain a plausible hypothesis at this point and require further exploration.

Using the aggregate sectoral estimates of the loss of income presented in Table 3, we accounted for the lost income due to violence for the different types of labor factor in various sectors of production activities recorded in Vietnam's 2011 SAM. We first estimated the aggregate loss of income for each type of labor factor in each sector for the sixteen aggregate sectors as given in Table 3. We then accounted for each type of labor factor, in every subsector, according to its contribution to overall income of the aggregate sector. For instance, the total loss of income in agriculture is attributed to each type of labor factor in every subsector according to the specific factor's contribution to the total labor factor income of the agriculture sector overall. So, the loss of income for the urban tertiary labor in the subsector of paddy is calculated by multiplying the share of this factor's income in the overall factor income with the total loss of income in agriculture. We performed this exercise and accounted for the lost income due to violence for each type of labor factor in all of the sixty-three subsectors of the Vietnamese economy. Finally, we added the lost income due to violence for each type of labor to the original income reported in Vietnam's 2011 SAM to arrive at the *violence accounted labor factor income* for all subsectors of the Vietnamese economy. This method is a conceptual departure from the usual formulation of cost to the national economy. Since the current macroeconomic output and income figures already incorporate the missed days of work for women and men in their estimates, we *add*, rather than deduct, the loss of income due to violence. We therefore estimate the *potential* income that could have been earned in the absence of violence.

The original total factor income and estimated violence accounted total factor incomes for different types of labor factors in the 2011 SAM, including urban labor with tertiary education, urban labor with secondary education, and so on, is shown in Table 4. The column "Other factors" represents the income earned by other factors of production like capital (both agriculture capital and non-agriculture capital), livestock, land, and fish. In the last two columns, we calculate the total value added only by the labor factor from the original and the violence accounted income entries of the 2011 SAM.

Our calculations reveal the extent of the macroeconomic loss due to violence. First, from the *potential* income that the Vietnamese economy could have earned in the absence of VAW and the actual income it earned, the percentage loss in GDP at factor cost in 2011 is 0.96 percent. Second, the total income lost as a percentage of GDP at market prices is 0.82 percent (see Table 4). Thus, the macroeconomic income loss to the Vietnamese economy due to VAW is 0.96 percent of GDP at factor cost and 0.82 percent of GDP at market prices, respectively.

Table 4 Violence-accounted labor factor incomes (in VND)

	Original	*Violence accounted*	*Other factors*	*Total value added (original)*	*Total value added (violence accounted)*
Agriculture	481,895	490,922	59,667	541,562	550,589
Mining	28,681	28,868	182,888	211,569	211,756
Manufacturing	179,705	183,357	234,038	413,743	417,394
Electricity	33,187	33,268	50,223	83,410	83,491
Water supply	4,343	4,400	3,771	8,114	8,172
Construction	146,352	147,616	44,957	191,309	192,573
Wholesale and retail	181,834	185,154	98,880	280,714	284,034
Hotels	5,347	6,290	10,218	15,565	16,508
Transport	59,716	60,517	63,716	123,442	124,232
Communication	49,752	49,958	29,876	79,628	79,833
Business and finance	41,984	42,537	55,766	97,750	98,303
Real estate	50,795	50,898	46,362	97,157	97,261
Public administration	74,187	74,880	20,617	94,804	95,497
Education	54,617	55,746	21,600	76,217	77,346
Health	18,216	18,535	6,300	24,516	24,835
Other services	22,035	22,574	12,437	34,472	35,012
Violence-accounted GDP at factor cost					2,396,836
Original GDP at factor cost					2,373,974
Percentage loss of GDP at factor cost					*0.96*
Total income loss for women and men					22,864
GDP at market prices					2,779,880
Percentage loss of GDP at market prices					*0.82*

Source: Authors' calculations.

