# Essays on the Economics of the Family in Mexico

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# Abstract

This thesis consists of three essays on the economics of the family. Empirical evidence is provided using applied microeconometrics techniques to analyse from different perspectives the marriage market in Mexico. The first chapter studies the impact of education on marriage dissolution exploiting a change in the length of compulsory education in Mexico as an instrument for education. Results demonstrate that the relationship between education and divorce is not causal and suggest that although higher levels of education are an undeniable trait observed in non-broken marriages, it is not education by itself one of the mechanisms leading to better marriage outcomes. The second chapter investigates the effect of changes in the divorce legislation on divorce rates in Mexico, given the remarkable growth of divorce rates over the past few decades in the country, but especially after the introduction of unilateral divorce. Following a difference-in-differences methodology and using panel state-level data, it is observed that unilateral divorce increases the number of divorces. Moreover, since unilateral divorce has been implemented gradually in the country, the rising trend in divorce rates is expected to continue over the coming years. The third chapter analyses the effect of domestic violence on women's earnings, when the levels and the frequency of abuse are considered. An index for domestic violence is designed to capture the variation observed, challenging the traditional use of a dichotomous variable within this context. In addition, to conduct a causal analysis, an instrument indicating the husband's random irritability is created. Findings show that women exposed to higher levels of domestic violence, economic, emotional or physical, struggle with lower salaries. Physical violence is the type of abuse with the largest negative incidence on earnings, followed by economic and emotional violence, respectively.

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# Declaration

I, Silvia Edith Aguirre Rodríguez, declare that this thesis entitled, "Essays on the Economics of the Family in Mexico" is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as references.

*Genesis 2:24 "Therefore a man shall leave his father and his mother and hold fast to his wife, and they shall become one flesh."*

# Introduction

There are 31.9 million households in Mexico, 88 percent considered family households.[1] Families are the foundational units determining the shape of societies. Consequently, changes in family structure have profound social and economic implications. Marriage has historically been the core element in family formation and it is perhaps the oldest social institution. However, trends in marriage have been changing notably worldwide, and Mexico has not been an exception, especially over the last decades. Marriage rates have declined while divorce rates have increased. This thesis aims to explain major drivers for these outcomes and to add to our understanding of the economics of the family.

Before Gary Becker published in 1973 the paper *A theory of marriage: Part I*, with the exception of an unpublished paper by Gronau (1970), no previous research by economists in this field had been done. Since then, the interest of economists has steadily increased and nowadays a vast collection of literature on the economics of the family can be found.

The theoretical model that Becker (1973) develops explaining the marriage decision has prevailed over time and remains as the fundamental economic approach to analyse marital patterns. In order to apply preference theory, the model relies on two assumptions, that individuals marry voluntarily and the existence of a marriage market where people search for a partner, given a set of restrictions.

Two decades after Becker established the economic framework to analyse marriage decisions, Weiss (1997) based on the idea that rational individuals decide to marry as a result of a utility maximization process, identifies two main marriage models, matching and search models. In the first model *Stable Matching*, equilibrium exists if no one that is married would like to be single and if there are no two individuals of opposite sexes that prefer being married between them instead of their current assignments. In the second model, the *Search* model, participants invest time and money trying to find their best match. Equilibrium is determined by the searching costs for a partner and by the searching policies of the other participants.

[1] INEGI 2015 Intercensal Survey. A family household consists of two or more individuals who are related by birth, marriage, or adoption, and one of them is the head of the household.

Interestingly, both Becker and Weiss allow for the possibility to divorce. Divorce has potential effects on several important dimensions in economics, including income distribution, well-being, crime and health, amongst others. From a microeconomic perspective, divorce can be seen as a positive mechanism that increases the individual's utility because the marriage will be ended if the husband, the wife, or both, expect to be better off divorced (Becker 1993). It has also been demonstrated that despite the traumatic experience that divorce can be in the short-run, the existence of psychological gains for divorcing couples is undeniable (Gardner and Oswald 2006). On the other hand, it is observed that married people are happier, healthier and live longer (Wilson and Oswald 2005). Evidence also suggests that divorce worsens economic conditions, increasing income inequality and violent crime rates (Caceres-Delpiano and Giolito 2012).

In addition, empirical research has been conducted to identify the effect of different factors that influence divorce decisions. Freiden (1974) demonstrates through a model of marriage that the potential returns to marriage and the cost of divorce explain some of the differences in marital behaviour in the United States. Goldin and Katz (2002) indicate that the birth control pill reduces the cost of waiting to marry, leading to longer and more informative courtships, and lowering the probability of divorce. Thompson (2008) shows that poor communication contributes to marital instability and predicts that the probability of divorce increases when there are communication problems. Dahl and Moretti (2008) investigate channels through which the gender of children affects family structure, finding that parents who have girls first have been historically more likely to be divorced than those having boys first.

This dissertation aims to address three main questions: Is education one of the mechanisms to prevent divorce? Do changes in divorce legislation have an impact on divorce rates in a developing country? Is it possible to estimate more accurately the effect of domestic violence on women's earnings?

Despite the relevant role attributed to education on marital outcomes, the existing literature does not show a generalized consensus regarding a positive or negative effect from education on marital decisions. Chapter 1 analyses the impact of education on marriage dissolution exploiting a change in the length of compulsory education in Mexico in 1993 as an instrument for education. The federal government increased compulsory education from completion of primary school, sixth grade, to completion of secondary school, ninth grade, at a national level. In the first part of the analysis, the probit models show that education is significant and negatively related to the probability of marital

breakdown. An additional year of education is associated with a decrease between 0.6 and 0.9 percentage points in the probability of marital disruption for the 2002-2012 period. However, the results using the instrumental variables methodology indicate that an additional year of schooling has no effect on the probability of marriage dissolution. This finding demonstrates that the relationship between education and divorce is not causal and suggests that although higher levels of education are an undeniable trait observed in non-broken marriages, it is not education by itself one of the mechanisms leading to better marriage outcomes.

Extending on the interest on divorce outcomes and after observing the remarkable growth of divorce rates over the past few decades in Mexico, but especially after the introduction of unilateral divorce, Chapter 2 investigates the effect of the changes in unilateral legislation on divorce rates in the country. In 2008 Mexico City was the first entity to approve unilateral divorce in Mexico and since then, 17 states out of 31 have also moved to eliminate fault-based divorce. Following a difference-in-differences methodology, two models are developed using state-level panel data. The results indicate that no-fault divorce accounts for a 26.4 percent increase in the total number of divorces in the adopting states during the period 2009-2015. Moreover, since no-fault divorce has been implemented gradually in the country, the rising trend in divorce rates is expected to continue over the coming years. Unilateral legislation has shown to be an effective tool in modifying family structures in Mexico, so it is relevant to be aware of the short- and medium-term consequences of the shift towards no-fault divorce, in order to improve the delivery of these policies in the country. This is especially important at this point in time, when 14 remaining states may potentially adopt unilateral legislation. This paper is the first one to address the effect of adopting unilateral divorce in the context of a Latin American country.

Given the important role that domestic violence may play triggering the divorce decision and affecting the structure of the families, Chapter 3 provides the first empirical evidence on the causal effects of intimate partner violence on women's earnings, when the levels and the frequency of abuse are considered. An index for domestic violence is designed to capture the variation observed, challenging the traditional use of a dichotomous variable within this context. In addition, to conduct a causal analysis, an instrument indicating the husband's random irritability is created. Results show that women exposed to higher levels of domestic violence, economic, emotional or physical, struggle with lower salaries. Physical violence is the type of abuse with the largest

negative incidence on earnings, followed by economic and emotional abuse, respectively. A one standard deviation increase in the physical violence index reduces earnings by 6.6 percent. Likewise, economic and emotional violence reduce earnings by 5.3 percent and 4.7 percent respectively. The stronger negative effect from physical abuse can be interpreted as a clear indication that this type of violence is the most difficult to cover. It is also observed that OLS underestimates the effect and the instrumental variables technique is relevant to correctly assess the impact of domestic violence on women's earnings.

Finally, in terms of the findings and policy implications derived from this thesis, Chapter 1 highlights that education is a powerful tool to reduce social, cultural and economic disadvantages; however, social studies that assume a causal relationship between education and marital disruption may need to be carefully rethought to disentangle the true effect of education on marital decisions. Chapter 2 sheds light on the effectiveness of policies addressed towards divorce legislation, allowing individuals who no longer wish to remain in a marriage to end it in a less costly, less time-consuming and less strenuous way. But it also poses the question of whether relaxing divorce laws encourages couples to quit their marriages more easily. Chapter 3 emphasizes that Mexico has a low female labour market participation and high gender-based violence rates, and draws attention to the importance to stimulate research and public polices to improve the position of women in the Mexican society.

# Chapter 1. The (non) impact of education on marital dissolution

## 1 Introduction

Significant research has been carried out to determine the effect of different factors that influence divorce decisions. Evidence suggests that female labour force participation, the family structure, and the costs of divorce, amongst others, have an impact on marital dissolution (Chiappori et al. 2009; Dahl and Moretti 2008; Freiden 1974). Education has traditionally been identified as one of the main traits that influence marriages. The accumulated level of schooling that each partner brings into the marriage is an important predictor of marriage stability. A higher level of schooling for either the wife or the husband stabilizes the marriage, as does complementarity in the schooling levels of the two partners (Weiss and Willis 1997). Education is also seen as an insurance against a bad marriage. The disparities in earning power and education across genders have contributed to create a vulnerable economic position for married women, and women in bad marriages are typically faced with suffering one of two fates: either divorce and struggle as low-income single mothers, or remain trapped in the marriage. In this sense education provides a route to emancipation for women (Guvenen and Rendall 2015). However, literature does not show a generalized consensus regarding a positive or negative effect from education on marital decisions. Marriages between highly educated individuals have greater gains because of the spouses' high levels of market and nonmarket skills. On the contrary, they have lower gains because they typically involve less specialization between spouses, since higher educated individuals participate more in the labour force. Consequently, there is no clear theoretical prediction about the net effect of schooling level on the gains from marriage (Becker et al. 1977).

It has been argued that higher educated individuals are better equipped to deal with the costs of divorce, since it can be easier for them to understand and handle the legal process. This contributes to them feeling less risk averse to take the divorce decision and therefore to be more prone to file for divorce (Hoem and Hoem 1992). In addition, moral objections against divorce tend to lessen for individuals with higher levels of education and there is

an increased confidence that they can set up a new and independent home (Kalmijn and Poortman 2006).

In contrast, higher-educated men have more liberal views on women's work and are generally more willing to participate in child rearing. This makes them more attractive to higher educated women and leads to more satisfaction in their marriages, lowering the risk of divorce (Kalmijn 2003). In support of this approach, education may increase the benefits of marriage because well-educated couples can interact better and build up stronger relationships, improving the quality of their marriages (Amato 1996).

Despite the relevant role of education on marriage outcomes, there are relatively few empirical studies focused on this relationship. Initially for the United States an ambiguous effect between education and marital dissolution is found (Becker et al. 1977). Later on, the influence of various socioeconomic and demographic factors on the probability of marital disruption, including education, is estimated for young black and white women aged 14 to 24 who were married at any point between 1968 and 1973. For both groups, the negative association between education and marital disruption probabilities is highly significant (Mott and Moore 1979). More recently, the trends in marriage dissolution rates by educational level for American women during 1975 to 1994 have been measured. The results indicate that marital dissolution rates fell among women with a 4-year college degree or more, but remained high among women with less than a 4-year college degree (Martin 2006). Expanding the research to analyse not only the United States, but also 16 additional countries, findings for Austria, Belgium and Lithuania support the conclusion that women with higher education face a lower risk of divorce. However, the data for France, Greece, Italy, Poland, and Spain, indicates the opposite, with a positive educational gradient of divorce. For the rest of the countries, Estonia, Finland, West-Germany, Hungary, Latvia, Sweden, Switzerland and Norway, no relationship between education and divorce is found (Harkonen and Dronkers 2006). For the United Kingdom, Berrington and Diamond (1999) investigate the hypothesis that there is a positive association between education and marital stability, but that this relationship is reduced once early marital factors such as the age at marriage and childbearing status are controlled for. The results suggest that individuals with degree-level qualifications are less likely to experience marital separation than those with lower levels of education. These educational effects are reduced when age at marriage is entered into the model and tend to increase once premarital cohabitation and childbearing status are included. Hewitt, Baxter and Western (2005) analyse the social factors associated with marital breakdown

in Australia. The authors find that higher education reduces the probability of divorce for men. In contrast, women with a bachelor's degree or higher qualifications face a higher probability of marriage breakdown than women in the lowest educational levels. Therefore, the husband's education increases the stability of the marriage, while higher levels of education allow women to leave an unsatisfactory marriage.

There is clearly conflicting evidence about the effect of education on marital stability. Some literature argues a positive relationship while other claims a negative impact. However, none of these studies demonstrate a causal effect, and the impact of education on marital dissolution is still an unresolved empirical question worthy to address in this study. To accomplish this target, the analysis is conducted in two parts. First, different probit model specifications are estimated to examine the impact of education, and other divorce determinants, on the likelihood of marital dissolution in Mexico. Later, to identify not only the impact of education on marital disruption but its causal effect, the use of an instrumental variable for education is incorporated into the analysis due to the potential omitted-variable bias in the model. I believe this study is the first to formally address the causality literature within this context.

The length of compulsory education was raised in Mexico in 1993. The federal government increased compulsory education from completion of primary school, sixth grade, to completion of secondary school, ninth grade,[2] at a national level. This modification in 1993 is an exceptional opportunity to create an instrument for education in Mexico, exploiting this change in the law as an exogenous variation in the number of years of schooling.

In the seminal work of Angrist and Krueger (1991), compulsory education laws are presented for the first time as a natural experiment. Although the quarter of birth is the instrument used for education, and not the compulsory school attendance per se, the authors provided the basis for further research on this subject. Changes in compulsory schooling laws as an instrument for education have been used to study the economic returns to schooling (Harmon and Walker 1995), to estimate the effect of education on participation in criminal activity (Lochner and Moretti 2004), to determine whether education has a causal effect on mortality (Lleras-Muney 2005), to analyse the quantity of education on the distribution of earnings (Brunello et al. 2009), amongst others. Yet,

[2] In Mexico children enter primary school at age six and typically finish secondary education around age 14 or 15.

we still know nothing about the true impact of education on marriage dissolution. This paper fills this gap.

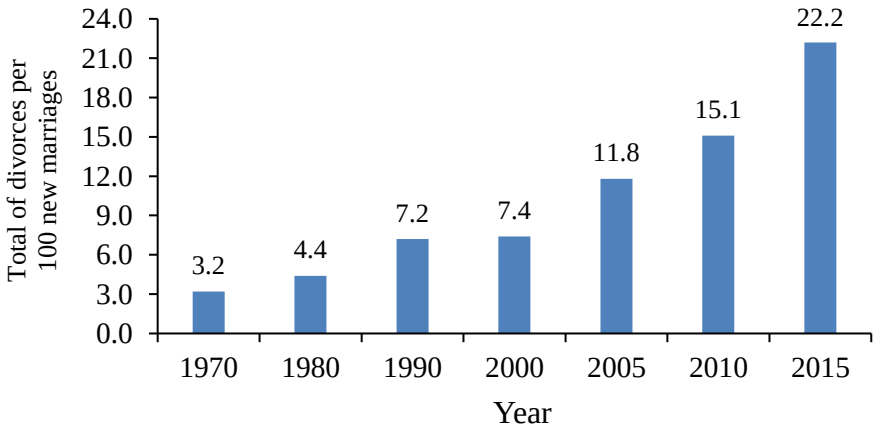
The results obtained from the probit specifications indicate that an additional year of education reduces the probability of marital breakdown between 0.6 and 0.9 percentage points. However, when determining its causal effect, although still negative in sign, the estimates indicate that education does not have a statistically significant effect on the probability of marital dissolution. This finding demonstrates that the effect found between education and divorce through the probit estimations is not causal and suggests that although higher levels of education are a trait observed in non-broken marriages, it is not education by itself one of the mechanisms leading to better marriage outcomes.

The paper is organized as follows: Institutional details of divorce in Mexico are described in Section 2. Section 3 presents the data. In Section 4 the estimation strategy is discussed, followed in Section 5 and Section 6 by the empirical findings. Section 7 concludes.

## 2 Institutional details of divorce in Mexico

Over the last forty-five years, and especially during the past two decades, the number of divorces relative to the number of new marriages per year has increased substantially in Mexico (see Figure 1.1). According to data from the National Institute of Statistics and Geography (INEGI), in 1970 for every 100 new marriages there were three divorces. By 1990 and 2000 this rate rose to seven, and in 2015 it reached 22 per 100 new marriages.

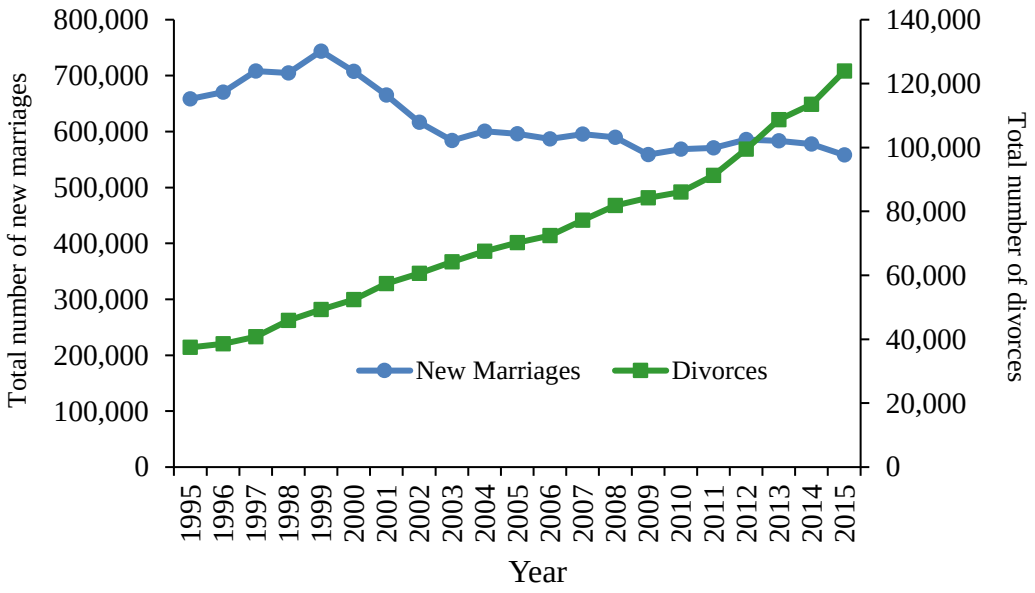
**Figure 1.1** Divorces per 100 new marriages in Mexico




Source: National Institute of Statistics and Geography (INEGI).

These changes are the combination of less couples getting married and more couples getting divorced every year (see Figure 1.2). During the period from 1995 to 2015, the average rate of growth is -0.7 percent for the total number of new marriages, and 6.2 percent for the total number of divorces.

**Figure 1.2** Evolution of new marriages and divorces in Mexico

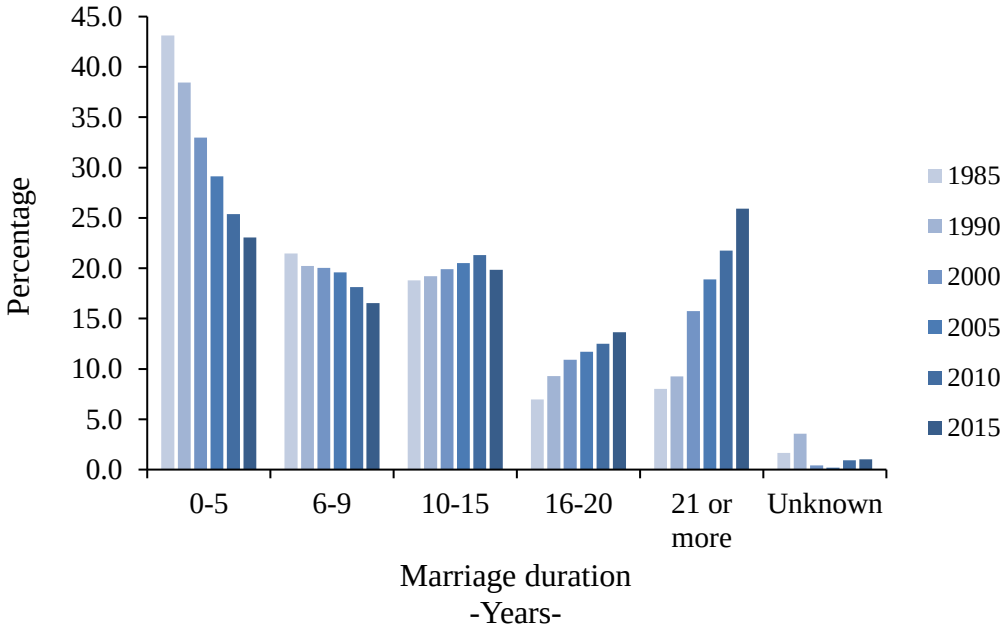



Source: National Institute of Statistics and Geography (INEGI).

Despite these changes in the marital patterns in Mexico and the important consequences of divorce on individuals and societies, this topic has not yet become relevant for policy makers or researchers in the country, and there is a lack of formal economic studies exploring the relationship between socio-economic factors and marriage dissolution.

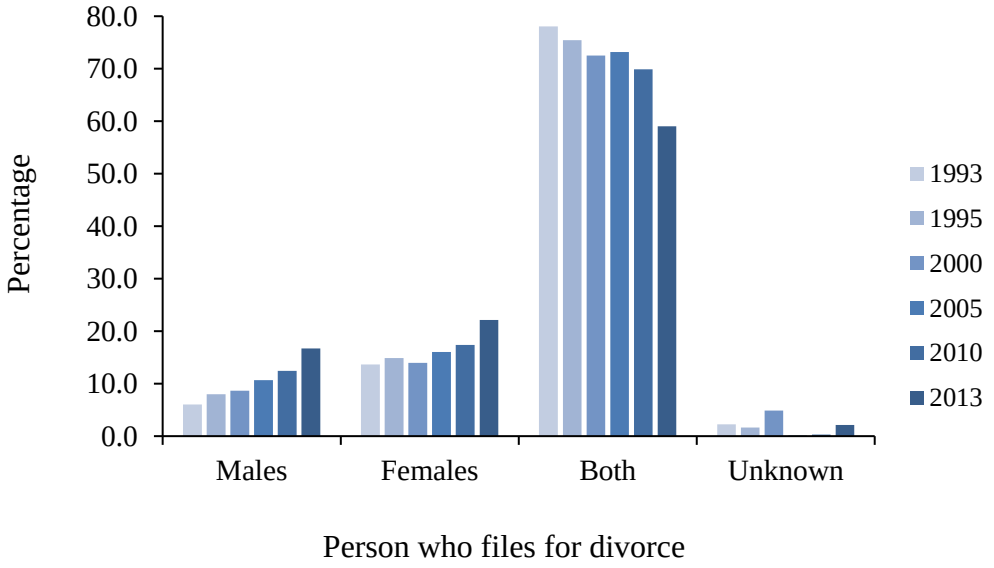
An important modification in marital patterns is presented in Figure 1.3. In 1985, 43 percent of the divorcing couples had a marriage that lasted no more than 5 years, while only 8 percent of the couples that got divorced had 21 or more years married. By 2015, these percentages were 23 percent and 25 percent, respectively. This means that even though in general terms the length of the marriage is an important factor that brings stability to the union, recently, couples are getting divorced regardless of the time they have spent together. In addition, in 1993, 78 percent of the divorces were filed by the couple, but ten years later, in 2013, only 59 percent of the divorces remained in this category (see Figure 1.4).

**Figure 1.3** Divorces per year by marriage duration




Source: National Institute of Statistics and Geography (INEGI).

