WIFE ASSAULT AND SOCIOECONOMIC CHARACTERISTICS

THE ASSOCIATION BETWEEN WIFE ASSAULT AND THE SOCIOECONOMIC

CHARACTERISTICS OF WOMEN AND THEIR FAMILIES

By

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A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfilment of the Requirements

for the Degree

Doctor of Philosophy

McMaster University

DOCTOR OF PHILOSOPHY (1998)

McMaster University

(Economics)

Hamilton, Ontario

TITLE: The Association Between Spousal Assault and the
                    Socioeconomic Characteristics of Women and Their
                    Families

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NUMBER OF PAGES: 103, xi

Abstract

This thesis is composed of three essays on the topic of wife assault and is based on the 1993 Violence Against Women survey (VAWS) data. In the first two essays, we estimate the impact of economic status on the frequency of wife assault using several models and large random samples. Tauchen, Witte and Long (1991) (TWL) find that both female and male income have a significant impact on the frequency of domestic abuse. Their study is based on a small, self-selected sample of battered women (n=125). In the first essay, we find similar results to TWL when we use a sample and a model much like theirs. However, when we use a Zero Inflated Poisson model and a less self-selected sample of physically abused women (n=877), we find there is less evidence of a significant relationship between either female or male income and the frequency of abuse. In the second essay, we expand the sample to include all currently married women (n=5596). Again we estimate several models and find little evidence of a significant relationship between either female or male income and the frequency of abuse.

In the third essay, we investigate the source of the positive association between the frequency of wife assault in a first marriage and the probability of that marriage ending. We find that the association between abuse and the decision to separate remains significant and largely unaffected when all VAWS variables thought to influence the decision to separate are added to the probit. Most of the variables that are not available in the VAWS do not appear to be capable of generating a spurious positive

relationship between the frequency of abuse and marital

dissolution. We also find no evidence of systematic reporting

differences that might generate a spurious association between

abuse and dissolution.

Acknowledgments

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I.   Introduction

This thesis is composed of three essays on wife assault. The essays are based on the 1993 Violence Against Women Survey which was conducted by Statistics Canada. This database provides a rich source of information on the male violence experiences of 12,300 women aged 18 years and older.

The first essay investigates whether or not the economic status of the male and/or the female is associated with the frequency of wife assault in relationships with a history of violence. The essay focusses on this segment of the population because an earlier American study (Tauchen, Witte, and Long, 1991) found that the frequency of violence for this group is significantly associated with both male income (positively) and female income (negatively). The second essay expands on the first one. It investigates whether or not the economic status of the male and/or the female is associated with the frequency of wife assault in all male-female unions (i.e. those with and without a history of abuse). These two essays should be of interest to economists and policy makers. If economic status were found to influence violence, it could affect the design or targeting of economic programs to reduce violence against women. Moreover, reducing or eliminating domestic violence in one generation might have intergenerational effects since research in sociology finds that domestic violence is transmitted within families. Economists also study intrahousehold allocation and male/female contributions to public goods shared by the couple, such as goods

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for children. As difficult as it may be to accept, violence may be one tool used in the intrahousehold bargaining process.

The third essay explores the association between wife assault and marital dissolution. The strong association between abuse and marital dissolution raises questions about how to interpret the common finding (from the National Longitudinal Survey of Children and Youth and other data sources) that the children of lone mothers have more health and academic problems than the children of couples, even controlling for income and other variables. This finding could be due either to the lack of economic or other resources in single-mother families. It could also be due to the legacy of parental and child abuse in a previous marriage. If the latter is true, social policy directed at supporting the two parent family would not improve, but could possibly worsen, the health and welfare of children. Social policy directed at decreasing violence in the home, however, may improve the situation for many children and also improve the stability of the family.

II.   **Essay One: Does Economic Status Affect the Frequency of**

   Wife Assault in Relationships with a History of Violence?

1. **Introduction**

        Domestic violence reduces the quality and, possibly, the

length of life. It inflicts both physical and psychological pain

and creates an atmosphere of fear, which can have long term

consequences for the recipient and any children in the household.

A child raised in an abusive family may learn that violence is an

acceptable way to resolve conflicts. Family violence research

finds that experiencing parental violence significantly increases

the probability of entering into violent adult relationships.[1]

Discussions of domestic violence in the popular press often cite

economic variables as one of the factors that may influence both

the occurrence of the problem and the effectiveness with which it

is dealt. These factors often include the relative economic

resources (especially human capital) of the partners and the

economic stress to which the family is subject. However, there is

almost no research by economists on the causes of domestic

violence. Tauchen, Witte, and Long (1991) (hereafter referred

to as TWL) is one important exception.

        One reason economists are interested in studying domestic

violence is to explore possible ways to reduce the incidence

through policy variables such as welfare receipts, education,

and employment opportunities. TWL find that an increase in the

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[1]   This is discussed later in this essay.

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female (male) income decreases (increases) the frequency of wife assault in low to middle income households. However, in higher income households in which the female earns the bulk of the income, they find that an increase in the female income increases the frequency of violence. A major limitation of the TWL study is that the sample is a small (n=125), self-selected group of abused women from a single county in the United States. If TWL results can be proven to hold for a national random sample of battered women, this could affect the design of economic programs, in particular those that affect female incomes in the low to middle income households. Moreover, reducing or eliminating domestic violence in one generation might have intergenerational effects since research in sociology finds that domestic violence is transmitted within families as mentioned above. Economists also study intra household allocation and male/female contributions to public goods shared by the couple. Violence may be one tool used in the intra household bargaining process.

The purpose of this essay is to ascertain whether or not results similar to that of TWL can be found with a model similar to that of TWL and a second, arguably more appropriate, model. Both models are estimated with a sample selected in a manner much like that of TWL and with a random sample of currently married women who report physical abuse by their current spouse. This essay contains the following sections: 2) a discussion of the potential determinants of wife assault, 3) a presentation of the Violence Against Women survey (VAWS) data in more detail, 4) a presentation of our analysis based on the TWL model and an alternative model, 5) a discussion of sensitivity tests performed on the results, and 6) a summary of our results.

2. Potential Determinants of Wife Assault

Why does a woman stay with her abusive partner? One reason that is often cited is the woman believes that she would not be able to support herself and her children outside the relationship. Variables such as income, human capital, and such marriage specific capital as children may affect the viability of the outside option. The ability of a woman to support herself may affect the credibility of a threat to leave should the violence escalate. Assuming the male prefers that the union remains intact, as we do throughout this thesis, the value of the outside option may impact on the frequency of violence by the male.[2]

The ability of a woman to support herself and her children may be reflected in her current income and her educational attainment. We would expect, therefore, that the value of these variables would be negatively related to the frequency of violence.

Theory suggests, as TWL note, that the age and relationship of the children in the marriage may impact on the frequency of wife assault.[3] Young children are time intensive and, therefore, mothers of young children are apt to be financially dependent on their partners for support. Hence young children may diminish the battered woman's credibility that she will leave if the abuse continues. As children age, they require less care and may become more aware of the violence in their

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[2]   Please see Becker (1976, pp.205-250) and TWL (1991, pp. 494-497) for a more extensive discussion of this topic.
[3]   The relationship of the children refers to whether or not they were the product of the current union.

homes. Therefore, the abused mothers of older children may become less financially dependent on their partners and have more reason to shield their children from violence than mothers of younger children. As children age, their mothers' credibility that she will leave if the abuse continues may be restored. Therefore, we would expect that the children's age would be negatively related to the frequency of wife assault.

Family violence research finds that girls who witness their parents' domestic violence or experience child sexual assault (CSA) are more likely to enter into violent adult relationships than girls who do not experience such violence.[4] Therefore, we might expect that domestic violence in the female's family of origin and CSA to be positively associated with the number of incidents of abuse.

TWL propose that the male may abuse his partner in order to release his frustration regarding his economic situation. Family violence research finds that males raised in abusive homes may be more prone to violence than other males.[5] Therefore, we would expect male income and the male's educational attainment to be negatively associated, and a woman having an abused mother-in-law to be positively associated, with the frequency of violence.

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[4]   Straus & Yodanis (1996, pp.835-837) and, for a review of earlier research, please see Cahill, Llewelyn and Pearson (1991, pp. 122-123) and Gelles (1980, pp.878).
[5]   Straus & Yodanis (1996, pp.835-837) and, for a review of earlier research, please see and Gelles (1980, pp.878).

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3. Data

3.1. Description of the VAWS data

In February of 1993, Statistics Canada conducted a
national telephone survey on VAWS. Interviews took place weekdays
between 10am and 11pm (EST).[6] A random sample of households was
selected and about 50% of the telephones calls were answered. An
attempt was made to interview a randomly selected female resident
who was at least 18 years of age. In total, 22,319 calls were
answered and 19,309 of these households included an eligible
female. The response rate of the eligible females was about 64%
resulting in a sample size of 12,300.[7] About 29% of ever married
women in this sample report that they have been physically
attacked by a spouse.

The manner in which survey questions are worded is
extremely important when dealing with issues of violence.
Differences in the interview technique can dramatically affect the
prevalence rates. The Conflict Tactic Scales (CTS) is the most
widely used technique for determining the rate of violence.[8] The
VAWS uses a variation of the Conflict Tactics Scales (CTS) and
women were asked whether or not they had ever experienced specific
violent actions. For example, instead of asking 'has your
husband/partner ever abused your?', the VAWS asks several
questions like 'has [your husband/partner] ever hit you with
something that could hurt you?'. The former question requires all

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[6]   No household was called after 8pm local time.
[7]   Statistics Canada (1994, pp. 6-8).
[8]   For further information, criticisms, and the variations
on the CTS used in the VAWS in order to address these problems,
please see Johnson and Sacco (1995, p.291-293)

participants (i.e. interviewer and all respondents) to have the same definition of abuse and for the respondents to scan their memories for incidents that might fit this definition of abuse. This question also imposes a label upon the woman, if she replies in the affirmative; therefore, she may deny that the abuse occurred to the interviewer and, possibly, herself. The benefit of questions like the latter one are that they are unambiguous and require the respondents to scan their memories for incidents that fit the description of one action at a time. The question also does not require the woman to label herself as abused to answer in the affirmative.[9]

In this essay, we use 877 of the 12,300 observations.[10,11] Our sample is comprised of those women who report physical abuse by their current partner.[12] It should be noted here that we are following TWL for the selection of this sample. Women who either left or were never part of an abusive relationship are included in neither the TWL sample nor our sample.

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[9] A person may admit to blackouts and missed work due to drinking, but say that they are not an alcoholic. So too can a woman say that she has been hit, slapped, punched, etc., but that she is not an abused wife without being aware of the inconsistency of her responses.

[10] The reasons for not including the other 11,423 observations are explained in detail in Appendix A.1.

[11] It should be noted that this sample is between the ages of 18 and 65 and that our definition of marriage includes both registered and non-registered unions.

[12] We ignore abuse by previous partners in this essay. Therefore, if the woman reports that her current spouse has not been physically abusive or the woman is currently unattached, she is excluded from our sample even if she reports physical abuse by a previous partner. In Chapters Three and Four, we include all currently married and all ever married women, respectively.

3.2. Definition of Wife Assault

The VAWS has data on the following four forms of wife assault: 1) threat of violence, 2) emotional abuse, 3) physical attack, and 4) sexual violence. Physical attack is defined as the male throwing something at his partner that could hurt; pushing, grabbing or shoving her; slapping, kicking, biting, or punching her; hitting her with something that could hurt; and/or beating or choking her, or threatening her with a gun or a knife. Sexual violence is defined as the male forcing or attempting to force his partner into any sexual activity by either threatening her, holding her down or inflicting pain on her. In this essay, we follow TWL and restrict our investigation to physical abuse, which includes physical attacks and sexual violence.[13] We refer to these acts collectively as physical assault or abuse.

3.3. Differences between the VAWS and the TWL data

As noted above, there is little published literature on this topic to provide guidance besides TWL. Hence, this essay follows the approach of TWL as closely as possible. Most of the TWL variables are available directly from the VAWS; however, some TWL variables must be approximated while others cannot be even approximated. We review the differences between the TWL and the VAWS data below.

3.3.1. Number of incidents of abuse

The TWL data includes the number of incidents of abuse over a fixed six month period for all women in their sample. The

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[13]   Only 5% of all emotionally or physically abused women report only emotional abuse.

variable is continuous and ranges between a low of zero to a high of 180 (i.e daily beatings). The VAWS, on the other hand, does not provide the number of incidents of abuse for each battered woman over a fixed interval of time. It does, however, contain the total number of incidents of abuse and when the first and most recent incident occurred. The number of incidents includes the number of threats, physical attacks and sexual attacks by the woman's partner. The actual number of incidents reported is given if less than six. Incidents numbering between six and ten are captured in one category and reports numbering eleven or more are captured in another. In order to estimate the number of incidents, we use the value of eight for the "six to ten" category and the value of eleven for the "eleven or more" category.[14]

The VAWS information on physical abuse extends over the duration of the marriage, but the income information is for the current period only. Hence, we will focus our attention on 'recent' incidents of abuse. The number of years since the last incident of abuse is reported if it occurred within the past ten years. Reports of incidents occurring more than ten years ago are grouped together. For about 82% of the sample either the last incident of abuse was more than four years prior to the VAWS or abuse began within this period. Therefore, the actual number of incidents during the four year window is known with certainty for almost the entire sample. For the small number of cases for which this is not true, we estimate the total number of assaults within

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[14] Since the latter category does not have an upper bound, it is not possible to take a midpoint; therefore, to be conservative, we chose the lower bound of eleven. Please see Table 2.7 for the results of sensitivity tests on this top category.

four years prior to the VAWS based on the total number of assaults
reported and the timing of the first and the most recent assault.
(Please see Appendix A.2 for more details.) Actual or estimated
abuse within the four years is deemed to be 'recent abuse' for the
purposes of this essay. About 49% (or 431) of our sample report
that they had been abused in the four years prior to the VAWS.
The Table 2.1 presents the estimated number of recent incidents of
abuse.

3.3.2. Income Variables

The TWL data includes continuous measures of female, male,
and household incomes. The VAWS includes categorical information
on female and household incomes only. There are eleven income
categories, the highest of which is '$80,000 and above'. We
translate these categories, as best as possible, into continuous
income variables.

The availability of only female and household income in
the VAWS, along with the top coding of each variable, limits our
ability to estimate male income. We have chosen to supplement the
VAWS with income data from another source, in the manner
specified below, for two reasons:

1.   TWL use a continuous measure of male income in their
       analysis.

2.   About 231 families (or about 26% of the sample)
       include adults, other than the two partners, who
       receive an undetermined amount of income. Data
       supplementation is the only way to estimate male
       income in these households.

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For supplementation purposes, we use the Canadian Survey
of Consumer Finances for 1992 (hereafter referred to as SCF). We
select a subsample consisting of 17,739 currently married couples
aged 18 to 65 years.[15] (For details regarding how this estimation
is performed, please see Appendix A.3.)

3.3.3. Child Variables

The TWL model includes variables such as the presence of
pre-school children, number of children and the presence of
stepchildren in the household. These variables can be imputed
from the VAWS, albeit sometimes quite imperfectly.

TWL uses the number of children in the relationship in
part to proxy for the duration of the relationship. The number of
years together is directly available from the VAWS. The presence
of a single child under the age of 25 is also directly available
from the VAWS. We use a binary variable for the presence of a
child, the number of years together, and the interaction between
these two variables. The latter two variables are used to proxy
the age of the children in the home. To proxy stepchildren, we
cross the presence of a child binary variable with a binary
variable indicating that the female has had at least one prior
marriage.[16]

3.3.4. Other TWL Variables

The TWL model also includes the amount of welfare
received, and binary variables for the female having a place to

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[15]   Married couples includes common-law as well as registered
unions. Both the male and the female must be between 18 and 65
years of age to be included in the sample.
[16]   No information is provided as to whether or not the male
has had a previous marriage.

stay if she feels threatened by her partner, for the ethnicity of the woman, and for the ethnicity of her spouse. These variables are not available either directly or indirectly from the VAWS.

3.3.5. VAWS variables not available to TWL

The VAWS includes potentially important information on the couple that is not available in the TWL data. This includes information on the educational attainments and the employment information of the partners. There is also information on other violent experiences of those interviewed including domestic violence in the family of origin and child sexual assault (CSA).[17]

4. Empirical Model

In this section, we report the results of estimating two versions of the TWL model and a count model using a sample similar to TWL (n=77) and our larger sample (n=877) both of which are drawn from the VAWS.

4.1. TWL model

TWL develop and estimate a model to predict the frequency of wife assault. TWL discuss the merits of using OLS, Tobit, and a bounded influence regression (BIR) model. They state that, because the percentage of zeros in their data is small (about 14%), there would be little difference between the estimates of

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[17] This is a sexual assault that was perpetrated before the woman was 19 years old by a man (or men) the woman knew, but was (were) never at anytime romantically linked to her. Research in sociology finds that sexual assault by a known male is more devastating and has longer lasting implications than sexual assault by a stranger. Child sexual assault (CSA) is generally defined as a sexual assault on a person 18 years or younger by a person five years or more her senior. We exclude all sexual assaults after age 18 and all those perpetrated by a date or romantic partner in our definition of CSA. Please see Hanson (1990) for a review of this literature.

the OLS and Tobit models. TWL explore a number of specifications
for the income variables and find that the uppertail in the
studentized residuals is thicker than can be accounted for by a
normal distribution. They propose that, at a certain level,
violence becomes uncontrollable and that it is this process that
generates the large residuals. Therefore, TWL use a BIR
estimation technique in order to reduce the weight of these
outliers in the regression and allow for the non-normality of the
errors. They compare the results of OLS and a BIR and find the
latter provides a better fit for their data.