We further analyzed the level of loss of income for different types of labor factor, namely, urban and rural labor with tertiary, secondary, and primary education, in all of the production sectors of the Vietnamese economy, and the results are presented in Figure 2.[9] Figures 2A and 2B show the violence-accounted income for the urban and rural factors in all the sectors. It is clear from Figure 2A that in terms of the urban labor categories, urban tertiary labor (flab-u-t) loses the most in retail and wholesale, manufacturing, public administration, education, financial, real estate, construction, health, and other services. However, in the agriculture sector, urban secondary labor (flab-u-s) loses the most due to violence.

In the rural labor category, rural secondary labor (flab-r-s) loses heavily in agriculture, manufacturing, construction, and retail and wholesale. Note that the loss suffered by rural secondary labor in agriculture is large, relative to all the other sectors, and we show it in the inset of Figure 2B on its own scale. It is interesting to note that rural tertiary labor (flab-r-t) loses the most

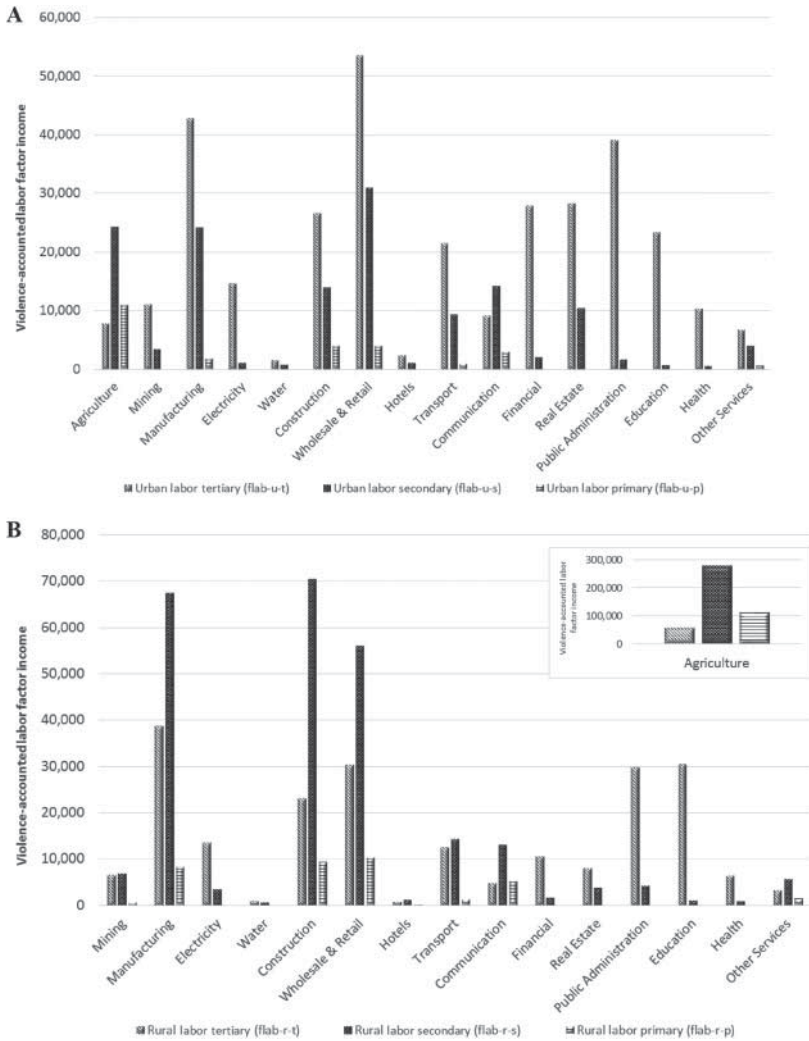

Figure 2 Violence-accounted labor factor incomes (in VND) for (A) urban and (B) rural households
Source: Authors' calculations.

in the aggregate sectors of public administration, education, electricity, financial, real estate, and health.

Multiplier loss due to violence

Next, using the 2011 SAM, we calculated the multiplier effects arising from both the income and consumption expenditure loss due to violence.