**Figure 1.4** Divorces per year by person who files for divorce

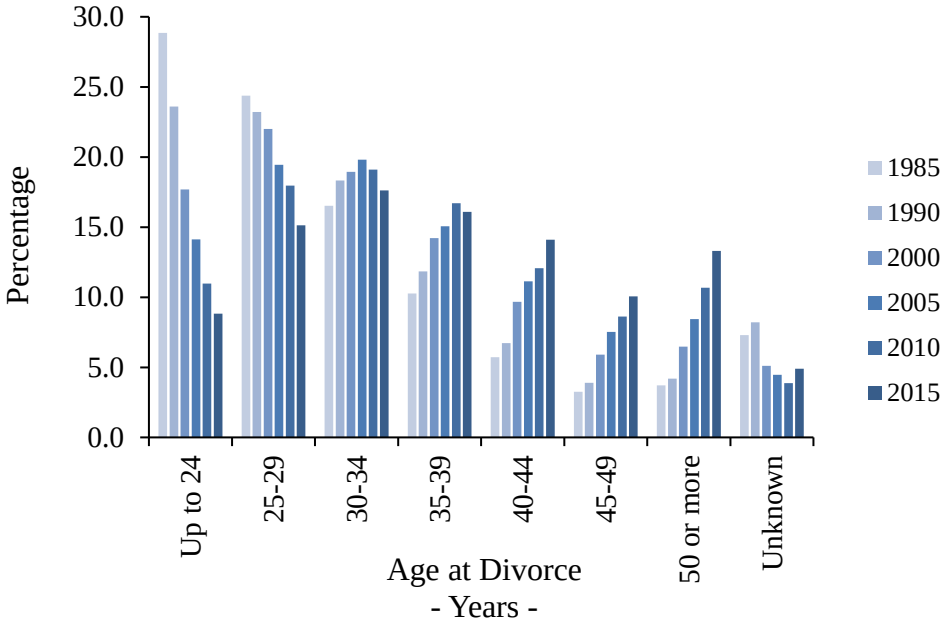



Source: National Institute of Statistics and Geography (INEGI).

Figure 1.5 and Figure 1.6 complement the above information showing that for both, females and males, the age at divorce presents a similar pattern, with a decrease over time in the percentage of the younger group of people getting divorced and an increase in the

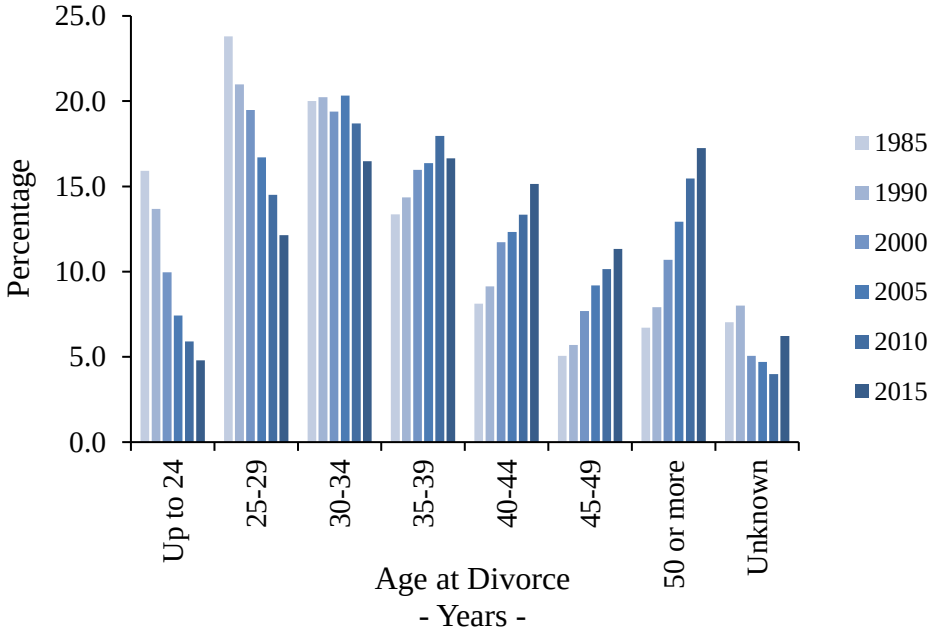
percentage of the older group of people doing so. It should be highlighted that despite these changes, more than 50 percent of the people that got divorced in 2015 were still under 40 years of age.

**Figure 1.5** Divorces per year by age at divorce -Females-




Source: National Institute of Statistics and Geography (INEGI).

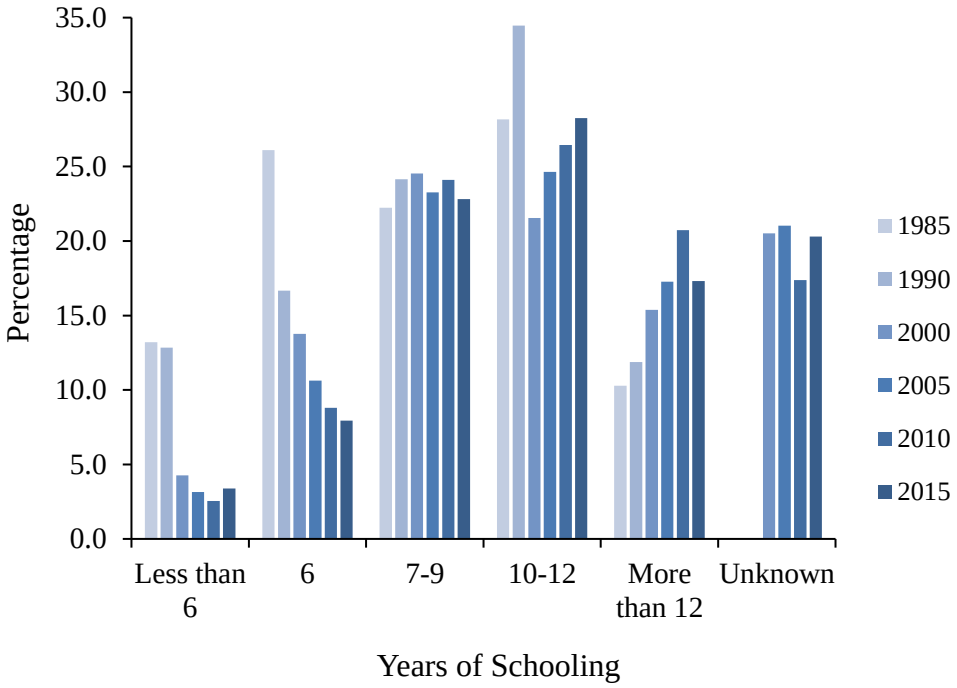
**Figure 1.6** Divorces per year by age at divorce -Males-




Source: National Institute of Statistics and Geography (INEGI).

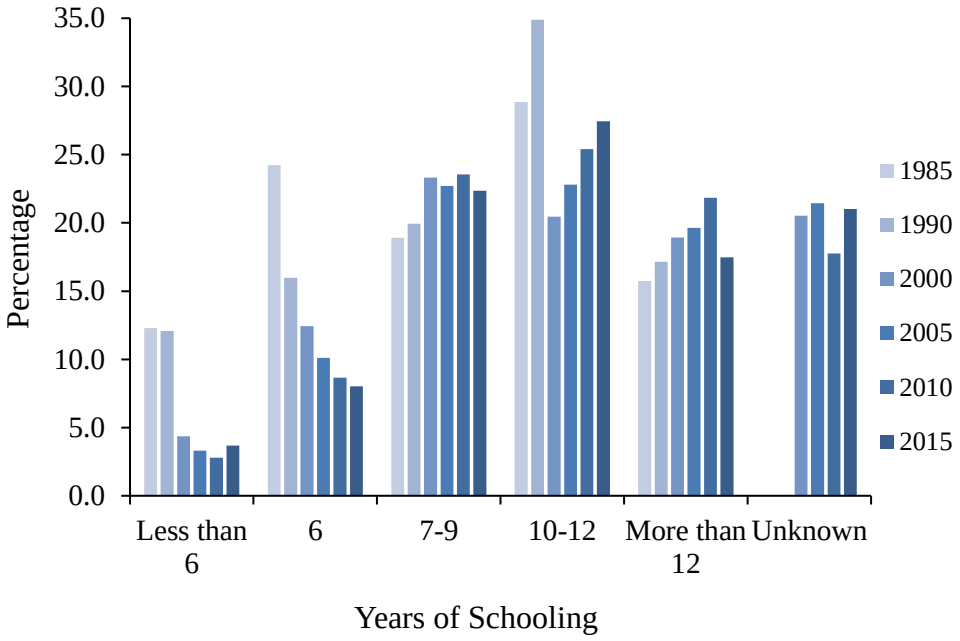
Finally, the percentage of females with six or less years of education getting divorced declined almost 28 percentage points between 1985 and 2015 (see Figure 1.7). The corresponding decline for males was 24 percentage points (see Figure 1.8). In contrast, the percentage of females getting divorce with more than 12 years of education was 10 percent in 1985 and 17 percent twenty years later in 2015. Comparing the percentage for males in this same category, the incremental shift was from 15 percent to 17 percent. The cohorts with secondary education (7-9 years of schooling) for females and males, have behaved similarly during the 30-year period, fluctuating around 22 percent of people divorced. But the most noticeable aspect to highlight is that around 30 percent of the people divorced in 1985 and in 2015 were in the 10-12 years of schooling cohort. As a consequence, approximately 70 percent of the total population that has experience divorce in the past 30 years have attended as a maximum only 12 years of schooling.

**Figure 1.7** Divorces per year by years of schooling -Females-




Source: National Institute of Statistics and Geography (INEGI).

**Figure 1.8** Divorces per year by years of schooling -Males-




Source: National Institute of Statistics and Geography (INEGI).

# 3 Data

The Mexican Family Life Survey (MxFLS) is the first longitudinal, multi-thematic survey representative of the Mexican population at national, urban, rural and regional levels. The MxFLS collects information on a wide range of socioeconomic and demographic indicators at the individual, household, and community level, providing retrospective information on education and marriage, amongst others, for each one of the individuals that comprise the sample. There have been three rounds: 2002, 2005-2006 and 2009-2012, and the data for this 10-year period is public.[3]

A common problem that researchers face in Mexico is the lack from suitable data. The possibility to conduct research using the information from the Mexican Family Life Survey is a unique opportunity to understand in more detail the structure of the families in the country, and especially since the MxFLS third round, according to the original design of the MxFLS survey, will probably be the last one collected.

[3] www.ennvih-mxfls.org.

The dependent variable in the analysis is marital status ($Ds$), defined as 1 if the person has ever been divorced or separated from marriage[4] or 0 if is currently married with no previous divorce or separation history. The main independent variable, education, is a measure of the number of years of schooling ($Ed$). This is the standard approach followed in most of the relevant literature, and for this case it has been computed using the available information on the latest level of schooling reached by the individual, the latest grade concluded, and if the person obtained the certificate of completion for some levels of education (high school, undergraduate and postgraduate).

Given that the MxFLS is a household survey, if all the observations were included in the analysis, then a double count of married individuals from the same household would be present in the study. In order to define an appropriate strategy to identify the impact that education has on the probability of marital dissolution and to deal with a potential distortion generated if duplicated observations for a household were considered when keeping the information for the husband and also for the wife, the strategy to follow is to use the record of the individual in the household with the highest level of education. Then if the wife has 8 years of education, but the husband has 9 years, the information of the latter is used.

A typical approach is to conduct the analysis separately for women and men. However, due to the sample size, the *highest educated* option is considered the most suitable path to follow. Although this is the main strategy, robustness checks are also provided using the average level of education for married couples, and the gender strategy, splitting the dataset between women and men. The purpose is to compare how different the results are when following these other approaches and to verify if the main findings are still valid.

## 3.1 Summary statistics

Descriptive statistics on the variables used in the analyses are presented in Table 1.1. Slightly more than half of the sample consists of females (54 percent) representing 53 percent of the married subsample and 64 percent of the divorced subsample. 55 percent of the individuals live in urban areas, and not surprisingly, less than 19 percent belong to

[4] The MxFLS allows to distinguish from those separated from marriage and those separated from cohabitation. Typically, studies consider separated individuals as part of their divorced subsample (Becker at el. 1977; Marinescu 2015), therefore, for this study divorced and separated persons are treated as part of the same group.

an ethnic group and only 51 percent are employed (which is consistent with most of the females not reporting earnings as will be shown below). In addition, 50 percent of the married subsample consists of people with more than 20 years of marriage, and people with 5 or less years of marriage duration represent the highest share in the divorced subsample (37 percent). Around 17 percent of the individuals have been affected by the reform, and the birth cohort of people born between 1929 and 1948 has the lowest representation in the sample (19 percent).[5] Finally, as it can be observed, 8 percent of the sample are divorced individuals.

**Table 1.1** Descriptive statistics

| **Description** | **Overall sample %** | **Married %** | **Divorced %** |
|---|---|---|---|
| Females | 54.6 | 53.7 | 64.6 |
| Urban Strata | 55.7 | 54.5 | 68.3 |
| Ethnic group | 18.8 | 19.3 | 13.0 |
| Employed | 51.6 | 51.0 | 57.8 |
| 0-5 years of marriage duration | 13.9 | 11.8 | 37.3 |
| 6-10 years of marriage duration | 11.5 | 11.0 | 17.7 |
| 11-15 years of marriage duration | 11.1 | 10.6 | 16.2 |
| 16-20 years of marriage duration | 11.8 | 11.7 | 11.8 |
| More than 20 years of marriage duration | 51.5 | 54.7 | 16.8 |
| Affected by the reform | 17.1 | 17.7 | 11.3 |
| Birth cohort 1929-1948 | 19.2 | 19.2 | 19.3 |
| Birth cohort 1949-1968 | 41.0 | 40.5 | 46.7 |
| Birth cohort 1969-1988 | 39.7 | 40.2 | 33.8 |
| **Total of observations** | **12 501** | **11 458 (91.7%)** | **1 043 (8.3%)** |

Source: Mexican Family Life Survey (MxFLS).

Table 1.2 presents the average years of schooling, age at marriage, and number of children, for married and divorced people. Although the differences between these two subsamples are not very large, on average, divorced individuals are higher educated, go into marriage younger and have more children.

[5] People born before 1929 and after 1988 were excluded from the sample due to the scarce number of observations available in each of these years.

**Table 1.2** Descriptive statistics – Mean and standard deviation values

| Description | Overall sample | | Married | | Divorced | |
|---|---|---|---|---|---|---|
| | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation |
| Years of schooling | 6.6 | 3.6 | 6.5 | 3.6 | 6.8 | 3.6 |
| Age at marriage | 21.7 | 5.6 | 21.8 | 5.6 | 20.7 | 5.4 |
| Number of children | 3.4 | 2.6 | 3.3 | 2.6 | 3.7 | 2.7 |

Source: Mexican Family Life Survey (MxFLS).

According to the MxFLS fieldwork protocols the individuals who answered the marital history section in the MxFLS first round did not have to re-answer it in the second and third rounds. They only had to update this information if they changed their marital status since the previous round. Therefore, the above statistics are based on information provided in the three rounds.[6] In addition, it is important to mention that the information for an individual has been completed using the data provided during the three rounds. For instance, if an individual reported a divorced marital status in round one but the years of education are not available, then, round two and three are used to obtain the level of education for this person, if reported in any of them.

Two additional factors may be considered important when analysing marital decisions, earnings and the years of schooling not only of the individual that is under analysis, but also the level of education of the other person involved in the relationship. Table 1.3 presents the number of observations reporting missing values in the variable earnings for each round.[7] Earnings are not reported for a large proportion of observations.[8] For instance, in the second round, 83 percent of all married women have missing data, given their low participation in the labour market. Regarding the inclusion in the model of the years of schooling of the other person involved in the relationship, the issue is again related to the levels of non-response. 27 percent of the divorced population did not provide information about the years of schooling of their ex-husbands or ex-wives. Even though there are techniques to impute omitted values, or indicator variables could be created to control for not reported values, since the percentages of missing information are so high, these options are left out and it has been decided not to consider these two variables in the study rather than to include them.

[6] The final dataset includes all those who turned to divorce or separated in the second and third rounds as well.
[7] The variable considered is the income reported in the last twelve months.
[8] There are two reasons for these missing values, the person does not work or the person is working but did not report the information.

**Table 1.3** Earnings – Missing values

| Round | Married | | | | Divorced/Separated | | | |
|---|---|---|---|---|---|---|---|---|
| | Females | | Males | | Females | | Males | |
| | Total | % | Total | % | Total | % | Total | % |
| First round | 5 041 | 81.8 | 1 942 | 36.6 | 411 | 60.9 | 126 | 34.1 |
| Second round | 5 162 | 83.8 | 2 018 | 38.0 | 449 | 66.6 | 159 | 43.0 |
| Third round | 5 191 | 84.2 | 2 562 | 48.3 | 479 | 71.0 | 196 | 53.1 |

Source: Mexican Family Life Survey (MxFLS).

# 4 Estimation strategy

## 4.1 Identification strategy

To identify the causal effect of education on marital dissolution the following equations are estimated:

$$Ds_i = \beta_{Ed}Ed_i + \beta_{Am}Am_i + \beta_{Ch}Ch_i + \beta_{Es}Es_i + \beta_{Ar}Ar_i + \beta_{Et}Et_i + \beta_{Md}Md_i + \beta_{Bc}Bc_i + \beta_{Gn}Gn_i + v_i \quad (1)$$

$$Ed_i = \beta_{In}In_i + \beta_{Am}Am_i + \beta_{Ch}Ch_i + \beta_{Es}Es_i + \beta_{Ar}Ar_i + \beta_{Et}Et_i + \beta_{Md}Md_i + \beta_{Bc}Bc_i + \beta_{Gn}Gn_i + \varepsilon_i \quad (2)$$

Where $Ds$ is a binary indicator for marital status (divorced/separated = 1), $Ed$ are the years of schooling, $Am$ is the age at marriage, $Ch$ is the number of children, $Es$ is the employment status (employed = 1), and $Ar$, $Et$, $Md$, $Bc$, $Gn$, and $In$, are indicator variables for area where the individual lives (urban area = 1), ethnic group (belongs to an ethnic group = 1), marriage duration (0-5 years = 1, 6-10 years = 2, 11-15 years = 3, 16-20 years = 4, more than 20 years = 5), birth cohort (born between 1929-1948 = 1, born between 1949-1968 = 2 and born between 1969-1988 = 3), gender (woman = 1), and instrument (affected by the change in the law = 1), respectively. Specification (1) is based on Becker at el. (1977) but it has been adapted for the Mexican case and according to the information available. It also represents the probit model to be estimated in the first part of the analysis. In Becker's model, two regressions were estimated separately, one for

men and another for women. In this case due to sample size, it has been decided to estimate on the pooled sample and to control for gender instead.

Given that the dependent variable in the analysis is dichotomous and the endogenous regressor is continuous, the maximum likelihood estimation using an IV probit model is the preferred approach to follow. This procedure is adopted over the two-stage least squares (2SLS) regression analysis, because maximum likelihood makes stronger specification assumptions, being more efficient than other estimators. In addition, it allows to predict outcomes between 0 and 1, while in 2SLS there is nothing to bind the value to the [0-1] range (Lewbel et al. 2012).

## 4.2 Validity of the instrument

Table 1.4 shows the enrolled students and potential students in secondary school during the period 1988-1998. In the academic years previous to the change in the law, a percentage decrease is observed in the ratio enrolled/potential students in 1989-1990 and 1990-1991, and a slight increase is registered in 1991-1992 and 1992-1993. However, in the academic year directly affected by the reform, 1993-1994, and the two subsequent academic years, this ratio shows higher percentage increases. To the best of my knowledge, there were no other modifications that would have affected the educational attainment around the reform date, therefore this can be considered a positive indicator about the validity of the instrument.

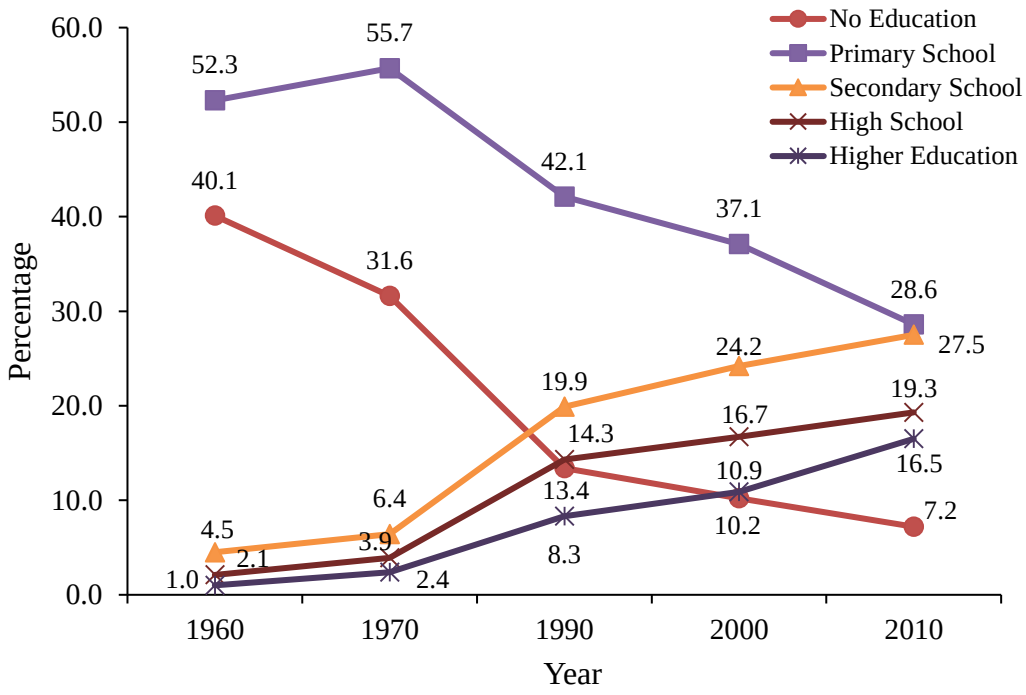
**Table 1.4** Enrolled and potential students – Secondary school

| Academic year | Enrolled students | Potential students | % (Enrolled / Potential) | % increase |
|---|---|---|---|---|
| 1988-1989 | **4 355 334** | 7 438 743 | 58.5 | |
| 1989-1990 | **4 267 156** | 7 410 859 | 57.5 | **-0.9** |
| 1990-1991 | **4 190 190** | 7 354 602 | 56.9 | **-0.6** |
| 1991-1992 | **4 160 692** | 7 286 822 | 57.1 | **0.1** |
| 1992-1993 | **4 203 098** | 7 221 894 | 58.2 | **1.1** |
| 1993-1994 | **4 341 924** | 7 169 977 | 60.5 | **2.3** |
| 1994-1995 | **4 493 173** | 7 135 485 | 62.9 | **2.4** |
| 1995-1996 | **4 687 335** | 7 118 062 | 65.8 | **2.8** |
| 1996-1997 | **4 809 266** | 7 115 739 | 67.5 | **1.7** |
| 1997-1998 | **4 929 301** | 7 127 587 | 69.1 | **1.5** |

Source: Enrolled students: Secretariat of Public Education. Educational statistics. Historical statistics.
Potential students: Author's elaboration based on World Bank data. World Development Indicators. Population, total and Birth rate, crude (per 1 000 people).
http://data.worldbank.org/indicator/SP.POP.TOTL?locations=MX
http://data.worldbank.org/indicator/SP.DYN.CBRT.IN?locations=MX

The highest attained level of education has increased considerably in Mexico. Figure 1.9 shows for 1960, 1970, 1990, 2000 and 2010, the percentage of the population aged 15 and older by level of education. As can be observed, the percentage of population with no education and only primary education has steeply decreased over time from 40.1 percent and 52.3 percent in 1960, respectively, to 7.2 percent and 28.6 percent in 2010, respectively. On the other hand, higher percentages for people with secondary school, high school and higher education, have been gradually reached. In 1970 only 6.4 percent of Mexicans attended secondary school, while in 1990 this percentage tripled.

**Figure 1.9** Percentage of population aged 15 and older -Level of education-




Source: National Institute of Statistics and Geography (INEGI). For some years percentages do not add up to 100 percent due to the non-specified category.

Since the instrument proposed tries to capture the causal effect by the exogenous variation induced by the 1993 reform, the existing positive trend in the levels of education has to be addressed in the analysis. Failure to account for it would generate biased estimations, because the growing tendency in the years of education would be incorrectly attributed to the instrument. In order to control for the positive trend in the years of education, individuals are grouped in three birth cohort groups, 1929-1948, 1949-1968 and 1979-1998. This also provides the opportunity to control for other possible intergenerational changes such as different attitudes towards divorce for example.