For the VAWS data, a BIR estimation technique would not
likely be required to limit the impact of the dependent variable
since this variable has an upper bound of eleven. Using our
subsample of VAWS data, we estimate the TWL-like model using a
Tobit since the dependent variable in the VAWS has a higher
percentage of zeros (50%) than the TWL.

We estimate two versions of the TWL-like model: a) a
restricted version, which uses only those variables available to
TWL; and b) an expanded version, which uses the TWL variables as
well as educational attainments and sociological variables
available from the VAWS. We estimate the two versions of the
model based on a) a sample much like that of TWL (n=77), which we
call the 'TWL-like sample' below, and b) our sample of all
currently married abused women (n=877).

TWL's data consists of currently married women who had
both experienced wife assault and had sought the help of community
support services. For a first look at the data, we attempt to
keep our estimation as similar as possible to TWL; therefore,

from our sample we select a subset of all currently married abused women of those who report that they have used community services and found them useful.[18] As we stated earlier, some variables used in the TWL model are not directly available (i.e. age of children) or even indirectly available (i.e. ethnicity) from the VAWS. Also the range of the dependent variable in the TWL data (zero to 180) is much wider than it is in the VAWS data (zero to eleven). These factors alone could cause our results to differ from those of TWL.

Table 2.2 below displays the results of estimating the restricted version of the TWL-like model with the TWL-like sample. TWL's primary finding is that female income has a significant negative relationship with the frequency of domestic abuse, while their secondary finding is that male income has a significant positive relationship with the frequency of such abuse. As can be seen from this table, our results agree with both TWL's primary and secondary findings. We also find that the income variables are jointly significant at the 0.5% level.

In Table 2.3, we display the results of estimating the expanded version of the TWL-like model. We find that the results are in agreement with TWL in that female income is negatively related to the frequency of wife assault, but there is now no statistically significant evidence of a relationship between male income to the frequency of abuse.[19] The income variables,

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[18]   For the TWL data (n=125), the majority of abused women were identified by their use of community services. Arguably, women who found these services helpful would be more visible to community service workers since they probably make more use of the services than those women who were unsatisfied with the services.
[19]   Removing educational attainment from the tobit does not have a significant impact on these findings.

however, remain jointly significant at the 0.5% level.

By iteratively running the Tobit estimation of the smaller
sample and expanded model, we find that we are able to generate
results similar to TWL as long as CSA is omitted from the
estimation. Therefore, our results appear to reveal that not
controlling for CSA's negative impact on the gain from marriage in
our data generates the finding that male income is significantly
related to the frequency of violence. The reason for this is not
known. Research finds evidence that women who have experienced
CSA search for a mate for a shorter period of time than do other
women.[20] We would expect then that the gains to marriage for the
CSA survivours to be lower than for other women. Therefore, we
would have expected that controlling for CSA would generate
stronger not weaker results with respect to male income.

Table 2.4 below displays the results of estimating the
restricted version based on the larger sample of abused women
(n=877). As can be seen from this table, female income has a
significant inverse relationship to the number of incidents of
abuse reported by physically abused women, but male income is
again not significant as it was in Tables 2.2. The only other
significant variable in this model is the duration of the union,
which we find also has an inverse relationship to the frequency of
violence.

To explore whether or not there is a difference between
the income response of low to middle income households as opposed

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[20]   Russel (1986) as cited in Cahill, Llewelyn and Pearson
(1991, page 123).

to high income[21] households in which the female earns more than half the income, we estimate these two groups separately. We find that for low to middle income household (n=338), no income variables are significant. However, for high income households in which the female earns more than half the income (n=120), female income is negatively associated with the frequency of abuse.

Table 2.5 displays the results of the estimation of the expanded model on the larger sample. As can be seen from this table, female income is negatively related to the frequency of violence, which is in agreement with TWL's primary finding. Again however, the results are not in agreement with TWL's secondary finding that male income is positively associated with the frequency of violence. Instead, we find that male income has no significant relationship to the frequency of wife assault in this model. A test of the income variables shows that the income variables are not jointly significant at even the 25% level.

In both the restricted and the expanded models, the correlation between female income and the frequency of abuse is significant, but its magnitude is small. In the expanded model with the larger sample, a ten percent increase in female income is associated with a decrease in 0.085 incidents of abuse over the four year period. We also find that, in both the restricted and the expanded versions of the TWL-like model, the income variables are not jointly significant at even the 10% level. We find that variables such as education and abuse in the family of origin, which do not appear in the TWL study, have a much stronger relationship to the frequency of abuse. In the following section,

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[21]   Defined as receiving more than $40,000 per year.

we present and estimate a count model as an alternative to the Tobit model.

4.2. Count Model

A more appropriate model for looking at the VAWS data may be a count model since we are trying to estimate the number of incidents of abuse over a period of time. The simple Poisson regression model, which places strict assumptions on the mean and variance of the dependent variable, may not be an attractive model, however. There have been efforts made to develop Poisson models that can deal with over dispersion (implying 'too many zeros') and/or under dispersion (implying 'too few zeros'). In our sample of the VAWS, there are many more zeros in our sample than would be predicted by the simple Poisson model; therefore, we employ the Zero Inflated Poisson (ZIP) model that was developed by Lambert (1992). (For more details on the ZIP model, please see Appendix A.5.) The ZIP model uses the distribution above zero to differentiate between two assumed types of zero responses. Individuals may be at zero because they are either at a corner solution or they are now of a different type that is not prone to violence.[22] The ZIP model is composed of a 'hurdle' part (those below the hurdle are not prone to violence) and a 'count' part (for those prone to violence).

When estimating the ZIP model, we find the TWL specification corresponds to the highest p-values for the

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[22]   Ex-smokers are implicitly treated as if they are of the same type as those who have never smoked when estimating the consumption of tobacco by a double hurdle model. In keeping with this precedent here, we treat relationships that have not been violent in four years as being of the non-violent type.

coefficients of the income variables.[23] The results of this estimation can be found in Table 2.6. As can be seen in that table, no income variable is significantly related to jumping the hurdle or the frequency of abuse given that the hurdle is jumped.[24] However, the male income variables are jointly significant at the 10% level for both the hurdle and count part of the estimation.[25]

We find that the female's educational attainment is negatively associated with the hurdle being jumped. We find that the woman's age, experiencing CSA, having an abused mother-in-law, and living in an urban area are positively associated with the frequency of wife assault given the hurdle has been jumped. We find that the female having a high school diploma and the male having a school diploma is positively and negatively, respectively, associated with the frequency of violence given the hurdle has been jumped. The signs are as predicted on male educational attainment, experiencing CSA, and having an abused mother-in-law. However, the sign on female educational attainment

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[23]   Specifically these variables are as follows: male income, male income squared, female income, female income squared, female income x male income, percentage of the year the male works, percentage of the year the male works squared, percentage of the year the male works x male income, percentage of the year the male works x female income, percentage of the year the female works x male income, percentage of the year the female works x female income, percentage of the year the female works, percentage of the year the female works squared, and percentage of the year the male works x percentage of the year the female works.

[24]   It should be noted that in the simple Poisson, which was rejected by testing the significance of the hurdle part of the ZIP model (see test 1.1 of Table 2.6), female income is negatively associated with the frequency of violence.

[25]   This finding appears fragile. When other specifications of the income variables are used, both the male and the female income variables are jointly and individually insignificant.

is surprising.

We find that the income variables are jointly significant with respect to the frequency of abuse at the 10% level. The TWL initial findings and our earlier extensions suggested the importance of the relationship between female income and abuse. Perhaps this is because higher income gives women a more viable outside option and, hence, a better bargaining stance within the relationship. This current set of findings suggests a different but related channel that a once-abused woman's educational attainment (again related to her potential to survive outside the relationship) may be associated with a smaller probability of having any recent abuse. It also may be that with such a highly parameterized model it is difficult to find significant relationships, but we note that income variables are jointly significant at the 10% level.

5. Sensitivity tests

In this section, we present sensitivity tests on our results. We test our results in the following areas: 1) the choice of the four year window, 2) the use of the SCF data to supplement the VAWS data, 3) choice of the sample, 4) choice of eleven as the value assigned to the dependent variable's top code, and 5) choice of model. These tests are summarized in Table 2.7 below.

5.1. Four year window

In this essay, we restrict our analysis to abuse within the four years prior to the VAWS. On one hand, we need to have income information at the time of the abuse and only current income information is contained in the VAWS. The longer the

window, the less relevant current income will be as an indicator of actual income at the time of the abuse. On the other hand, for estimation purposes we want to have a large number of strictly positive responses. By looking at abuse within the four years prior to the VAWS, we hoped to balance these opposing interests. This introduces a problem, however, in that about 11% (or 102) of the women in our sample report that they have been married one to three years. The sensitivity tests we do to gauge the extent of this problem are as follows: 1) adding a linear spline for being married four years or more, 2) adding a quadratic spline for being married four years or more, 3) adjusting the window to include abuse within one year of the VAWS only, 4) dropping those couples who have been married three years or less, and 5) adjusting the number of incidents of abuse for those married three years or less.[26,27] In each of these individual tests, we find that no income variable is significantly associated with the frequency of abuse. As can be seen by referring to Table 2.7, the income variables remain jointly significant at the 10% level, except in the last three tests (1.3, 1.4, 1.5) in which they are jointly insignificant at the 10% level.

5.2. Income variable

In this essay, we supplement the VAWS income data, which

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[26] A linear spline allows for a change of slope and a quadratic linear allows for a change in of slope and the rate of change in the slope of a variable. By adding a linear spline at four years of marriage, we allow, for example, for relationship between years together and the frequency of abuse to be positive prior to four years and negative thereafter.
[27] To adjust the number of incidents for those married three years or less, we took the annual number of incidents of abuse over the duration of the marriage and multiplied by four and rounded to the nearest whole number.

provides only categorical income data with the top code of '$80,000 and above', with the SCF data. In order to gauge the impact of the supplementation on our results, we estimate the ZIP model with the information available from the VAWS alone. For this estimation, we use the midpoints of the income categories, set $80,000 as the top income, and include binary variables for female and household income in the top category. As can be seen by referring to test 2.1 in Table 2.7, we find that the income variables are now jointly insignificant at the 10% level.

Educational attainments are not included in the TWL model, but we include them in our estimation. Since education and income tend to be correlated, we drop the former and reestimate the ZIP model to see if the income variables gain in significance. As can be seen by referring to test 2.2 in Table 2.7, we find that the income variables are now jointly significant at the 5% level, but both male and female income continue to be individually insignificant.

5.3. Sample

Only currently married battered women are included in the TWL sample; therefore, for this essay, we drop all women who report no history of physical abuse. In order to investigate whether or not this sample selection problem affected our results with regard to the income variables, we expand our sample to include all currently married women and reestimate the ZIP model. We again find that individually the income variables are not significantly related to the frequency of abuse; however, they are jointly significant at the 1% level as can be seen by referring to test 3.1 in Table 2.7.

5.4. Dependent variable

The dependent variable is top coded in the VAWS data; therefore, we assigned the top category a value of eleven in this essay. About eight percent (or 70) of the women in our sample report that they have been abused eleven or more times. We reestimate the ZIP model with the value assigned to the top code at 15, 20, and then 30 incidents of abuse. We find that all variables in the estimation maintain their level of importance, whether significant or insignificant, in all three variations from assigned value of eleven. The income variables continue to be individually insignificant, but the they rise in their joint significance. The results of tests are summarized in 4.1, 4.2 and 4.3 of Table 2.7.

5.5 Choice of model

We use the ZIP model due to a preponderance of zeros in the data. Other models have also been developed in order to deal with such over dispersion including the negative binomial model.[28] We reestimate using a negative binomial model with the same variables used in the ZIP model. We find again that no individual income variable is significantly related to the frequency of abuse. We also find that the income variables are not jointly significant at the 10% level. The result of test are summarized in 5.1 of Table 2.7 .

6. Conclusions

By using a sample and model similar to TWL, we are able to

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[28]   For details on the negative binomial model please see Greene (1994).

replicate their findings that female income and male income are related, negatively and positively respectively, to the frequency of domestic abuse. We find the same results when the binary variables for educational attainment, female disability, domestic violence in the partner's family of origin, urban residence, and province of habitation are added to the model. However, when child sexual assault, which has been found to affect the woman's success in both the labour market and marriage market, is added to the estimation, male income becomes insignificant.

The results are in agreement with TWL's primary finding that female income has a negative relationship with the frequency of wife assault when using a Tobit model with the larger sample of all ever abused women (n=877). Male income is again insignificant. This finding holds in both the restricted and expanded versions of the TWL-like model.

We find that income variables are not individually related, but the male income variables are jointly related, to the frequency of wife assault when we use a count model, which is arguably a more appropriate model for the VAWS data. We do find, however, that the educational attainments of the partners are associated with the occurrence of recent violence and with the frequency of violence if there has been recent violence. These variables appear to have been unavailable to TWL.

We perform a variety of tests on our ZIP results with respect to the choice of the four year window, the use of the SCF data to supplement the VAWS data, the choice of the sample, the choice of eleven as the value assigned to the dependent variable's

top code, and choice of model. Based on these results, our finding that male and female income are not individually, but are sometimes jointly, related to the frequency of wife assault appears to be robust.

We find that female education is negatively associated with the probability of being recently abused and male education is negatively associated with the frequency of abuse given that there has been recent abuse. These findings suggest that, for the female, more options in the labour market may translate into a stronger bargaining position in the home. For the male, these results suggest that education may reduce his economic stress, which may reduce the number of violent episodes in the home. The benefits of education, therefore, do not end with more financial security for the family. It also may mean a healthier family life.

We find in this essay that domestic violence in the partners' families of origin is strongly correlated with the frequency of wife assault. Other research finds that witnessing domestic abuse in the home as a child is significantly related to the probability of entering into a violent adult relationship as mentioned earlier. In the future, we will use the data from the National Longitudinal Survey of Children and Youth (NLSCY) to investigate how violence is transmitted across generations. The NLSCY is a new, large survey of children 0 to 11 years of age and their families that contains many measures of child health and development. These include measures of conduct (violence to others, cruelty to animals, etc) and emotional disorders as reported by parents and teachers. Also included are questions

concerning parenting styles and violence in the home (frequency
of exposure to teens or adults in the house physically fighting,
hitting or otherwise trying to hurt others, frequency of exposure
to violence on TV shows or movies) along with a full battery of
socioeconomic questions. These type of data provide a strong tie-
in with an extremely important dimension of our research.

The NLSCY data should be an improvement over the VAWS
since it is a panel study, it will provide current information on
male income, female income, as well as current information on
domestic abuse. Data sources like the NLSCY will eventually
provide us with a much better view of how the level and sources of
both permanent income and transitory income fluctuations relate to
wife assault.

Table 2.1 -- Estimated Number of Incidents of Recent Abuse by Current Partner Reported by Women Who Have Ever Been Physically Abused
(n=877)

Number of recent Incidents of abuse (i.e. within past four years)	Percentage of Ever Physically Abused Women Reporting
One	26.2
Two	6.3
Three	3.8
Four	4.1
Five	2.9
Six to Ten	0.3
Eleven or more	2.3
Total	100%
Note: The percentages may not sum to 100 due to rounding.	

Table 2.2 -- Tobit Estimates: The Restricted Version of the TWL-Like Model
Women who have found Community Services Helpful
(n=77)

Log Likelihood = -101.63172

	Coefficient	t-value	10% change
male income	-0.0250	-1.44	0.2394
male income squared	0.0003	1.33	
female income	-0.0360	-1.77	-0.0215
female income squared	-0.0008	-1.44	
female income x male income	0.0006	1.74	
percentage of the year the male works	0.1949	0.22	-0.0008
percentage of the year the male works squared	0.3205	0.36	
percentage of the year the male work x male income	-0.0073	-0.35	
percentage of the year the male works x female income	0.0557	2.31	
percentage of the year the female works x male income	0.0007	0.06	
percentage of the year the female works x female income	-0.0423	-1.91	
percentage of the year the female works	2.2704	2.73	0.1329
percentage of the year the female works squared	-0.6657	-0.91	
percentage of the year the male works x percentage of the year the female works	-1.5542	-2.62	
male is five years or more the woman's junior	-0.3299	-1.60	
male is five years or more the woman's senior	-0.0882	-0.76	
marriage is registered	0.9609	4.94	
female's age	0.0290	2.95	
number of years together	-0.0559	-4.07	
approximate age of the children	-0.9192	-4.17	
presence of a step child	-0.1775	-0.83	
presence of a child	0.0166	1.27	
constant	-0.9712	-2.44	

Joint tests	
1. Income Variables	χ^2_9=24.30^c
2. Independent variables	χ^2_{22}=51.80^c
^{c} denotes significant at α=0.005	

Note: For those right hand side variables whose coefficients have p-values of 0.10 or less, the effect on the number of incidents of abuse corresponding to a 10% change in the right-hand-side variable is calculated. Calculations are done at the point of the means. Changes include the effects both through the variable itself and all algebraically-related variables. For example, the effect of female income increasing by 10% in Table 2.2 also includes the effect through the variables female income x male income, percentage of the year the male works x female income, and percentage of the year the female works x female income.