Table 5 Violence-accounted multiplier loss

	Output multiplier	*Income multiplier*	*Value-added multiplier (labor)*	*Total*
Agriculture	0.50	0.36	0.39	1.26
Mining	0.04	0.03	0.04	0.11
Manufacturing	0.48	0.35	0.38	1.21
Electricity	0.01	0.01	0.01	0.03
Water supply	0.02	0.01	0.02	0.05
Construction	0.02	0.01	0.01	0.04
Wholesale and retail	0.03	0.02	0.02	0.08
Hotels	0.04	0.03	0.03	0.10
Transport	0.04	0.03	0.03	0.10
Communication	0.02	0.02	0.02	0.06
Business and finance	0.03	0.02	0.02	0.08
Real estate	0.01	0.01	0.01	0.03
Public administration	0.03	0.02	0.02	0.06
Education	0.03	0.02	0.02	0.07
Health	0.02	0.02	0.02	0.06
Other services	0.03	0.02	0.03	0.08

Source: Authors' calculations.

As explained earlier, we estimated the actual total demand vector (Z) using the original 2011 SAM. Then we estimated the potential total demand vector (Z_v) that accounts for the loss of income for factors of production and the corresponding potential loss in consumption expenditures incurred by the household categories. The difference between the potential and the actual total demand vector (that is, $Z^* = Z_v - Z$) yields the multiplier loss due to violence. In Table 5, we show the estimated output, income, and value-added multiplier loss for different sectors of the Vietnamese economy for the year 2011. We note that we have taken only the labor factor in our value-added multiplier calculations, that is, value added by the labor factors only. The estimated loss in the output multiplier for agriculture owing to violence is 0.5 times the size of exogenous demand shocks for agricultural products. In other words, at the given level of the incident rate (IR), the output loss faced in agriculture for any exogenous shock – say, for instance, of 1 billion Vietnamese Dong export demand shock – would be equal to 0.5 times 1 billion Vietnamese Dong. This takes into account all of the forward and backward linkages of agriculture with other sectors of the economy. The loss in household income and value-added multipliers would be to the tune of 0.36 and 0.39 times the exogenous export demand shock worth of 1 billion Vietnamese Dong, respectively. Thus, the estimated total multiplier loss in agriculture would be to the extent of 1.26 times the size of the exogenous shock to the Vietnamese economy.

Similarly, the total multiplier loss for the manufacturing sector would be to the extent of 1.21 times the size of the exogenous demand shock. The loss in output, household income, and the value-added multipliers in manufacturing amounts to 0.48, 0.35, and 0.38 times the size of the exogenous demand shock, respectively. Other female-dominated sectors such as hotels, retail and wholesale, education, and other services also show total multiplier losses in the range of 0.10 to 0.08. An interesting anomaly to this pattern are the two male-dominated sectors of mining and transport with total multiplier losses of 0.11 and 0.10, respectively.

The low values of the total multiplier loss in the female-dominated aggregate sectors other than agriculture and manufacturing could be due to their relatively lower backward and forward linkages with the rest of the Vietnamese economy. The other reason for the relatively lower values of the multiplier could be that these sectors may have high import penetration (see supplemental online Table D for import penetration ratios). Examples of such sectors are hotels (0.10), financial (0.08), education (0.08), and health (0.05), which exhibit high import penetration, of roughly 28, 18, 20, and 13 percent, respectively. However, there are two counter examples to the above pattern. First, in the mining sector, the total multiplier loss is 0.11, but it has a very low import penetration ratio (2.9 percent). Second, the manufacturing sector, which exhibits relatively high total multiplier loss, also has a high import penetration ratio. This could be due to the import of fuel and other intermediary capital goods, such as petroleum products (69 percent) and vehicles (61 percent). Overall, in terms of the total multiplier loss, the labor-intensive sectors with high backward and forward linkages and with low import penetration do seem to suffer higher loss of income than other sectors of the economy. In addition to the total multiplier loss, we also looked at the value-added multiplier loss, which provides an understanding of which type of labor suffers the most loss in various sectors of production.