Another issue that has to be considered is the potential sample selection bias in the nature of the analysis being conducted. The dataset only includes people married, divorced and separated, and it is likely that those individuals who were affected by the reform and are married, divorced or separated at the time of the survey, are also those with lower levels of educational attainment.[9] However, the selection bias present in the sample is offset by another important feature of the dataset. The 1993 change in the law, encourages students that would previously have not attended or completed secondary education to stay in school until they finish it. However, it has no effect on those individuals who initially were determined to pursue higher levels of education. Clark and Royer (2013) show that these reforms generate only weak spillovers to higher levels of educational attainment. On the bases of the foregoing, all those persons with more than 12 years of education are excluded from the sample. Two main implications should be highlighted: 1) Not to consider the group of individuals above 12 years of education contributes to reduce the potential selection bias mentioned earlier. The higher the level of education, the less likely to be married, divorced or separated if affected by the change in the compulsory years of schooling. 2) The analysis is centered only on the effect of education on marital disruption for the group of people with no more than 12 years of schooling. Although the 2010 Census indicates that 82.6 percent of the Mexican population has as a maximum 12 years of education and 61.1 percent of the divorced population in 2010 are also in this group (up to 12 years of education), the findings in this analysis should carefully not be extended to the entire Mexican population.

# 5 Probability of marital dissolution

## 5.1 Empirical results

The marginal effects obtained for the probit specification established in this analysis, when treating schooling as exogenous, are presented in Table 1.5. Column (1) reports the results for the simplest model, when the age at marriage, the number of children and the employment status are not considered. It could be argued that these three covariates are

[9] All those who were born in 1979 were the first generation affected by the compulsory schooling change, since they were finishing 8th grade and starting 9th in 1993.

themselves affected by schooling, representing one of the channels by which education affects marriage dissolution. Therefore columns (2) to (4) show the estimations when adding these variables initially excluded from the model, one at a time. Finally, in column (5) the complete model specified is presented (Equation 1).

The relationship between all the explanatory variables and the probability of marriage dissolution is significant. Moreover, the data indicates that an additional year of schooling is associated with a decrease between 0.006 and 0.009 in the probability of marital dissolution, depending on the controls used, for those with 12 years of education as a maximum.[10] This means that for the period 2002-2012, an extra year of education makes an individual between 0.6 to 0.9 percentage points less likely to get divorced.

According to column (5), the age at marriage and belonging to an ethnic group reduce the probability of marriage dissolution by 0.01 and 0.02, respectively. Marriage duration also indicates that the longer the marriage, the lower the probability of marital breakdown. On the contrary, living in an urban area increases this probability by 0.03. All these four variables present the expected association according to literature. A variable that shows a different path is the number of children. The data indicates that in Mexico an additional child increases the probability of marriage dissolution by 0.006. A potential explanation for this to happen in the country, is that the analysis is restricted to the group of people with no more than 12 years of education, therefore, an additional child represents higher household expenditure, increasing internal financial family strain that leads to instability within the marriage. Finally, the employment status indicates that employed individuals increase by 0.04 their probabilities of separation. Yet this result should not be considered as conclusive as the others, because for this specific variable a different effect between the subgroups of women and men is expected. The issue will be addressed below, when a gender strategy for the probit estimation is performed.

It could be argued that the effect of education on marital dissolution seems to be relatively small versus other variables in the model, such as marriage duration. However, given that divorce rates early-on in marriages are higher, and later-on lower, the larger effect of the variable marriage duration is reasonable. In addition, considering that only 8.3 percent of the dataset are divorced individuals and the impact of an additional year of schooling is of the same magnitude as an additional child (but opposite in direction), the marginal effect obtained for the years of schooling should not be minimized at this stage.

[10] All results only apply to this subgroup even if not explicitly mentioned.

For instance, completion of secondary school (9 years of education) decreases in 1.8 percentage points the probability of marital dissolution, compared to completion of primary school (6 years of education).

The results for the complete model are in line with those reported in columns (1) to (4), for all the variables. In particular for education, a stronger negative effect on marital dissolution (0.009) is observed at first, and then it is reduced when the age at marriage and the number of children are incorporated to the model, but not when only the employment status is added.

**Table 1.5** Probit estimates

| | **Marginal Effects** | | | | |
|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Years of schooling | -0.009*** | -0.006*** | -0.007*** | -0.009*** | -0.006*** |
| | (0.0009) | (0.0009) | (0.0010) | (0.0009) | (0.0009) |
| Area (urban=1) | 0.044*** | 0.043*** | 0.045*** | 0.041*** | 0.039*** |
| | (0.0058) | (0.0054) | (0.0057) | (0.0057) | (0.0053) |
| Ethnic group | -0.026*** | -0.023*** | -0.027*** | -0.027*** | -0.025*** |
| | (0.0067) | (0.0061) | (0.0064) | (0.0065) | (0.0058) |
| Marriage duration | | | | | |
| 6-10 years | -0.191*** | -0.215*** | -0.209*** | -0.193*** | -0.224*** |
| | (0.0254) | (0.0253) | (0.0252) | (0.0255) | (0.0250) |
| 11-15 years | -0.310*** | -0.356*** | -0.341*** | -0.317*** | -0.382*** |
| | (0.0264) | (0.0267) | (0.0260) | (0.0264) | (0.0266) |
| 16-20 years | -0.483*** | -0.636*** | -0.517*** | -0.484*** | -0.655*** |
| | (0.0237) | (0.0254) | (0.0234) | (0.0238) | (0.0248) |
| More than 20 years | -0.585*** | -0.741*** | -0.616*** | -0.583*** | -0.754*** |
| | (0.0193) | (0.0186) | (0.0193) | (0.0196) | (0.0185) |
| Age at marriage | | -0.011*** | | | -0.010*** |
| | | (0.0006) | | | (0.0006) |
| Number of children | | | 0.010*** | | 0.006*** |
| | | | (0.0011) | | (0.0010) |
| Emp. Status (emp=1) | | | | 0.050*** | 0.047*** |
| | | | | (0.0070) | (0.0066) |
| Total of observations | 8 468 | 8 468 | 8 468 | 8 468 | 8 468 |

Source: Mexican Family Life Survey (MxFLS). Robust standard errors in parentheses. Marginal effects at sample means. All regressions include a constant term and gender and birth cohort control dummies. Marriage duration categorical base: 0-5 years of marriage. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level.

## 5.2 Probability of marital dissolution – Average schooling

As previously mentioned, to define an appropriate strategy to identify the impact that education has on the probability of marital dissolution, and to deal with a potential distortion generated if duplicated observations for a household were considered in the analysis since information was available for the husband and also for the wife, the

decision taken was to use the record of the individual in the household with the highest level of education. Thus, if the wife had 8 years of education, but the husband had 9 years, the information of the latter was used. The results obtained for this approach were presented in the previous section 5.1. The main purpose of this section is to compare the results when a different strategy is followed, when the average level of education for married couples is used in the study. It is important to include these results and to verify if the effect of schooling on the probability of marriage dissolution is still negative when the approach is modified. Table 1.6 provides the marginal effects for the five different specifications discussed earlier.

**Table 1.6** Probit estimates – Average schooling

| | **Marginal Effects** | | | | |
|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Years of schooling | -0.005*** | -0.003*** | -0.003*** | -0.005*** | -0.002*** |
| | (0.0010) | (0.0010) | (0.0010) | (0.0010) | (0.0010) |
| Area (urban=1) | 0.041*** | 0.040*** | 0.042*** | 0.038*** | 0.037*** |
| | (0.0059) | (0.0055) | (0.0058) | (0.0059) | (0.0054) |
| Ethnic group | -0.022*** | -0.020*** | -0.023*** | -0.023*** | -0.022*** |
| | (0.0070) | (0.0064) | (0.0068) | (0.0069) | (0.0061) |
| Marriage duration | | | | | |
| 6-10 years | -0.188*** | -0.212*** | -0.207*** | -0.190*** | -0.223*** |
| | (0.0252) | (0.0252) | (0.0251) | (0.0253) | (0.0249) |
| 11-15 years | -0.306*** | -0.351*** | -0.339*** | -0.313*** | -0.380*** |
| | (0.0264) | (0.0268) | (0.0260) | (0.0264) | (0.0266) |
| 16-20 years | -0.483*** | -0.637*** | -0.518*** | -0.484*** | -0.657*** |
| | (0.0236) | (0.0253) | (0.0233) | (0.0236) | (0.0247) |
| More than 20 years | -0.582*** | -0.739*** | -0.615*** | -0.581*** | -0.753*** |
| | (0.0193) | (0.0187) | (0.0192) | (0.0195) | (0.0185) |
| Age at marriage | | -0.011*** | | | -0.010*** |
| | | (0.0006) | | | (0.0006) |
| Number of children | | | 0.012*** | | 0.007*** |
| | | | (0.0011) | | (0.0011) |
| Emp. Status (emp=1) | | | | 0.048*** | 0.046*** |
| | | | | (0.0072) | (0.0067) |
| Total of observations | 8 468 | 8 468 | 8 468 | 8 468 | 8 468 |

Source: Mexican Family Life Survey (MxFLS). Robust standard errors in parentheses. Marginal effects at sample means. All regressions include a constant term and gender and birth cohort control dummies. Marriage duration categorical base: 0-5 years of marriage. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level.

A negative and significant impact on the probability of marital dissolution is reported for an additional year of schooling. As it can be expected, when using the average education of the household, rather than the highest level, the impact of schooling on the probability of marriage dissolution is smaller. Column (5) of Table 1.6 indicates that an extra year of education reduces by 0.2 percentage points the probability of marriage dissolution. The rest of the variables present a similar behavior. This evidence supports

the conclusions obtained through the main approach established in the first part of the analysis. It also contributes to dispel the argument that the inclusion in the dataset of the highest educated individuals is the real driving force for the findings in this study.

## 5.3 Probability of marital dissolution – Only women and only men

Typically, empirical studies based on marriage decisions are conducted splitting the dataset by gender. Then, conclusions obtained for the women subgroup are compared with the men subgroup. Due to the lack of surveys for Mexico that include variables such as the age of marriage, and the number of children for men, not much work has been devoted to study this topic. Although the information provided by the MxFLS survey offers an opportunity to analyse marriage dissolution decisions, splitting the dataset for females and males is not considered the best strategy to follow in here, given the instrument used to establish the causal effect between education and marital breakdown. The change in the compulsory years of education was implemented in 1993. If the only women/only men approach is followed, the number of people divorced and separated affected by this change is considerably reduced within each subset.

The limitation in the number of observations to conduct the analysis following the gender strategy restricts the IV methodology but not the probit estimation. Therefore, in this subsection, results are provided when the probit analysis is conducted by gender. The reader is asked to bear in mind that these results are presented only as complementary information, since they are not considered for the second part of the analysis, the causality approach.

Tables 1.7 and 1.8 present the marginal effects for the only women and only men subsamples, respectively. The variable years of schooling continues to exhibit a negative effect for both, the female and male subsamples, but it is only consistently significant for women. The results reported when the years of schooling are significant for both, women and men, column (1) and column (4) in Tables 1.7 and 1.8, indicate that an additional year of education decreases by 0.003 the probability of marital dissolution for women, while it only reduces in 0.001 the probability of marital dissolution for men. This finding highlights an important implication: the level of education that the wife brings into the marriage plays a more relevant role than the level of education of the husband, in terms of marital stability. Another notable finding is that an additional child increases only by

0.2 percentage points the probability of marital disruption for women, but it increases by 0.7 percentage points the probability for men (column [5] in Tables 1.7 and 1.8). As mentioned earlier, more children in the household represent higher financial strain. However, women are far more likely to stay with the children and continue to live in the family home than men after marriage dissolution. Therefore, as the number of children in the marriage increases, men have a greater opportunity than women to change their lifestyle through marital breakdown. This is an important result against the strategy commonly followed in other studies where the number of children is not considered when the marital decisions of men are modelled. Finally, and perhaps the most striking finding in this subsection: the variable employment status shows a positive impact for the only women results, while for the only men results it exhibits a negative effect. This variable is the only one that presents opposite signs when splitting the dataset by gender, suggesting for the particular subgroup of people with no more than 12 years of education, that employed females and unemployed males are more likely to be divorced. Taken together, these two results might be a potential indicator that production complementarities within the household (Becker 1993) are important in Mexico, with more stable marriages with working husbands and non-working wives.

**Table 1.7** Probit estimates – Only women

| | Marginal Effects | | | | |
|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Years of schooling | -0.003*** | -0.001 | -0.001** | -0.003*** | -0.001** |
| | (0.0008) | (0.0008) | (0.0009) | (0.0008) | (0.0008) |
| Area (urban=1) | 0.030*** | 0.030*** | 0.032*** | 0.023*** | 0.024*** |
| | (0.0055) | (0.0050) | (0.0055) | (0.0053) | (0.0048) |
| Ethnic group | -0.017*** | -0.016*** | -0.018*** | -0.019*** | -0.018*** |
| | (0.0065) | (0.0056) | (0.0063) | (0.0060) | (0.0050) |
| Marriage duration | | | | | |
| 6-10 years | -0.220*** | -0.258*** | -0.233*** | -0.227*** | -0.272*** |
| | (0.0293) | (0.0299) | (0.0294) | (0.0298) | (0.0303) |
| 11-15 years | -0.338*** | -0.384*** | -0.359*** | -0.352*** | -0.416*** |
| | (0.0309) | (0.0318) | (0.0310) | (0.0310) | (0.0321) |
| 16-20 years | -0.495*** | -0.661*** | -0.520*** | -0.498*** | -0.681*** |
| | (0.0276) | (0.0309) | (0.0279) | (0.0276) | (0.0298) |
| More than 20 years | -0.576*** | -0.752*** | -0.604*** | -0.570*** | -0.762*** |
| | (0.0236) | (0.0237) | (0.0242) | (0.0242) | (0.0239) |
| Age at marriage | | -0.009*** | | | -0.008*** |
| | | (0.0006) | | | (0.0005) |
| Number of children | | | 0.006*** | | 0.002*** |
| | | | (0.0011) | | (0.0009) |
| Emp. Status (emp=1) | | | | 0.071*** | 0.066*** |
| | | | | (0.0084) | (0.0079) |
| Total of observations | 6 833 | 6 833 | 6 833 | 6 833 | 6 833 |

Source: Mexican Family Life Survey (MxFLS). Robust standard errors in parentheses. Marginal effects at sample means. All regressions include a constant term and birth cohort control dummies. Marriage duration categorical base: 0-5 years of marriage. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level.

**Table 1.8** Probit estimates – Only men

| | Marginal Effects | | | | |
|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Years of schooling | -0.001** | -0.001** | -0.0007 | -0.001** | -0.0006 |
| | (0.0007) | (0.0006) | (0.0007) | (0.0007) | (0.0005) |
| Area (urban=1) | 0.024*** | 0.018*** | 0.022*** | 0.024*** | 0.017*** |
| | (0.0047) | (0.0039) | (0.0043) | (0.0047) | (0.0036) |
| Ethnic group | -0.008 | -0.007 | -0.008 | -0.008 | -0.006 |
| | (0.0053) | (0.0041) | (0.0046) | (0.0053) | (0.0037) |
| Marriage duration | | | | | |
| 6-10 years | -0.151*** | -0.178*** | -0.193*** | -0.150*** | -0.211*** |
| | (0.0344) | (0.0387) | (0.0360) | (0.0344) | (0.0392) |
| 11-15 years | -0.256*** | -0.357*** | -0.322*** | -0.255*** | -0.428*** |
| | (0.0339) | (0.0391) | (0.0349) | (0.0339) | (0.0397) |
| 16-20 years | -0.364*** | -0.569*** | -0.424*** | -0.363*** | -0.625*** |
| | (0.0311) | (0.0359) | (0.0326) | (0.0311) | (0.0365) |
| More than 20 years | -0.419*** | -0.620*** | -0.466*** | -0.417*** | -0.666*** |
| | (0.0280) | (0.0313) | (0.0302) | (0.0280) | (0.0324) |
| Age at marriage | | -0.005*** | | | -0.004*** |
| | | (0.0005) | | | (0.0005) |
| Number of children | | | 0.010*** | | 0.007*** |
| | | | (0.0010) | | (0.0009) |
| Emp. Status (emp=1) | | | | -0.011 | -0.012** |
| | | | | (0.0069) | (0.0058) |
| Total of observations | 5 668 | 5 668 | 5 668 | 5 668 | 5 668 |

Source: Mexican Family Life Survey (MxFLS). Robust standard errors in parentheses. Marginal effects at sample means. All regressions include a constant term and birth cohort control dummies. Marriage duration categorical base: 0-5 years of marriage. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level.

In terms of gender, this section enriches the previous findings. Interesting results are observed from this strategy, although due to sample size reasons it is not followed when determining the causal effect of education on marriage dissolution.

# 6 The causal effect of education on the probability of marital dissolution

To identify not only the association of education on marital disruption but its causal effect, the use of the 1993 change in the length of compulsory education in Mexico is incorporated into the analysis as an instrument for education. The IV probit estimates (Equation 1 and Equation 2) using models identical to the earlier probit specifications are presented in Table 1.9 and Table 1.10.

The results obtained for the Wald-test of exogeneity indicate that the null hypothesis of no endogeneity is rejected and therefore the use of an instrument for the years of schooling is an appropriate decision. This test is assessing whether the error terms in Equation (1) and Equation (2) are correlated. If the test is not significant, the null

hypothesis cannot be rejected and a probit regression would be the appropriate strategy to estimate the effect of education on marital dissolution, since there is no endogeneity and no need for instrumental variables (Wooldridge 2010).

**Table 1.9** IV probit estimates

| | **Marginal Effects** | | | | |
|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Years of schooling | -0.008* | -0.005* | -0.007 | -0.009* | -0.005 |
| | (0.0053) | (0.0031) | (0.0078) | (0.0050) | (0.0040) |
| Area (urban=1) | 0.042** | 0.040*** | 0.043 | 0.039*** | 0.037** |
| | (0.0172) | (0.0123) | (0.0302) | (0.0153) | (0.0153) |
| Ethnic group | -0.022* | -0.017** | -0.023 | -0.023** | -0.018* |
| | (0.0120) | (0.0084) | (0.0194) | (0.0117) | (0.0103) |
| Marriage duration | | | | | |
| 6-10 years | -0.277*** | -0.276*** | -0.287** | -0.277*** | -0.279*** |
| | (0.0730) | (0.0261) | (0.134) | (0.0662) | (0.0285) |
| 11-15 years | -0.462*** | -0.599*** | -0.482** | -0.463*** | -0.604*** |
| | (0.107) | (0.0609) | (0.206) | (0.0957) | (0.0842) |
| 16-20 years | -0.603*** | -0.851*** | -0.625*** | -0.600*** | -0.853*** |
| | (0.105) | (0.0648) | (0.201) | (0.0925) | (0.0892) |
| More than 20 years | -0.685*** | -0.922*** | -0.707*** | -0.681*** | -0.922*** |
| | (0.0555) | (0.0338) | (0.108) | (0.0490) | (0.0468) |
| Age at marriage | | -0.014*** | | | -0.013*** |
| | | (0.0036) | | | (0.0048) |
| Number of children | | | 0.009* | | 0.003** |
| | | | (0.0054) | | (0.0015) |
| Emp. Status (emp=1) | | | | 0.044*** | 0.039*** |
| | | | | (0.0152) | (0.0153) |
| Total of observations | 8 468 | 8 468 | 8 468 | 8 468 | 8 468 |
| Wald test of exogeneity | 96.07 | 260.88 | 42.18 | 106.81 | 171.0 |
| Prob > chi | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| First-stage coefficient instrument | 0.391*** | 0.693*** | 0.207** | 0.439*** | 0.492*** |
| | (0.104) | (0.107) | (0.103) | (0.104) | (0.106) |
| F-test for instrument | 14.0895 | 41.994 | 4.06411 | 17.8264 | 21.4003 |
| Prob > F | 0.0002 | 0.0000 | 0.0438 | 0.0000 | 0.0000 |

Source: Mexican Family Life Survey (MxFLS). Robust standard errors in parentheses. Marginal effects at sample means. All regressions include a constant term and gender and birth cohort control dummies. Marriage duration categorical base: 0-5 years of marriage. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level. *Statistically significant at the 90% confidence level.

A further important question is if the change in the number of years of compulsory education in Mexico is a valid instrument for the years of schooling or if this is a weak instrument. Since the first stage of the model specification is linear, the approach followed is to estimate its linear version and compare the obtained F-statistic for instrument weakness with the rule of thumb indicated by Staiger and Stock (1997). According to this rule, the F-statistic should be greater than 10 for weak identification not to be seen as a problem. Therefore, since the estimated value of the F-statistic for the simplest model

(column [1]) and the complete model (column [5]) are 14.0 and 21.4, respectively in Table 1.9; and 11.6 and 14.8, respectively in Table 1.10; the instrument can be considered relevant.

**Table 1.10** IV probit estimates – Average schooling

| | **Marginal Effects** | | | | |
|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** |
| Years of schooling | -0.004 | -0.002 | -0.002 | -0.005 | -0.001 |
| | (0.0046) | (0.0029) | (0.0071) | (0.0043) | (0.0039) |
| Area (urban=1) | 0.039** | 0.037*** | 0.040 | 0.036** | 0.034** |
| | (0.0173) | (0.0128) | (0.0328) | (0.0152) | (0.0167) |
| Ethnic group | -0.018 | -0.013 | -0.019 | -0.019* | -0.015 |
| | (0.0116) | (0.0086) | (0.0193) | (0.0112) | (0.0106) |
| Marriage duration | | | | | |
| 6-10 years | -0.275*** | -0.276*** | -0.287* | -0.276*** | -0.279*** |
| | (0.0787) | (0.0267) | (0.160) | (0.0697) | (0.0301) |
| 11-15 years | -0.460*** | -0.599*** | -0.481* | -0.461*** | -0.605*** |
| | (0.116) | (0.0679) | (0.247) | (0.101) | (0.0996) |
| 16-20 years | -0.602*** | -0.854*** | -0.627*** | -0.600*** | -0.856*** |
| | (0.113) | (0.0720) | (0.239) | (0.0974) | (0.105) |
| More than 20 years | -0.683*** | -0.922*** | -0.706*** | -0.680*** | -0.922*** |
| | (0.0597) | (0.0374) | (0.129) | (0.0514) | (0.0549) |
| Age at marriage | | -0.015*** | | | -0.014** |
| | | (0.0040) | | | (0.0058) |
| Number of children | | | 0.010 | | 0.004** |
| | | | (0.0072) | | (0.0019) |
| Emp. Status (emp=1) | | | | 0.042*** | 0.038** |
| | | | | (0.0154) | (0.0171) |
| Total of observations | 8 468 | 8 468 | 8 468 | 8 468 | 8 468 |
| Wald test of exogeneity | 84.51 | 225.32 | 32.12 | 96.82 | 134.97 |
| Prob > chi | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| First-stage coefficient instrument | 0.353*** | 0.609*** | 0.171* | 0.405*** | 0.408*** |
| | (0.104) | (0.106) | (0.102) | (0.103) | (0.106) |
| F-test for instrument | 11.6187 | 32.6798 | 2.78878 | 15.3298 | 14.8883 |
| Prob > F | 0.0007 | 0.0000 | 0.0950 | 0.0001 | 0.0001 |

Source: Mexican Family Life Survey (MxFLS). Robust standard errors in parentheses. Marginal effects at sample means. All regressions include a constant term and gender and birth cohort control dummies. Marriage duration categorical base: 0-5 years of marriage. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level. *Statistically significant at the 90% confidence level.

However, the estimates in columns (1) through (5), although still negative in sign, do not show that an additional year of schooling reduces the probability of marital dissolution at standard confidence levels. For instance, none is statistically significant at the 5 percent level. This result suggests that the previous relationship found between education and divorce through the probit estimations is not causal and indicates that although higher levels of education are an undeniable trait observed in non-broken marriages, it is not education by itself one of the mechanisms leading to better marriage outcomes. The rest

of the variables present effects consistent with the findings observed in sections 5.1 and 5.2. The only exception is the variable ethnic group which is not statistically significant, for example, in the complete model (columns [5] in Tables 1.9 and 1.10).

As discussed earlier, the use of the IV technique obtains consistent estimators that traditional methodologies fail to account for. In this particular case, the probit model that ignores the endogeneity in education suggests that an additional year of schooling is associated with a decrease between 0.6 and 0.9 percentage points in the probability of marital dissolution. However, when using an instrument for the years of schooling, the effect of education is not statistically significant on the probability of marital breakdown. Comparing the values obtained for the probit and the IV probit coefficients for education, it is observed that the probit estimators are downward-bias.