Table 2.3 -- Tobit Estimates: The Expanded Version of the TWL-Like Model Women who have found Community Services Helpful (n= 77) Log Likelihood = -77.63	Coefficient	t-value	10% change
male income	-0.0187	-1.50	n/s
male income squared	0.0001	0.84	
female income	-0.0316	-2.06	-0.2406
female income squared	-0.0003	-0.80	
female income x male income	0.0003	1.03	
percentage of the year the male works	0.7084	0.95	-0.1417
percentage of the year the male works squared	-0.5077	-0.65	
percentage of the year the male works x male income	-0.0005	0.49	
percentage of the year the male works x female income	0.0618	3.35	
percentage of the year the female works x male income	0.0094	1.02	
percentage of the year the female works x female income	-0.0436	-2.61	
percentage of the year the female works	2.2981	3.63	0.0468
percentage of the year the female works squared	-0.7260	-1.44	
percentage of the year the male works x percentage of the year the female works	-1.9901	-4.13	
male is five years or more the woman's junior	-0.0715	-0.41	
male is five years or more the woman's senior	0.0753	0.84	
marriage is registered	0.8208	5.98	
female's age	0.0178	2.39	
number of years together	-0.0433	-4.12	
approximate age of the children	0.0100	0.99	
presence of a step child	-0.6573	-4.29	
presence of a child	-0.2311	-1.48	
female has at least a high school diploma	-0.0776	-0.75	
male has at least a high school diploma	0.0639	0.63	
female has a disability	0.0937	1.10	
mother-in-law was abused	0.4853	6.03	
mother was abused	0.0692	0.58	
female experienced csa	0.5280	4.41	
lives in the Atlantic Provinces	0.0511	0.33	
lives in Ontario	0.3814	2.67	
lives in the Prairie Provinces	0.1373	0.90	
lives in British Columbia	0.3281	1.97	
lives in an urban area	0.0626	0.57	
constant	1.4351	3.76	

n/s ~ not significant

Joint tests	
1. Income Variables	$\chi^2_9=28.86^c$
2. Independent variables	$\chi^2_{35}=99.80^c$
^{c} denotes significant at $\alpha=0.005$	

See note to Table 2.2.

Table 2.4 -- Tobit Estimates: The Restricted Version of the TWL-Like Model
All Abused Women from the VAWS
(n=877)

Log Likelihood = -1386.4259

	Coefficient	t-value	10% Change
male income	-0.0185	-1.42	n/s
male income squared	0.0001	1.10	
female income	-0.0347	-2.53	-0.0809
female income squared	0.0003	1.02	
female income x male income	0.0001	0.26	
percentage of the year the male works	0.4617	0.63	n/s
percentage of the year the male works squared	-0.6375	-0.96	
percentage of the year the male works x male income	0.0066	0.49	
percentage of the year the male works x female income	0.0169	1.46	
percentage of the year the female works x male income	0.0024	0.33	
percentage of the year the female works x female income	-0.0085	-0.94	
percentage of the year the female works	-0.2040	-0.30	n/s
percentage of the year the female works squared	0.7552	1.25	
percentage of the year the male works x percentage of the year the female works	-0.5138	-1.32	
male is five years or more the woman's junior	0.2743	1.11	
male is five years or more the woman's senior	0.1157	1.07	
marriage is registered	-0.1969	-1.39	
female's age	0.0034	0.34	
number of years together	-0.0590	-5.19	
approximate age of the children	-0.0129	-1.22	
presence of a step child	0.0818	0.38	
presence of a child	0.0102	0.06	
constant	1.4351	3.76	

n/s ~ not significant

Joint tests	
1. Income Variables	χ^2_9=12.88
2. Independent variables	χ^2_{22}=204.12[c]
[a] denotes significant at α=0.10 [c] denotes significant at α=0.005	

See note to Table 2.2.

Table 2.5 -- Tobit Estimates: The Expanded Version of the TWL-Like Model

All Abused Women from the VAWS

(n=877)

Log Likelihood = -1371.2086

	Coefficient	t-value	10% change
male income	-0.0149	-0.83	n/s
male income squared	0.0001	1.12	
female income	-0.0454	-2.41	-0.0713
female income squared	0.0003	0.81	
female income x male income	0.0001	0.32	
percentage of the year the male works	0.4234	0.43	n/s
percentage of the year the male works squared	-0.6712	-0.74	
percentage of the year the male works x male income	0.0036	0.19	
percentage of the year the male works x female income	0.0206	1.29	
percentage of the year the female works x male income	-0.0004	-0.04	
percentage of the year the female works x female income	-0.0072	-0.58	
percentage of the year the female works	-0.3607	-0.39	n/s
percentage of the year the female works squared	0.9925	1.21	
percentage of the year the male works x percentage of the year the female works	-0.3946	-0.74	
male is five years or more the woman's junior	0.4363	1.30	
male is five years or more the woman's senior	0.1947	1.33	
marriage is registered	-0.3021	-1.56	
female's age	0.0093	0.69	
number of years together	-0.0879	-5.58	
approximate age of the children	-0.0147	-1.02	
presence of a step child	0.0658	0.22	
presence of a child	0.0641	0.26	
female has at least a high school diploma	-0.1641	-0.94	
male has at least a high school diploma	-0.3080	-2.06	
female has a disability	0.1214	0.69	
mother-in-law was abused	0.6357	4.47	
mother was abused	0.0332	0.23	
female experienced CSA	0.5666	1.63	
lives in New Brunswick	-0.0501	-0.14	
lives in Nova Scotia	0.1111	0.37	
lives in PEI	0.6559	1.60	
lives in Newfoundland	-0.1086	-0.21	
lives in Ontario	0.0787	0.27	
lives in Manitoba	0.1675	0.64	
lives in Saskatchewan	0.5004	1.62	
lives in Alberta	-0.0498	-0.18	
lives in British Columbia	0.0282	0.10	
lives in an urban area	0.1779	1.23	
constant	1.5213	2.62	

n/s ~ not significant

Joint tests		
1. Income Variables	χ^2_9=11.32[a]	
2. Independent variables	χ^2_{18}=249.18[c]	

[a] denotes significant at α=0.10 [c] denotes significant at α=0.005

*See note to Table 2.2.

Table 2.6 : ZIP Regression Estimations based on
All Abused Women from the VAWS
(n=877)

Log Likelihood: -1348.817631	Iterations:6.000000

1. Probit Estimates		
Variable*	Marginal Effects	t-value
male income	-0.0010	-0.14
female income	-0.0066	-1.02
percentage of the year the male works	-0.0027	-0.18
percentage of the year the female works	0.0004	0.06
male is five years or more the woman's junior	0.0767	0.49
male is five years or more the woman's senior	0.0907	1.39
union is registered	-0.1553	-1.44
female's age	-0.0817	-0.71
number of years together	0.0062	0.09
presence of a stepchild	-0.0420	-0.32
presence of a child	0.0483	0.45
female has at least a high school diploma	-0.1525	-1.68
male has at least a high school diploma	0.0427	0.65
female has a disability	0.0066	0.09
mother-in-law was abused	0.0291	0.49
mother was abused	0.0022	0.03
female experienced CSA	0.0678	0.45
lives in New Brunswick	0.0017	0.01
lives in Nova Scotia	-0.0237	-0.19
lives in PEI	-0.0004	0.00
lives in Newfoundland	0.0296	0.19
lives in Ontario	-0.0537	-0.54
lives in Manitoba	0.0585	0.50
lives in Saskatchewan	0.0132	0.11
lives in Alberta	-0.0105	-0.09
lives in British Columbia	-0.1409	-1.26
lives in an urban area	0.0022	0.04

Prediction Success Table			
		Actual	
		0	1
Predicted	0	277	82
	1	169	349
Percentage predicted correctly			71%
Percentage of women reporting recent abuse			49%

* Although only male income, female income, percentage of the year the female works, and percentage of the year the male works are presented in this table, the ZIP estimation includes all TWL variables. This variables are listed in footnote 23. The calculation of the marginal effects includes the effects both through the variable itself and all algebraically related variables that have a p-value of 10% or better. For example, suppose the female income variable and all its cross variables have a p-value of 10% or better. The marginal effect of a 10% increase in female income would include the effect through female income squared, female income x male income, percentage of the year the male works x female income, and percentage of the year the female works x female income.

Table 2.6 : ZIP Regression Estimations (contd.)		
2. Poisson Estimates		
Variable*	Marginal Effects	t-value
male income	-0.0018	-0.23
female income	-0.0057	-0.76
percentage of the year the male works	-0.0208	-1.19
percentage of the year the female works	0.0002	0.03
male is five years or more the woman's junior	0.1400	0.93
male is five years or more the woman's senior	-0.0066	-0.09
union is registered	-0.1417	-1.60
female's age	0.2634	1.90
number of years together	0.0668	0.97
presence of a stepchild	0.1874	1.60
presence of a child	0.0930	0.90
female has at least a high school diploma	0.1825	2.01
male has at least a high school diploma	-0.3924	-4.66
female has a disability	0.0978	1.12
mother-in-law was abused	0.6313	6.84
mother was abused	0.0211	0.29
female experienced CSA	0.5107	3.47
lives in New Brunswick	-0.0891	-0.47
lives in Nova Scotia	0.0893	0.62
lives in PEI	-0.1616	-0.53
lives in Newfoundland	0.5163	2.54
lives in Ontario	0.2642	2.14
lives in Manitoba	0.4125	2.81
lives in Saskatchewan	-0.0647	-0.40
lives in Alberta	-0.0763	-0.55
lives in British Columbia	0.3037	2.27
lives in an urban area	0.1957	2.39
the mean of the dependent variable		1.34

Joint tests	
1) the hurdle part	
1.1) independent variables[29]	$\chi^2_{39}=355.90^c$
1.2) income variables	$\chi^2_9=18.42^b$
1.2.1) male income	$\chi^2_5=10.76^a$
1.2.2) female income	$\chi^2_5= 8.32$
2) the count part	
2.1) income variables	$\chi^2_9=15.30^a$
2.1.1) male income	$\chi^2_5=10.62^a$
2.1.2) female income	$\chi^2_5= 8.40$
3) the model	
3.1) independent variables	$\chi^2_{78}=461.90^c$
3.2) income variables	$\chi^2_{18}=33.72^b$
[a] denotes significance at $\alpha=0.10$ [c] denotes significance at $\alpha=0.010$ [b] denotes significance at $\alpha=0.05$ [d] denotes significance at $\alpha=0.005$	

[29] This is a test of the significance of the ZIP model versus the simple Poisson model.

Table 2.7 -- Sensitivity Tests on the ZIP Results	
Model	Joint of the Income Variables
Base ZIP Model (Table 2.6)	χ^2_9=15.30[a]
1. Four year window:	
1.1. adding a linear spline for being married more than three years (n=877)	χ^2_9=15.46[a]
1.2. adding a quadratic spline for being married more than three years (n=877)	χ^2_9=15.40[a]
1.3. estimating the number of incidents of abuse over the 12 months, instead of the four years, prior to the VAWS (n=877).	χ^2_9=7.30
1.4. including only those married four years or more (n=775)	χ^2_9=10.30
1.5. estimating the number of incidents of abuse over four years for those married less than four years (n=877)	χ^2_9=13.91
2. Income variable:	
2.1. using the midpoints of the income brackets with $80,000 as the highest income and including dummy variables for female income and household income greater than $80,000 instead of relying on the SCF data (n=877)	χ^2_{14}=21.34
2.2. omitting the binary variables for the female and the male having at least a high school diploma (n=877)	χ^2_9=16.02[b]
3. Sample:	
3.1. including all (i.e. ever and never abused) currently married women (n=5596)	χ^2_9=22.80[c]
4. Dependent variable:	
4.1. adjusting upper bound to 15 (n=877)	χ^2_9=23.06[c]
4.2. adjusting upper bound to 20 (n=877)	χ^2_9=25.20[d]
4.3. adjusting upper bound to 30 (n=877)	χ^2_9=24.08[d]
5. Model	
5.1. Negative binomial (n=877)	χ^2_9=8.64

[a] denotes significance at α=0.10   [c] denotes significance at α=0.010
[b] denotes significance at α=0.05   [d] denotes significance at α=0.005

Appendix

A.1. Exclusion of observations

In this essay, we use 877 of the 12,300 observations. The other 11,423 observations are not used in our analysis due to the following reasons:[30]

1. 3882 women report that they are not currently married.

2. 303 women report that they have been married for less than one year.

3. 956 women report that they and/or their partner are over the age of 65.

4. 1563 women do not provide information on at least one variable deemed vital for our analysis. Such variables are: the female's weeks worked (49), her partner's weeks worked (133), her partner's education (132), her education (3), her income (302), household income (398), duration of the marriage (8), domestic abuse in her family of origin

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[30]   Observations were deleted as soon as they failed to pass one of the sample selection hurdles. The hurdles were ordered as they are listed here. For example, supposed one woman reported that she is divorced, 70 years of age, and did not state her personal income. She would be excluded from the sample and be counted among those who were excluded based on marital status, but not amongst those who were excluded based on age or those failing to report personal income. Therefore, the sum of the number of observations excluded for the reason listed is equal to the total number of observations excluded from the sample (i.e. 11,423).

(108), domestic abuse in her partner's family of origin (397), the most recent incident of domestic abuse (19), sexual assault by a known male who was never romantically involved with the woman (1), number of incidents of domestic abuse (9), when the first incident of domestic abuse happened (4).

5.   4719 women report no history of wife assault.[31]

A.2. Estimation of the recent number of incidences of abuse

Women are deemed to be recently abused if they report that abuse has occurred within four years prior to the VAWS. The definition of "recent " reflects a compromise between the competing objectives of having a large sample of abused women on one hand and being able to match the timing of the abuse with the economic information provided on other hand.

In accordance with our definition of recent abuse, we set the number of incidents of abuse equal to zero if no abuse has occurred in the relationship within the four years prior to the VAWS (n=446). If the woman reports that abuse began within the four years, we use the number of incidents reported (n=274). If the woman had been abused within the past four year, but the abuse began five or more years prior to the VAWS, we assumed that the number of incidents were evenly distributed over this interval and rounded up to the nearest whole number (n=157).

A.3. Supplementation of the VAWS Income Data

We supplement the VAWS income information using a sample of 17,739 currently married couples from the Survey of Consumer

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[31]   We include this group of women in Chapter Three.

Finances (SCF), which is comparable to the US March Current

Population Survey.[32]   For each of the 877 observations in our

VAWS sample, we set family and female income equal to the average

SCF family and female income, respectively,   within the VAWS

category excluding the top category. For the VAWS families

earning above $79,999 per year (n=107), we estimate a family

income regression equation using a sample of married couples in

the SCF who receive more than $79,999 per year (n=2456). We then

predict family income for each VAWS couple in the top category

using all variables with a p-value of ten percent or better. The

family income regression equation is displayed in Table A.1. Only

a small number of currently married women receive more than

$79,999 per year (n=107); therefore, we use the average income

of this group, which is about $87,400, to estimate VAWS female

income in the same income category (n=4). We estimate the

average family and female income for our VAWS sample to be about

$51,100 and $18,800, respectively.

To estimate male income, we divide the VAWS sample into

two parts: subsample (A) in which male income can be calculated

directly from the VAWS and subsample (B) in which another

representative sample must be used to estimate male income.

Subsample A consists of families in which only the female and/or

male partner(s) receive any income (n=646). Subsample B consists

of all other families (n=231).[33]

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[32]   From our SCF sample, we also drop the six observations for
which male or female income was less than -$30,000. This left
-$10,000 as the lowest level of income in the SCF sample. We also
dropped one observation for which family income was greater than
$339,000. This left $311,900 as the highest family income.
[33]   Families in which individuals, other than just the male
and/or female partner(s), receive income.

For subsample A, male income is estimated by subtracting female income from family income. For subsample B, we estimate a male income regression equation using a subsample of the SCF(n=7097). We condition on all variables that are common to the VAWS and the SCF and that have a p-value of 10% or better. Table A.2 summarizes the male income equation. We estimate the average income for men in the VAWS who have used wife assault to be about $30,800.

A.4. ZIP Model

An often cited example of over dispersion of the dependent variable is the number of cigarettes consumed by individuals. Many individuals respond that they do not purchase cigarettes resulting in many more zeros in the data than the simple Poisson model would have predicted. The Zero Inflated Poisson (ZIP) model has been developed in order to deal with such a situation.