Loss in value-added multiplier by type of labor

To understand which type of labor suffered the most in terms of loss of income due to violence, we further analyzed the loss in the value-added multiplier by the type of labor factor for the urban and rural categories. As noted before, the Vietnamese SAM has six types of labor, namely, urban labor with tertiary level of education (flab-u-t), urban labor with secondary level of education (flab-u-s), urban labor with primary level of education (flab-u-p), rural labor with tertiary level of education (flab-r-t), rural labor with secondary level of education (flab-r-s), and rural labor with primary level of education (flab-r-p). The analysis of which type of labor suffers the most in the total loss in the value-added multiplier can be quite useful both from an economic policy perspective and from the perspective of devising

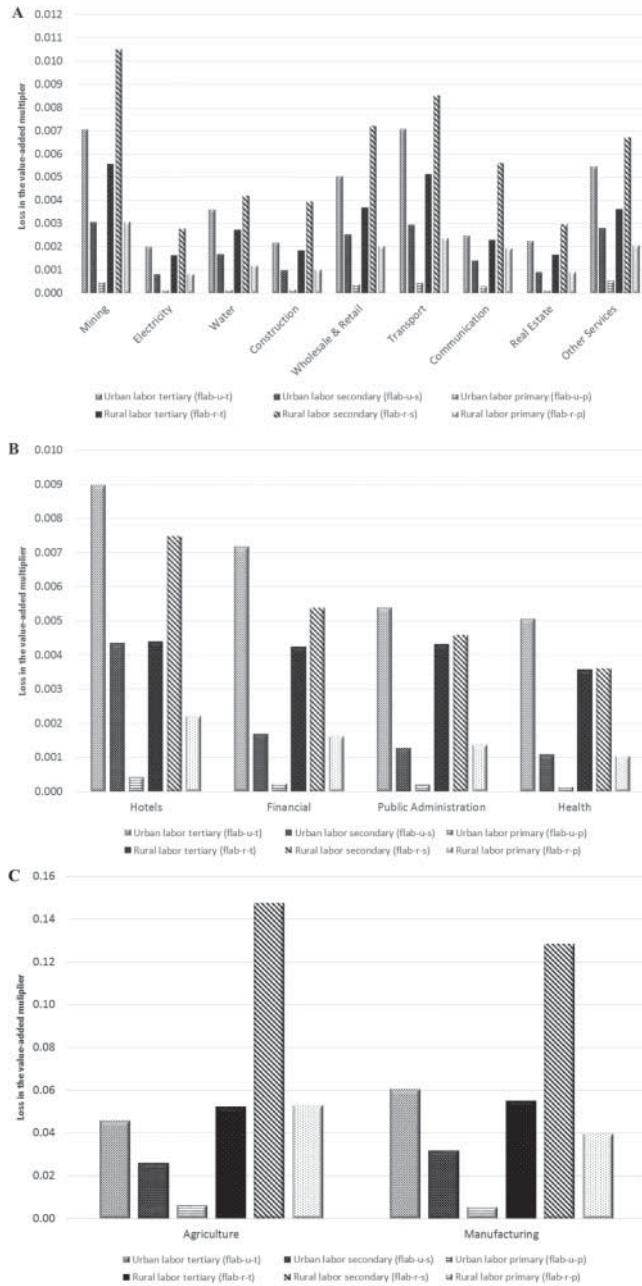

Figure 3 Loss in value-added multiplier: urban and rural labor categories
Notes: (A) Highest loss among rural labor secondary; (B) Highest loss among urban labor tertiary; (C) Mixed pattern.
Source: Authors' calculations.

effective intervention strategies (see supplemental online Table B). In Figure 3, we show the loss in the value-added multiplier by the types of labor factor, and they show which type of labor suffers the most in the overall loss in value added in various sectors owing to violence.[10]