# 7 Conclusion

This work aims to answer the following question: Is it possible to establish a causal effect of education on the probability of marital dissolution? While there is vast economic literature related to marital decisions, the emphasis has been mainly addressed to analyse the impact of factors such as female labour force participation, costs of divorce, communication, amongst others. In terms of showing an impact from education on marriage outcomes, studies where education is associated with marital dissolution decisions can be found for Australia, Lithuania, United States, United Kingdom, and other countries. However, none of these studies demonstrate a causal effect. In addition, relationships have been found to be ambiguous and to differ by country. For some countries education exerts a positive effect on the probability of marriage dissolution, while for others, a negative or null association is identified. Furthermore, to the best of my knowledge, empirical evidence showing the impact of education and other potential divorce determinants on marriage dissolution is non-existent for Mexico. This can be attributed to the lack of surveys in the country with adequate information to study this topic fully, discouraging researchers to work on this field.

In the first part of the analysis, the probit models reveal that education is significant and negatively related to the probability of marriage dissolution. An additional year of education is associated with a decrease between 0.6 and 0.9 percentage points in the

probability of marital dissolution for the 2002-2012 period. However, the results using the IV methodology indicate that an additional year of schooling has no effect on the probability of marital dissolution, suggesting that the relationship initially found between education and divorce is not causal. This finding highlights the relevance of the instrumental variables technique in the analysis in order to correctly assess the impact of education on marital decisions. Although higher educated individuals indeed face a lower probability of divorce, education is not one of the driving forces leading to better marriage outcomes.

Education is a powerful tool to reduce social, cultural and economic disadvantages. Since divorce rates have greatly increased in recent years in Mexico, this work adds knowledge to understand better the mechanisms behind marital dissolution in the country, underlining the role of education. This study also suggests that other social studies that assume a causal relationship between education and marital disruption may need to be carefully rethought. Further research should be devoted in Mexico, and other developing countries, to investigate one of the most important non-market institutions; the institution of marriage.

# Chapter 2. Do changes in divorce legislation have an impact on divorce rates? The case of unilateral divorce in Mexico

## 1 Introduction

Divorce has legally existed in Mexico for over a century. In contrast to other countries such as Italy, Brazil, Spain, Argentina, Ireland or Chile, where divorce was forbidden until 1971, 1977, 1981, 1987, 1997 and 2004, respectively, Mexico has allowed for divorce since 1914. However, to file for divorce, a mutual agreement between the spouses had to exist; otherwise, a contested divorce (in which the parties do not agree and need to fight it out in court) still had to occur. Therefore, compared to Australia or the United States, where unilateral divorce (a divorce in which one spouse ends the marriage without the consent of the other spouse) has been popular since the early 1970s, Mexico has lagged behind.

Divorce rates in Mexico have exhibited an upward trend in recent decades, but after the introduction of unilateral divorce in some entities, this trend has grown remarkably. Therefore, the objective of this study is to analyse whether divorce rates respond to the implementation of unilateral divorce within the context of a developing country – in this case, Mexico.

Mexico comprises 32 entities, 31 states and Mexico City. Each one regulates its citizens independently through their own constitutions, civil codes and penal codes, among other means, which are the counterparts to the comprehensive federal regulatory structure. All petitions for divorce are handled by entity courts. In October 2008, Mexico City was the first entity in Mexico to approve unilateral divorce, and since then, 17 states have also moved to eliminate fault-based divorce. It took until 2015 – seven years – for these changes to occur in 12 entities, but in the following year, 2016, six more allowed no-fault divorce.[11] A possible explanation for the increasing number of states that have

[11] No-fault divorce is a petition by either party of the marriage in which the petitioner does not to provide evidence that the defendant has breached the marital contract. However, the terms "unilateral divorce" and "no-fault divorce" are used synonymously throughout this paper because one implies the other for the case of Mexico.

recently modified their divorce legislation is that in July 2015, the Supreme Court of Justice of the Nation determined that it is unconstitutional for states not to allow a spouse to end a marriage unilaterally, without needing to provide a cause to dissolve the marriage.[12] However, the Supreme Court resolution regarding unilateral divorce does not make any state law invalid because it is only a jurisprudential thesis.[13] From a legal perspective, unilateral divorce is therefore settled in the country, but there is an implementation problem that causes longer and strenuous divorce processes in states that have not yet adopted no-fault divorce. Table 2.1 shows the entities that have modified their local laws to adopt no-fault divorce, the years when these modifications were introduced, and information about the legislation that validates unilateral divorce in the state.[14]

**Table 2.1** Mexican states with no-fault divorce legislation

| State | Year of the reform | Legislation | Article |
|---|---|---|---|
| 1. Aguascalientes | 2015 | Civil Code | No. 288 |
| 2. Baja California Sur | 2016 | Civil Code | No. 273 |
| 3. Coahuila | 2013 | Family Code | No. 153 |
| 4. Colima | 2016 | Civil Code | No. 268 |
| 5. Guerrero | 2012 | Divorce Law | No. 27 |
| 6. Hidalgo | 2011 | Family Code | No. 470 |
| 7. Mexico | 2012 | Civil Code | No. 4.89 |
| 8. Mexico City | 2008 | Civil Code | No. 266 |
| 9. Michoacan | 2015 | Family Code | No. 254 and No. 255 |
| 10. Morelos | 2016 | Family Code | No. 174 |
| 11. Nayarit | 2015 | Civil Code | No. 260 |
| 12. Nuevo Leon | 2016 | Civil Code | No. 267 |
| 13. Puebla | 2016 | Civil Code | No. 442 |
| 14. Quintana Roo | 2013 | Civil Procedures Code | No. 985 Bis |
| 15. Sinaloa | 2013 | Family Code | No. 181 |
| 16. Tamaulipas | 2015 | Civil Code | No. 248 |
| 17. Tlaxcala | 2016 | Civil Code | No. 106 and No. 123 |
| 18. Yucatan | 2012 | Family Code | No. 191 |

Source: Author's elaboration based on the standing legislation in each state. Note: Legislation of the remaining 14 states not included in this table was also verified (Baja California, Campeche, Chiapas, Chihuahua, Durango, Guanajuato, Jalisco, Oaxaca, Queretaro, San Luis Potosi, Sonora, Tabasco, Veracruz and Zacatecas). Unilateral divorce is not valid in any of them. Last updated: January 2017.

[12] The declaration of unconstitutionality means that when a married individual asks a federal judge for an injunction against the state that denies the unilateral divorce, the judge must grant it.

[13] The jurisprudential thesis implies that this determination does not directly repeal any law prohibiting unilateral divorce.

[14] For simplification purposes, Mexico City will be referred to as a state in the rest of the document.

The economic literature suggests that state interventions to correct externalities are not necessary when property laws are clear and transaction costs are low because the involved parties will negotiate a private agreement until they reach an efficient solution. Based on this assumption, efficient bargaining has been extended to marriage decisions, and if the spouse who wishes to leave the marriage can bargain at a low cost with the spouse who wishes to stay, the only factor that matters for the dissolution of the union is the compensation negotiated, regardless of the allocation of property rights or legal liability (Becker et al. 1977). The argument is further elaborated in Becker (1993, p. 331): "A husband and wife would both consent to a divorce if, and only if, they both expected to be better off divorced. Although divorce might seem more difficult when mutual consent is required than when either alone can divorce at will, the frequency and incidence of divorce should be similar with these and other rules if couples contemplating divorce can easily bargain with each other. This assertion is a special case of the Coase theorem (1960) and is a natural extension of the argument (…) that persons marry each other if, and only if, they both expect to be better off compared to their best alternatives." The theoretical justification provided by Becker (1993) framed in terms of Coase's (1960) theorem leads to the conclusion that only inefficient marriages would dissolve and efficient divorces would occur, regardless of the legal system. Therefore, modifications to divorce legislation should have no effect on the total number of divorces, and the adoption of a no-fault divorce regime should have no effect on divorce rates.

However, critics of Becker's proposition have emerged. Even if there were perfect information and no transactional costs, it has been argued that divorce laws would affect divorce decisions because of the importance of assets and resource allocation before and after the divorce, along with divorce legislation, for determining the gains and losses from dissolution and for influencing the decision to end the marriage (Clark 1999).

In addition, discarding Coase's theorem as applied to marriage contracts; then, assuming that divorce rates are not influenced by divorce legislation because the gains from marriage are not affected by more liberal divorce laws denies the possibility that as it becomes easier to obtain a divorce, the value of marital surplus decreases due to more attractive outside options (Mechoulan 2005).

In an effort to reconsider the theoretical validity of the so-called Becker–Coase theorem within the context of households that consume public as well as private goods, it has been found that as a general rule, reforms in divorce legislation are expected to affect divorce rates, but this effect can be either positive or negative depending on the

situation of each couple. Moreover, this finding opens up the possibility that the Becker–Coase theorem can still hold as long as the consumption of the public goods involved in the marriage is not altered after the divorce (Chiappori et al. 2015).

Sometimes, changes in public policies have unintended effects on people's lives and their relationships with others. Although no-fault divorce legislation was originally intended as a solution for inherent disputes in a fault-based divorce regime, research in different countries has demonstrated that unilateral divorce laws have caused an increase in the total number of divorces than would have occurred otherwise.

The impact of unilateral divorce has been hotly debated in the public sphere. While some claim that the unilateral divorce system is less adversarial, respecting the privacy of the marriage because no evidence against either of the spouses is needed, others argue that unilateral divorce laws undermine the institution of marriage, encouraging marital irresponsibility and taking away bargaining leverage from the party who is neither at fault nor desirous of a breach, as the processes of determining property distribution, alimony and child custody are separated from the divorce trial.

Adding to the debate on the effects of unilateral divorce, it has been argued that social changes after World War II led to a rise in the number of inefficient marriages and that no-fault legislation contributed to transforming previously inefficient marriages into efficient divorces but also efficient marriages into inefficient divorces (Allen 1998). Furthermore, it has been suggested that from 1965 to 1996, the adoption of unilateral divorce law in the United States caused an increase in violent crime rates of approximately 9 percent. In the years following the reform, it was observed that mothers in adopting states were more likely to become heads of household and to fall below the poverty line, especially less educated mothers. A potential link between the unilateral reform and the increase in crime might have been the worsening of the economic conditions of mothers and the increase in income inequality as unintended consequences of the reform (Caceres-Delpiano and Giolito 2012). Empirical evidence also shows that adults who were exposed to unilateral divorces as children have lower family incomes, are less educated and separate more often (Gruber 2004). On the other hand, making divorce easier to obtain decreases domestic violence for both men and women, reduces female suicide, lowers the number of females murdered by intimates and has a positive effect on marriage investments, such as female labour force participation (Stevenson and Wolfers 2006; Stevenson 2007).

Research on no-fault divorce indicates both positive and negative effects of legislation allowing for unilateral divorce, depending on the particular subject under analysis. From a policy perspective, changes in divorce legislation might play an even more important role in Mexico than in developed countries, strengthening women's bargaining position in the household, where women often lack the authority to make key decisions. For instance, in terms of gender violence, data for Mexico show that approximately 45 percent of women who were in a relationship between 2006 and 2016 experienced intimate partner violence.[15] Unilateral divorce not only represents an option for abused wives to escape their marriages but also contributes to reducing domestic violence because husbands are less likely to abuse when their wives can more credibly threaten to leave the marriage. Women in developing countries are also more economically dependent on men. Mexican female labour market participation is below the average for OECD countries, with the second-lowest rate only after Turkey (OECD 2017). As a result, the potential costs of divorce that Mexican married women bear can be disproportionately higher relative to men. Divorce on no grounds reduces the time spent on accusations and legal fees, helping women better cope with the financial burdens of divorce and increasing their likelihood of ending a bad marriage.

In this paper, to analyse the effect of unilateral divorce legislation on divorce rates in Mexico, a difference-in-differences (DD) analysis is conducted using aggregate divorce data at the state level, following the methodology proposed by Wolfers (2006) and Friedberg (1998). In each year, the states that have adopted unilateral divorce are considered the treatment group, while the states that remain under the fault-based legislation are considered the control group. The DD technique has been widely used to study numerous policy questions, and it is considered a popular tool for applied research in economics.

The results indicate that the shift towards divorce on no grounds raises the divorce rate by 0.30 annual divorces per thousand people and accounts for a 26.4 percent increase in the total number of divorces in the states that modified their legislation during the 2009–2015 period. To the best of my knowledge, this study is the first to analyse the impact of unilateral divorce legislation on divorce rates in a Latin American country[16] and it aims

[15] National Surveys on the Dynamics of Household Relationships (ENDIREH), 2006, 2011 and 2016.
[16] Beleche (2010) evaluates the impact of the liberalization of divorce laws in Mexico on divorce rates for the period 1993 to 2005, but her analysis does not include unilateral divorce. Her findings suggest no relationship between these two variables.

to contribute to a better understanding of divorce outcomes in the region, as well as the implications of these types of policies in developing countries.

The remainder of the paper is outlined as follows: Section 2 introduces the relevant literature; Section 3 discusses the estimation strategy; Section 4 presents the data; Section 5 shows the results for the static and dynamic specifications, as well as the results for the alternative empirical approaches followed; and Section 6 presents the conclusions.

## 2 Literature review

Over the last 30 years, economists have devoted considerable empirical efforts to determine whether liberalization in divorce laws is responsible for the rise in marital dissolution. Initially, unilateral divorce legislation was found not to have an effect on the probability that a woman becomes divorced in the United States (Peters 1986), supporting the validity of the Becker–Coase theorem. However, in an open criticism of this work, it was argued that the findings are incorrect, mainly due to the misclassification of no-fault and fault states and the inclusion of regional dummies; once the methodological issues are corrected, the results show that the shift from fault to no-fault divorce regimes indeed increases divorce rates (Allen 1992).

As an alternative to address the lack of robustness of previous research, using a panel of state-level divorce rates for the United States, a DD methodology is followed to identify the effect of unilateral divorce on divorce rates (Friedberg 1998). The main concern to address is endogeneity, given the earlier adoption of unilateral divorce legislation in states with higher divorce rates. Estimations are performed using the number of divorces that occur within a state each year as the dependent variable, divided by the state population in thousands. For the main independent variable, a dichotomous variable is created, which takes the value of 1 if the state had adopted unilateral divorce legislation in that year and zero otherwise. State effects, year effects and state-specific linear and quadratic time trends are included as controls. The findings show not only that states with legislation towards unilateral divorce have higher divorce rates but also that from 1968 to 1988, unilateral divorce accounted for 17 percent of the rise in divorce rates, suggesting a more permanent rather than temporal effect.

To reassess whether the short-run and long-run implications of the shifts in divorce regimes are different, previous research was expanded to incorporate the dynamics of divorce responses (Wolfers 2006). The argument for the extension of the analysis is based on the notion that state-specific trends might capture not only preexisting trends but also the dynamic effects of the change in the legislation, confounding the two. To address this possibility, similar regressions to Friedberg's are estimated, but the sample period is modified to 1956–1988, and eight dichotomous variables are created to indicate whether the adoption of unilateral divorce legislation had been in place for at least 2 years, 3–4 years, 5–6 years, 7–8 years, 9–10 years, 11–12 years, 13–14 years, or 15 years or more. The results indicate that a change in divorce legislation leads to a temporary increase in divorce rates but that there is no evidence to suggest that this rise is permanent, showing that after a decade, the increase reverses.

Similar research has been carried out to analyse the effect of changes in divorce legislation on divorce rates in Europe. Pooling data from 18 countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom), the evidence supports previous findings that modifications in divorce law increase divorce rates, with strong long-term effects (Gonzalez and Viitanen 2009).

Furthermore, following an interactive fixed effects approach for a given number of factors (Kim and Oka 2014) and for an unknown number of factors (Moon and Weidner 2015), a short-term effect on divorce rates due to unilateral divorce legislation in the United States has also been found. The purpose of using an interactive fixed effects model in this context is to control for unobserved heterogeneity across states (family size, religious beliefs and female labour force participation) that might evolve over time in a complex way, leading to mixed empirical evidence. Wolfers' specifications are followed, but the random error is assumed to consist of unobserved common shocks and an idiosyncratic error. Estimations are performed following Bai (2009) and the least squares (LS) estimator, respectively. It is important to highlight that the interactive fixed effects methodologies used within this context are valid only for panel data with large cross-sectional units (N) and large time periods (T).[17] Their potential implementation therefore

[17] Usually, both N and T are larger than 30.

relies on the specific characteristics of the datasets available. In this case, the panel data consist of 48 states over 33 years.[18]

For developing countries, and more precisely for Latin American countries, scholarly economic research on the effects of unilateral divorce legislation on divorce rates is rare. This scarcity is not surprising, as no-fault divorce has been in place for only a few years in some of these countries, and there is limited quantitative information available to analyse its consequences for family structures. It is expected that this paper will stimulate interest in monitoring, reporting and evaluating the effects of these changes in policies in the region and that more research will occur to better understand the role that they play, given their specific cultural context.

# 3 Estimation strategy

The DD methodology has been widely used to study numerous policy questions, and it is now considered a popular tool for applied research in economics. It measures outcomes and covariates before and after an intervention for two groups: a treatment group, which receives a treatment in an experiment, and a control group, which does not receive the treatment and is used as a baseline measure. The DD estimator depends on a comparison of the treatment and control groups before and after the intervention.

Following Khandker, Koolwal and Samad (2010:71-73), given a two-period setting where t=0 before the program and $t = 1$ after program implementation, letting $Y_t^T$ and $Y_t^C$ be the respective outcomes for a program beneficiary and nontreated units in time $t$, the DD method will estimate the average program impact as follows:

$$DD = E(Y_1^T - Y_0^T | T_1 = 1) - E(Y_1^C - Y_0^C | T_1 = 0) \quad (1)$$

Where $T_1 = 1$ denotes the treatment or the presence of the program and $T_1 = 0$ denotes untreated areas.

[18] These data are different from those used by Friedberg and Wolfers, given the need for a balanced panel in interactive fixed effects.

The DD estimate can also be calculated within a regression framework as follows:

$$Y_{it} = \alpha + \beta T_{i1} t + \gamma t + \rho T_{i1} + \varepsilon_{it} \quad (2)$$

Where coefficient $\beta$ on the interaction between the post-program treatment variable $T_{i1}$ and time $t$ gives the average DD effect of the program. In addition, the variables $T_{i1}$ and $t$ are included separately to pick up any separate mean effects of time, as well as the effect of being targeted versus not being targeted. Equation (2) can be generalized with multiple time periods and multiple regions, which is the particular approach followed in this study.

The adoption of no-fault divorce in several entities in Mexico beginning in 2008 represents an exceptional opportunity to use this natural experiment to identify the effects of unilateral divorce on divorce rates in the country by using the DD methodology.

## 3.1 Identification strategy

To analyse whether divorce rates in Mexico respond to the implementation of no-fault divorce, we first follow the DD estimation approach used by Friedberg (1998):

$$Divorce\ Rate_{s,t} = \beta Unilateral_{s,t} + \sum_s State\ fixed\ effects_s + \sum_t Time\ fixed\ effects_t + \sum_s State_s * Time_t + \sum_s State_s * Time_t^2 + \varepsilon_{s,t} \quad (3)$$

Where $Divorce\ Rate$ is the total divorces per thousand people[19] and $Unilateral$ is a binary indicator for divorce legislation (unilateral = 1). State fixed effects are included to control for heterogeneity within states. Time fixed effects account for changes in divorce patterns at a national level. Linear and quadratic state-specific time trends capture changes within states (s) over time (t).

In contrast to other papers focusing on the classification of state divorce laws, which has the potential for different conclusions depending on the definition used, this is not a problem in the Mexican case. Although no-fault divorce and unilateral divorce

[19] It has been argued that the divorce rate should be measured using the number of marriages instead of the population. However, since the information on marriages is not readily available, this definition of the divorce rate has been commonly accepted.

correspond to different situations, according to the reforms adopted in Mexico, each state that has eliminated grounds for divorce has simultaneously incorporated unilateral divorce into its legislation.

As mentioned in the previous section, Friedberg's methodology poses the latent risk of confounding preexisting trends with the full adjustment of divorce rates after the change in legislation. To rule out this possibility, Equation (3) is modified to capture the dynamic response of the policy reform, and Equation (4) is also estimated. It is worth emphasizing that this step should not be seen as a mere extension or a robustness check but as a better specification to control for the dynamics generated in the marriage market. The results obtained will help determine if the introduction of unilateral divorce has had a more temporal rather than a permanent effect on divorce rates.

$$Divorce\ Rate_{s,t} = \sum_{k\geq 1} \beta_k Unilateral\ divorce\ has\ been\ in\ effect\ for\ k\ periods_{s,t} + \sum_s State\ fixed\ effects_s + \sum_t Time\ fixed\ effects_t + \sum_s State_s * Time_t + \sum_s State_s * Time_t^2 + \varepsilon_{s,t} \quad (4)$$

The binary indicator for divorce legislation in Equation (3) is substituted by three dummy variables that indicate if unilateral divorce has been effective for 1 to 2 years, 3 to 4 years, and 5 years or more. The inclusion of these variables allows us to identify to what extent the increase in divorce rates is affected by modifications in divorce legislation (Wolfers 2006).

Heterogeneity across states and time exists and may affect divorce rates and divorce legislation. The inclusion of factors such as unemployment and fertility rates in the standard approach allows for estimating the parameters more precisely (Gonzalez and Viitanen 2009). Equation (3) and Equation (4) are thus re-estimated with the following set of controls: female labour force participation, unemployment, fertility rate, education and gross domestic product.

Since the divorce rate is the total divorces per 1 000 people, the error term represents the sum of all individual disturbances in a state (s) at time (t), divided by the population, leading to heteroscedasticity. To correct standard errors and to gain efficiency, weighted least squares (WLS) using the population is implemented for all estimations.[20]

[20] Following Hsiao (2014), when using standard errors clustered by the cross-sectional variable, the number of groups should be large, which supports the use of WLS as a more appropriate strategy, given that there are only 32 states in the analysis.

# 4 Data

The National Institute of Statistics and Geography (INEGI) provides information on all divorces registered in the country by year. For the purposes of this analysis, state-level panel data are used for a period of 10 years, from 2005 to 2015. Although Mexico City was the first entity to adopt unilateral divorce in 2008 and 17 more states have allowed divorce on no grounds since then, the sample is extended back to 2001 and 1993 to address potential preexisting state-specific trends and to verify whether the main results remain valid.

Table B.5 in the Appendix shows the divorce rates by state for the period analysed. For most of the states that adopted unilateral divorce legislation, a substantial rise in the divorce rates is observed in the year when no-fault divorce was adopted or in the year after, and no anticipation effect is identified prior to the change in the law. Thus, for states that modified their legislation in the second half of the year, the first year considered as affected by the reform is the following year.[21] Following this approach, and because divorce data are available up to 2015, ten treatment states are included in the analysis: Aguascalientes, Coahuila, Mexico City, Guerrero, Hidalgo, Mexico, Nayarit, Quintana Roo, Sinaloa and Yucatan.[22] Table B.5 does not indicate any systematic increase in divorce rates before the adoption of unilateral divorce, suggesting no endogenous legislation. It was verified whether a correlation exists between the initial divorce rates and the change in a state's divorce law and between the initial divorce rates and the year the state adopted divorce on no grounds. The lack of significance for all the correlation coefficients reported in Table B.6 in the Appendix suggests that it is unlikely that reverse causality exists and that the shift towards no-fault divorce is exogenous rather than caused by a preexisting rise in divorce rates in the adopting states.