There are two types of individuals in the cigarette data. A Type B individual responds to the changes in the price of cigarettes. Such a person will buy a positive quantity, if their price below her reservation price, and will buy no cigarettes, if the price is above her reservation price. A Type A individual does not respond to such price changes. For such an individual, there is no positive price of cigarettes for which they would be willing to purchase any positive quantity. Therefore, the zero responses are made by both Type A and Type B individuals while non-zeros responses are made by strictly Type B individuals. The ZIP model attempts to differentiate between the two types of individuals. The ZIP model estimates the number of Type B individuals based on the assumption that we have a mix of a

Poisson distribution with a degenerative distribution on zero. It therefore estimates the percentage of Type B individuals in the group of all those responding 'zero' based on the number of strictly positive responses and requirement of a Poisson distribution. Referring to Figure 1, the ZIP model estimates that OA are Type B while AB are of Type A based on the distribution of responses above zero (CD).

The development of the ZIP model has been attributed to Lambert (1992). The observed dependent variable, y, is assumed to be the product of two latent variables - a binary (0/1) variable, t, and a variable that is distributed by Poisson, y^*. Assuming that t is equal to one if the person is Type B and equal to zero if Type A. The ZIP model would then be as follows:

$$pr(y_i=0) = pr(t_i=1, \quad y_i=0) + pr(t_i=0)$$

$$pr(y_i=k) = pr(t_i=1, \quad y_i=k) \qquad \text{for } k=1, \quad 2, \quad 3, \quad \ldots$$

This model simplifies to the following:

$$pr(Y_i=y_i) = pr(t_i=1, \quad y_i=c) + d_i*pr(t_i=0)$$

$$\text{where } d_i=1 \quad \text{if } c=0$$

$$d_i=0 \quad \text{otherwise}$$

Therefore, if a person is a Type A individual, the observed dependent variable will be equal to zero. If the person is a Type B individual, the dependent variable follows a poisson distribution over non-negative values, which includes zero.

We use a probit estimation for the splitting mechanism. For the conditional count variable, we assume a Poisson distribution. The probability density function for the observed variable, y_i, is therefore as follows:

$$\text{pr}(Y_i=y_i) = p_i = \Phi(\gamma'x_i)^* \xi + d_i * (1-\Phi(\gamma'x_i))$$

where $\Phi(\cdot)$ ~ cumulative normal density function

$$\xi = e^{-\lambda}\lambda^{y_i}/y_i!$$

$$\lambda = \exp(\beta'x_i)$$

The log-likelihood function is:

$$\text{LnL} = \Sigma\ln(p_i)$$

The gradient for the splitting mechanism is:

$$\delta\ln L/\delta\gamma = \Sigma(\xi - d_i)\phi(\gamma'x_i)/ p_i$$

where $\phi(\cdot)$ ~ standard normal density function

The gradient for the conditional count would be as follows:

$$\delta\ln L/\delta\beta = \Sigma[\Phi(\gamma'x_i) * \xi *x_i(y_i-\lambda)]/ p_i$$

The Hessian for the splitting mechanism would be as follows:

$$\delta^2\ln L/\delta\gamma\delta\gamma' = - \Sigma\{(x_i(\xi - d_i)\phi(\gamma'x_i)(p_i +(\xi - d_i)\phi(\gamma'x_i)))/ p_i^2\}'x_i$$

The Hessian for the conditional count would be as follows:

$$\delta^2\ln L/\delta\beta\delta\beta' = - \Sigma\{x_i*\Phi(\gamma'x_i) *\xi*[\Phi(\gamma'x_i)* \xi*(y_i-\lambda)^2-(y_i- \lambda)^2-\lambda)]/ p_i^2\}'x \, p_i$$

The cross derivatives would be as follows:

$$\delta^2\ln L/\delta\gamma\delta\beta' = \Sigma\{x_i[\phi(\gamma'x_i) \xi (y_i-\lambda)p_i-(\xi - d_i)\Phi(\gamma'x_i)]/ p_i^2\}'x_i$$

In this essay, we assume that the distribution of incidents of violence chosen by Type B individuals conform to a Poisson distribution. We assume that Type A individuals are quite different. We assume that they will choose not to abuse their partners (i.e., we assume that the distribution of incidents of abuse are degenerative on zero.)

A.5. Comparison of ZIP estimates with the Nonlinear Least Squares estimates

In this section, we compare the marginal effects estimates

from the ZIP model with those from a non-linear least squares estimates. In order to minimize the clutter, we estimate the reduced form of the ZIP model by dropping the independent variable with the lowest p-value. The ZIP model was then estimated again and again we drop the variable with the lowest p-value. This procedure was continued until all variables in the poisson part of ZIP model had a p-value of 10% or better. The final results of this estimation are presented in Table A.3. Next, we estimate the simple nonlinear least squares model as follows:

$$Z = \exp(\beta'x_i) + u$$

where Z = frequency of abuse

u = normally distributed error term

Table A.4 displays the results of this estimation. As one can see from comparing Tables A.3 and A.4, the marginal effects of the poisson part of the ZIP model and the nonlinear least squares model are quite similar.

Table A.1 - Estimation of Family Income if Greater than $79,999		
Variable	Coefficient	Standard error
female income	0.538	0.033
number of individuals in family	1498.603	448.465
male's age	451.613	59.84
female works for pay	14659.118	3535.864
number of weeks per year the female works	238.498	36.635
lives in Newfoundland	-6957.221	2748.834
lives in New Brunswick	-7474.177	2191.534
lives in Quebec	-3454.24	1373.836
male has a high school diploma only	7531.077	1963.543
male has some postsecondary education only	5561.968	1693.963
male has a university degree	16627.276	1677.475
female works full time	-8649.973	1470.724
constant	54319.061	5654.396
R^2 adjusted		0.172

Table A.2 - Estimation of Male Income in Subsample B		
Variable	Coefficient	Standard Error
household income	0.871	0.005
female income	-0.847	0.013
number of individuals in family	-893.172	105.551
male's age	- 86.532	25.411
male is looking for paid look	1434.852	372.050
number of weeks per year the male works	117.120	8.585
female's age	-53.403	25.883
female is looking for paid look	2275.699	434.452
number of weeks per year the female works	103.645	10.184
male is a full time student	-2309.359	758.055
female has at least a high school diploma	836.028	242.630
male has some postsecondary education	1103.893	248.876
male has a university degree	3505.640	381.207
male works full time	1411.578	409.178
female works full time outside the home	1644.62	439.528
female works full time outside the home	979.118	471.949
number of paid workers in the home	-5496.609	179.684
constant	10670.806	828.098
R^2 adjusted		0.911

Table A.3: ZIP Regression Estimations
All Abused Women from the VAWS
(n=877)

Log Likelihood: -1372.78   Iterations: 7.00

a.   Probit Estimates

Variable	Coefficients	t-ratios	Marginal Effects
female income squared	0.000005	0.11	0.000002
percentage of the year the male works	-0.008721	-0.95	-0.003453
female's age	0.041400	4.55	0.016400
mother-in-law was abused	0.134000	1.10	0.053000
female experienced CSA	0.387600	1.07	0.153500
number of years together	-0.054394	-8.53	-0.021537
lives in an urban area	0.079600	0.69	0.031500
male has at least a high school diploma	0.073700	0.58	0.029200
presence of a child	0.127800	0.65	0.050600
approximate age of children	-0.011025	-1.02	-0.004365
lives in Newfoundland	0.363600	1.40	0.144000
lives in Ontario	-0.028930	-0.21	-0.011454
lives in Manitoba	0.253700	1.35	0.100400
lives in British Columbia	-0.193526	-1.13	-0.076620

b.   Poisson Estimates:

Variable	Coefficients	t-ratios	Marginal Effects
female income squared	-0.000080	-2.09	-0.000085
percentage of the year the male works	0.015127	2.91	0.016115
female's age	0.012394	3.14	0.013204
mother-in-law was abused	0.537079	8.53	0.572166
female experienced CSA	0.278540	2.06	0.296737
number of years together	0.008156	2.42	0.008689
lives in an urban area	0.173624	0.69	0.184967
male has at least a high school diploma	-0.345390	-5.07	-0.367954
presence of a child	0.264030	2.73	0.281279
approximate age of children	-0.026481	-3.31	-0.028211
lives in Newfoundland	0.298573	1.75	0.318079
lives in Ontario	0.259237	3.21	0.276173
lives in Manitoba	0.290156	2.73	0.309112
lives in British Columbia	0.288947	3.08	0.307825

Table A.4: Non-linear Regression Estimations All Abused Women from the VAWS (n=877)			
Iterations: 13		residual SS =	3699.48
a. Probit Estimates			
Variable	Coefficients	t- ratios	Marginal Effects
female income squared	-0.000200	-2.57	-0.000200
percentage of the year the male works	0.000100	1.04	0.000100
female's age	0.021100	4.22	0.019100
mother-in-law was abused	0.553700	6.71	0.500100
female experienced CSA	0.326900	2.24	0.295300
number of years together	-0.038600	-4.38	-0.034900
lives in an urban area	0.289300	2.76	0.261200
male has at least a high school diploma	-0.402500	-4.63	-0.363500
presence of a child	0.291100	2.25	0.262900
approximate age of children	-0.031400	-2.25	-0.028400
lives in Newfoundland	0.338000	1.32	0.305200
lives in Ontario	0.203100	1.89	0.183400
lives in Manitoba	0.169100	1.22	0.152700
lives in British Columbia	0.227600	1.94	0.205500

Figure I

Overdispersion of Data

data

Simple Poisson
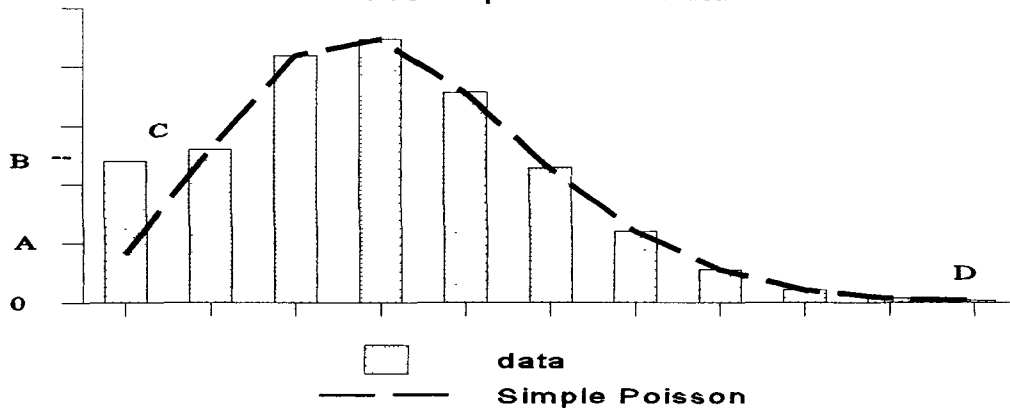
III. Essay Two: The Association Between Socio-Economic Characteristics and the Frequency of Wife Assault

1. Introduction

A limitation of both the TWL study and our analysis in Chapter Two is that they are both based on a sample of women in abusive relationships. Using a random sample of all currently married women, we will estimate the association between the income of each partner and the incidence of wife assault including 'no incidents'.[34] If these income effects are significant, there might be important implications for the design of income transfer programs or of programs targeted more directly at the problem of domestic violence. Moreover, reducing or eliminating domestic violence in one generation might have intergenerational effects since research in sociology finds that domestic violence is transmitted within families as mentioned above. Economists also study intrahousehold allocation and male/female contributions to public goods shared by the couple, such as goods for children. As difficult as it may be to accept, violence may be one tool used in the intrahousehold bargaining process.

The purpose of this chapter is to ascertain whether or not results similar to that of TWL can be found with a random sample of currently married women. We use such a sample to estimate a

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[34]   It could be that a significant income effect for women is to leave a violent relationship as soon as they can economically afford to. This effect cannot be measured using our data since we have little information on previous relationships and have only current income data.

model similar to that of TWL and a second, arguably more appropriate, model. This chapter contains the following sections: 2) a presentation of VAWS sample we will use for this chapter, 3) a discussion of the VAWS variables found to be correlated with abuse, 4) our analysis based on the TWL model and an alternative model, 5) a discussion of sensitivity tests performed on the results, and 6) a summary of our results.

2. Description of the VAWS sample

We stated in Chapter Two that the VAWS contains information on 12,300 women aged 18 years and older.[35] About 29% of ever married women in this sample report that they have been physically attacked by a spouse.

In this essay, we use 5596 of the 12,300 observations.[36,37] Our sample is comprised of those women who are currently married. We ignore abuse by previous partners in this essay. Therefore, if the woman reports that she is currently unattached, she is excluded from the sample.[38]

We stated in Chapter Two that the VAWS information on physical abuse extends over the duration of the marriage, but income information is for the current period only. Hence, we continue to focus our attention on 'recent' incidents of abuse. The number of years since the last incident of abuse is reported if it occurred within the past ten years. Reports of incidents

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[35] Statistics Canada (1994, pp. 6-8).
[36] The reasons for not including the other 6704 observations are explained in detail in Appendix A.1.
[37] It should be noted that this sample is between the ages of 18 and 65 and that our definition of marriage includes both registered and non-registered unions.
[38] To study the association between physical abuse and the probability of marital dissolution, we include all ever married women in Chapter Four.

occurring more than ten years ago are grouped together. One of the following is true for about 97% of our sample: there has never been any abuse; the last incident of abuse was more than four years prior to the VAWS; or abuse began within this period. Therefore, the actual number of incidents during the four year window is known with certainty for almost the entire sample. For the small number of cases for which this is not true, we estimate the total number of assaults within the four years prior to the VAWS based on the total number of assaults reported and the timing of the first and the most recent assault. (Please see Appendix A.2 for more details). Actual or estimated abuse within four years is deemed to be 'recent abuse' for the purposes of this essay. About 8% (or 431) of our sample report physical abuse by their current partner in the four years prior to the VAWS. Table 3.1 presents the estimated number of recent incidents of abuse.

3. Correlations with Recent Abuse

In this section, we look at the differences and similarities between those who report being recently abused by their current partner and those who report no such recent abuse.[39] We use a z-test to check for significant differences between these two group.[40] Our findings are summarized in Table 3.2 below. As one can see from this table, the two groups differ significantly except in their place of residence, the percentage of the year that the woman works, and the percentage having a child at home.

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[39] The latter group includes those who report never being abused.

[40] The z-test of the populations is as follows:

$$Z = \frac{(x_1 - x_2)}{(\sigma_1^2 / n_1 + \sigma_2^2 / n_2)^{0.5}},$$ where $x_i \sim$ mean of group i, i=1,2
$\sigma_i^2 \sim$ variance of group i
$n_i \sim$ sample size of group i.

We find that the average female income, household income, male income, respondent's age, the duration of the union, and the percentage of the year the male works are each significantly higher for the group of women who report no recent physical abuse by their current partner than the group who do report such abuse. Also, the percentage stating that they are in a registered union, they have completed high school, and that their partner has completed high school are each also significantly higher for the group reporting that they have not been recently abused by their current spouse than for the group who do report such abuse. These findings are generally in accordance with our expectations that are discussed above.

We find that the percentage of women stating that their mother was abused, their partner's mother was abused, their partner is five years or more their senior, and they have experienced CSA are each significantly lower for the group of women who report that they have not been recently abused by their current spouse than for the group who do report such abuse. These findings are also generally in accordance with our expectations that are discussed above. In addition, the percentage stating that they have a disability is significantly lower for those reporting that they have not been recently abused by their current spouse than for the group who do report such abuse. This result may be due to the fact that some women become disabled due to their physical abuse by their partners. Alternatively, it could be that women who are in a vulnerable situation, either economically or physically, are more likely to be abused since they would have fewer outside options than other women.

In a multi-variate model, we would expect that the many of the variables with significantly different means between the groups to be significant in predicting the probability of recent abuse. We would also expect to find that some of the variables with similar means between the groups to be significant in predicting this probability. In the next section, we estimate and report the relationship between wife assault and these variables in a multivariate setting.

4. Empirical Model

In this section, we report the results of estimating two versions of a model like TWL's and a count model using our random sample of currently married women (n=5596) from the VAWS.

4.1. TWL model

TWL's data consists of currently married women who had both experienced spousal assault and had sought the help of community support services. In Chapter Two, we first select a subset of all currently married abused women who report that they have used community services and found them useful.[41] We find that by using this selected sample and only those variables included in TWL, we find results similar to TWL. Specifically, we find that female income has a significantly negative relationship with the frequency of domestic abuse, while male income has a significantly positive relationship with the frequency of such abuse. We also find that the income variables are jointly

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[41] For the TWL data (n=125), the majority of abused women were identified by their use of community services. Arguably, women who found these services helpful would be more visible to community service workers since they probably make more use of the services than those women who were unsatisfied with the services.

significant at the 0.5% level. However, when the list of
regressors is expanded, referred to as the expanded model below,
the significant relationship between male income and abuse
disappears while the negative association between female income
and the frequency of abuse remains. When the we expand the sample
to include all currently married abused women, we find that female
income is negatively associated while male income, again, has no
significant association to the frequency of abuse.