Three broad groups emerge. In the first group, shown in Figure 3A (Highest loss among rural labor secondary), the largest loss is suffered by rural secondary labor followed by urban tertiary and rural tertiary labor. The leading sectors where rural secondary labor suffers the most seem to be mining, manufacturing, transport, retail and wholesale, communication, and other services. The second group, shown in Figure 3B (Highest loss among urban labor tertiary), comprises of the most loss suffered by urban tertiary labor followed by rural secondary and rural tertiary labor. The leading sectors in this group seem to include hotels, financial, public administration, and health. The third group, shown in Figure 3C (Mixed pattern), is comprised of sectors that do not exhibit a common pattern like the first and second group. For example in agriculture, loss is high for rural secondary followed by rural primary. Interestingly, the education sector is an anomaly, where the rural tertiary labor loses the most, followed by urban tertiary labor, and rural secondary labor in the loss in the value-added multiplier.

CONCLUSION

The main aim of this paper is to estimate the macroeconomic loss due to VAW that takes into account the structural linkages of production, which contribute to the generation of employment and income in the economy. We develop a method based on the social accounting framework to estimate macroeconomic loss, and we apply this method to the case of Vietnamese economy using the 2011 Vietnam SAM.

The macroeconomic loss due to violence is estimated to be 0.96 percent of GDP at factor cost and 0.82 percent of the GDP at market prices. In terms of the sectoral contribution to the total income loss, the agricultural sector accounts for almost 40 percent of the total loss followed by manufacturing (16 percent) and retail and wholesale (14.5 percent), as given in Table 3. Our analysis provides further insight into the loss of income incurred due to violence by the different types of labor in the production sectors of the Vietnamese economy (see Figure 2). The result shows that the loss of income due to VAW is spread across urban and rural areas and is at its greatest for urban labor with tertiary education and for rural labor with secondary education. The positive association with the level of education both in the urban and rural areas, notwithstanding the sectoral and geographical wage differentials is surprising. Further exploration is needed to determine if this is simply mirroring a positive association between education and wage or indeed reflects the fact that the levels of

IPV do not in fact vary significantly across educational levels in Vietnam (see Duvvury, Nguyen, and Carney [2012]).

The multiplier analysis provides further insight into the way the loss due to VAW propagates through the various sectors of the economy. The loss is more pronounced in the major sectors that have high linkages with the rest of the economy such as agriculture and wholesale and retail. Further disaggregation of the total multiplier loss into output and income multipliers, highlights the crippling effect of the loss due to VAW on output and income in agriculture and other sectors linked to it. For instance, the agriculture sector's output multiplier loss is estimated to be 0.5, which means that the magnitude of the multiplier effect of a positive demand shock for agriculture is halved due to VAW. The loss due to VAW limits the full realization of the multipliers due to the exogenous demand shock, be it export demand or government expenditure, and the magnitude of the loss is an *invisible leakage* that is permanently lost from the circular flow.

From a macroeconomic policy perspective, the loss due to violence is an invisible leakage to the circular flow, which can undermine, weaken, or potentially neutralize the effect of expansionary government spending on social welfare programs; in effect, it acts as an *endogenous destabilizer*. In other words, minimizing the loss due to VAW can be a significant contributor in achieving efficiency gains for governments' social expenditure programs. This constraint is even more binding in the context of a shrinking fiscal space, and it would not be prudent if policymakers do not take into account the loss due to VAW in their economic policy deliberations.

Srinivas Raghavendra
Department of Economics,
J.E. Cairnes School of Business & Economics, Galway, Ireland
e-mail: s.raghav@nuigalway.ie
http://orcid.org/0000-0003-2058-822X

Nata Duvvury
Global Women's Studies Programme, School of Political Science and Sociology
National University of Ireland Galway, Ireland
e-mail: nata.duvvury@nuigalway.ie

Sinéad Ashe
School of Economics, University of Edinburgh, Edinburgh, UK
e-mail: sinead.ashe@ed.ac.uk

NOTES ON CONTRIBUTORS

Srinivas Raghavendra is Lecturer in Economics in the National University of Ireland, Galway. The primary focus of his research lies in

macroeconomics, with a special emphasis on the interrelation between the real economy and the financial sector in the context of modern financialization.