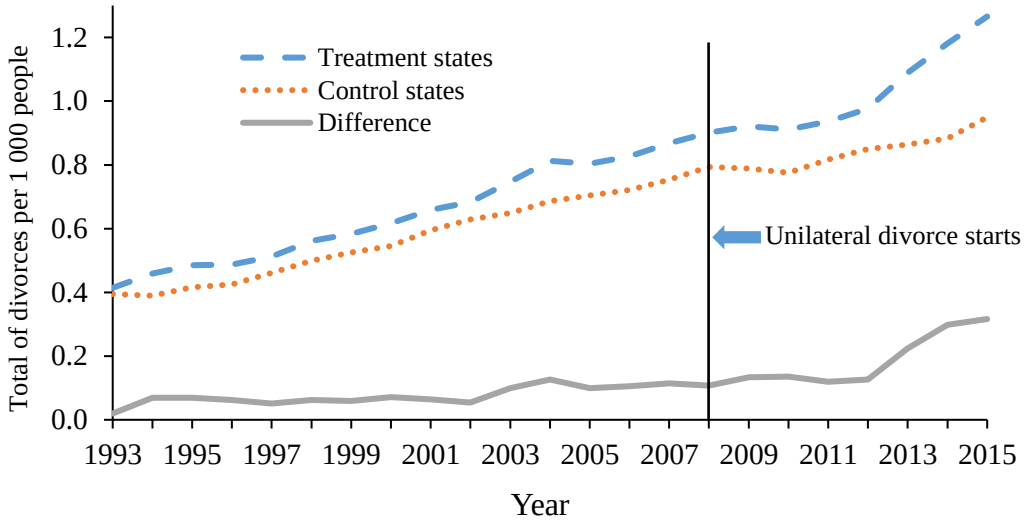
It is also relevant to ask to what extent the inclusion of state-level fixed effects in the model is justified in controlling for different unobserved state-level factors affecting divorce rate trends. Figure 2.1 illustrates the average divorce rate for the group of states that have adopted no-fault divorce (treatment states) and those who remain under the traditional divorce legislation (control states) for the 1993–2015 period. The difference

[21] Baja California Sur, Mexico City, Michoacan, Nuevo Leon, and Tamaulipas are in this situation.

[22] As Table 2.1 indicates, from 2008 to 2016, 18 states changed their divorce law. However, divorce data are not yet available for 2016, so the six states that moved towards unilateral divorce in 2016 (Baja California Sur, Colima, Morelos, Nuevo Leon, Puebla and Tlaxcala) and the two states that shifted to it in the second half of 2015 (Michoacan and Tamaulipas) are not included as treatment states in the analysis.

observed between the average divorce rates for the treatment and control groups is close to zero during the first 10 years, but it begins to gradually increase afterwards, providing evidence for differentiated trends and reaching a maximum of 0.32 in 2015. Similar average divorce rates, especially before any state adopted no-fault divorce, could be an early indication that unobserved heterogeneity across states does not represent a threat of omitted variable bias and may suggest that state-level fixed effects might not play as much of a crucial role in Mexico as in other countries.

**Figure 2.1** Average divorce rates




Source: Author's calculations. National Institute of Statistics and Geography (INEGI).

Data on the state population are needed to obtain the divorce rates. The National Population Council (CONAPO) provides only projected estimates for the 2010 to 2015 period; therefore, the Mexican Labour Force Survey (ENOE) collected by INEGI is a more accurate source of these data, as well as for data on female labour force participation and unemployment rates. Fertility rates and gross domestic product were also obtained from INEGI, and education data were obtained from the Secretariat of Public Education (SEP). Finally, the standing legislation in each state has been verified to fully identify the states that have legalized unilateral divorce versus those that still require grounds to grant divorce.

In contrast to the dataset used for the United States, a potential limitation in the Mexican case is the borderline small number of cross-sectional units (32 states) and time periods (10 to 22 years) available to conduct the analysis. In DD empirical applications,

it has been customary to overlook the possible consequences of the terms of statistical inference within this context, but a growing body of literature acknowledges the need for alternative techniques to properly account for problems such as serially correlated errors, cross-sectional dependence and heteroscedasticity (Donald and Lang 2007; Conley and Taber 2011; Ferman and Pinto 2018). There is no consensus on a straightforward approach to follow, and each method, such as cluster residual bootstrap, synthetic control estimators, feasible generalized least squares, and two-step estimators, among others, aims to address specific circumstances. Moreover, as indicated earlier, 10 states in Mexico have shifted their legislation towards unilateral divorce in the dataset available (treatment states); however, for Aguascalientes and Nayarit, the change occurred only in the last year, 2015. This situation poses an additional challenge for identifying the true effect of the policy change, rather than its immediate effect. This study takes a proactive approach and provides sensitivity analyses and robustness checks that aim to validate the main results obtained following the standard approach.

# 5 Results

The results are presented in the following sections. Section 5.1 provides the estimations for the static specifications, while Section 5.2 presents the outcomes when the model is enhanced to properly capture the dynamic response of divorce rates. In Section 5.3, control variables are added to the static and dynamic models to account for observed heterogeneity, and in Section 5.4, alternative empirical approaches are followed to determine whether the main conclusions continue to be valid.

## 5.1 Static specifications

Table 2.2 reports estimates of the static effects on divorce rates when unilateral divorce legislation is adopted. The estimates suggest that such legislation raises divorce rates in Mexico, and all coefficients of unilateral are statistically significant. The first specification in column (1) does not include fixed effects, and its coefficient for unilateral is the largest, capturing not only the effect of the modification in the divorce legislation

but also other changes in divorce patterns over time and across states. To improve the model by controlling for the average differences in states and years, specification (2) includes year and state effects. The coefficient indicates that the adoption of unilateral divorce raises the divorce rate by 0.32 annual divorces per thousand people. While the year effects capture evolving unobserved characteristics at a country level and the state effects control for constant factors that influence divorce decisions over time, specifications (3) and (4) represent more flexible models in which attributes that affect the divorce propensities in each state are allowed to change over time. The results exhibit a smaller effect of no-fault divorce when linear and quadratic state trends are included.

The F statistics for the state trends in columns (3) and (4) show that the significance level of the test equals zero, reflecting that both state trends – linear and quadratic – are jointly significant. In addition, moving across the columns, the adjusted $R^2$ increases from 0.89 in specification (2) to 0.95 in specification (4), supporting the inclusion of state trends as relevant to the model. A possible explanation for the modest variation in the unilateral coefficient when state trends are added compared to countries such as the United States, might be the homogenous gender inequality that is predominant in all Mexican states. Women's decision-making power within the household is limited in Mexico, and therefore only an external shock such as an unexpected change in the divorce legislation triggers a structural change in the marriage market, disrupting traditional gender roles and stereotypes. It may also be that the main factors that have an impact on divorce rates within states have not changed much over the period analysed. In Section 5.3, the results are presented when some of these potential factors are explicitly included in the estimations. As an only exception, in specification (4), the F-test for the year effects fails to reject the null hypothesis that the coefficients for all years are jointly equal to zero, suggesting that there is no need to include time fixed effects in the model. Table B.7 in the Appendix provides the estimations for all specifications excluding year effects. The impact of unilateral divorce legislation on divorce rates remains positive, significant and similar in magnitude.

Considering that Friedberg (1998) uses specifications similar to those in Table 2.2 for the United States and obtains a variation between 0.004 and 1.80 in annual divorces per thousand people due to unilateral divorce legislation, it can be argued that in the case of Mexico, regardless of the model used, the static effects of unilateral divorce legislation do not vary much across specifications, from 0.23 to 0.39. This finding suggests that the model is appropriate for the country and that there is a strong and steady relationship

between changes in divorce law and divorce rates in Mexico. The unilateral coefficient in specification (3), for instance, represents 34.9 percent of the average divorce rate of 0.85 annual divorces per 1 000 people for the period analysed. Moreover, the adoption of unilateral divorce legislation has increased the divorce rate by 26.4 percent in the shifting states during the 2009–2015 period.

**Table 2.2** Static effects on divorce rates – 2005 to 2015

| | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Unilateral | 0.394*** | 0.321*** | 0.300*** | 0.231*** |
| | (0.0532) | (0.0271) | (0.0319) | (0.0345) |
| Adjusted $R^2$ | 0.133 | 0.896 | 0.943 | 0.955 |
| Time effects | No | Yes, F = 8.85 | Yes, F = 2.22 | Yes, F = 1.18 |
| Prob > F | | 0.000 | 0.017 | 0.304 |
| State effects | No | Yes, F = 81.15 | Yes, F = 37.75 | Yes, F = 26.66 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 9.32 | Yes, F = 2.64 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 3.32 |
| Prob > F | | | | 0.000 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level.

An issue for the robustness of the results presented above is whether the number of years considered in the analysis before the policy shock allows to properly account for preexisting state trends. This problem is less severe for states that shifted to unilateral divorce more recently but remains an issue for those that did so earlier, such as Mexico City (2008) and Hidalgo (2011). Table 2.3 reports the static effects on divorce rates for the 2001 to 2015 period. Comparing Table 2.2 and Table 2.3 shows that the inclusion of additional years before the reform plays no major role in the analysis. Estimations for a larger period from 1993 to 2015 are also provided in Table B.8 in the Appendix and the findings remain unchanged. It should be noted that adding data where all states are untreated (1993 to 2004) tends to increase the unilateral coefficient. For instance, in Table 2.2, specification (4) indicates that no-fault legislation increases divorce rates by 0.23 annual divorces per thousand people, whereas in Table 2.3, specification (4) shows an increase by 0.29 annual divorces per thousand people. Contrary to these observations, it is expected that adding data in which all states are untreated will reduce the coefficient. This finding might reflect the almost null variation in divorce rates during the pre-reform years at the national level, reinforcing the effect of the change in the divorce legislation

rather than diluting it when the data are extended back. According to data from INEGI, in 1990 and 2000, there were seven divorces for every 100 new marriages. By 2005, this rate rose to 11.8, and in 2015, it reached 22 per 100 new marriages (see Figure 1.1 in Chapter 1).

**Table 2.3** Static effects on divorce rates – 2001 to 2015

| | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Unilateral | 0.433*** | 0.295*** | 0.327*** | 0.291*** |
| | (0.0499) | (0.0252) | (0.0277) | (0.0297) |
| Adjusted $R^2$ | 0.134 | 0.883 | 0.939 | 0.954 |
| Time effects | No | Yes, F = 14.14 | Yes, F = 1.66 | Yes, F = 1.92 |
| Prob > F | | 0.000 | 0.060 | 0.023 |
| State effects | No | Yes, F = 93.12 | Yes, F = 40.24 | Yes, F = 25.27 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 13.78 | Yes, F = 4.47 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 5.48 |
| Prob > F | | | | 0.000 |
| Total of observations | 480 | 480 | 480 | 480 |

Source: National Institute of Statistics and Geography (INEGI), National Population Council (CONAPO) for states' population from 2001 to 2004, and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level.

## 5.2 Dynamic specifications

The aim of this section is to consider a potential bias resulting from unmeasured confounders. As mentioned earlier, outcomes from Equation (3) might be biased measures of the causal effect of unilateral divorce on divorce rates because the unilateral coefficient is not allowed to change after the adoption of no-fault divorce, confounding preexisting trends with the dynamic effects of the policy shock. When a policy shock occurs, depending on the circumstances, the impact may be immediate or occur with considerable delay; it either has a permanent effect or dies out at a relatively fast pace. Wolfers (2006) analyses the short-, medium- and long-run effects of the adoption of unilateral divorce law in the United States. In the case of Mexico, the shift towards no-fault divorce legislation was recent, starting in 2008, so the analysis is focused on the short and medium terms. Table 2.4 presents the effects that unilateral divorce legislation has on divorce rates within the first 2 years of the change in the law, during years 3 and 4, and after 5 or more years. All unilateral coefficients are statistically significant, with

the exception of column (4) after 5 years or more. State trends are jointly significant, and the adjusted $R^2$ increases from specifications (1) to (4).

According to estimates in columns (2) to (4), the introduction of unilateral reforms increases divorce rates in the short-run from 0.21 to 0.28 annual divorces per thousand people. Over years 3 and 4, the effect increases in size for specifications (2) and (3) and remains very similar for specification (4). Finally, 5 or more years after the reform, the impact remains positive but starts to diminish, affecting divorce rates by 0.29 and 0.25 annual divorces per 1 000 people, according to specifications (2) and (3), respectively. Tests have been performed on the equality of the three coefficients of unilateral in each specification, rejecting the hypothesis that they are similar for specifications (3) and (4) at standard confidence levels, supporting the strategy followed in this section. A potential explanation for the higher effect of the change in law in years 3 and 4, rather than during the first 2 years, is that initially, the changes in the divorce regime are not widely known by the population, taking time for the information to be disseminated. Time is also necessary for divorce to become more acceptable, and people gradually become more open to ending an inefficient marriage as more couples separate. In addition, the process of filing for divorce under different rules can be difficult to understand in the beginning, delaying the decision to file. The positive but smaller size of the effect on divorce rates of no-fault divorce after 5 or more years indicates that although the dynamic response to the policy shock persists in the medium-term, the effect of the law change over the following years might gradually be reduced as an adjustment to a temporary boom of inefficient marriages dissolving immediately after the reform. It is important to highlight that when comparing the static and dynamic estimates for unilateral in Table 2.2 and Table 2.4, the coefficients show little variation and remain very similar, confirming a close relationship between changes in divorce legislation and divorce rates, regardless of the approach followed.

**Table 2.4** Dynamic effects on divorce rates – 2005 to 2015

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | | | | |
| First 2 years | 0.336*** | 0.285*** | 0.276*** | 0.216*** |
| | (0.0765) | (0.0322) | (0.0332) | (0.0367) |
| Years 3 and 4 | 0.424*** | 0.371*** | 0.363*** | 0.215*** |
| | (0.0804) | (0.0351) | (0.0454) | (0.0615) |
| 5 years or more | 0.482*** | 0.299*** | 0.259*** | 0.0347 |
| | (0.126) | (0.0559) | (0.0839) | (0.109) |
| Adjusted $R^2$ | 0.131 | 0.897 | 0.945 | 0.956 |
| Time effects | No | Yes, F = 7.82 | Yes, F = 1.67 | Yes, F = 1.37 |
| Prob > F | | 0.000 | 0.086 | 0.193 |
| State effects | No | Yes, F = 82.08 | Yes, F = 38.59 | Yes, F = 27.09 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 9.63 | Yes, F = 2.54 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 3.16 |
| Prob > F | | | | 0.000 |
| Equality of coefficients | F = 0.63 | F = 2.58 | F = 5.26 | F = 3.10 |
| Prob > F | 0.535 | 0.077 | 0.005 | 0.046 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level.

## 5.3 Control variables

To explicitly account for observed heterogeneity, five variables are included in the analysis: education,[23] female labour force participation, fertility rates,[24] gross domestic product (GDP) and unemployment. The inclusion of these controls aims to reassess the impact of unilateral divorce legislation on divorce rates when some state-level variables are added to the model. The results for the static and dynamic specifications reported in Table B.9 and Table B.10 in the Appendix are virtually identical to those presented in Sections 5.1 and 5.2 for the effect of divorce legislation, validating the inclusion of state fixed effects and trends in the analysis to capture the effect of other factors that affect divorce rates.

In terms of the new variables added to the model, only unemployment is statistically significant in most specifications. However, contrary to what the literature suggests (Becker et al. 1977), an increase in unemployment is negatively related to divorce rates

[23] Average grade of schooling.
[24] Total number of live births per 1 000 females of childbearing age between the ages of 15 and 49 years.

in Mexico. An explanation for this finding is that divorce itself costs money, so the inability to afford a divorce for individuals facing unemployment, and the fact that it costs more for a couple to live separately than together, may prevent married couples in developing countries from filing for divorce when unemployment rates are higher. Another possible explanation is that marriage might be seen as a type of informal insurance against unemployment, becoming more valuable when unemployment is high.

## 5.4 Unweighted specifications and changes in the functional form

All the previous estimations have been performed using weighted least squares (WLS) to correct for the presence of heteroscedasticity generated by the use of state-level divorce rates rather than individual data on divorce decisions. However, it has been argued that estimations under WLS and ordinary least squares (OLS) should be similar if the unobserved heterogeneity is adequately addressed (Kim and Oka 2014). Following Droes and Lamoen (2010), the transformed model using analytical weights is:

$$Divorce\ Rate_{s,t}\sqrt{pop_{s,t}} = \beta Unilateral_{s,t}\sqrt{pop_{s,t}} + \sum_s State\ fixed\ effects_s \sqrt{pop_{s,t}} + \sum_t Time\ fixed\ effects_t\sqrt{pop_{s,t}} + \sum_s State_s * Time_t\sqrt{pop_{s,t}} + \sum_s State_s * Time_t^2\sqrt{pop_{s,t}} + \varepsilon_{s,t}\sqrt{pop_{s,t}} \quad (5)$$

Where $pop$ is the state population in thousands. It is observed that the coefficient for unilateral divorce remains equal after the transformation. Using Wolfers (2006) and Friedberg's (1998) data, Lee and Solon (2011) and Droes and Lamoen (2010) estimate the effect of unilateral divorce using OLS. In addition, Lee and Solon (2011) perform estimations using the logarithm of the divorce rate, claiming that it is also a valid functional specification. The results for the United States suggest that the change in law has no effect on divorce rates either when OLS regressions are estimated or when the dependent variable in the analysis is the divorce rate in log, casting doubt on the true effect of unilateral divorce legislation in that country.

Weighting by population to correct for heteroscedasticity and obtain efficient estimators relies on the strong assumption of homoscedastic and independent error terms for individuals within the state. However, if individual error terms share a common state-

level error component, the unweighted state-average error terms are closely homoscedastic. In this scenario, the use of WLS would exacerbate any existing heteroscedasticity, and OLS estimation would be more efficient than WLS. Large discrepancies between the results obtained using WLS and OLS might be an indication of the functional form or model misspecification. Therefore, estimations based on OLS without weighting are also important to perform and report. Likewise, given the nature of the dependent variable used within this context – an always positive divorce rate – it is possible to consider different functional specifications, such as the logarithm of divorce rates. Typically, the results based on changes in functional form assumptions are expected not to be extremely sensitive to these modifications, supporting previous findings and providing compelling evidence for the main conclusions in the analysis.

To determine if the results obtained for Mexico are still valid following these approaches, Tables B.11 and B.12 in the Appendix report the OLS estimates, and Tables B.13 to B.16 present the estimations when using the log of the divorce rate. As discussed by Lee and Solon (2011), the OLS coefficients obtained are smaller than the WLS estimates, given that WLS places more weight on states that are more populated and given that unilateral divorce has larger effects on these states. However, in contrast to the results for the United States, the coefficients obtained for unilateral divorce legislation continue to be positive and statistically significant in practically all specifications. These findings provide compelling evidence that unilateral divorce has an effect on the divorce rates in Mexico, regardless of the estimation methods or the functional form assumed in this study.

# 6 Conclusion

This study evaluates the effect of unilateral divorce legislation on divorce rates in Mexico. Much economic research has analysed the relationship between these two variables using different methodologies. Findings for the United States and Europe indicate that no-fault divorce has a role in explaining the increases in divorce rates. However, no previous studies analyse the consequences of unilateral divorce legislation on divorce rates in Latin America, possibly because divorce on no grounds has been only recently enacted in the region.

Following a DD approach, two models are developed using panel state-level data. The preferred static specification indicates that the shift towards divorce on no grounds raises the divorce rate by 0.30 annual divorces per thousand people and accounts for the 26.4 percent increase in the total number of divorces in the adopting states during the 2009–2015 period. To distinguish between the immediate effects of the policy shock and the impact that it has in the medium-run, a dynamic model is also estimated. The preferred dynamic specification suggests that during the first 2 years after the change in law, the divorce rate increases by 0.27 annual divorces per thousand people, but in the third and fourth years, the effect is even larger, with 0.36 annual divorces per thousand people. Five or more years after the reform, although the effect is still positive and significant, a smaller effect by 0.25 divorces per 1 000 people per year is observed. These results may be an early indication of an inverted U-shaped relationship between the divorce rates and changes in divorce law over time in Mexico. In addition, they illustrate the importance of promoting information about the reform.

The positive effect of unilateral divorce legislation on divorce rates rejects the empirical validity of the Becker–Coase theorem for Mexico, at least in the short and medium terms. Moreover, because divorce on no grounds has been adopted gradually by different states, the rising trend in divorce rates is expected to continue in the following years.

The findings of this research are relevant for Mexico, especially during this transition period, as a total of 18 states have already changed their divorce legislation towards no-fault divorce but there remain 14 states that may potentially adopt unilateral divorce. First, the findings explain the higher divorce rates observed in Mexico, particularly over the last few years. Moreover, they shed light on the effectiveness of these types of policies, allowing individuals who no longer wish to remain in a marriage to end it in a less costly, less time-consuming and less strenuous way. However, the findings also pose the question of whether relaxing divorce laws encourages couples to quit their marriages more easily, especially among younger people, undermining the institution of marriage. In terms of additional policy implications typically associated with other countries that allow unilateral divorce, there is a lack of studies in Mexico and Latin America. More research on the region is needed to understand the effects of changes in divorce legislation on domestic violence, female labour force participation, fertility rates, children's outcomes and income inequality, among others. Because unilateral divorce legislation has proven to be an effective tool for modifying family structures in Mexico, it is important for policy

makers to be aware of the consequences of the shift towards unilateral divorce to deliver changes in divorce laws more effectively.

# Appendix B

**Table B.5** Divorce rates by state – Total number of divorces per 1 000 people

| State | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aguascalientes* | 1.11 | 1.06 | 0.95 | 1.12 | 1.1 | 1.19 | 0.98 | 1.14 | 1.21 | 1.06 | **1.34** |
| Baja California | 1.54 | 1.44 | 1.06 | 1.07 | 0.99 | 0.96 | 1.03 | 0.98 | 0.99 | 0.88 | 1.04 |
| Baja California Sur | 1.04 | 0.97 | 1.03 | 1.23 | 1.09 | 0.86 | 1.05 | 1.06 | 1.15 | 0.98 | 0.96 |
| Campeche | 0.98 | 1.05 | 0.97 | 1.03 | 1.07 | 1.11 | 1.16 | 1.31 | 1.35 | 1.51 | 1.33 |
| Chihuahua | 1.52 | 1.22 | 1.37 | 1.39 | 1.37 | 1.46 | 1.59 | 1.72 | 1.7 | 1.6 | 1.9 |
| Chiapas | 0.29 | 0.31 | 0.32 | 0.34 | 0.33 | 0.35 | 0.37 | 0.42 | 0.41 | 0.44 | 0.48 |
| Coahuila* | 0.97 | 1.13 | 1.18 | 1.23 | 1.3 | 1.17 | 1.2 | 1.28 | **1.9** | 2.44 | 2.08 |
| Colima | 1.13 | 1.22 | 1.36 | 1.36 | 1.45 | 1.39 | 1.29 | 0.95 | 1.06 | 1.25 | 1.21 |
| Mexico City* | 0.79 | 0.77 | 0.78 | **0.86** | 1.05 | 1.24 | 1.28 | 1.25 | 1.24 | 1.15 | 1.38 |
| Durango | 0.73 | 0.85 | 0.88 | 0.8 | 0.81 | 0.82 | 0.85 | 0.94 | 0.91 | 1.0 | 1.09 |
| Guerrero* | 0.37 | 0.35 | 0.41 | 0.35 | 0.35 | 0.39 | 0.38 | **0.48** | 0.66 | 0.61 | 0.56 |
| Guanajuato | 0.63 | 0.67 | 0.73 | 0.79 | 0.8 | 0.8 | 0.84 | 0.84 | 1.01 | 1.08 | 1.27 |
| Hidalgo* | 0.28 | 0.3 | 0.32 | 0.35 | 0.49 | 0.48 | **0.51** | 0.69 | 0.8 | 0.89 | 0.89 |
| Jalisco | 0.47 | 0.53 | 0.6 | 0.61 | 0.57 | 0.58 | 0.58 | 0.56 | 0.54 | 0.55 | 0.53 |
| Mexico* | 0.52 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 | 0.56 | **0.8** | 1.11 | 1.13 | 1.18 |
| Michoacan* | 0.62 | 0.66 | 0.65 | 0.64 | 0.65 | 0.65 | 0.75 | 0.8 | 0.79 | 0.77 | **0.88** |
| Morelos | 0.5 | 0.43 | 0.45 | 0.57 | 0.6 | 0.67 | 0.72 | 0.75 | 0.71 | 0.71 | 0.8 |
| Nayarit* | 0.9 | 1.03 | 1.06 | 0.85 | 0.81 | 0.81 | 0.83 | 0.93 | 0.93 | 0.85 | **0.9** |
| Nuevo Leon | 0.99 | 1.04 | 1.34 | 1.52 | 1.58 | 1.42 | 1.45 | 1.54 | 1.33 | 1.58 | 1.74 |
| Oaxaca | 0.13 | 0.12 | 0.16 | 0.16 | 0.16 | 0.16 | 0.15 | 0.2 | 0.26 | 0.25 | 0.29 |
| Puebla | 0.34 | 0.35 | 0.38 | 0.38 | 0.38 | 0.4 | 0.41 | 0.48 | 0.51 | 0.52 | 0.47 |
| Queretaro | 0.67 | 0.78 | 0.79 | 0.83 | 0.73 | 0.81 | 0.85 | 0.84 | 1.08 | 1.13 | 1.32 |
| Quintana Roo* | 0.86 | 1.0 | 1.17 | 1.33 | 1.36 | 1.15 | 1.19 | 0.7 | **0.69** | 0.95 | 1.14 |
| Sinaloa* | 1.0 | 1.02 | 1.13 | 1.17 | 1.07 | 1.14 | 1.23 | 1.29 | **1.41** | 1.88 | 1.93 |
| San Luis Potosi | 0.42 | 0.48 | 0.53 | 0.52 | 0.57 | 0.58 | 0.65 | 0.66 | 0.65 | 0.58 | 0.61 |
| Sonora | 0.96 | 1.0 | 1.07 | 1.12 | 1.06 | 1.05 | 1.02 | 1.07 | 1.13 | 1.15 | 1.13 |
| Tabasco | 0.61 | 0.69 | 0.63 | 0.77 | 0.83 | 0.7 | 0.74 | 0.78 | 0.66 | 0.72 | 0.71 |
| Tamaulipas* | 0.58 | 0.62 | 0.68 | 0.67 | 0.6 | 0.57 | 0.62 | 0.69 | 0.58 | 0.57 | **0.95** |
| Tlaxcala | 0.12 | 0.16 | 0.22 | 0.29 | 0.25 | 0.26 | 0.33 | 0.37 | 0.39 | 0.44 | 0.43 |
| Veracruz | 0.45 | 0.46 | 0.49 | 0.54 | 0.53 | 0.52 | 0.57 | 0.58 | 0.61 | 0.53 | 0.55 |
| Yucatán* | 1.23 | 1.08 | 1.14 | 1.21 | 1.16 | 1.03 | 1.22 | **1.21** | 0.93 | 0.85 | 1.26 |
| Zacatecas | 0.75 | 0.82 | 0.86 | 0.84 | 0.94 | 0.95 | 0.97 | 1.17 | 1.18 | 1.19 | 1.19 |

Source: Author's calculations using National Institute of Statistics and Geography (INEGI) information. *States with unilateral divorce legislation. In 2016, Baja California Sur, Colima, Morelos, Nuevo Leon, Puebla and Tlaxcala, also modified their legislation towards no-fault divorce, but 2016 divorce data are not yet available. Note: Bolded cells indicate the year when the state adopted unilateral divorce.