One of the most important relationships between income (or
other variables) and wife assault may be reflected in whether or
not there has been any physical abuse. If the sample is
restricted to those who have been abused, as in TWL and Chapter
Two, this relative income effect could not be measured. In this
essay, however, we include all currently married women, both ever
abused and never abused, in order to pick up this potentially
important dimension of the income effect.

In this essay, we estimate the two versions of the TWL-
like model that were previously estimated in Chapter Two. These
are: a) a restricted version, which uses only those variables
available to TWL; and b) an expanded version, which uses the TWL
variables as well as educational attainments and sociological
variables available from the VAWS. We estimate the two versions
of the model using our sample of all currently married women
(n=5596).[42]

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[42]   As we stated earlier, some variables used in the TWL
model are not directly available (i.e. age of children) or even
indirectly available (i.e. ethnicity) from the VAWS. Also the
range of the dependent variable in the TWL data (zero to 180) is
much wider than it is in the VAWS data (zero to eleven). These
factors alone could cause our results to differ from those of TWL.

Table 3.3 displays the results of estimating the restricted version of the TWL-like model. As can be seen from this table, the marginal effects of female income and male income are in accordance with the results of TWL. The marginal effect of female income is negatively associated while the marginal effect of male income is positively associated with the number of incidents of abuse reported. The magnitudes of these effects, however, are essentially zero. The percentage of the year that the female works and the percentage of the year that the male works are both found to be negatively related to the frequency of abuse, but again the magnitudes are essentially zero. We find that the male being five years or more older or five years of more younger than the women is positively associated with abuse. Being in a registered marriage instead of a common-law relationship, and the duration of the union is negatively related to the number of incidents of abuse. The marginal effect of each of the above variables on the frequency of abuse, however, is minute. In Chapter Two, we find that, besides female income, the only significant variable using a sample of ever abused currently married women is the duration of the union, which we find also has an inverse relationship to the frequency of violence.

Table 3.4 displays the results of estimating the expanded model. As can be seen from this table, the marginal effects of female income and male income are again in accordance with the results of TWL. The marginal effect of an increase in the female income is negatively associated while the marginal effect of an increase in the male income is positively associated with the number of incidents of abuse reported. The magnitude of these effects, however, are essentially zero. A test of the income

variables shows that the income variables are not jointly significant at the 10% level.

We find that the variables that were significant in the restricted model are again significant in the expanded model and their marginal effects are of the same sign and essentially the same magnitude. In addition, we find that several of the new regressors are significant in the expanded model, however, their marginal effects are essentially zero. These variables include the binary variable indicating that the male has at least a high school diploma and the female has at least a high school diploma, which are negatively associated with the frequency of abuse. Also, the binary variables indicating that the female has a disability, the male had an abused mother, the female had an abused mother, and the female had experienced CSA are each positively associated with the frequency of abuse.

In both the restricted and the expanded models, the associations between female income and male income with the frequency of abuse are significant, but their marginal effect is essentially zero. We find that, in both the restricted and the expanded versions of the TWL-like model, the income variables are not jointly significant at even the 10% level. We find that variables such as education and abuse in the family of origin, which are not used in the TWL study,[43] have a much stronger relationship to the frequency of abuse. These are also the two variables found to be most significant in Chapter Two. In the following section, we present and estimate a count model as an

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[43] These variables might not have been available in the TWL data.

alternative to the Tobit model.

4.2. Count Model

When estimating the ZIP model, we find the TWL specification corresponds to the highest p-values for the coefficients of the income variables.[44] Therefore, this is the specification that we continue to use for the ZIP. The results of this estimation can be found in Table 3.5. As can be seen in that table, male income and female income are not significantly related to the probability that recent abuse has occurred or the frequency of abuse given that this hurdle is jumped at the 10% level.[45] However, the income variables are jointly significant at the 5% and the 10% level for both the hurdle and count part of the estimation, respectively.[46]

Table 3.5 shows that we find that the union being registered instead of common-law, the woman's age, the number of years the couple has been together, and the female having at least a high school diploma as opposed to not finishing high school are each negatively associated with the probability that recent abuse

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[44]   Specifically these variables are as follows: male income, male income squared, female income, female income squared, male income x female income, percentage of the year the male works, percentage of the year the male works squared, percentage of the year the male works x male income, percentage of the year the male works x female income, percentage of the year the female works x male income, percentage of the year the female works x female income, percentage of the year the female works, percentage of the year the female works squared, and percentage of the year the male works x percentage of the year the female works.

[45]   It should be noted that in the simple Poisson, which was rejected by testing the significance of the hurdle part of the ZIP model (see test 1.1 of Table 3.5), female income is negatively associated with the frequency of violence.

[46]   This finding appears fragile. When other specifications of the income variables are used, both the male and the female income variables are jointly and individually insignificant.

has occurred. We find the binary variables for the male being at least five years the woman's senior, the female having a disability, having an abused mother-in-law, having an abused mother, and the female experiencing CSA being equal to one (true) instead of zero (false) are each positively associated with the probability that abuse has occurred. These findings reflect our earlier comparison between women who have not recently been abused by their current spouse and those who have been so abused. In addition, we find that women who live in Ontario or in the Prairie Provinces are more likely to report that they have been recently abused than woman who live in Quebec.

Table 3.5 shows that male educational attainment is negatively associated with the frequency of wife assault given that recent abuse has been reported. We also find the binary variables for the female having at least a high school diploma, the female having a disability, the male having an abused mother, the female experiencing CSA, and living in an urban area being equal to one (true) instead of zero (false) are each positively associated with the frequency of violence given that recent violence has been reported. In addition, women living in Ontario, Manitoba, and British Columbia report significantly more incidents of abuse than those who live in Quebec given that they report recent abuse. The above findings are in accordance with our earlier predictions with respect to the variables associated with abuse, with the exception of female education and place of habitation for which we made no predictions.

The TWL initial findings and our earlier extensions suggested the importance of the relationship between female income

and abuse. Perhaps this is because higher income gives women a more viable outside option and, hence, a better bargaining stance within the relationship. This current set of findings suggests a different but related channel that a once-abused woman's educational attainment (again related to her potential to survive outside the relationship) may be associated with a smaller probability of having any recent abuse. It also may be that with such a highly parameterized model it is difficult to find significant relationships, but we note that income variables are jointly significant with respect to the frequency of abuse at the 1% level.

5. Sensitivity tests

In this section, we present sensitivity tests on our results. We test our results in the following areas: 1) the choice of the four year window, 2) the use of the SCF data to supplement the VAWS data, 3) the choice of eleven as the value assigned to the dependent variable's top code, and 4) the choice of model. These tests are summarized in Table 3.6 below.

5.1. Four year window

In this essay, we restrict our analysis to abuse within the four years prior to the VAWS. On one hand, we need to have income information at the time of the abuse and only current income information is contained in the VAWS. The longer the window, the less relevant current income will be as an indicator of actual income at the time of the abuse. On the other hand, for estimation purposes we want to have a large number of strictly positive responses. By looking at abuse within the four years prior to the VAWS, we hoped to balance these opposing interests.

This introduces a problem, however, in that about 14% (or 763) of the women in our sample report that they have been married one to three years. The sensitivity tests we do to gauge the extent of this problem are the following: 1) adjusting the window to include abuse within one year of the VAWS only, and 2) dropping those couples who have been married three years or less, and 3) adjusting the number of incidents of abuse for those married three years or less.[47,48] In each of these individual tests, we find that no income variable is significantly associated with the frequency of abuse. As can be seen by referring to Table 3.6, the joint significance of the income variables falls for each of these tests in comparison with the base model.

5.2. Income variable

In this essay, we supplement the VAWS income data, which provides only categorical income data with the top code of '$80,000 and above', with the SCF data. In order to gauge the impact of the supplementation on our results, we estimate the ZIP model with the information available from the VAWS alone. For this estimation, we use the midpoints of the income categories, set $80,000 as the top income, and include binary variables for female and household income in the top category. As can be seen by referring to test 2.1 in Table 3.6, we find that the income

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[47] A linear spline allows for a change of slope and a quadratic linear allows for a change in of slope and the rate of change in the slope of a variable. By adding a linear spline at four years of marriage, we allow, for example, for relationship between years together and the frequency of abuse to be positive prior to four years and negative thereafter.
[48] To adjust the number of incidents for those married three years or less, we took the annual number of incidents of abuse over the duration of the marriage and multiplied by four and rounded to the nearest whole number.

variables are now jointly significant at the 1% level. However, the marginal effect of a 10% increase in either male income or female income remains insignificant at the 10% level.

Educational attainments are not included in the TWL model, but we include them in our estimation. Since education and income tend to be correlated, we drop the former and reestimate the ZIP model to see if the income variables gain in significance. As can be seen by referring to test 2.2 in Table 3.6, we find that the income variables are now jointly significant at the 0.5% level, but marginal effects of a 10% increase in either male or female income continue to be insignificant at the 10% level.

5.3. Dependent variable

The dependent variable is top coded in the VAWS data; therefore, we assigned the top category a value of eleven in this essay. About one percent (or 70) of the women in our sample report that they have been abused eleven or more times. We reestimate the ZIP model with the value assigned to the top code at 15, 20, and then 30 incidents of abuse. We find that all variables in the estimation maintain their level of importance, whether significant or insignificant, in all three variations from assigned value of eleven. The marginal effects of the income variables continue to be individually insignificant, but the income variables rise in their joint significance. The results of varying the upper bound are summarized in 3.1, 3.2 and 3.3 of Table 3.6.

5.4 Choice of Model

We use the ZIP model due to a preponderance of zeros in the data. Other models have also been developed in order to deal

with such over-dispersion including the negative binomial model and the Zero Altered Poisson (ZAP) model.[49] We reestimate using a negative binomial model and a ZAP model with the same variables used in the ZIP model. We find again that the marginal effects of a 10% increase in either male income or female income are not significant at the 10% level in either estimation. We also find that the income variables are not jointly significant at the 10% level in the negative binominal while they are jointly significant at the 1% level in the ZAP model. The results of these tests are summarized in 4.1 and 4.2 of Table 3.6.

6. Conclusions

By using a model similar to TWL, we are able to replicate their findings that female income is negatively associated with and male is positively associated with the frequency of domestic abuse. However, the marginal effects of both female and male income are essentially zero.

Using a count model, which is arguably a more appropriate model for the VAWS data, we find that the marginal effect of a 10% increase in either male or female income is not significantly associated with the respondent reporting recent abuse or the frequency of abuse given that the respondent reports that recent abuse has occurred. The income variables are jointly significant in both the probit and the Poisson parts of the estimation. We find, however, that the educational attainments of the partners, which may affect the permanent income streams of the partners, are associated with the occurrence of violence during the last four

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[49] For further details on the negative binomial model and the ZAP model please see Greene (1994) and Winkelmann and Zimmermann (1995), respectively.

years and with the frequency of violence if there has been
violence during this time.

We perform a variety of tests on our ZIP results with
respect to the choice of the four year window, the use of the SCF
data to supplement the VAWS data, the choice of eleven as the
value assigned to the dependent variable's top code, and choice
of the model. Based on these results, our finding that male and
female income are not individually, but are sometimes jointly,
related to the frequency of wife assault appears to be robust.

We find that female education is negatively associated
with the probability of being recently abused and male education
is negatively associated with the frequency of abuse given that
there has been recent abuse. These findings suggest that, for the
female, more options in the labour market may translate into a
stronger bargaining position in the home. For the male, these
results suggest that education may reduce his economic stress,
which may reduce the number of violent episodes in the home. The
benefits of education, therefore, do not end with more financial
security for the family. It also may mean a healthier family
life.

Table 3.1 -- Estimated Number of Incidents of Recent Abuse by Current Partner Reported by Currently Married Women (n=5596)	
Number of recent Incidents of abuse (i.e. within past four years)	Percentage of Married Women Reporting
One	4.34
Two	1.02
Three	0.61
Four	0.66
Five	0.46
Six to Ten	0.55
Eleven or more	0.36
Total	100%
Note: The percentages may not sum to 100 due to rounding.	

Table 3.2: Comparison of Variable Means Between Recently and Not Recently Abused Women (standard deviations)			
Variable	Recently Abused* (n=448)	Not recently abused** (n=5148)	Z-Statistic
income of the female ($ '000's)	18.1016 (15.9194)	19.8932 (16.8369)	-2.27
income of the household ($ '000's)	48.7576 (27.7918)	53.8297 (28.0360)	-3.70
income of the male ($ '000's)	29.8727 (19.7465)	32.2696 (21.2166)	-2.45
age of the female	34.6071 (8.9549)	39.2292 (9.9128)	-10.39
marriage is registered	0.7656 (0.4241)	0.8945 (0.3072)	-6.29
female has a high school diploma	0.7723 (0.4198)	0.8248 (0.3802)	-2.56
male has a high school diploma	0.6964 (0.4603)	0.7500 (0.4331)	-2.37
lives in the Atlantic Provinces	0.2165 (0.4123)	0.2399 (0.4271)	-1.15
lives in Quebec	0.1272 (0.3336)	0.1573 (0.3642)	-1.82
lives in Ontario	0.2121 (0.4092)	0.2016 (0.4013)	0.52
lives in Manitoba	0.0938 (0.2918)	0.0688 (0.2531)	1.76
lives in Saskatchewan	0.0714 (0.2578)	0.0721 (0.2586)	-0.05
lives in Alberta	0.1473 (0.3548)	0.1311 (0.3376)	0.93
lives in British Columbia	0.1317 (0.3385)	0.1292 (0.3354)	0.15
mother was abused	0.2813 (0.4501)	0.1667 (0.3727)	5.23
mother-in-law was abused	0.2969 (0.4574)	0.0971 (0.2962)	9.08
male five years or more the woman's junior	0.0513 (0.2209)	0.0328 (0.1782)	1.73
male five years or more the woman's senior	0.2701 (0.4445)	0.2176 (0.4126)	2.41
number of years together	10.4621 (8.2832)	15.5033 (10.5449)	-12.06
female has a disability	0.1696 (0.3757)	0.1154 (0.3195)	2.96
lives in an urban area	0.6964 (0.4603)	0.6593 (0.4740)	1.63
female has experienced CSA	0.0424 (0.2017)	0.0153 (0.1229)	2.79
percentage of the year the woman works	0.5493 (0.4159)	0.5646 (0.4219)	-0.75
percentage of the year the male works	0.7763 (0.3508)	0.8152 (0.3354)	-2.26
a child is present in the home	0.7009 (0.4584)	0.6826 (0.4655)	0.81

* Recent abuse is abuse in the four years prior to the VAWS.
** Includes those who have never been abused.

Table 3.3 - Tobit Estimates
The Restricted Version of the TWL-like Model
All Currently Married Women from the VAWS
(n=5596)

Log Likelihood = -2361.95

	Coefficient	t-value	Marginal Effects*
male income	-0.0429	-1.17	0.0060
male income squared	-0.0001	-0.38	
female income	-0.0889	-2.21	-0.0061
female income squared	0.0004	0.81	
male income x female income	0.0014	2.25	
percentage of the year the male works	1.5081	0.66	-0.0077
percentage of the year the male works squared	-2.0235	-0.96	
percentage of the year the male works x male income	0.0349	0.89	
percentage of the year the male works x female income	0.0134	0.35	
percentage of the year the female works x male income	-0.0120	-0.47	
percentage of the year the female works x female income	-0.0231	-0.76	
percentage of the year the female works	3.2270	1.77	0.0048
percentage of the year the female works squared	-0.4315	-0.28	
percentage of the year the male works x percentage of the year the female works	-2.4402	-1.75	
male five years or more the woman's junior	1.6917	2.23	0.0774
male five years or more the woman's senior	0.6656	1.96	0.0276
marriage is registered	-1.4684	-3.41	-0.0649
female's age	-0.0745	-2.14	-0.0046
number of years together	-0.0666	-2.21	-0.0051
approximate age of children	-0.0196	-0.60	-0.0014
presence of a step child	-0.2877	-0.44	-0.0113
a child is in the home	0.5683	1.07	0.0224

* Marginal effects are calculated based on a 10% increase in the significant income variables, change from 0 to 1 in the binary variables, and a one unit increase in all other variables. The marginal effects are calculated at the means.