Nata Duvvury is Senior Lecturer and Director of the Centre for Global Women's Studies at National University of Ireland, Galway. Dr. Duvvury has significant research experience on the issue of gender-based violence, particularly IPV, in developing country contexts. She has led several studies to estimate the costs of violence against women in Bangladesh, Morocco, Uganda, and Vietnam. Her other research interests include modeling impacts of gender equality on economic growth and poverty reduction, gender analysis of policy responses to economic crisis, and dynamics of asset ownership and rural identity.

Sinéad Ashe is Senior Teaching Fellow in the School of Economics at the University of Edinburgh. Her research interests are primarily in the area of macroeconomic modeling, with a particular emphasis on Dynamic Stochastic General Equilibrium (DSGE) models, growth models, and development. She is interested in the interaction between the financial and the real economy during crisis periods.

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NOTES

[1] See Duvvury, Nguyen, and Carney (2012) for a more systematic understanding of the cultural and gender norms that perpetuate VAW in Vietnam, and IPV in particular. Patriarchal norms and cultural understanding of what constitutes "a good woman" also limit the extent to which women seek outside help and thus make the costs of violence invisible.

[2] The sample was drawn from four provinces and three central cities of Vietnam reflecting the seven regions considered in the 2009 National Study on Domestic Violence undertaken by the General Statistics Office and the World Health Organization. The national survey had a sample of 4,300 women. Using the prevalence rate of the 2009 study of 10.9 percent for experience of physical and sexual violence in the last twelve months, a sample of 1,050 was finalized (95 percent confidence, with a confidence interval of 3). Ultimately, 1,053 women were surveyed. The survey provided the unit cost per incident, which were applied to the national prevalence rate from the 2009 study for estimating the macro costs.

[3] The survey asked the total number of incidents experienced in the last twelve months, and women reported a total of 9,815 incidents. The cost data for an incident of violence was collected iteratively, with woman first reporting on the most recent incident, then subsequent incident, and so on until women could recall no more.

Through this method, the survey collected detailed information on 1,041 incidents, and this data was used to derive average costs per incident.

[4] The information on missed days of work missed by men was based on women's respones to the question: "Did your husband miss work after the incident of violence? If so, how many days?" The fact that men may also miss work after an incident of violence is confirmed by several other studies, including Vara Horna (2013) and Overseas Development Institute (ODI; Darko, Smith, and Walker 2015). An earlier study in India (Burton, Duvvury, and Varia 2000) also reported that men on average missed a higher number of days than women following an incident of violence. This was also reported in Vara Horna's (2013) Peru study, in which annual days of missed work was twenty-four days for women and thirty-five days for men.

[5] The hotels sector includes accommodation and food service activities, a sector that has had an increase of 108 percent in the labor force between 2005 and 2010 (Breu et al. 2012).

[6] It is important to note that women gave detailed information on all the incidents, including the number of incidents that resulted in missed work for them and their intimate partners.

[7] We calculate the incident rate (IR) as the proportion of incidents that result in missed work, and the average number of days missed per incident (7.4 incidents per woman) is taken as representative across all sectors of the economy, since there is no sector-specific incidence rate data available for Vietnam.

[8] With almost full employment in Vietnam in 2011, market wages are assumed to reasonably reflect the loss of income arising from days of work lost due to violence.

[9] See supplemental online Table B for detailed estimates.

[10] See supplemental online Table C for detailed estimates.

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APPENDIX

Appendix A1: General model of SAM

In terms of various accounts, we denote P_A for production activities, C for commodities, F for factors, H for households, and E for exogenous sectors. The uppercase boldface characters indicate matrices (for example, $\mathbf{Z}$ is the intermediate demand matrix), the lowercase boldface characters indicate vectors ($\mathbf{z}$ is the final demand vector), and vectors with a hat (such as $\hat{\boldsymbol{x}}$) indicate a diagonal matrix with vectors (such as $\mathbf{x}$) on its main diagonal. All vectors are column vectors unless explicitly transposed (for example, $\boldsymbol{v}^{\boldsymbol{T}}$) and $\mathbf{1}$ is the sum vector. Non-boldface characters indicate scalar magnitudes (Y, E etc.).