**Table B.6** Correlation coefficients

| Initial Divorce Rate | Divorce Rates Vs. Adoption of Unilateral Legislation | Divorce Rates Vs. Year Adopting Unilateral Legislation |
|---|---|---|
| 2005 | 0.1286 | 0.4318 |
| | (0.4830) | (0.2127) |
| 2001 | 0.1062 | 0.3385 |
| | (0.5630) | (0.3388) |
| 1993 | 0.0431 | -0.0639 |
| | (0.8147) | (0.8608) |

Source: Author's calculations using National Institute of Statistics and Geography (INEGI) data and information from the standing legislation in each state.
Note: Significance levels in parentheses.

**Table B.7** Static effects on divorce rates – Excluding time fixed effects

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | 0.394*** | 0.435*** | 0.303*** | 0.215*** |
| | (0.0532) | (0.0257) | (0.0307) | (0.0323) |
| Adjusted $R^2$ | 0.133 | 0.871 | 0.941 | 0.955 |
| Time effects | No | No | No | No |
| Prob > F | | | | |
| State effects | No | Yes, F = 65.41 | Yes, F = 38.10 | Yes, F = 29.19 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 13.28 | Yes, F = 2.69 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 3.82 |
| Prob > F | | | | 0.000 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level.

**Table B.8** Static effects on divorce rates – 1993 to 2015

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | 0.526*** | 0.264*** | 0.323*** | 0.319*** |
| | (0.0466) | (0.0241) | (0.0223) | (0.0260) |
| Adjusted $R^2$ | 0.146 | 0.865 | 0.937 | 0.952 |
| Time effects | No | Yes, F = 38.49 | Yes, F = 3.36 | Yes, F = 4.69 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State effects | No | Yes, F = 100.60 | Yes, F = 36.93 | Yes, F = 18.39 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 26.23 | Yes, F = 6.26 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 7.14 |
| Prob > F | | | | 0.000 |
| Total of observations | 736 | 736 | 736 | 736 |

Source: National Institute of Statistics and Geography (INEGI), National Population Council (CONAPO) for states' population from 1993 to 2004, and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level.

**Table B.9** Static effects on divorce rates – 2005 to 2015 – Control variables

| | **(1)** | **(2)** | **(3)** | **(4)** |
|---|---|---|---|---|
| Unilateral | 0.133*** | 0.289*** | 0.302*** | 0.225*** |
| | (0.0480) | (0.0275) | (0.0317) | (0.0352) |
| Education | 0.248*** | -0.182 | -0.187 | -0.103 |
| | (0.0346) | (0.129) | (0.427) | (0.494) |
| Female labour force | -0.010** | 0.006 | 0.009* | -0.003 |
| | (0.0043) | (0.0049) | (0.0051) | (0.0060) |
| Fertility | -0.003 | 0.001 | 0.001 | 0.002 |
| | (0.0018) | (0.0015) | (0.0016) | (0.0016) |
| GDP | 0.002 | 0.0001 | -0.001 | -0.0009 |
| | (0.0047) | (0.0035) | (0.0028) | (0.0027) |
| Unemployment | -0.038** | -0.053*** | -0.027** | -0.009 |
| | (0.0156) | (0.0128) | (0.0110) | (0.0136) |
| Adjusted $R^2$ | 0.425 | 0.903 | 0.945 | 0.955 |
| Time effects | No | Yes, F = 1.94 | Yes, F = 0.85 | Yes, F = 0.49 |
| Prob > F | | 0.040 | 0.577 | 0.892 |
| State effects | No | Yes, F = 55.02 | Yes, F = 24.46 | Yes, F = 14.89 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 8.39 | Yes, F = 2.42 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 2.91 |
| Prob > F | | | | 0.000 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level. *Statistically significant at the 90% confidence level.

**Table B.10** Dynamic effects on divorce rates – 2005 to 2015 – Control variables

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | | | | |
| First 2 years | 0.141** | 0.261*** | 0.279*** | 0.211*** |
| | (0.0643) | (0.0317) | (0.0329) | (0.0373) |
| Years 3 and 4 | 0.167** | 0.335*** | 0.368*** | 0.213*** |
| | (0.0682) | (0.0354) | (0.0449) | (0.0621) |
| 5 years or more | -0.017 | 0.222*** | 0.270*** | 0.037 |
| | (0.111) | (0.0575) | (0.0832) | (0.110) |
| Education | 0.256*** | -0.190 | -0.250 | -0.057 |
| | (0.0350) | (0.131) | (0.421) | (0.491) |
| Female labour force | -0.009** | 0.006 | 0.007 | -0.004 |
| | (0.0043) | (0.0049) | (0.0050) | (0.0059) |
| Fertility | -0.002 | 0.002 | 0.001 | 0.002 |
| | (0.0018) | (0.0015) | (0.0015) | (0.0016) |
| GDP | 0.001 | -0.00001 | -0.002 | -0.0009 |
| | (0.0047) | (0.0034) | (0.0028) | (0.0027) |
| Unemployment | -0.040*** | -0.053*** | -0.028*** | -0.007 |
| | (0.0158) | (0.0127) | (0.0109) | (0.0135) |
| Adjusted $R^2$ | 0.426 | 0.905 | 0.947 | 0.955 |
| Time effects | No | Yes, F = 1.86 | Yes, F = 0.63 | Yes, F = 0.59 |
| Prob > F | | 0.050 | 0.781 | 0.819 |
| State effects | No | Yes, F = 55.48 | Yes, F = 24.20 | Yes, F = 14.96 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 8.66 | Yes, F = 2.32 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 2.72 |
| Prob > F | | | | 0.000 |
| Equality of coefficients | F = 1.18 | F = 3.09 | F = 5.45 | F = 2.90 |
| Prob > F | 0.307 | 0.046 | 0.004 | 0.056 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using state and year population-weighted least squares. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level.

**Table B.11** Static effects on divorce rates – 2005 to 2015 – OLS

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | 0.308*** | 0.213*** | 0.194*** | 0.154*** |
| | (0.0666) | (0.0351) | (0.0393) | (0.0435) |
| Adjusted $R^2$ | 0.055 | 0.862 | 0.927 | 0.940 |
| Time effects | No | Yes, F = 6.56 | Yes, F = 1.47 | Yes, F = 1.39 |
| Prob > F | | 0.000 | 0.149 | 0.182 |
| State effects | No | Yes, F = 65.08 | Yes, F = 37.15 | Yes, F = 25.34 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 9.95 | Yes, F = 2.15 |
| Prob > F | | | 0.000 | 0.001 |
| State trend, quadratic | No | No | No | Yes, F = 2.93 |
| Prob > F | | | | 0.000 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using ordinary least squares. ***Statistically significant at the 99% confidence level.

**Table B.12** Dynamic effects on divorce rates – 2005 to 2015 – OLS

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | | | | |
| First 2 years | 0.292*** | 0.184*** | 0.181*** | 0.145*** |
| | (0.0909) | (0.0407) | (0.0403) | (0.0469) |
| Years 3 and 4 | 0.321*** | 0.255*** | 0.244*** | 0.157* |
| | (0.106) | (0.0490) | (0.0581) | (0.0842) |
| 5 years or more | 0.337* | 0.267*** | 0.142 | -0.00525 |
| | (0.189) | (0.0871) | (0.112) | (0.157) |
| Adjusted $R^2$ | 0.050 | 0.862 | 0.928 | 0.940 |
| Time effects | No | Yes, F = 5.99 | Yes, F = 1.24 | Yes, F = 1.40 |
| Prob > F | | 0.000 | 0.265 | 0.179 |
| State effects | No | Yes, F = 65.15 | Yes, F = 37.27 | Yes, F = 25.25 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 9.98 | Yes, F = 2.09 |
| Prob > F | | | 0.000 | 0.001 |
| State trend, quadratic | No | No | No | Yes, F = 2.89 |
| Prob > F | | | | 0.000 |
| Equality of coefficients | F = 0.04 | F = 1.03 | F = 1.68 | F = 1.27 |
| Prob > F | 0.964 | 0.358 | 0.187 | 0.281 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using ordinary least squares. ***Statistically significant at the 99% confidence level. *Statistically significant at the 90% confidence level.

**Table B.13** Static effects on divorce rates – 2005 to 2015 – WLS – Divorce rate in log

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | 0.499*** | 0.332*** | 0.325*** | 0.262*** |
| | (0.0723) | (0.0297) | (0.0335) | (0.0353) |
| Adjusted $R^2$ | 0.117 | 0.931 | 0.966 | 0.974 |
| Time effects | No | Yes, F = 14.62 | Yes, F = 1.73 | Yes, F = 1.82 |
| Prob > F | | 0.000 | 0.074 | 0.058 |
| State effects | No | Yes, F = 130.2 | Yes, F = 99.79 | Yes, F = 69.51 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 11.00 | Yes, F = 3.41 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 3.91 |
| Prob > F | | | | 0.000 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using ordinary least squares. ***Statistically significant at the 99% confidence level.

**Table B.14** Dynamic effects on divorce rates – 2005 to 2015 – WLS – Divorce rate in log

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | | | | |
| First 2 years | 0.427*** | 0.287*** | 0.301*** | 0.247*** |
| | (0.104) | (0.0351) | (0.0348) | (0.0376) |
| Years 3 and 4 | 0.535*** | 0.401*** | 0.400*** | 0.245*** |
| | (0.109) | (0.0383) | (0.0475) | (0.0631) |
| 5 years or more | 0.614*** | 0.277*** | 0.294*** | 0.0708 |
| | (0.172) | (0.0609) | (0.0878) | (0.112) |
| Adjusted $R^2$ | 0.115 | 0.933 | 0.967 | 0.974 |
| Time effects | No | Yes, F = 13.94 | Yes, F = 1.64 | Yes, F = 2.07 |
| Prob > F | | 0.000 | 0.093 | 0.027 |
| State effects | No | Yes, F = 133.1 | Yes, F = 102.7 | Yes, F = 70.44 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 11.20 | Yes, F = 3.28 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 3.64 |
| Prob > F | | | | 0.000 |
| Equality of coefficients | F = 0.54 | F = 4.30 | F = 5.90 | F = 2.74 |
| Prob > F | 0.581 | 0.014 | 0.003 | 0.066 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using ordinary least squares. ***Statistically significant at the 99% confidence level. *Statistically significant at the 90% confidence level.

**Table B.15** Static effects on divorce rates – 2005 to 2015 – OLS – Divorce rate in log

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | 0.359*** | 0.190*** | 0.182*** | 0.148*** |
| | (0.0927) | (0.0388) | (0.0397) | (0.0442) |
| Adjusted $R^2$ | 0.038 | 0.911 | 0.961 | 0.968 |
| Time effects | No | Yes, F = 11.30 | Yes, F = 1.34 | Yes, F = 1.64 |
| Prob > F | | 0.000 | 0.208 | 0.094 |
| State effects | No | Yes, F = 108.4 | Yes, F = 106.8 | Yes, F = 71.79 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 13.71 | Yes, F = 3.41 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 2.87 |
| Prob > F | | | | 0.000 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using ordinary least squares. ***Statistically significant at the 99% confidence level.

**Table B.16** Dynamic effects on divorce rates – 2005 to 2015 – OLS – Divorce rate in log

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Unilateral | | | | |
| First 2 years | 0.325** | 0.141*** | 0.164*** | 0.139*** |
| | (0.126) | (0.0449) | (0.0406) | (0.0476) |
| Years 3 and 4 | 0.378** | 0.260*** | 0.236*** | 0.160* |
| | (0.148) | (0.0541) | (0.0586) | (0.0853) |
| 5 years or more | 0.448* | 0.286*** | 0.0972 | -0.0232 |
| | (0.263) | (0.0960) | (0.113) | (0.159) |
| Adjusted $R^2$ | 0.033 | 0.912 | 0.961 | 0.968 |
| Time effects | No | Yes, F = 10.63 | Yes, F = 1.31 | Yes, F = 1.68 |
| Prob > F | | 0.000 | 0.222 | 0.085 |
| State effects | No | Yes, F = 109.5 | Yes, F = 107.9 | Yes, F = 71.9 |
| Prob > F | | 0.000 | 0.000 | 0.000 |
| State trend, linear | No | No | Yes, F = 13.67 | Yes, F = 3.28 |
| Prob > F | | | 0.000 | 0.000 |
| State trend, quadratic | No | No | No | Yes, F = 2.80 |
| Prob > F | | | | 0.000 |
| Equality of coefficients | F = 0.10 | F = 2.43 | F = 2.55 | F = 1.70 |
| Prob > F | 0.900 | 0.090 | 0.080 | 0.185 |
| Total of observations | 352 | 352 | 352 | 352 |

Source: National Institute of Statistics and Geography (INEGI) and standing legislation in each state. Divorce rates are measured as the total divorces per thousand people. Standard errors in parentheses. All regressions include a constant term and are estimated using ordinary least squares. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level. *Statistically significant at the 90% confidence level.

# Chapter 3. Domestic violence and women's earnings: Does frequency matter?

## 1 Introduction

Domestic violence is a serious global challenge. Although its prevalence and incidence vary between societies, there are no countries with all the potential mechanisms set in place to fully prevent intimate partner violence.[25] A major concerns is how to modify social norms to eradicate women's acceptance of domestic abuse. According to the Social Institutions and Gender Index (SIGI), domestic violence (DV) is justifiable by one in three women across 108 countries (OECD 2014). Women are at risk regardless of their country of origin, level of education, age, or labour status. In addition, estimations for Australia, Brazil, United Kingdom and Vietnam indicate an economic loss from 1 percent to 2 percent of gross domestic product due to costs associated with DV (Duvvury et al. 2012; WHO-CDC 2008; Walby 2004; Access Economics 2004). Moreover, at the individual level, intimate partner violence (IPV) has severe and sometimes fatal consequences on physical and mental health, jeopardizing women's productivity in the labour market (United Nations 2015).

This chapter provides an empirical analysis of the effects of domestic violence on women's earnings, a particular area that has not yet received much attention in the literature, despite the increasing economic research focused on domestic violence. Even though some studies have examined the relationship between earnings and intimate partner violence (Vyas 2013; Duvvury et al. 2012; Sanchez and Ribero 2004; Morrison and Orlando 1999), to the best of my knowledge, none of them considers a variation in the frequency of domestic violence the woman has been exposed to, as an alternative measure to IPV. Rather, most analyses are conducted comparing women who had suffered IPV at least once, against women who have never been abused. This is an understandable strategy followed by researchers given the official United Nations

[25] In a broader sense the term "domestic violence" can be used to indicate any type of abuse in a domestic setting, whereas the term "intimate partner violence" is only used when violence is inflicted from one spouse or partner against the other. Both terms are used indistinctively throughout this paper, referring to violence within a couple, perpetrated from a man to a woman.

definition of violence against women: "any act of gender-based violence that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or private life."[26] Furthermore, the incidence of IPV is not easy to track and how to create an adequate indicator of domestic violence is an even more difficult task.

The contribution of this study is to estimate the effect of the different types of domestic violence, economic, emotional and physical; considering different levels of their frequency, on women's earnings. It also aims to provide, for the first time, empirical evidence on how a different definition of IPV can lead to very different size effects. This paper has by no means the intention to diminish the severity of domestic abuse irrespective to its frequency, so it is important to explicitly mention that intimate partner violence must be rejected at all levels. However, women trapped in a vicious cycle of abuse might be particularly susceptible to the effects of DV on their productivity, the framework this article intends to highlight. Sample selection bias and endogeneity issues are also considered.

Given the nature of the indicator of domestic violence that is suggested in this paper, a standardized variable that measures the different types of IPV only when the woman is working, the conventional Heckman model is not possible to apply. Following a methodology suggested by Wooldridge (2010) a correction is implemented to properly account for self-selection into the labour market. This technique is additionally useful when causality is addressed. Using the husband's random irritability, an instrument for domestic violence is created. The main idea is to analyse to what extent women's earnings are affected not only when they are abused, but when the abuse is unpredictable and they have no options left in order to prevent or minimize it. The analysis is conducted for Mexico using the National Survey on the Dynamics of Household Relationships (ENDIREH by its acronym in Spanish) 2016 and 2006. According to this survey 43 percent of women have experienced intimate partner violence during their current relationship, reporting emotional abuse as the most common type of violence.

Findings reveal that domestic violence reduces women's earnings, despite the IPV definition used. Physical abuse has the greatest impact of all types of violence. A one standard deviation increase in the physical violence index reduces earnings by 6.6

[26] United Nations General Assembly. Declaration on the Elimination of Violence Against Women. In: 85th Plenary Meeting. December 20, 1993. Geneva, Switzerland; 1993.

percent. Likewise, economic and emotional violence reduce earnings by 5.3 percent and 4.7 percent respectively. If the "traditional" measure of DV is adopted (any form of abuse), the results show that women with at least one incident of physical violence earn on average 22.4 percent less than women never abused. Using this same definition, earnings also decrease by 16.4 percent for economic violence and 14.5 percent for emotional violence. Although the estimations obtained from these two different approaches are not directly comparable, calculations for a hypothetical case reveal that earnings are reduced in 46.9 percent for a woman facing the highest level of physical abuse when using the index for IPV instead of the traditional measure of DV.

The rest of the article is organised as follows: Section 2 presents the literature review. An overview of the context of women in Mexico is provided in Section 3. The estimation strategy is discussed in Section 4. In Section 5 the data used is described and Section 6 presents the estimation results. Conclusion is set out in Section 7.

## 2 Literature review – Measures of domestic violence

From a theoretical perspective, despite the ambiguous effect that domestic violence exerts on women's labour force participation (Lloyd 1997; Morrison and Orlando 1999; Farmer and Tiefenthaler 2004; Crowne et al. 2011), the mechanism through which DV affects earnings is very straightforward. Women suffering intimate partner violence are more likely to experience depression, substance abuse, female reproductive disorders, sexually transmitted infections, low back pain, headaches, gastroesophageal reflux disease, amongst others (Anderson et al. 2003; Martin et al. 2008; Bonomi et al. 2009); conditions that seriously compromise job performance for those in the labour market.

Very few empirical studies have analysed the relationship between earnings and domestic violence. One of the earliest papers analyses two Latin American countries, Chile and Nicaragua (Morrison and Orlando 1999). The paper classifies IPV into four different types: moderate and severe physical violence, as well as psychological and sexual abuse.[27] The indicator for DV is equal to one if the woman has experienced any

[27] Moderate physical violence, fewer than five acts of moderate physical violence in last year. Severe physical violence, more than five acts of moderate physical violence or any act of severe physical violence in a year. Psychological violence, insults or threats more than five times a year. Sexual violence, any type of coercion to force a woman to have sex.

type of domestic abuse, or zero otherwise. Regression estimates indicate that domestic abuse is significantly related to lower women's monthly earnings. Abused women in Chile and Nicaragua earn on average 34 percent and 46 percent less, respectively, than women who have never been exposed to IPV.[28] One of the main limitations in the analysis is the sample size. Surveys were conducted just in two cities, Santiago in Chile and Managua in Nicaragua, and the earnings equations were estimated using only 106 observations for Chile and 121 observations for Nicaragua. Morrison and Orlando (1999) also indicate that results using the different types of domestic violence separately show a negative and significant effect on earnings, but the article does not provide any additional information so it is not possible to identify the type of violence with the strongest negative impact on earnings.

In a more recent analysis, using data from Tanzania, Propensity Score Matching (PSM) methods are implemented to identify the effects of partner violence on earnings for women working in formal waged work and non-agricultural self-employment (Vyas 2013). Four measures of DV are established: Lifetime physical and/or sexual violence; lifetime physical (severe) and/or sexual violence; current physical and/or sexual violence (past 12 months); and current physical (severe) and/or sexual violence (past 12 months). The domestic violence measure takes the value of one if the woman reported having experienced any act that fits into the definition.[29] General findings show lower earnings for abused women when compared to women never exposed to IPV. Most extreme differences are for women that have experienced current physical (severe) and/or sexual violence (total sample) with 47 percent to 53 percent lower earnings and for women in formal waged work that have experienced physical (severe) and/or sexual violence (current and lifetime) with 57 percent to 61 percent less earnings. Vyas (2013) indicates that the largest female employment sector in Tanzania is agricultural self-employment, but it was not included in the analysis because data was not available. It is also mentioned that the use of PSM attempts to reduce the potential bias in the non-randomness of partner violence, but inferring a causal relationship might be difficult given the unobserved heterogeneity not addressed in the analysis.

[28] Results for Nicaragua include a correction for selection bias. The authors indicate that the earnings equation results reported for Chile does not include this term given its lack of significance. In addition, to address reverse causality between earnings and IPV, simultaneous equations models for earnings and violence are performed. However, estimations indicate that women's earnings are not a determinant of domestic violence.

[29] Lifetime measure excludes abuse in the last 12 months.

Given the inherent difficulties in most of the analyses conducted when trying to disentangle all the potential sources of heterogeneity, the true effects between any type of violence against women (VAW) and earnings are not easy to determine. Sabia et al. (2013) is the only formal economic paper, to the best of my knowledge, that strongly controls for a wide range of community, school, family and individual levels of heterogeneity in a related context. Although the article does not address intimate partner violence but sexual assault, it is found that hourly wages for young adult women who reported sexual violence are 5.1 percent lower compared to earnings from women never sexually abused.

For the particular case of Mexico, no previous studies have directly analysed the relationship between domestic violence and earnings. An inspiring paper by Bobonis et al. (2013), discusses the effects on domestic violence of conditional cash transfers to beneficiary women enrolled in the Mexican Oportunidades program,[30] compared to non-beneficiary women. IPV is categorised as physical, sexual or emotional abuse. A dichotomous variable for each measure of DV takes the value of one if the female has suffered that type of violence in the past 12 months. Results reveal that beneficiary women are less likely to experience physical abuse as an improvement in their bargaining power, but they are also more likely to suffer emotional violence, possibly as an alternative used by male partners to reposition themselves as the dominant figure within the household.