Joint tests	
1. Income Variables	$\chi^2_9 = 14.54$
2. Independent variables	$\chi^2_{22} = 171.33^d$
[a] denotes significant at $\alpha=0.10$ [d] denotes significant at $\alpha=0.005$	

Table 3.4 : Tobit Estimates
The Expanded Version of the TWL-like Model
All Currently Married Women from the VAWS
(n=5596)

Log Likelihood = -2266.39

	Coefficient	t-value	Marginal Effects *
male income	-0.0118	-0.33	0.0042
male income squared	-0.0002	-0.50	
female income	-0.0788	-2.01	-0.0047
female income squared	0.0002	0.51	
male income x female income	0.0012	2.14	-0.0051
percentage of the year the male works	1.4367	0.65	
percentage of the year the male works squared	-1.7508	-0.86	
percentage of the year the male works x male income	0.0175	0.47	
percentage of the year the male works x female income	0.0243	0.66	
percentage of the year the female works x male income	-0.0178	-0.73	
percentage of the year the female works x female income	-0.0170	-0.59	
percentage of the year the female works	3.6557	2.08	0.0060
percentage of the year the female works squared	-1.1213	-0.76	
percentage of the year the male works x percentage of the year the female works	-2.0629	-1.54	
male five years or more the woman's junior	1.2688	1.76	0.0685
male five years or more the woman's senior	0.7307	2.27	0.0372
marriage is registered	-1.2517	-3.00	-0.0665
female's age	-0.1042	-3.09	-0.0026
number of years together	-0.0490	-1.73	-0.0056
approximate age of the children	-0.0063	-0.20	-0.0003
presence of a stepchild	-0.5646	-0.92	-0.0266
a child is in the home	0.5556	1.10	0.0269
female has at least a high school diploma	-0.8702	-2.18	-0.0448
male has at least a high school diploma	-0.8292	-2.37	-0.0422
female has a disability	1.3479	3.37	0.0719
mother-in-law was abused	3.7958	10.46	0.2273
mother was abused	0.9828	2.98	0.0509
female experienced CSA	2.2028	2.76	0.1266
lives in New Brunswick	-0.5748	-0.74	-0.0271
lives in Nova Scotia	0.2810	0.41	0.0141
lives in PEI	-0.6134	-0.75	-0.0288
lives in Newfoundland	-0.8315	-0.74	-0.0382
lives in Ontario	-0.8252	-1.27	-0.0387
lives in Manitoba	0.3779	0.62	0.0190
lives in Saskatchewan	1.1230	1.59	0.0597
lives in Alberta	-0.0385	-0.06	-0.0019
lives in British Columbia	0.1160	0.18	0.0058
lives in an urban area	0.5029	1.57	0.0244

* Marginal effects are calculated based on a 10% increase in the significant income variables, change from 0 to 1 in the binary variables, and a one unit increase in all other variables. The marginal effects are calculated at the means.

Joint tests	
1. Income Variables	χ^2_a=11.94
2. Independent variables	χ^2_{38}=374.89[d]
[a] denotes significant at α=0.10 [d] denotes significant at α=0.005	

**Table 3.5: ZIP Regression Estimations based on All
Married Women from the VAWS
(n=5596)**

Log Likelihood: -2283.570484

a. Probit Part	Marginal Effects	t-value
male income	0.0010	0.829
female income	-0.0008	-0.785
percentage of the year the male works	-0.0009	-0.338
percentage of the year the female works	-0.0003	-0.361
male five years or more the woman's junior	0.0326	1.391
male five years or more the woman's senior	0.0242	2.447
marriage is registered	-0.0357	-2.868
female's age	-0.0027	-3.149
number of years together	-0.0022	-2.815
female has been married previously	-0.0219	-1.183
a child is in the home	0.0118	1.038
female has at least a high school diploma	-0.0379	-2.814
male has at least a high school diploma	-0.0062	-0.577
female has a disability	0.0391	3.190
mother-in-law was abused	0.1204	10.759
mother was abused	0.0299	2.817
female experienced CSA	0.0478	1.968
lives in the Atlantic Provinces	0.0152	0.982
lives in Ontario	0.0262	1.720
lives in the Prairie Provinces	0.0353	2.434
lives in British Columbia	0.0182	1.050
lives in an urban area	0.0070	0.735

Prediction Success Table			
	Actual		
		0	1
Predicted	0	5143	436
	1	5	12
Percentage predicted correctly:			92%
Percentage of women reporting recent abuse:			8%

* Although only male income, female income, percentage of the year the female works, and percentage of the year the male works are presented in this table, the ZIP estimation includes all TWL variables. This variables are listed in footnote 44. The calculation of the marginal effects includes the effects both through the variable itself and all algebraically related variables that have a p-value of 10% or better. For example, suppose the female income variable and all its cross variables have a p-value of 10% or better. The marginal effect of a 10% increase in female income would include the effect through female income squared, female income x male income, percentage of the year the male works x female income, and percentage of the year the female works x female income.

Table 3.5 (continued)		
b. Poisson Part:	Marginal Effects	t-value
male income	-0.0008	-0.058
female income	-0.0014	-0.103
percentage of the year the male works	-0.0086	-0.261
percentage of the year the female works	0.0001	0.004
male five years or more the woman's junior	0.2531	0.955
male five years or more the woman's senior	-0.0506	-0.356
marriage is registered	-0.2589	-1.632
female's age	0.0013	0.107
number of years together	-0.0259	-2.345
female has been married previously	0.3299	1.332
a child is in the home	-0.0683	-0.408
female has at least a high school diploma	0.3569	2.144
male has a high school diploma	-0.4223	-2.643
male has some post secondary education	-0.7380	-4.616
male has a university degree	-0.9646	-3.956
female has a disability	0.2609	1.700
mother-in-law was abused	1.1937	10.461
mother was abused	0.0766	0.574
female experienced CSA	1.2859	5.187
lives in the Atlantic provinces	0.0789	0.338
lives in Ontario	0.4376	2.005
lives in Manitoba	0.7310	2.957
lives in Saskatchewan or Alberta	-0.2446	-1.068
lives in British Columbia	0.4630	1.923
lives in an urban area	0.3845	2.728

Joint tests	
1) the hurdle part:	
1.1) independent variables[50]	$\chi^2_{35}=2147.05^d$
1.2) income variables	$\chi^2_{9}=17.20^b$
1.2.1) male income	$\chi^2_{5}=9.33^a$
1.2.2) female income	$\chi^2_{5}=11.88^b$
2) the count part:	
2.1) income variables	$\chi^2_{9}=22.80^c$
2.1.1) male income	$\chi^2_{5}=14.06^b$
2.1.2) female income	$\chi^2_{5}=10.08^a$
3) the model:	
3.1) independent variables	$\chi^2_{78}=551.72^d$
3.2) income variables	$\chi^2_{18}=37.42^d$
[a] denotes significance at α=0.10 [c] denotes significance at α=0.010 [b] denotes significance at α=0.05 [d] denotes significance at α=0.005	

[50]   This is a test of the significance of the ZIP model versus the simple Poisson model.

Table 3.6 -- Sensitivity Tests on the ZIP Results	
Model	Joint of the Income Variables
Base ZIP Model (Table 3.5)	χ^2_9=22.80[c]
1. Four year window:	
1.1. estimating the number of incidents of abuse over the 12 months, instead of the four years, prior to the VAWS (n=5596).	χ^2_9=18.78[b]
1.2. including only those married four years or more (n=4833)	χ^2_9=13.90
1.3. estimating the number of incidents of abuse over four years for those married less than four years (n=877)	χ^2_9=17.00[b]
2. Income variable:	
2.1. using the midpoints of the income brackets with $80,000 as the highest income and including dummy variables for female income and household income greater than $80,000 instead of relying on the SCF data (n=5596)	χ^2_{14}=34.06[c]
2.2. omitting the binary variables for female and male education (n=5596)	χ^2_9=24.04[d]
3. Dependent variable:	
3.1. adjusting upper bound to 15 (n=5596)	χ^2_9=27.22[d]
3.2. adjusting upper bound to 20 (n=5596)	χ^2_9=36.33[d]
3.3. adjusting upper bound to 30 (n=5596)	χ^2_9=52.96[d]
4. Model	
4.1. Negative Binomial model (n=5596)	χ^2_9=7.92
4.2. Zero Altered Poisson model (n=5596)	χ^2_9=21.96[c]

[a] denotes significance at α=0.10   [c] denotes significance at α=0.010
[b] denotes significance at α=0.05   [d] denotes significance at α=0.005

Appendix

A.1. Exclusion of observations

In this essay, we use 5596 of the 12,300 observations. The other 6704 observations are not used in our analysis due to the following reasons:[51]

1.   3882 women report that they are not currently married.

2.   303 women report that they have been married for less than one year.

3.   956 women report that they and/or their partner are over the age of 65.

4.   1563 women do not provide information on at least one variable deemed vital for our analysis. Such variables are: the female's weeks worked (49), her partner's weeks worked (133), her partner's education (132), her education (3), her income (302), household income (398), duration of the marriage (8), domestic abuse in her family of origin

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[51]   Observations were deleted as soon as they failed to pass one of the sample selection hurdles. The hurdles were ordered as they are listed here. For example, supposed one woman reported that she is divorced, 70 years of age, and did not state her personal income. She would be excluded from the sample and be counted among those who were excluded based on marital status, but not amongst those who were excluded based on age or those failing to report personal income. Therefore, the sum of the number of observations excluded for the reason listed is equal to the total number of observations excluded from the sample (i.e. 6704).

(108), domestic abuse in her partner's family of
origin (397), the most recent incident of domestic
abuse (19), sexual assault by a known male who was
never romantically involved with the woman (1),
number of incidents of domestic abuse (9), when the
first incident of domestic abuse happened (4).

A.2. Estimation of the recent number of incidences of abuse

Women are deemed to be recently abused if they report that
abuse has occurred within four years prior to the VAWS. The
definition of "recent" reflects a compromise between the competing
objectives of having a large sample of abused women on one hand
and being able to match the timing of the abuse with the economic
information provided on other hand.

In accordance with our definition of recent abuse, we set
the number of incidents of abuse equal to zero if no abuse has
occurred in the relationship within the four years prior to the
VAWS (n=5196).[52] If the woman reports that abuse began within
the four years, we use the number of incidents reported (n=274).
If the woman had been abused within the past four year, but the
abuse began five or more years prior to the VAWS, we assumed that
the number of incidents were evenly distributed over this interval
and rounded up to the nearest whole number (n=157).

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[52]   In total, 4719 women report that they have never been abused
by their current spouse while 477 report that they have been
physically abused by their current spouse but not in the four year
prior to the VAWS.

IV. Essay Three: The Association Between the Frequency of Wife Assault and Marital Dissolution

1. Introduction

This essay explores the association between the frequency and the severity of domestic abuse and the probability of a marriage ending. Although economists have explored the dynamics of marital formation and dissolution, to our knowledge there has been no study of the effect of spousal violence on marital stability. This essay raises questions regarding the interpretation of the common finding that the children of lone mothers have more problems than the children of couples even controlling for income and other variables. This finding could be due either to the lack of economic resources or the lack of parental time in the lone mother families. Alternatively, this finding could be the result of parental and child abuse in the previous marriage. This essay also provides evidence to dispute the widely held belief that women do not leave violent relationships. This essay contains the following sections: 2) a literature survey, 3) a description of the data and our results, 4) a description of the sensitivity tests performed on the results, and 5) a summary of our findings.

2. Literature survey

Research has found that surprises after marriage can affect the hazard rate of leaving a marriage. In Becker et. al. (1977), the authors suggest that large deviations between actual

and expected characteristics (i.e. fertility, wages, etc.) affect the expected gain from specialization in either home or market production. This in turn impacts on the hazard rate of exiting marriage. Specifically, the authors find that positive (negative) deviations in the male (female) wage will significantly decrease the hazard rate of leaving the marriage and vice versa. Schultz (1993) and Weiss and Willis (1997) have also found that surprises with regard to wages can significantly affect the hazard rate. However, Hoffman and Duncan (1994) find that female wages and male incomes have only a very small impact on the divorce rate. It has been established in these above mentioned papers that age at first marriage and the number and age of children in the relationship are significantly associated with the probability of dissolution.

In this essay, information gained after marriage with respect to the quality of the match is assumed to affect the hazard rate of exiting marriage.[53] During marriage, the partners are assumed to learn about each others ability to resolve conflicts and cope with stress in non-violent ways. A woman is assumed to reevaluate the gains to her marriage based on the frequency and severity of spousal assault. The proposition is in direct opposition to the stereotype that women do not leave violent relationships and that she is, therefore, in a way a 'willing victim'.

Domestic violence may have long lasting affects on a family even if the marriage dissolves. Dooley et. al. (1997) find that a child of a lone mother is significantly more likely to

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[53]   We include both registered and common-law marriages.

experience hyperactivity, conduct disorders, emotional disorders, repeated grade, poor school performance, and frequent social problems than children in two parent families. The results are found even when, among other things, conditioning for income, and mother's education and age. This finding may be the legacy of spousal and child abuse in the previous marriage.[54]

3. Data

In February of 1993, Statistics Canada conducted the national Violence Against Women survey (VAWS). A random sample of households with telephones was selected and about 50% of the telephones calls were answered. An attempt was made to interview a randomly selected female resident who was at least 18 years of age. In total, 19,309 of households were called that included an eligible female.[55] A sample size of 12,300 eligible females was obtained.[56,57]

In this essay, we use 7853 ever married women 18 years of age and over from the VAWS. This sample consists of 5856 women who have remained in their first marriage and 1997 women whose first marriage has dissolved.[58] Of the latter group, 1044 women report that they have remarried.

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[54] After completion of this paper, I became aware of the unpublished paper by Bowlus and Seitz (1998). That work looks at the effect of domestic violence on marital and labour supply decisions of females. The paper is also based on the VAWS. It considers the issue of sensitivity testing much less thoroughly than is done in this paper.

[55] No household was called after 8pm local time.

[56] The response rate was about 64%.

[57] Statistics Canada (1994, pp. 6-8).

[58] I drop all observations for which the women report that their first marriage ended due to the death of their partner.

3.1 Variables

The VAWS includes information on the frequency of abuse in the current and/or a previous relationship and, if applicable, severity of that abuse.[59] The frequency of abuse is the number of physical assaults on the female by her male partner over the course of their relationship. The VAWS also includes information on the age at first marriage, domestic violence in the female's family of origin, domestic violence in her first partners' family of origin, presence of a child in the home, the female's educational attainment, whether or not the woman lives in an urban area, and her province of habitation.

3.2 Incidence of abuse

Approximately 24 percent of the ever married women in this sample report that they have been physically attacked during their first marriage.[60] However, failed first marriages appear to be much more violent than those marriages that are still intact. About 14% of women who remain in their first union report being physically attacked by their partner. However, about 53% of women whose first marriage has ended report physical abuse prior to the end of that union.[61] These statistics are summarized in Table 4.1 below.

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[59]   Since information on only one previous spouse is included and the order of that spouse is not identified, we drop all women (n=1021) who report more than one previous spouse. In section 4, we investigate the effect that dropping these observations has on our results.
[60]   Physical attack includes a physical assault and/or forced sexual activity. For further details please see pages 6 and 7.
[61]   An additional three percent of women whose first marriage has ended report that the abuse began after the union dissolved. Therefore, about 56 percent of women whose first marriage has ended report physical abuse by their first partner at some time.

3.3   Variables associated with abuse

One can see by referring to Table 4.2 below that the frequency of domestic abuse is much lower for intact unions than for those that have ended. The frequency of abuse reported by women whose first union has ended is over eight times higher than that for women who remain with their first partner. This correlation could indicate a causal relationship between violence and the decision to separate. Alternatively, the correlation could indicate that there is an underlying variable(s) that has a causal relationship with marital dissolution and is correlated with violence. Of the other VAWS variables, the woman's age at first marriage, the woman's education, and the marriage cohort[62] have been found to be related to the probability of divorce in previous research.

Many other VAWS variables also appear to be correlated with the decision to separate. One can see by referring to Table 4.2 that the average woman's age at first marriage, and the percentage of women having a high school diploma, and the percentage of women having been married prior to 1965 is much higher for those in intact first marriages than for those whose first marriage ended. The percentage of women reporting that they have an abused mother, have an abused mother-in-law, live in British Columbia, are disabled, and are in an unregistered marriage are each much higher for those whose first union has ended than for those who have remained in their first marriage.

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[62]   We generate two marriage cohorts for our sample. The marriage cohort variable indicates that the marriage formed prior to 1965.

Average age of children at home,[63] and percentage of women

reporting that they live in Newfoundland, New Brunswick, or

Manitoba, and have a child at home are each much lower for those

whose first union has dissolved than for those who have remained

in their first marriage. It could be that one or more of these

variables, which are correlated with dissolution, may be also

correlated with violence. To explore this possibility, we

summarize the data by the frequency of abuse in the first union.

3.4   Variables associated with wife assault

Table 4.3 shows that the percentage of women whose first

marriage has dissolved increases as the number of violent

incidents in the first union increases. From this table, one can

see that about 65% of women who report three or more incidents of

abuse in their first marriage are no longer in that marriage.

This finding is in direct opposition to the stereotype that women

do not leave violent relationships. The average age at first

marriage decreases and the percentage of women who report having

an abused mother-in-law increases as the frequency of abuse in the

first marriage increases. To investigate whether or not the

association between either age at first marriage or having an

abused mother-in-law and violence might be driving the association

between violence and dissolution, we turn now to probit regression

equations.

3.5   Multivariate analysis

Table 4.4.1 shows that both the frequency of abuse and the

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[63]   This is actually a proxy for the age of the children.
It is calculated by multiplying the number of years since first
married multiplied by the binary variable for having a single
child under the age of 25 at home.

binary variables indicating the severity of spousal violence in
the first relationship have significantly positive relationships
with the probability of that relationship ending. When age at
first marriage and the binary variable for having an abused
mother-in-law are added to the equation, we find that the marginal
effect of the frequency of abuse on the probability of the
relationship ending is reduced by about 0.2 percentage points from
about 0.025 to about 0.023. The greatest change in marginal
effect of the indicators variables is about 0.6 percentage points
from about 0.098 to about 0.92. The coefficients on the frequency
of abuse and the indicator variables still have p-values of less
than 0.001. A one unit increase in the number of incidents of
abuse is associated with an increase in the probability of
dissolution of about 2.3 percentage points. These results are
displayed in Table 4.4.2.