The income of the respective accounts (columns) is given by,

$$\boldsymbol{x}^T = 1^T\mathbf{Z} + \boldsymbol{v}^T; \boldsymbol{z}^T = 1^T\hat{\mathbf{x}} + 1^T; V = \boldsymbol{v}^T 1; Y = 1^T c + S; E = 1^T e$$

And the expenditure side (rows) is given by,

$$x = \hat{\mathbf{x}}1; z = \mathbf{Z}1 + \boldsymbol{c} + \boldsymbol{e}; V = \boldsymbol{v}^T 1; Y = \boldsymbol{v}^T 1; E = \boldsymbol{l}^T 1 + S$$

Table A1 General model of SAM

	P_A	C	F	H	E	T
P_A	$\mathbf{0}$	$\hat{x}$	0	$\mathbf{0}$	$\mathbf{0}$	x
C	$\mathbf{Z}$	$\hat{0}$	$\mathbf{0}$	$\mathbf{C}$	$\mathbf{e}$	$\mathbf{z}$
F	v^T	$\mathbf{0}^T$	0	0	0	V
H	$\mathbf{0}^T$	$\mathbf{0}^T$	$v^T 1$	0	0	Y
E	$\mathbf{0}^T$	l^T	$\mathbf{0}$	S	0	E
T	x^T	z^T	V	Y	E	

The assumptions used here are as follows:

1. Gross output by activity is at basic prices of x.
2. Total demand by commodity z is at market prices, and it includes imported as well as domestically produced commodities.
3. Intermediate consumption matrix $\boldsymbol{Z}$ (necessarily) includes both domestically produced and imported commodities and so does, therefore, the technical input matrix A.
4. There is no explicit treatment of investment.
5. There are no (net) taxes on production, that is, on activities (there are only taxes on commodities).
6. Vector l^T stands for imports-cum-taxes on products.

The intensity (that is, per unit of output, income, and so on) equations are:

$$\boldsymbol{A} = Z\hat{x}^{-1}; \boldsymbol{B} = \hat{x}\hat{z}^{-1}; \hat{\boldsymbol{a}}_{\boldsymbol{l}} = \hat{l}\hat{z}^{-1}; a_s = S/Y; \boldsymbol{a_c} = C/Y; \hat{\boldsymbol{a}}_{\boldsymbol{v}} = \hat{v}\hat{\boldsymbol{x}}^{-1}$$

Using these intensity equations, the row/column accounting identities are given by: $1^{\boldsymbol{T}} = 1^{\boldsymbol{T}}\boldsymbol{B} + 1^{\boldsymbol{T}}\hat{a}_l$; $x = \boldsymbol{Bz}$; $\boldsymbol{z} = \boldsymbol{A}x + a_c Y + \boldsymbol{e}$; $1 = 1^{\boldsymbol{T}}\boldsymbol{a_c} + a_s$; $E = \hat{\boldsymbol{a}}_{\boldsymbol{l}}^{\boldsymbol{T}}\boldsymbol{z} + a_s Y$; $V = \hat{\boldsymbol{a}}_{\boldsymbol{v}}^{\boldsymbol{T}}\boldsymbol{x}$; $Y = V$

Substituting and further simplification yields the system of equations,

$$\boldsymbol{z} = (\boldsymbol{I} - \boldsymbol{AB} - \boldsymbol{a_c a_v}^{\boldsymbol{T}}\boldsymbol{B})^{-1}\boldsymbol{e} \tag{A1}$$

$$E = (\boldsymbol{a_l}^{\boldsymbol{T}} + (1 - 1^T\boldsymbol{a_c})\boldsymbol{a_v}^{\boldsymbol{T}}\boldsymbol{B})\boldsymbol{z}, \quad \textit{with} \quad E = 1^{\boldsymbol{T}}\boldsymbol{e} \tag{A2}$$