Domestic violence analyses are typically conducted using as a measure of IPV an indicator with only two options, abused or not abused. Erten and Keskin (2018) provide an interesting different approach in order to determine the causal effect of education on domestic violence in Turkey, exploiting a change in compulsory education. Based on a full set of questions related to DV, a binary variable is created for each question. If the woman has ever suffered that particular act of abuse from her partner, it takes the value of one, or zero if she has never been exposed to it. Later, the z-scores per question are obtained and grouped into four categories: physical, sexual, psychological or economic violence, according to the type of violence they assess. Finally, for each category the average of the z-scores is calculated and used to create the four indices of IPV. Evidence confirms adverse impacts by the educational reform on psychological and economic violence and no effects on physical and sexual abuse, for women in rural areas. Even

[30] Oportunidades used to be the main anti-poverty government social program in the country.

though the DV index does not capture different levels of violence inflicted, it is a remarkable introduction to the traditional measures of domestic violence used in the literature. It also provides the basis for the IPV indicator proposed in this paper, further explained in Section 4.

# 3 Mexican women – A contextual approach

According to the 2010 census of Mexico, 112 million people live in the country. Women account for 51.2 percent of the population, holding a slight lead over men. The average years of schooling for women are 8.5.[31] Efforts continue under way to eradicate illiteracy with 8.1 percent of women remaining illiterate. Fertility rate has declined to 1.7 children per woman, compared to 2.4 in 1990.[32] Considering the level of education, women with no more than compulsory school (9 years) bear on average 2.7 children, while women with higher levels of education only have 1.1. Among women aged 15 years or older, 42.6 percent are married, 27.5 percent are single, 15.1 percent cohabitate and 14.6 percent are either separated, divorced or widow.[33]

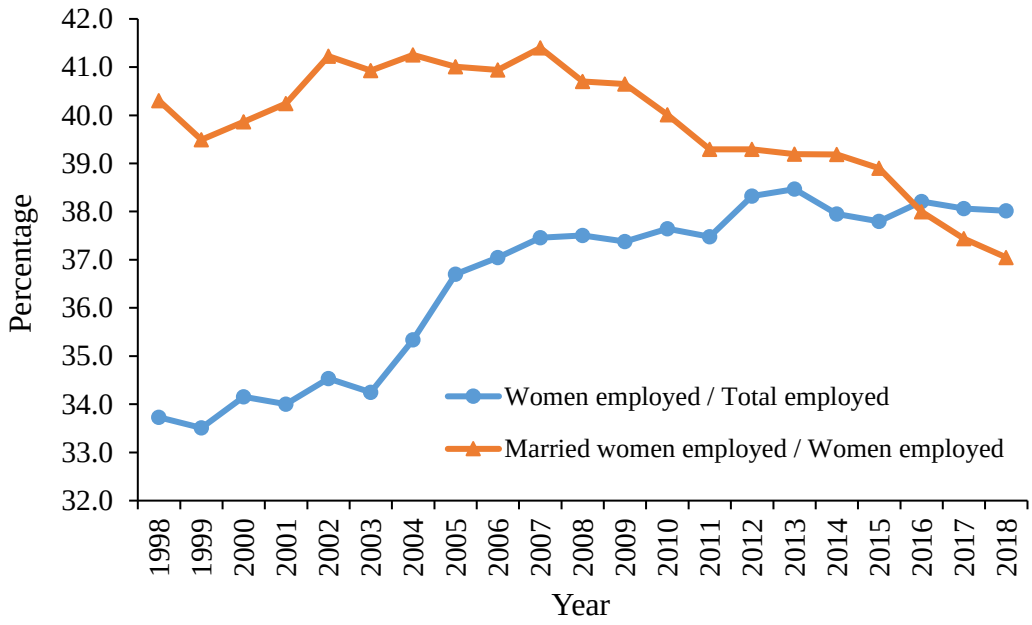
## 3.1 Women at work

Over the last 20 years a gradual increase in women's working patterns has been observed in Mexico. In 2018 women represented 38 percent of the total employed population, compared to 33.7 percent in 1998. However, the proportion of employed married women has declined from 40 percent in 1998 to 37 percent in 2018, when only considering employed women (see Figure 3.1). This fall has been partially compensated by a continuous rise in the proportion of cohabiting women employed, 6.4 percent in 1998 and 14.9 percent in 2018.[34] The current unemployment rate in Mexico is around 3.2 percent. Women represent about 40 percent of the unemployed population, a percentage that has

[31] Women aged 15 years or older.
[32] Women aged between 15 to 49 years old. Average number of children born alive.
[33] Percentages do not add up to 100 because 0.2 percent of women did not report their marital status.
[34] National Employment Survey (ENE) for 1998 and National Survey of Occupation and Employment (ENOE) for 2018.

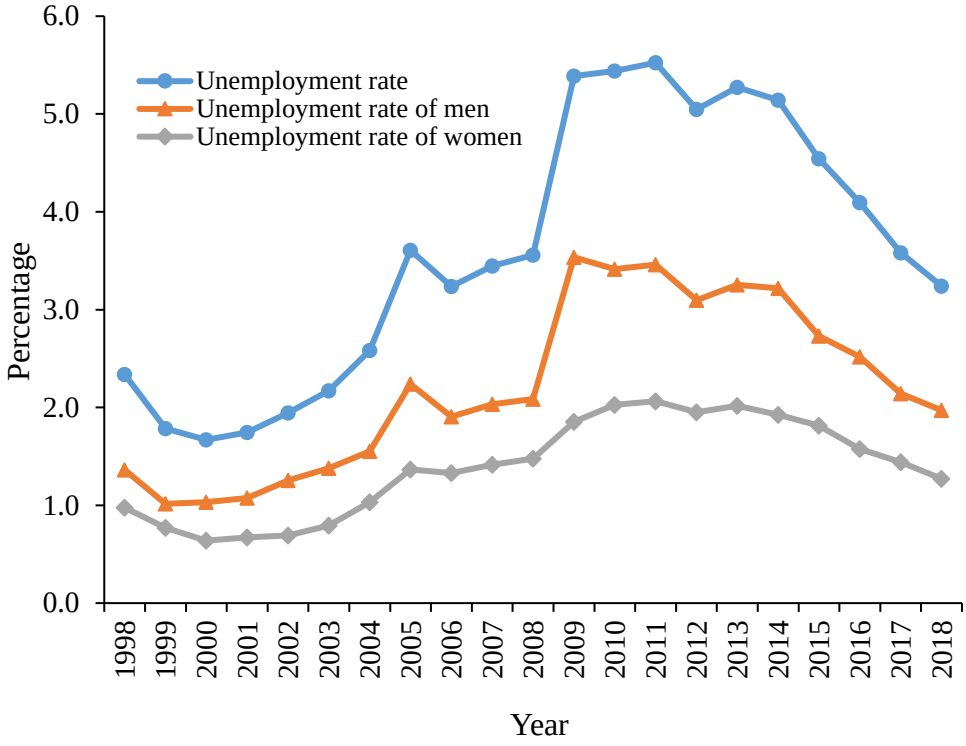
remained relatively stable since 1998, with 671 226 unemployed women during the first trimester of 2018 (see Figure 3.2). Data by sectoral participation indicates that women are mostly engaged in the tertiary sector (services), the prevailing sector in the Mexican economy, representing almost 50 percent of the employed population in 2018. On the contrary, women's participation in the primary sector (agriculture) and the secondary sector (industry), has not only steadily decreased but is much less than half of men (see Figure 3.3). Not surprisingly, women comprise the majority of the economically inactive population. For the period 2005-2018, on average, 75 percent of the working-age population not in the labour force were females. Besides, among females, married women lead this trend with 12.1 million out of the labour market in 2018 (see Figure 3.4). While these data provide a very general overview on the evolution of women's labour force participation in Mexico, there are no striking features indicating a radical change on female labour supply during the past two decades.

**Figure 3.1** Women and employment



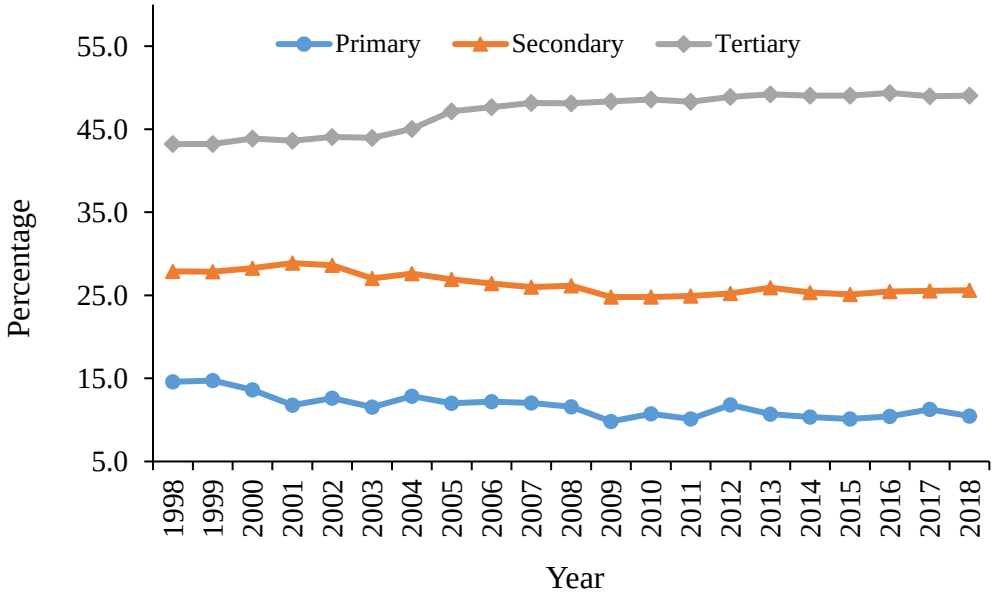

Source: National Institute of Statistics and Geography (INEGI). National Survey of Occupation and Employment (ENOE) for 2005 to 2018. National Employment Survey (ENE) for 1998 to 2004. Second trimester reported. ENE was replaced by ENOE in 2005, so they are not strictly comparable.

**Figure 3.2** Unemployment rates



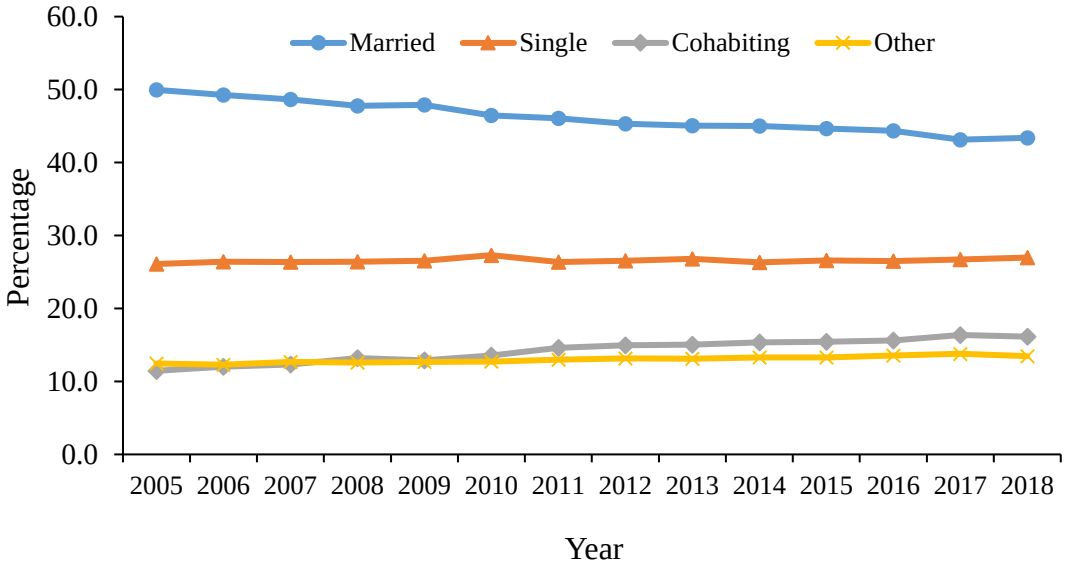

Source: National Institute of Statistics and Geography (INEGI). National Survey of Occupation and Employment (ENOE) for 2005 to 2018. National Employment Survey (ENE) for 1998 to 2004. Second trimester reported. ENE was replaced by ENOE in 2005, so they are not strictly comparable.

**Figure 3.3** Sectorial participation of women




Source: National Institute of Statistics and Geography (INEGI). National Survey of Occupation and Employment (ENOE) for 2005 to 2018. National Employment Survey (ENE) for 1998 to 2004. Second trimester reported. ENE was replaced by ENOE in 2005, so they are not strictly comparable.

**Figure 3.4** Women out of the labour force




Source: National Institute of Statistics and Geography (INEGI). National Survey of Occupation and Employment (ENOE). Second trimester reported. Category "Other" includes marital status divorced, separated, widow and not specified.

In fact, Mexican female labour market participation is below the average for OECD countries with the second-lowest rate only after Turkey. Barriers for females to join and remain in the workforce in Mexico are several. In addition to low salaries, long commutes and an employment legislation that could be improved in terms of gender and parenting; employees in Mexico are expected to work at least ten hours daily (regardless of the cap of 8 hours established in most workplaces), around 60 percent of the population believe that female breadwinners pose a threat to household stability, a lack of adequate supply of childcare for young children exists and rates of violence against women continue to be alarming (OECD 2017). All these factors represent additional difficulties for women to participate in the labour force. The next section provides information on gender-based violence to present a summarized outline about its prevalence in Mexico.

## 3.2 Gender-based violence in Mexico

On average, 7.5 women were killed every day in Mexico in 2016. Since 2011, femicide rates have been at their highest levels, with 4.6 women murdered for every 100 000 women in 2011 and 2012, against 1.9 in 2007, the lowest rate recorded over the last 30 years. For the period 2012-2016, a rise in the number of women murdered between 20

and 40 years old, specifically during women's reproductive age, reveals an important change in the structure of women's homicides and might be considered an indicator of the increasing levels of intimate partner violence suffered by women (Echarri 2017). Moreover, by comparing estimations for female homicides per 100 000 women in 2016 for five different countries, the vulnerable situation that Mexican women face is evident (see Table 3.1).

**Table 3.1** Women killed by 100 000 women in 2016

| Country | Rate |
|---|---|
| 1. Colombia | 4.1 |
| ***2. Mexico*** | ***4.4*** |
| 3. Peru | 3.3 |
| 4. United States | 1.9 |
| 5. United Kingdom | 0.6 |

Source: Author's own calculations for Colombia - Departamento Administrativo Nacional de Estadistica (DANE); Peru - Instituto Nacional de Estadistica e Informatica (INEI); United States – STATISTA; and United Kingdom - Office for National Statistics (ONS). Data for Mexico from Echarri 2017.

Although a partner should be someone to rely upon and trust, women are more likely to suffer violence from intimate partners/family, than by any other type of perpetrators. Global data indicates that almost 50 percent of all women murdered in 2012 died at hands of their partners or family, but less than 6 percent of men were killed under these circumstances (UNODC 2013).

Data for Mexico shows that around 45 percent of women that have been in a relationship between 2006 and 2016 have experienced intimate partner violence.[35] Furthermore, 78.6 percent of Mexican women that suffered physical or sexual abuse from partners never reported the incident.[36] While 28.8 percent of these women suggested the violent episode was not relevant enough to be disclosed, many others did not come forward because they were afraid, ashamed, did not know how and where to file the complaint, or do not trust the authorities, to mention some of the most important reasons. On top of that, 35 percent of these women reported having suffered physical damage, mainly in the form of bruises or inflammation, but also as haemorrhages, bleeding, burns, lost teeth, fractures, amongst others.[37]

[35] National Surveys on the Dynamics of Household Relationships (ENDIREH). 2006, 2011 and 2016.
[36] National Survey on the Dynamics of Household Relationships 2016 (ENDIREH).
[37] National Survey on the Dynamics of Household Relationships 2016 (ENDIREH).

There has been a growing recognition of the importance of gender-based violence in Mexico. Two efforts are worth highlighting. In 2007, the General Law on Women's Access to a Life Free of Violence was published.[38] Its aim is to prevent, to punish and to eradicate violence against women. Six types of violence are identified: psychological, physical, violence against property, economic, sexual, and violence against the woman's dignity, integrity or freedom. A number of modifications have been continuously implemented to this law in order to have a better tool to combat gender-based violence. Secondly, since 2003 the National Institute of Statistics and Geography (INEGI) has carried out the National Survey on the Dynamics of Household Relationships (ENDIREH) to collect information on emotional, physical, patrimonial, economic and sexual violence that Mexican women experience with intimate partners, within the family, at work, at school or in their communities. There have been four cross-sectional surveys conducted in 2003, 2006, 2011 and 2016. This initiative has helped to generate statistics and indicators on VAW, and more importantly, to raise awareness of its magnitude in the country. However, while there has been some progress on violence and gender issues, much remains to be done.

Mexico ranks 81st in the Global Gender Gap Index (only above Brazil, Paraguay and Guatemala from the Latin America region), and the position drops to 124th when considering the Economic Participation and Opportunity subindex (WEF 2017). Efforts need to continue to reduce discrimination against women at all levels, in terms of justice, security, employment, health, education and social protection. Challenging tasks are to improve women's current conditions and to modify attitudes towards them at very young ages, at school and at home; otherwise women will continue to be trapped in a cycle of violence that is affecting not only women, but the Mexican society as a whole (OECD 2017).

# 4 Estimation strategy

The human capital earnings function can be considered one of the most popular benchmark models in applied econometrics to study the relationship between earnings and education, but it certainly has been widely used to analyse the influence of many

[38] Official Journal of the Federation. February 1st, 2007.

others factors on earnings as well. To examine the effect of domestic violence on women's earnings the following variation of the Mincer equation (Mincer 1974) is considered as the baseline regression in this paper:

$$LnW_i = \beta_{Ed}Ed_i + \beta_{Ex}Ex_i + \beta_{Ex^2}Ex_i^2 + \beta_{Ar}Ar_i + \beta_{Et}Et_i + \beta_{Ch}Ch_i + \beta_{Ye}Ye_i + \beta_{Dv}Dv_i + \varepsilon_i \quad (1)$$

Where the subscript $i$ refers to women and $i = 1, \dots, n$; $LnW_i$ is the natural logarithm of earnings, $Ed_i$ is the number of years of schooling, and $Ex_i$ and $Ex_i^2$ are the potential years of labour market experience and its square. In addition, four binary variables denoting if the woman $i$ lives in an urban area $Ar_i = 1$, belongs to an ethnic group $Et_i = 1$, has at least one child $Ch_i = 1$, and belongs to ENDIREH 2006 $Ye_i = 1$; or zero otherwise, are included. Finally, $Dv_i$ is the indicator of domestic violence.

## 4.1 An index for domestic violence

As explained earlier, domestic violence is complex to measure. Even if underreporting is ignored given the reluctance of the victims to report the abuse, or extensive efforts are addressed to accurately count all the incidents, it is difficult to differentiate in terms of units the level of abuse a husband that kicks his wife once per week is inflicting on her, compared to a husband that chokes his wife "only" every two months. This can be an additional argument supporting the most commonly strategy used when trying to measure domestic violence, any act of abuse experienced identifies the woman as abused. On the contrary, it can be argued that the level of domestic violence a woman has faced because her partner pushed her or pulled her hair one time is definitively not the same as the IPV suffered by a woman from a partner slapping her daily.

As one of the contributions of this paper, an indicator capturing variation in the levels of domestic violence is presented. It is not expected to be perfect, but it is an interesting initial effort to introduce and highlight how relevant it is to consider the frequency of domestic abuse. Hopefully it will challenge the traditional use of a dichotomous variable in the literature on DV and will also stimulate researchers to develop more precise measures of intimate partner violence.

DV is classified in three different types: economic, emotional and physical, according to the set of questions designed in the survey to identify each category of violence.[39] All questions have three possible outcomes to determine the regularity of that particular act of abuse the woman has experienced in the last 12 months from her intimate partner: more than once, only once or never.[40] One variable is created for every question. If the woman has never been abused, the variable takes the value of 0; if she has suffered that abuse one time, then the value of the variable is 1; and if she has been abused more than once, the variable takes the value of 2.

Once a variable with three levels (0, 1 or 2) is generated for all questions, the next step is to obtain the frequency of the abuse by adding up the different levels by question within each type of domestic violence. Given that the number of questions by category varies, for example, there are 13 questions to identify emotional abuse and six questions related to economic abuse, then, emotional violence can reach 26 points as a maximum, whereas economic violence can go up to 12 points. To adjust for the differences in the number of questions per type of IPV, the final index is calculated from standardizing the frequency of abuse for each dimension of violence. As a result, three indices are constructed: economic violence index, emotional violence index and physical violence index. All of them with a mean of zero and a standard deviation of one. This approach allows to analyse the effect that one standard deviation increase (or decrease) in any of the indices on domestic violence has on earnings, considering at the same time the levels and frequencies of the abuse, and not only identifying if the woman has experienced any act of violence in that particular dimension.

[39] Survey interview questions grouped by dimension of domestic violence are presented in Table C.12 in the Appendix. There are some differences between the questions asked in ENDIREH 2006 and ENDIREH 2016. Efforts were addressed to match both surveys.

[40] ENDIREH 2016 has not only three but four different categories to determine the level of abuse: very often, a few times, only once or never. A difficulty arises when trying to record "very often" and "few times". While the difference from never abused to abused once is very straightforward, just one jump in the unit of measurement, it is not specified if few times is less than ten times or five times; or if very often is more than five times or ten times, for instance. Thus, the breaking point between "very often" and "few times" is not clear, and self-perception of the woman plays an even more important role. Whereas some women could have reported ten times as few times, others could have reported it as very often. To overcome this challenge, the decision taken is to merge both categories into one, because what is known for sure is that few times and very often is more than one time. So the variable takes the value of 2 if the woman has reported very often or few times in ENDIREH 2016, indicating a woman that has experienced that kind of abuse on two or more occasions, which is in line to the options available for ENDIREH 2006.

## 4.2 Sample selection bias – Working against non-working married women

In this paper the analysis is centred on married women and the impact of domestic violence on their earnings. As mentioned earlier, women's participation rate in the Mexican labour market is not massive, so self-selection bias in the nature of the analysis conducted is highly likely to be present. Women who join the workforce might have characteristics that systematically differentiate them from non-working females. Not to consider that the earnings for non-working women are not included in the analysis can be problematic when trying to establish inferences about the relationship between domestic violence and married women's earnings as a whole.

The method most widely used to correct for sample selection bias is a two-step procedure proposed by Heckman (1976), also known as the Heckit model. In broad terms, the estimation comprises in the first stage a selection equation that determines the probability of participation in the labour force, and as the second step an outcome equation to estimate the wage offer conditional on the woman joining the labour market.

Based on the indices of domestic violence defined previously, the Heckit model cannot be applied directly here. The z-scores calculated through the standardization process are only obtained using the subsample of working females, so the measurements of abuse are not available for non-working women and the traditional Heckit estimation cannot take place because now one of the explanatory variables (the most relevant) is also truncated.[41] Later on, in the identification strategy section, the details on how to perform the estimations using as a baseline the Heckman model are presented.

## 4.3 Claiming causality

A problem when trying to establish a causal effect is to prove that variable A, in our case domestic violence, is beyond reasonable doubt a factor affecting variable B, women's earnings. If a direct link between these two variables cannot be established, then

[41] If the z-scores are obtained using both groups, working and non-working females, then, when trying to estimate the impact of each type of domestic abuse on earnings, the indices of violence will not comply with the characteristics of a standardized variable, a mean of zero and a standard deviation of one. It is important to distinguish that the adjustment done for the sample selection bias through the selection equation is to obtain unbiased estimators to make more accurate inferences about the population, but the estimation of the outcome equation incorporating the correction is only performed on the subsample of working women.

uncertainty about other possible variables affecting earnings through domestic abuse cannot be discarded, and causality would be far from being claimed. For instance, it can be argued that alcoholic husbands are more likely to abuse their wives, so a real root cause for lower earnings among married women may be to have a partner that drinks heavily and not domestic violence per se.

A technique successfully employed in economics to overcome the endogeneity problem is the method of instrumental variables. The key element is to find a valid instrument meeting three main requirements. The instrument must have a causal effect on the variable whose effects are trying to be captured, in this case domestic violence. It should be also unrelated to the omitted variables that would be ideal to control for, as an alcoholic husband for example. Lastly, the instrument has to affect the outcome, earnings, only through a single channel, domestic abuse, and not through other explanatory variables like the years of schooling or if the woman belongs to an ethnic group (Angrist and Pischke 2015).