As can be seen by referring to Table 4.4.3, when all other
21 VAWS variables from the earlier tables are added to the
equation, the frequency and severity of violence maintain their
significantly positive association with the probability of the
first relationship ending. The marginal effect of the frequency
of abuse decreases by only about 0.1 percentage points, which
represents a percentage change of about 5%, when age at first
marriage, the binary variable for having an abused mother-in-law,
and the other 21 VAWS variables are added. A one unit increase in
the number of incidents of abuse is now associated with the
probability of dissolution increasing by about 2.4 percentage
points. Hence, it would appear that none of the VAWS variables,
which were found to be related to frequency of domestic abuse and
the probability of the first relationship ending, are able to shed

light on the significantly positive association between the abuse variables and the probability of the first union failing. Thus, if the abuse variables are only associated with a variable that has a direct impact on the probability of dissolution, that variable is not contained in the VAWS.

All indicator variables for the severity of the spousal abuse are still significant at least the 0.2% level. The percentage change in the marginal effects of four of the five variables is between 1% and 11% and their p-values remain below 0.001. The percentage change in the marginal effects of the other variable, sev3, is about 26% and its p-value has dropped to 0.002. The lack of much change in the marginal effects of most of the indicator variables, especially those indicating the most severe abuse, appears to suggest that the other VAWS variables are also not able to shed light on the association between the severity of spousal abuse and the probability of marital dissolution.

In Table 4.4.3, we also find that having a university degree is associated with a higher probability of marital dissolution. Becker et. al. (1977) suggest that if schooling increases a person's productivity in both the market and the home, schooling will increase the gain to marriage, but will also limit the range for specialization within a marriage. For women who obtain a university degree, the latter force appears to be stronger. For lower levels of education, it appears that either education does not affect the probability of dissolution or that the opposing forces cancel each other out.

Variables that appear to be negatively correlated with the probability of dissolution include residing in Newfoundland and

residing in British Columbia as opposed to in Quebec. Other
variables that appear to be positively correlated with the
probability of dissolution include living in an urban as opposed
to a rural area, having a child at home as opposed to having no
children at home, the approximate age of the child, and being in a
common-law as opposed to a registered marriage.

3.6 Other variables linked to wife assault and marital dissolution

Many variables that have been linked to the probability of
divorce are not available in the VAWS. These variables include
socio-economic information on the previous spouse, the number of
children, presence of a pre-schooler in the household, and the
duration of the marriage.

Research by Tauchen, Witte and Long (1991) finds that male
and female income are associated with the frequency of abuse,
although Chapter Two casts some doubt on this finding. TWL find
that female income has a significantly negative association with
the frequency of abuse and that male income has a significantly
positive association with the frequency abuse. As earlier
mentioned, divorce research finds that male income is negatively
related to the probability of divorce while female income is
positively related to the probability of divorce. If the
direction of these correlations are correct, we can rule out the
association between the partners' income and the frequency of
abuse as a possible explanation of the association between abuse
and the probability of separation. If male income were negatively
associated with the frequency of abuse and the probability of
abuse, male income could perhaps be driving the association

between abuse and dissolution.

TWL also find that the total number of children and having a child under the age of six to be positively related to the frequency of abuse. Divorce research finds the more marriage specific capital a couple has the lower the probability of divorce.[64] Moreover, research finds that having a child under six significantly reduces the probability of divorce. Again if these correlations are correct, the child variables would not be able to explain the positive association between violence and the probability of the first marriage ending.

4. Sensitivity analysis

Becker et. al. (1977) suggest that large deviations between actual and expected characteristics affect the expected gain from specialization in either home or market production. In this essay, however, we include the total number of incidents of abuse. Therefore, as a first test of the sensitivity of our results, we estimate the difference between the actual and expected level of violence in the relationship. We include this differential on the right hand side of the probit instead of the total number of incidents of abuse.

The VAWS used a form of the Conflict Tactics (CT) Scales to measure violence.[65] As a result, the VAWS questions are unambiguous and require the respondents only to scan their memories for incidents that fit the description of one act of

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[64]   However, large deviations between expected and actual fertility is positively related to the probability of divorce (Becker et. al. (1977)).

[65]   For further information, criticisms, and the variations on the CT Scales used in the VAWS in order to address these problems, please see Johnson and Sacco (1995, p.291-293)

abuse at a time. The questions also do not require the woman to label herself as abused to answer in the affirmative.[66]

It is still possible, however, that the strong correlation between the abuse and the probability of marital dissolution could be due to systematic under reporting of abuse by women who have remained in their first marriage. These women may falsely report that they have never been abused by their current partner or they may under report the number of times that they have been abused. In this section, we perform a test on the VAWS data to gauge the amount of under reporting that would be required in order to eliminate the significance of this correlation. Alternatively, the significant relationship between the frequency of abuse and the probability of marital dissolution could be due to other systematic reporting differences such as potential over reporting by women whose first marriage has ended. In order to assess this possibility, we slice the data by age, by marriage cohort, and by current marital status of women whose first union has dissolved. As a final check, we also add back in the 1407 observations that were dropped either because the woman reports having more than one previous partner or because she did not report on whether or not there was abuse in the male's family of origin. This last step is taken to ensure that our results are not the product of sample selection.

4.1 Difference between the actual and the expected level of violence

There are 305 women in our sample that report that they were

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[66]   For more discussion of the benefits of the form of the CT Scales used in the VAWS, please see Chapter Two.

abused by their partner prior to marriage.[67] Although we are not

able to predict their expected level of abuse after marriage, we

believe that an objective person would not be surprised that abuse

continued after marriage.[68] Therefore, we set the difference

between the actual and expected level of abuse for these

observations to zero. The difference for all other observations

is set equal the total number of incidents of abuse. As can be

seen from Table 4.5, including the difference between the actual

and expected level of violence instead of the total number of

incidents of violence has no significant impact on our results.

4.2 Possible under reporting by women who remain in their first

marriage

About 86% of women who remain with their first partner

report that they have never experienced spousal abuse as opposed

to 47% of women whose first marriage has dissolved. It is

possible that some of the women in the former group have not

chosen to disclose either the full extent of their abuse or any of

their abuse. Therefore, we randomly assign one incident of abuse

to approximately 55% of the women in the former group in order to

bring the percentage of zero responses down to that of women in

the latter group (i.e. 47%). We then inflate all non-zeros

responses of women who have remained with their first spouse until

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[67]   There were five women who did not report whether or not they
were abused by their partner prior to marriage. These women were
dropped from the sample for this sensitivity test.

[68]   Many abusers promise their partners that the most recent
incident of abuse was the final assault and, at least for a time,
their partners may believe them. Therefore, some women may enter
into marriage with a known abuser believing that they will never be
abused again. If this were true for all such women in our sample,
the expected number of incidents of abuse would be equal to zero and
the results in Table 4.4.3 would hold.

the point where the coefficient on the frequency of abuse in the probit has a p-value of greater than 10%. We find that the total number of incidents of abuse reported by women who have remained in the first marriage must be inflated by about 650% in order for the relationship between the frequency of abuse and dissolution to be rendered insignificant.[69,70] Therefore, if systematic under reporting by women who remain in their first marriage is to explain the association between abuse and the dissolution, these women must on average report less than 18% of all their incidents of abuse. Table 4.6 depicts the results of one such trial. In this example, the total number of incidents reported by women who remain in their first marriage must be inflated by 653% in order for the p-value on the coefficient on abuse to be increased to 10 percent. Therefore, the women who remain in their first marriage must report only 18% of their incidents of abuse for the association between abuse and dissolution to be spurious.

4.3 Other possible forms of systematic reporting difference

Another explanation of the association between abuse and marital instability could be that there are systematic reporting differences by age, by marriage cohort, or by current marital status of women whose first union has ended. We slice the data by these variables to find evidence of reporting differences.

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[69] The equation we estimate does not include the five indicator variables for the severity of abuse. Keeping these variables in the equation would require us to also assign levels of severity of abuse reported by the women who remain in their first union.

[70] This procedure of randomly assigning abuse and inflating the incidents of abuse was repeated ten times. The total amount of inflation that was required over these trials to provide insignificant results was between 647% and 660%.

We would get a spurious correlation between the abuse and dissolution if younger women are more apt to leave their partners and also more apt to reveal abuse. There could also be a marriage cohort effect. Women who were married less recently must scan far back in their memories to recall an incident(s) of abuse. Women who were married more recently may have an easier time remembering incidents of abuse and, therefore, may appear to have had more violent relationships. If unions formed recently also have a higher failure rate than union formed in the more distant past, the systematic differences in reporting by marriage cohort may generate a spurious correlation between abuse and marital failure. There could also be another systematic difference in reporting by current marital status of women whose first union has dissolved. It could be that women whose first union has ended may have some hostility towards their former partner and, for that reason, they may over report the number of incidents of abuse.[71] We propose that women who have formed another union may be less hostile towards their former partner than those who remain without a partner.[72] Therefore, if hostility leads to over reporting, we should see some difference between these two groups.

One can readily see that the average number of incidents of abuse reported by women whose first marriage has ended is

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[71]   A woman might over report abuse, but she would have very little to gain from doing so since the survey was given anonymously and the interviewers were professionals.
[72]   We have no way of estimating the time since the first union dissolved. If the woman has had time to remarry, the first union cannot have failed very recently. Remarriage may also indicate that the woman has moved on with her life and put the failed relationship in her past. For these reasons, we assume that, as time goes by, the hostilities toward former partners decrease.

consistently around 3.5 no matter how the data are sliced in Table
4.7 below. Also, the average is consistently about 0.5 incidents
of abuse for those women who have remained with their first
partner. There appears to be no systematic reporting differences
between the mean number of incidents of abuse reported by age, by
marriage cohort, or by current marital status of women whose first
union has dissolved.

4.4 Expanding the sample

The VAWS includes information on only one previous spouse.
If a woman had three failed relationships only one of which was
abusive, we would have no information on either of the non-
violent relationships. The VAWS asks whether or not the woman has
ever been in a violent partnership that has ended. If yes, she
is asked further questions about this violent relationship only.
By asking questions in this manner, the association between abuse
and marital dissolution may appear stronger than it really is if
women who report having had more than one previous partner are
included in the sample. Therefore, in our earlier estimates 968
observations were omitted because the woman reports more than one
previous partner.[73]

We dropped 539 observations because information on spousal
abuse in the male's family of origin is unknown.[74] However, as
Table 4.4.3 illustrates, wife assault in the male family of origin

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[73]   Earlier, we stated that 1021 observations are dropped due
to the woman reporting more than one previous partner. However,
fifty three of these observations are also missing other needed
information.
[74]   Five hundred and fifty four observations are dropped due
to the woman not reporting whether or not there was spousal abuse
in the male's family of origin. However, fifteen of these
observations are also missing other needed information.

is not significantly associated with the probability of marital
dissolution. Since this variable does not appear to be important,
we add these observations back in to test for sample selection
bias. Table 4.8 displays the results of adding women who report
more than one previous partner and adding back in the observations
for which spousal abuse in the male's family of origin is
unknown.[75] We find that adding back these observations does not
affect our finding that there is a strong positive association
between the abuse variables and the probability of marital
dissolution. In fact, as was earlier predicted, the correlation
has become stronger.[76]

We find that a high rate of under reporting is required to
generate insignificant results. We also find no evidence of
systematic reporting differences by age, by marriage cohort, or by
the marital status of women whose first union has dissolved.
Therefore, there appears to be no evidence that the association
between abuse and marital dissolution has been manufactured by the
way in which different subsamples of our sample report, or fail to
report, incidents of abuse. We find that the association between

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[75] The binary variable for having an abused mother-in-law has
been dropped, of course, from the probit.
[76] As alluded to earlier, this result may be due to the VAWS
asking whether or not the woman has ever had a previous partner
who has ever been abusive. In the section on previous marriages,
women are asked to respond in the affirmative to questions on
abuse "if (any of) [their] previous husband(s)/partner(s) ever"
behaved in the manner described. A woman may have had three
previous partners of which only one was violent. The woman would
report on her only violent partner and provide no information on
the two other nonviolent relationships. Including women who have
had more than one previous partners would serve to inflate the
association between abuse and dissolution if not all the previous
spouses were equally violent or non-violent. About 68% of women
with multiple previous partners report violence in a previous
union as opposed to 53% of women who report just one previous
partner.

the abuse variables and dissolution is not affected by adding back in observations in which the woman reports more than one previous partner or for which information on spousal abuse in the male's family of origin is unknown.

5.   Conclusion

Failed first marriages appear to be much more violent than those marriages that remain intact. About 14% of women who remain in their first union report being physically attacked by their partner. However, about 53% of women whose first marriage has ended report physical abuse prior to the end of that union. Further, about 65% of women who report three or more incidents of abuse in their first marriage are no longer in that marriage. The correlation between abuse and marital dissolution could indicate a causal relationship between violence and the decision to separate. Alternatively, the correlation could indicate that there is an underlying variable(s) that has a causal relationship with marital dissolution that is (are) correlated with violence.

A few of the VAWS variables have been found in previous research to be associated with the probability of marital dissolution. These variables include the woman's age at first marriage, the woman's education, and the marriage cohort. We find no evidence that these, nor any other, VAWS variables are able to shed light on the association between domestic abuse and the probability of the first marriage failing. Many variables that have been linked to the probability of divorce are not available in the VAWS. It could be that one or more of these latter variables would be able to explain the association.

Male income, total number of children and having a child

under the age of six have been found to be negatively associated with the probability of divorce, while female income is positively associated with the probability of divorce. One possible reason for the association between divorce and abuse is that the correlations between the above variables (income and child variables) and divorce could be of the same sign as the correlations between these variables and abuse. However, the TWL study shows that these sets of correlations are not opposite in sign. However, TWL find that male income is positively associated with the frequency of abuse.

In this essay, we inflate the frequency of abuse reported by women who remain in their first marriage to gauge the amount of under reporting required in order to generate a spurious association between dissolution and abuse. We find that we must inflate the number of incidents of abuse reported by women who have remained in the first marriage by about 650% in order for the significant relationship between the frequency of abuse and dissolution to disappear. This means that these women must report less than 18% of all incidents of abuse. We explore the data for possible reporting differences by age, marriage cohort, and current marital status of women whose first union has ended. We find no evidence that the association between the frequency of abuse and dissolution has been manufactured by systematic differences in reporting abuse. We also add back in observations in which the woman reports more than one previous partner (n=1021) and for which spousal abuse in the male's family is unknown (n=544). We find that our results are not significantly changed.

The strong association between abuse and marital

dissolution raises questions about how to interpret the common finding (from the National Longitudinal Survey of Children and Youth and other data sources) that the children of lone mothers have more health and academic problems than the children of couples, even controlling for income and other variables. This finding could be due either to the lack of economic or other resources in single-mother families. It could also be due to the legacy of parental and child abuse in a previous marriage. If the latter is true, social policy directed at supporting the two parent family would not improve, but could possibly worsen, the health and welfare of children. Social policy directed at decreasing violence in the home, however, may improve the situation for many children and also improve the stability of the family.

Other variables are found to be significantly related to the probability of dissolution including education. Becker et. al. (1977) suggest that if schooling increases a person's productivity in both the market and the home, schooling will increase the gain to marriage, but will also limit the range for specialization within a marriage. For women who obtain a university degree, the latter force appears to be stronger and we find that education has increased the probability of marital dissolution.

In the future, we plan to explore the relationships between wife assault, marital stability and the health and academic performance of children. From this exercise, we hope to sort out the effect of lone parenthood and domestic violence on children.