Equation (A1) is the multiplier equation and yields the resultant total demand for given (level and sectoral composition) exogenous expenditure. Equation (A2) is the consistency relation which states that given the vector of exogenous expenditure there is a consistency relation between total demand and exogenous expenditure induced by imports (a_l) and the propensity to save ($a_s = 1 - 1^T\boldsymbol{a_c}$), as in the aggregate simple Keynesian multiplier setting. If we denote, $\boldsymbol{\lambda}^T = (\boldsymbol{a_l}^{\boldsymbol{T}} + (1 - 1^T\boldsymbol{a_c})\boldsymbol{a_v}^{\boldsymbol{T}}\boldsymbol{B})$, we would have $E = \boldsymbol{\lambda}^T\boldsymbol{z}$, which in a scalar context is expressed as a multiplier relation $Z = E/\lambda$, where Z total demand generated by the exogenous outlays E with the multiplier represented by the leakages λ.

The method we adopt in this paper is to include the lost income due to VAW by *augmenting* factor incomes (**v**) by an amount corresponding to an estimate of income foregone. This would alter $\hat{\boldsymbol{a}}_{\boldsymbol{v}}^{\boldsymbol{T}}$ that enters into the inverse matrix of the multiplier equation (A1). But in a demand-induced setting like this (where we

have the exogenous expenditure **e** as the demand inducing variable), modifying factor incomes without necessarily changing expenditure may be problematic. For instance, changing factor incomes (**v**) at the same level of **Z**, the intermediate inputs, increases the gross output (**x**) to the same extent. This would imply that the additional hours of work leads to additional purchasing power for each round of *existing* expenditure.

Here, assuming that the additional hours of work would conform to the current technical conditions, we account for the additional expenditure (consumption expenditure) that would have been generated in the economy. In particular, we consider that the additional income (W_v) is partially consumed (and partially saved), given by the consumption coefficients

$$C_v = (1 - a_s)\, W_v$$

Let $\boldsymbol{\theta}_c$ be the vector of proportional distribution of consumption, meaning, in the two-sector case $\boldsymbol{\theta}_c = \begin{bmatrix} \theta_{c_1} \\ \theta_{c_2} \end{bmatrix}$, where $\theta_{c_1} = C_1/(C_1 + C_2)$ and $\theta_{c_2} = C_2/(C_1 + C_2)$, so that the additional expenditure in each product is given by

$$\boldsymbol{e}_v = \begin{bmatrix} E_{v_1} \\ E_{v_2} \end{bmatrix} = \begin{bmatrix} \theta_{c_1} C_v \\ \theta_{c_2} C_v \end{bmatrix}$$

Thus, we estimate $\boldsymbol{e}_v$ is the vector of additional consumption expenditure from the factor incomes due to the lost hours.

Therefore, we can compute the additional total demand, meaning, the potential demand, by accounting for expenditure foregone due to violence as,

$$\Delta \boldsymbol{z} = \boldsymbol{z}_v = (\boldsymbol{I} - \boldsymbol{AB} - \boldsymbol{a_c a_v}^{\boldsymbol{T}} \boldsymbol{B})^{-1} \boldsymbol{e}_v \tag{A3}$$

Equation (A3) can be thought of as the violence-accounted final demand, or violence-accounted multiplier ($\boldsymbol{z}_v$), and the difference between the actual multiplier (1) and the potential multiplier (3), $\boldsymbol{z}^* = (\boldsymbol{z}_v - \boldsymbol{z})$, would provide us the multiplier loss due to violence.

We can also calculate the additional net income, that is, potential macroeconomic income, by accounting for expenditure foregone due to violence

$$Y_v = \boldsymbol{a_v}^{\boldsymbol{T}} \boldsymbol{B z_v} \tag{A4}$$

Thus, from Equations (A1), (A3), and (A4) we can estimate the macroeconomic loss, both the level and the multiplier loss arising from lost work due to VAW.