Table 4.1: Incidence of Abuse Reported by Women			
	Ever Married (n=7853)	Still in first marriage (n=5856)	First marriage has dissolved (n=1997)
no violence	76%	86%	47%
one or more incidents of violence	24%	14%	53%

Table 4.2: Means of All Potential Variables (Standard Deviations)	All Marriages n=7853	Intact Marriages n=5856	Separated Couples n=1997
frequency of abuse	1.2461 (3.077)	0.4242 (1.694)	3.6565 (4.619)
age at first marriage	21.9623 (3.945)	22.3448 (3.824)	20.8408 (3.656)
mother was abused*	0.1687 (0.436)	0.1424 (0.357)	0.2459 (0.431)
mother-in-law was abused*	0.1268 (0.375)	0.0992 (0.306)	0.2078 (0.406)
lives in Newfoundland*	0.0619 (0.333)	0.0709 (0.261)	0.0356 (0.185)
lives in PEI*	0.0262 (0.241)	0.0272 (0.161)	0.0235 (0.152)
lives in Nova Scotia*	0.0835 (0.160)	0.0828 (0.275)	0.0856 (0.280)
lives in New Brunswick*	0.0684 (0.277)	0.0726 (0.259)	0.0561 (0.230)
lives in Quebec*	0.1560 (0.252)	0.1522 (0.360)	0.1673 (0.373)
lives in Ontario*	0.1994 (0.363)	0.1967 (0.399)	0.2073 (0.406)
lives in Manitoba*	0.0727 (0.400)	0.0775 (0.266)	0.0586 (0.235)
lives in Saskatchewan*	0.0760 (0.260)	0.0789 (0.266)	0.0676 (0.251)
lives in Alberta*	0.1277 (0.265)	0.1259 (0.334)	0.1332 (0.340)
lives in British Columbia*	0.1281 (0.334)	0.1154 (0.317)	0.1652 (0.372)
has a high school diploma*	0.7638 (0.334)	0.7698 (0.404)	0.7461 (0.435)
has a disability*	0.1445 (0.425)	0.1303 (0.320)	0.1863 (0.389)
lives in an urban area*	0.6732 (0.352)	0.6492 (0.478)	0.7436 (0.437)
a child is in the home*	0.5831 (0.469)	0.6066 (0.473)	0.5143 (0.500)
(age-age at marriage) x child in the home*	9.1030 (9.795)	9.4373 (9.860)	8.1227 (9.535)
experienced csa*	0.0153 (0.123)	0.0123 (0.115)	0.0240 (0.153)
married by common-law*	0.1398 (0.123)	0.0622 (0.252)	0.3676 (0.482)
marriage formed prior to 1965*	0.2580 (0.347)	0.2741 (0.404)	0.2108 (0.408)

* indicates a binary variable that is equal to one if true for the respondent and equal to zero otherwise.

Table 4.3: Means of All Variables Number of Incidents of Abuse (Standard Deviations)					
	none n=6007	1-2 n=798	3-4 n=214	5-10 n=250	over 10 n=576
frequency of abuse	0.0000 (0.000)	1.1454 (0.353)	3.4112 (0.493)	7.0000 (1.417)	11.0000 (0.000)
first marriage dissolved	0.1571 (0.364)	0.3308 (0.471)	0.6449 (0.480)	0.6550 (0.476)	0.8368 (0.370)
age at first marriage	22.3088 (3.996)	21.6040 (3.676)	20.9346 (3.181)	20.5116 (3.485)	19.8767 (3.279)
mother was abused*	0.1363 (0.343)	0.2569 (0.437)	0.2523 (0.435)	0.3256 (0.470)	0.2830 (0.451)
mother-in-law was abused	0.0801 (0.273)	0.1880 (0.391)	0.2897 (0.455)	0.3372 (0.474)	0.3750 (0.485)
lives in Newfoundland*	0.0696 (0.255)	0.0313 (0.174)	0.0280 (0.166)	0.0116 (0.107)	0.0590 (0.236)
lives in PEI*	0.0270 (0.162)	0.0313 (0.174)	0.0327 (0.178)	0.0310 (0.174)	0.0260 (0.159)
lives in Nova Scotia*	0.0811 (0.273)	0.0764 (0.266)	0.0935 (0.292)	0.0853 (0.280)	0.1146 (0.319)
lives in New Brunswick*	0.0706 (0.256)	0.0639 (0.245)	0.0607 (0.240)	0.0426 (0.202)	0.0660 (0.248)
lives in Quebec*	0.1681 (0.374)	0.1328 (0.340)	0.1121 (0.316)	0.0853 (0.280)	0.1094 (0.312)
lives in Ontario*	0.1943 (0.396)	0.2130 (0.410)	0.2290 (0.421)	0.2597 (0.439)	0.1962 (0.398)
lives in Manitoba*	0.0741 (0.262)	0.0840 (0.278)	0.0374 (0.190)	0.0426 (0.202)	0.0694 (0.254)
lives in Saskatchewan*	0.0751 (0.264)	0.0764 (0.266)	0.0981 (0.298)	0.0853 (0.280)	0.0729 (0.260)
lives in Alberta*	0.1225 (0.328)	0.1366 (0.344)	0.1449 (0.353)	0.1667 (0.373)	0.1458 (0.353)
lives in British Columbia*	0.1177 (0.322)	0.1679 (0.374)	0.1636 (0.371)	0.1899 (0.393)	0.1406 (0.348)
has a high school diploma*	0.7713 (0.420)	0.7644 (0.425)	0.8364 (0.371	0.7287 (0.446)	0.6736 (0.469)
has a disability*	0.1262 (0.332)	0.1880 (0.391)	0.1542 (0.362)	0.2171 (0.413)	0.2396 (0.427)
lives in an urban area*	0.6621 (0.473)	0.6992 (0.459)	0.7336 (0.443)	0.7364 (0.441)	0.7031 (0.457)
a child is in the home*	0.5765 (0.494)	0.6353 (0.482)	0.6168 (0.487)	0.5930 (0.492)	0.5625 (0.497)
(age-age at marriage) x child in the home*	12.7035 (11.224)	13.5752 (10.597)	12.9159 (10.474)	12.0388 (10.232)	11.0313 (10.013)
experienced csa*	0.0128 (0.113)	0.0226 (0.149)	0.0234 (0.151)	0.0116 (0.107)	0.0295 (0.169)
married by common-law*	0.1150 (0.319)	0.1867 (0.390)	0.3037 (0.461)	0.2364 (0.426)	0.2292 (0.421)
marriage formed prior to 1965*	0.2745 (0.446)	0.1886 (0.189)	0.1402 (0.348)	0.2227 (0.417)	0.23684 (0.426)

* indicates a binary variable that is equal to one if true for the respondent and equal to zero otherwise.

Table 4.4: Probit Estimates -- Probability of being Separated All Ever Married Women (n=7853)

1. Association of abuse and the probability of separating:

Log Likelihood = -3578.447	X^2_8 =1748.53	
Variable	Marginal Effect	p-value
frequency of abuse	0.0246	0.000
sev2- something was thrown at the woman that could hurt her or she was pushed, grabbed, or shoved*	0.0981	0.000
sev3- the woman was slapped*	0.2207	0.000
sev4- the woman was kicked, bit, or hit*	0.3403	0.000
sev5- the woman was either threatened or choked*	0.3903	0.000
sev6- the woman was either threatened with a gun *or knifed or a knife or gun was used on her or she was forced into a sexual activity*	0.4915	0.000

2. Addition of variables that appear correlated with abuse:

Log Likelihood = -3548.2752	X^2_8 ==1808.87	
Variable	Marginal Effect	p-value
frequency of abuse	0.0233	0.000
sev2*	0.0919	0.000
sev3*	0.2116	0.000
sev4*	0.3312	0.000
sev5*	0.3838	0.000
sev6*	0.4787	0.000
age at marriage	-0.0106	0.000
mother-in-law was abused*	0.0042	0.788

3. Addition of all other VAWS variables:

Log Likelihood = -2988.4436	X^2_{29} =2691.75	
Variable	Marginal Effect	p-value
frequency of abuse	0.0235	0.000
sev2*	0.0523	0.000
sev3*	0.1876	0.012
sev4*	0.2721	0.000
sev5*	0.3817	0.000
sev6*	0.4645	0.000
age at marriage	-0.0389	0.000
mother-in-law was abused*	-0.0144	0.355
age at marriage^2	0.0006	0.005
mother was abused*	0.0275	0.051
experienced csa*	-0.0026	0.950
has a high school diploma*	-0.0068	0.650
has some post secondary education*	0.0078	0.606
has a university degree*	0.0345	0.069
has a disability*	0.0329	0.031
lives in an urban area*	0.0602	0.000
a child lives in the home*	-0.1506	0.000
(age-age at marriage) x child at home	0.0051	0.000
married by common-law*	0.4722	0.000
marriage formed prior to 1965*	-0.0202	0.195
experienced csa*	-0.0026	0.950
lives in Newfoundland*	-0.0919	0.000
lives in Manitoba*	-0.0351	0.086
lives in British Columbia*	0.0429	0.030

Note:
(*) dF/dx is for discrete change of dummy variable from 0 to 1 at the means
    z and P>|z| are the test of the underlying coefficient being 0.
Only those provincial binary variables that have a p-value of 0.10 or better are displayed in Table 4.4.3 in order to conserve space.

Table 4.5: Probit Estimates -- Probability of being Separated All Ever Married Women using the Expected Number of Incidents of Abuse (n=7848)		
Log Likelihood = -3014.3459	χ^2_{29} =2867.34	
Variable	Marginal Effect	p-value
actual frequency of abuse - expected frequency of abuse	0.0238	0.000
sev2*	0.0584	0.005
sev3*	0.2024	0.012
sev4*	0.2977	0.000
sev5*	0.3997	0.000
sev6*	0.5094	0.000
age at marriage	-0.0399	0.000
mother-in-law was abused*	-0.0079	0.615
age at marriage^2	0.0006	0.004
mother was abused*	0.0268	0.057
experienced csa*	-0.0060	0.888
has a high school diploma*	-0.0070	0.641
has some post secondary education*	0.0079	0.601
has a university degree*	0.0356	0.061
has a disability*	0.0329	0.031
lives in an urban area*	0.0591	0.000
a child lives in the home*	-0.1521	0.000
(age-age at marriage) x child at home	0.0051	0.000
married by common-law*	0.4735	0.000
marriage formed prior to 1965*	-0.0237	0.128
lives in Newfoundland*	-0.0905	0.000
lives in Manitoba*	-0.0381	0.097
lives in British Columbia*	0.0451	0.023

Note:
(*) dF/dx is for discrete change of dummy variable from 0 to 1 at the means
z and P>|z| are the test of the underlying coefficient being 0.
Only those provincial binary variables that have a p-value of 0.10 or better are
displayed in Table 4.4.3 in order to conserve space.

Table 4.6: Sensitivity Analysis on Under Reporting[**] (n=7853)		
Log Likelihood = -3670.847		X^2_{24} =1563.73
Variable	Marginal Effect	P-value
frequency of abuse	0.0022	0.100
age at marriage	-0.0697	0.000
age at marriage^2	0.0011	0.000
mother was abused*	0.0660	0.000
mother-in-law was abused*	0.1184	0.000
experienced csa*	0.0230	0.578
lives in Newfoundland*	-0.0771	0.001
lives in PEI*	0.0504	0.177
lives in Nova Scotia*	0.0295	0.183
lives in New Brunswick*	-0.0159	0.500
lives in Ontario*	0.0344	0.046
lives in Manitoba*	-0.0252	0.073
lives in Saskatchewan*	-0.0026	0.807
lives in Alberta*	0.0238	0.216
lives in British Columbia*	0.0671	0.001
has high school diploma*	-0.0292	0.039
has some post secondary education*	-0.0089	0.534
has a university degree*	0.0073	0.680
has a disability*	0.0785	0.000
lives in an urban area*	0.0730	0.000
a child is at home*	-0.1454	0.000
(age-age at marriage) x a child is at home	0.0048	0.000
married by common-law*	0.4552	0.000
marriage formed prior to 1965*	-0.0403	0.006

* dF/dx is for discrete change of dummy variable from
  0 to 1 at the means.

** Adjustments to generate an insignificant association between the frequency
of abuse and the probability of marital dissolution: For women who remain in
their first union, 55% of the zero responses are adjusted to one and then the
number of incidents of abuse are inflated by 550%. This represents a 653%
inflation in the average number of incidents of abuse reported by women who
remain in their first union.

Table 4.7: Mean Incidents of Abuse Reported by Demographic Traits	
	Mean Incidents of abuse reported
1. All observations (n=7853)	1.246
1. Remain in 1st union (n=5856)	0.451
2. Left 1st union (n=1997)	3.656
1. remarried (n=1044)	3.499
2. did not remarry (n=953)	3.829
2. 40 years of age or under (n=4122)	1.328
1. Remain in 1st union (n=2969)	0.451
2. Left 1st union (n=1153)	3.588
3. Over 40 years of age (n=3731)	1.155
1. Remain in 1st union (n=2887)	0.397
2. Left 1st union (n=844)	3.750
4. Married prior to 1965 (n=2026)	1.081
1. Remain in 1st union (n=1605)	0.386
2. Left 1st union (n=421)	3.732
5. Married in 1965 or later (n=5827)	1.303
1. Remain in 1st union (n=4251)	0.438
2. Left 1st union (n=1576)	3.636

Table 4.8: Probit Estimates: Sensitivity Test of Dropped Observations (n=9360)		
Log Likelihood = -3620.8082 χ^2_{28} =4577.43		
Variable	Marginal Effect	P-value
frequency of abuse	0.0279	0.000
sev2*	0.0802	0.000
sev3*	0.2535	0.000
sev4*	0.3072	0.000
sev5*	0.3820	0.000
sev6*	0.4931	0.000
age at marriage	-0.0573	0.000
age at marriage^2	0.0008	0.000
mother was abused*	0.0114	0.445
experienced csa*	-0.0249	0.585
lives in Newfoundland*	-0.1233	0.000
lives in PEI*	0.0289	0.632
lives in Nova Scotia*	0.0278	0.268
lives in New Brunswick*	-0.0238	0.381
lives in Ontario*	0.0169	0.392
lives in Manitoba*	-0.0327	0.201
lives in Saskatchewan*	-0.0257	0.317
lives in Alberta*	0.0148	0.498
lives in British Columbia*	0.0715	0.001
has a high school diploma*	-0.0006	0.973
has some post secondary education*	0.0054	0.743
has a university degree*	0.0438	0.033
has a disability*	0.0345	0.035
lives in an urban area*	0.0695	0.000
has a child at home*	-0.1906	0.000
(age-age at marriage)x has a child at home	0.0067	0.000
married by common-law*	0.5493	0.000
marriage formed prior to 1965*	-0.0139	0.416
(*) dF/dx is for discrete change of dummy variable from 0 to 1 at the means.		

Appendix

1. Exclusion of observations

In this essay, we use 7853 of the 12,300 observations. The other 4447 observations are not used in our analysis due to the following reasons:[77]

1. 1387 women report that they were never married.

2. 894 women report that they are widows.

3. 303 women report that they have been married for less than one year.

4. 1021 women report that they have had more than one previous partner.

5. 842 women do not provide information on at least one variable deemed vital for our analysis. Such variables are: her education (4), domestic abuse in her family of origin (202), domestic abuse in a partner's family of origin (544), sexual assault by a known male who was never romantically involved with the woman (9), number of

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[77] Observations were deleted as soon as they failed to pass one of the sample selection hurdles. The hurdles were ordered as they are listed here. For example, supposed one woman reported that she is a widow and has been divorced, and she did not report her educational attainment. She would be excluded from the sample and be counted among those who were excluded because they are widowed, but not amongst those who were excluded based on having more than one previous partner or those failing to report their educational attainment. Therefore, the sum of the number of observations excluded for the reason listed is equal to the total number of observations excluded from the sample (i.e. 4447).

incidents of domestic abuse (40), and severity of domestic

abuse (43).

V.   Summary

The first essay investigates whether or not results similar to TWL's can be found by using the subsample of women in the VAWS who have ever been battered (n=877). As the evidence in this new sample did not support the TWL findings concerning income, we use all (ever and never abused) currently married women in the VAWS (n=5596) to examine the links between income (and other socioeconomic variables) and the likelihood that the women has ever been assaulted by her current partner in the second essay. Again, we find little evidence of a role for the income of either partner. The VAWS measures current income only so that education may reflect, in part, the long run earnings potential of each partner. In these first two essays, we do find that female education is negatively associated with the probability of being recently abused and male education is negatively associated with the frequency of abuse given that there has been recent abuse. These findings suggest that, for the female, more options in the labour market may translate into a stronger bargaining position in the home. For the male, these results suggest that education may reduce his economic stress which may reduce the number of violent episodes in the home. The benefits of education, therefore, to do end with a more financial security for the family. It also may mean a healthier family life.

The third essay explores the impact of the frequency and the severity of wife assault on the probability of a marriage

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ending. About 14% of women who remain married report being
physically attacked by their first partner. However, about 53% of
women who have left their first partner report physical abuse
prior to the end of that union. We find that the strength nor the
significance of the association between the abuse variables and
the probability of a union ending is not significantly affected by
the inclusion of all VAWS variables that appear linked to the
probability of separation in the probit. These variables include
age at first marriage and marriage cohort that are found in other
work to be significant in the decision to separate and are
significantly related to the abuse variables. We also explore the
possibility of using female education as a policy variable to
affect the probability of marriage breakdown. We find, however,
that female education is not significant which is consistent with
Becker et. al. (1977). The authors suggest that if schooling
increases a persons productivity in both the market and the home,
schooling will increase the gain to marriage, but will also limit
the range for specialization within a marriage. These opposing
forces appear to cancel each other out in the VAWS sample.

The third essay raises questions about how to interpret
the common finding (from the National Longitudinal Survey of
Children and Youth (NLSCY) and other data sources) that the
children of lone mothers have more problems than the children of
couples even controlling for income and other variables. This
finding could be due either to the lack of economic resources or
the lack of parental time in the single-mother families. On the
other hand, it could be the legacy of parental and child abuse
in the previous marriage. The longitudinal feature of the NLSCY
(release of Cycle 2 is scheduled for Fall 1998) will allow us to

start sorting out these and other interpretations by observing

children as they move into and out of marital unions.

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