In some cases, it can be remarkably difficult to find an instrument satisfying these conditions. The domestic abuse variable is not easy to tackle. Many factors potentially triggering the levels of domestic violence such as having witnessed domestic abuse between parents or to have been victim of violence during childhood, fertility issues, a large age gap within the couple or financial problems, just to name a few, can also simultaneously affect the ability of the woman to earn money through other mechanisms, which invalidates their use as possible instruments.

To conduct a causal analysis in this paper, an instrument indicating the husband's random irritability is created. ENDIREH, the survey used, devotes a specific section where women are asked if their partners get angry with them under certain conditions. There are several questions, and the causes of anger are diverse, exploring if the husband gets upset with his wife because she uses contraceptives, he believes she has an affair, she fails to fulfill the agreements established, and so forth.

One of the questions is: "Does your husband or partner gets angry with you for everything or for no reason?" This is a very useful question when trying to find an instrument for domestic violence. While women report several other reasons they are aware irritate their partners, for this question in particular there is nothing they can actually do to avoid an episode of anger from them. If the wife knows that not to obey her husband is going to cause trouble, then she has two options, either not to disobey him at all, or to be prepared in advance to deal with the coming conflict. Unfortunately, when

the woman indicates her partner gets irritated for everything or for no reason, it means for example that if she talks he gets mad, but if she does not talk he also becomes hostile; if she leaves him alone he is displeased, and if she is with him all the time he is annoyed as well. In these situations the woman is left with no options to prevent the domestic abuse and the husband's inexplicable irritability can be considered randomly assigned because it is completely independent from specific factors or situations. In addition, the question explicitly indicates the partner's anger should be directed to the woman (gets angry with you), so it is sensible to assume a direct link existing between the husband's random irritability and the domestic abuse; assuming the existence of a first stage. An upset partner will necessarily manifest his irritation through an act of violence, any act, otherwise, there would not be a visible indication perceived by the woman about her partner's current anger condition. It is worth highlighting that the husband's random irritability can be used as an instrument for any of the types of domestic violence, economic, emotional and physical. Some partners stop talking to women to demonstrate irritation, others can hit them or restrict the access to money. Random aggressiveness includes a wide range of non-predetermined behaviours allowing its use as an instrument for all the categories of domestic abuse. The last criteria to verify in order to have a possible valid instrument is if the husband's random irritability has an effect on earnings only through domestic violence. Due to the inherent nature of the instrument suggested, an unexplained rush of anger, it is challenging to think in other mechanisms different to domestic abuse affected by the instrument and impacting women's earnings as a result. Women do not know the source of this unexpected irritation, but they do know for instance, it is not explained because they work or study, so there are no incentives to modify their working status or their level of education; satisfying the exclusion restriction.

The instrument chosen determines the subpopulation affected, as a consequence, the group's particular characteristics are important to consider when trying to determine the true causal effect. Using the husband's random irritability as the instrument for domestic violence indicates the women affected by the instrument are more likely to live in a constant state of alertness, they know a sudden boost of irritation can come from nowhere. Hence, the impact of domestic violence on earnings is expected to be downward biased, given that the instrument is affecting women that are even more vulnerable to the magnitudes of domestic violence.

Causal inference using instrumental variables (IV) is fairly well known, but IV estimators cannot be completely reliable when there are concerns about the presence of sample selection bias, as previously stated in this analysis, so the final approach adopted in this paper is described next.

## 4.4 Identification strategy

There are two issues preventing the use of conventional econometric tools to deal with sample selection bias and endogeneity. The standardized indices created to measure the different types of domestic violence cannot be used to implement the Heckman model in order to correct for sample selection bias because they are truncated. Additionally, the process involved in the IV estimation is not originally designed to address sample selection bias in a direct manner. Wooldridge (2010) suggests a method to obtain unbiased estimators in a similar context.

Adapting Wooldridge (2010:809) to the model described in Equation (1):

$$LnW_i = \alpha_{Ed}Ed_i + \alpha_{Ex}Ex_i + \alpha_{Ex^2}Ex_i^2 + \alpha_{Ar}Ar_i + \alpha_{Et}Et_i + \alpha_{Ch}Ch_i + \alpha_{Ye}Ye_i + \alpha_{\widehat{Im}}\widehat{Im_\iota} + \alpha_{\widehat{Dv}}\widehat{Dv_\iota} + u_i \quad (2)$$

$$Dv_i = \gamma_{Ed}Ed_i + \gamma_{Ex}Ex_i + \gamma_{Ex^2}Ex_i^2 + \gamma_{Ar}Ar_i + \gamma_{Et}Et_i + \gamma_{Ch}Ch_i + \gamma_{Ye}Ye_i + \gamma_{\widehat{Im}}\widehat{Im_\iota} + \gamma_{In}In_i + v_i \quad (3)$$

$$Em_i = \delta_{Ed}Ed_i + \delta_{Ex}Ex_i + \delta_{Ex^2}Ex_i^2 + \delta_{Ar}Ar_i + \delta_{Et}Et_i + \delta_{Ch}Ch_i + \delta_{Ye}Ye_i + \delta_{Ga}Ga_i + \delta_{In}In_i + \mu_i \quad (4)$$

Where (2) is the structural equation of interest, (3) is the linear projection for the endogenous variable $Dv$ and (4) is the selection equation.

Most variables denoted in Equations (2), (3), and (4) were initially defined in Equation (1). $LnW_i$ represents log of earnings, $Ed_i$ years of schooling, $Ex_i$ and $Ex_i^2$ potential experience and its square, $Ar_i$ area where the woman lives, $Et_i$ ethnic group, $Ch_i$ at least one child, $Ye_i$ year of the survey, and $Dv_i$ domestic violence. There are five new

variables: $\widehat{Im_i}$ denotes the inverse Mills ratio obtained, $\widehat{Dv_i}$ the level of domestic violence estimated, $In_i$ is the instrument, $Em_i$ is a binary variable equal to 1 if the woman $i$ is employed or zero otherwise, and $Ga_i$ is the gender attitudes index.

The inverse Mills ratio (IMR) and the level of domestic violence estimated are obtained as part of the process, as will be explained further. The instrument represents the husband's random irritability and takes the value of 1 if the husband gets angry with his wife for everything or for no reason, or zero otherwise. The gender attitudes index is created using the answers women provided on six different questions about the roles in the household, such as if they believe that women should be equally responsible as men as financial providers; or if they believe that good wives should always obey their husbands.[42] The highest possible score is 6 and the lowest is 0. The closer to 6, the index indicates a woman with more egalitarian attitudes towards gender roles; the closer to 0 shows a woman with more "traditional" views. The gender index is the factor affecting selection, the decision to join or not the labour market; thus, as can be observed, this variable is only used in the selection equation (4), explaining the probability of employment, but not the equation of interest, the earnings equation (2). As it is sometimes hard to come up with a variable affecting selection and not the outcome, technically, it is possible to estimate Equation (3) and Equation (4) using the same regressors. However, not to include the variable determining selection in Equation (4), would generate collinearity because the variables used to estimate Equation (4) and to obtain the inverse Mills ratio (IMR) from Equation (3) would be the same. The gender attitudes index created is a primarily force driving the decision about joining or not the labour force with a minimal influence on women's earnings.[43] After all, the hardest choice is whether or not to modify the traditional family structure, but once the woman is determined to join the labour force, she expects a financial reward according to the time and effort devoted to work.[44]

The estimation procedure is implemented as follows:

- First, Equation (4) is estimated using a probit model on all observations, working and non-working married women, to obtain the predicted inverse Mills

[42] Different questions were asked in ENDIREH 2006 and ENDIREH 2016. Efforts were addressed to match both surveys. Table C.13 in the Appendix section, details the questions used to create the gender attitudes index.

[43] Especially since the indicator is built based on different questions and not only on a single one.

[44] It could be argued that some of the questions are directly linked with the labour market, having a potential influence on earnings. To dispel any concern, additional robustness checks are performed using different definitions of the gender attitudes index, not including all the six questions.

ratios $\widehat{Im_\iota}$. The IMR is the ratio of the probability density function over the cumulative distribution function of a distribution. In this case, it shows the probability that a woman decides to work over the cumulative probability of a woman's decision and it is used to control the part of the error term influencing earnings given the decision to work.

- By using two-stage least squares (2SLS), Equations (2) and (3) are estimated on the subsample of working women, after including the IMR as an additional explanatory variable, and the husband's random irritability defined as the instrument for domestic violence.
- Finally, it should be verified that the IMR coefficient obtained in Equation (2) is statistically different from zero ($\alpha_{\widehat{Im}} \neq 0$) as evidence of sample selection, and to correct the standard errors and test statistics by bootstrapping.

# 5 Data

The analysis is based on the National Survey on the Dynamics of Household Relationships (ENDIREH by its acronym in Spanish) 2016 and 2006. ENDIREH has been strategically designed to obtain information about the frequency and magnitude of violence experienced by women within the household, as well as to identify events of discrimination, aggression and violence at school, at work, or in their families and communities. It is a cross-sectional national survey of women aged 15 and over in Mexico, led by the National Institute of Statistics and Geography (INEGI). The first survey was conducted in 2003, and subsequently in 2006, 2011 and 2016. Each delivery has been improved in terms of the conceptual framework and the questionnaires used to collect the information. In the 2016 survey, data is available for 111 256 women, whereas 133 398 women were interviewed in 2006.[45]

To study the effect of domestic violence on women's earnings, the target subpopulation are married women currently living with their husbands.[46] The group of

[45] ENDIREH 2003 and 2011 are excluded from this analysis because the question used to create the instrument for domestic violence under the instrumental variables methodology is not available for those years.

[46] Married women with absent husbands are not considered. In addition, civil marriages are the only ones legally recognized in Mexico, therefore, women in the sample are only those with a civil marriage or a civil

cohabiting women is excluded because it might be easier for them to leave an abusive partner or even to prevent abuse, compared to women in legally binding relationships.

ENDIREH is the only survey with national representative data about gender-based violence in Mexico, but a compromise needs to be done with the study to use it. Even though the survey provides information about total net weekly, fortnightly or monthly earnings, the total amount of hours worked is unknown, restricting the dependent variable to be monthly earnings instead of hourly earnings. While this could be considered a disadvantage in studies for developed countries where minimum wages are usually set on an hourly basis, for the case of Mexico, with a minimum wage established at 73.04 Mexican pesos per 8-hour workday in 2016,[47] it might be less of a problem. Thus, it is important to highlight that this paper identifies the effect of domestic violence on monthly earnings reported by women. Based on this, earnings are bottom-coded at 2 200 Mexican pesos per month[48] and the final sample consists of 27 823 married working women and 64 060 married non-working women aged 22 to 60.[49] Tables 3.2, 3.3 and 3.4 show some summary statistics. As expected, on average working women accumulate more years of education and report more egalitarian views than do non-working women. Considering only the subsample of working women, it is observed that never abused women have slightly higher levels of education and age. In addition, around 35 percent of working women have experienced at least one episode of IPV, being emotional violence the category of abuse with the highest incidence.

**Table 3.2** Summary statistics – Mean and standard deviation values for married women

| Variable | Working women | | Non-working women | |
|---|---|---|---|---|
| | Mean | Standard deviation | Mean | Standard deviation |
| Years of schooling | 11.6 | 4.5 | 8.3 | 4.3 |
| Age | 39.3 | 8.8 | 40.7 | 10.3 |
| Gender attitudes index | 4.9 | 1.0 | 4.3 | 1.3 |
| **Total** | **27 823** | | **64 060** | |

Source: Author's own elaboration with data from the National Survey on the Dynamics of Household Relationships 2016 (ENDIREH).

marriage and a religious marriage. Women married only through a religious ceremony were not included either.

[47] Official Journal of the Federation. December 18th, 2015. In terms of pounds sterling in 2016, the Mexican daily minimum wage represents around £3.

[48] Real wages. Base year 2016.

[49] University degrees are obtained around 22 years old, and employees are entitled to start receiving pension benefits at age 60.

**Table 3.3** Summary statistics – Mean and standard deviation values for married working women

| Variable | Abused women | | Never abused women | |
|---|---|---|---|---|
| | Mean | Standard deviation | Mean | Standard deviation |
| Years of schooling | 11.0 | 4.4 | 11.9 | 4.4 |
| Age | 38.7 | 8.7 | 39.7 | 8.9 |
| Gender attitudes index | 4.9 | 1.0 | 4.9 | 1.0 |
| **Total** | **9 642** | | **18 181** | |

Source: Author's own elaboration with data from the National Survey on the Dynamics of Household Relationships 2016 (ENDIREH).

**Table 3.4** Working married women and domestic violence incidence

| Any type of… | % |
|---|---|
| Domestic violence | 34.6 |
| Economic violence | 18.5 |
| Emotional violence | 29.3 |
| Physical violence | 10.0 |
| Husband's random irritability | 7.5 |

Source: Author's own elaboration with data from the National Survey on the Dynamics of Household Relationships 2016 (ENDIREH).

# 6 Estimation results

## 6.1 Main results

The coefficients obtained for each type of domestic violence using different methodological approaches are reported in Table 3.5. In addition to economic, emotional and physical abuse, estimations are also presented for a general indicator of domestic violence (all categories). Column (1) indicates the Ordinary Least Squares (OLS) results obtained when sample selection bias and endogeneity are ignored in the model. As it can be observed, all types of domestic violence have a negative and statistically significant impact on married women's earnings. Findings are alike in column (2) after controlling for sample selection bias, following the correction proposed by Wooldridge (2010) as detailed earlier.[50] Emotional violence is the abuse with the highest impact, followed by economic and physical abuse. However, once the husband's random irritability is used as

[50] The truncated nature in the domestic violence indices for the subgroup of non-working married women prevents the use of the Heckit model as mentioned before.

the instrument for domestic violence and the analysis is readdressed to the group of women completely captive to intimate partner violence, a notable difference is the relevant role played by physical violence when determining causality. Effects are still negative and significant but now larger for physical violence in both columns (3) and (4), the traditional two stage least squares (2SLS) estimation, and the 2SLS procedure with correction for sample selection bias, respectively. Considering column (4) as the preferred specification, a one standard deviation increase in the index of physical abuse decreases women's earnings on average in 6.6 percent. Economic violence also reduces earnings in 5.3 percent and emotional violence in 4.7 percent.

The question at hand is why when causation is tested the stronger implications of physical violence are unfolded. Though an important change is revealed for economic and emotional violence from specification (2) to (4), it is not as substantial as with physical violence. The answer relies as expected, in the nature of the instrument used. At first glance, considering endogeneity is not present, it can be argued that women suffering from economic abuse have no incentives to get better jobs or to pursue higher salaries, because the husbands are anyway controlling all the money and they have no autonomy to dispose of their own salaries. Also, women facing emotional abuse at home can be mentally more affected and therefore more likely to suffer abuse from bosses or co-workers, perceiving as a consequence lower wages. On the contrary, as long as wives exposed to physical violence from husbands can superficially hide the consequences of the abuse and pretend to go along with their employment, their earnings would not have to be affected. A different story to tell when causation is established. The instrument allows to focus the analysis in a particular group of women. Fearful and captive women, that need to be alert at all times because they never know where the sudden rush of anger from husbands will come from. These women are exposed to higher levels of violence since there are no available resources to prevent or evade the abuse. Under these circumstances, physical abuse is more difficult to cover, causing for instance, higher rates of absenteeism at work in order to not show a broken arm, black eye, or even worst, due to an emergency hospital admission. In this sense, the economic or emotional violence causal effect, although is still relevant,[51] should not be larger than the impact of physical abuse, because feeling demotivated or not to be concentrated at work is not expected to

[51] As it is observed from the higher coefficients obtained from column (4) when compared to column (2).

have the same negative effect on earnings than not attending work at all; disentangling the true effect of physical violence on women's earnings.

**Table 3.5** Main results – Domestic violence index

| | **OLS** | **OLS – SS** | **IV** | **IV – SS** |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| Economic violence | -0.015*** | -0.017*** | -0.036*** | -0.053*** |
| | (0.0032) | (0.0032) | (0.0092) | (0.0097) |
| Emotional violence | -0.016*** | -0.019*** | -0.032*** | -0.047*** |
| | (0.0032) | (0.0032) | (0.0081) | (0.0085) |
| Physical violence | -0.012*** | -0.013*** | -0.046*** | -0.066*** |
| | (0.0033) | (0.0033) | (0.0117) | (0.0123) |
| Domestic violence | -0.017*** | -0.019*** | -0.031*** | -0.046*** |
| | (0.0032) | (0.0032) | (0.0079) | (0.0083) |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. In columns (1) and (3) robust standard errors in parentheses. In columns (2) and (4) bootstrapped standard errors in parentheses (10 000 replications). All regressions include a constant term, the inverse Mills ratio correction, education, experience, experience squared and the indicator variables: area, ethnic group, children and year of survey. ***Statistically significant at the 99% confidence level.

To rely on the validity of the causal estimations obtained in column (4) on Table 3.5, additional factors need to be verified in order to claim that the instrumental variables technique is adequate.

The first stage shows the linear prediction of the endogenous variable, domestic violence, on the instrument, the husband's random irritability. Columns (1) to (4) in Table 3.6 report statistically significant coefficients obtained for this relationship through the IV estimations. Results indicate not only that the first stage exists, but also that women exposed to husband's random irritability are indeed subject to higher levels of domestic abuse, regardless of the type of violence experienced. In addition, to measure the relevance of the instrument used, the F statistic is reported. It is significant and exceeds by far the value of 10 established by Staiger and Stock (1997), so the presence of a weak instrument can be discarded. Lastly, Hausman tests to determine whether domestic violence (all types) is exogenous are performed. The null hypothesis is rejected in all cases, confirming that the IV methodology is appropriated.

**Table 3.6** Additional causality tests

| | Economic violence (1) | Emotional violence (2) | Physical violence (3) | Domestic violence (4) |
|---|---|---|---|---|
| First-stage coefficient | | | | |
| Husband's random irritability | 1.331*** | 1.503*** | 1.068*** | 1.539*** |
| | (0.0410) | (0.0408) | (0.0477) | (0.0422) |
| F-test for instrument | 3720.3 | 4938.85 | 2269.55 | 5243.5 |
| Prob > F | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Hausman test | 14.0 | 11.4 | 18.6 | 10.5 |
| Prob > chi | 0.0002 | 0.0007 | 0.0000 | 0.0012 |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. Bootstrapped standard errors in parentheses (10 000 replications). ***Statistically significant at the 99% confidence level.

Focusing now on the other variables incorporated in the model, Table 3.7 reports, per type of domestic violence, the regression estimates obtained for education, potential experience and its square, area, ethnic group and children, on earnings, when sample selection bias and endogeneity are considered (specification 4 in Table 3.5). Education shows a strong and expected positive significant effect. An additional year of schooling is associated on average with a 7.5 percent increase on earnings, a result consistent with the general findings in the literature. On the other hand, ethnic group and having children present a negative impact on earnings. Women belonging to ethnic groups are more likely to grow up in poverty and have less opportunities to excel in the labour market. Similarly, the decisions of married women with children in terms of employment are more dependent on other factors, such as the financial support of the husband, typically the main breadwinner in the household, or child care; as opposed to childless women; having as a consequence a more tangible effect on earnings.

**Table 3.7** Additional determinants of women's earnings

| | **Economic violence (1)** | **Emotional violence (2)** | **Physical violence (3)** | **Domestic violence (4)** |
|---|---|---|---|---|
| Years of schooling | 0.076*** | 0.075*** | 0.076*** | 0.075*** |
| | (0.0023) | (0.0024) | (0.0024) | (0.0024) |
| Experience | 0.008*** | 0.008*** | 0.008*** | 0.008*** |
| | (0.0013) | (0.0013) | (0.0013) | (0.0013) |
| Experience squared | 0.00003 | 0.00003 | 0.00003 | 0.00003 |
| | (0.00002) | (0.00002) | (0.00002) | (0.00002) |
| Area (urban=1) | -0.0002 | -0.002 | 0.001 | -0.001 |
| | (0.0171) | (0.0172) | (0.0172) | (0.0171) |
| Ethnic group | -0.043** | -0.044** | -0.040** | -0.043** |
| | (0.0178) | (0.0177) | (0.0179) | (0.0178) |
| Children (at least one=1) | -0.055*** | -0.054*** | -0.059*** | -0.055*** |
| | (0.0175) | (0.0176) | (0.0174) | (0.0175) |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. Bootstrapped standard errors in parentheses (10 000 replications). All regressions include a constant term, the inverse Mills ratio correction and year of survey variables. ***Statistically significant at the 99% confidence level. **Statistically significant at the 95% confidence level.

## 6.2 Robustness checking – Husband's observable traits

In section 4.3 it has been discussed that the husband's random irritability meets the three conditions to be used as an instrument for DV. Nonetheless, as a robustness check, it is relevant to examine the sensitivity of the results when some of the husband's observable traits are included in the estimations as additional controls. Specifically, given the rich dataset available, it is possible to capture the influence that an alcoholic/drug addict husband, a jealous husband, a workaholic husband or a possessive husband, might have on the analysis. As it can be seen in Table 3.8, the causal effects of IPV on women's earnings when these four additional variables are explicitly added in the model (column 1) remain very similar to those presented before, when none of them were considered (column 2). Coefficients are still significant and their magnitudes have not been drastically reduced, as it would have been expected in the presence of confounding variables. In addition, none of them with exception of having an alcoholic/drug addict husband play a significant role in the model, as is shown in Table 3.9. Only women married to alcoholic/drug addict husbands face around a 6 percent reduction on their earnings compared to women with alcohol/drug free husbands. This outcome is by itself

engaging, but most remarkably is the fact that despite the negative correlation found between alcoholic/drug addict husbands and women's earnings, the causal effect of DV does not fade away. These findings provide additional evidence about the relationship between domestic violence, the instrument used and particular personality traits of the husbands, supporting the robustness of the main conclusions drawn in this analysis.

**Table 3.8** Robustness check – Domestic violence index

| | **IV H - SS (1)** | **IV - SS (2)[a]** |
|---|---|---|
| Economic violence | -0.045*** | -0.053*** |
| | (0.0154) | (0.0097) |
| Emotional violence | -0.042*** | -0.047*** |
| | (0.0143) | (0.0085) |
| Physical violence | -0.059*** | -0.066*** |
| | (0.0204) | (0.0123) |
| Domestic violence | -0.040*** | -0.046*** |
| | (0.0138) | (0.0083) |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. Bootstrapped standard errors in parentheses (10 000 replications). All regressions include a constant term, the inverse Mills ratio correction, education, experience, experience squared and the indicator variables: area, ethnic group, children and year of survey. In addition, results in column (1) include the indicator variables: alcoholic/drug addict husband, jealous husband, workaholic husband and possessive husband. ***Statistically significant at the 99% confidence level.
a. Same results presented before in Table 3.5, column (4).

**Table 3.9** Husband's observable traits on women's earnings

| | **Economic violence (1)** | **Emotional violence (2)** | **Physical violence (3)** | **Domestic violence (4)** |
|---|---|---|---|---|
| Alcoholic/drug addict husband | -0.061*** | -0.063*** | -0.060*** | -0.062*** |
| | (0.0114) | (0.0110) | (0.0117) | (0.0112) |
| Jealous husband | -0.002 | 0.002 | 0.002 | 0.001 |
| | (0.0118) | (0.0125) | (0.0125) | (0.0123) |
| Workaholic husband | 0.004 | 0.004 | -0.001 | 0.003 |
| | (0.0106) | (0.0105) | (0.0101) | (0.0104) |
| Possessive husband | 0.018 | 0.023 | 0.023 | 0.022 |
| | (0.0171) | (0.0184) | (0.0185) | (0.0180) |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. Bootstrapped standard errors in parentheses (10 000 replications). All regressions include a constant term, the inverse Mills ratio correction, education, experience, experience squared and the indicator variables: area, ethnic group, children and year of survey. ***Statistically significant at the 99% confidence level.

## 6.3 The traditional measure of domestic violence

Earlier studies on intimate partner violence use a straightforward definition of abuse, as mentioned before. Women exposed to frequent episodes of violence and women that have faced only one incident are group together in a binary variable that takes the value of one for abused women or zero for women never exposed to DV. Although the coefficients obtained from this approach are not directly comparable with those in Section 6.1, it is interesting to report them in Table 3.10.[52]

Similar to results in Table 3.5, in all the specifications the different categories of IPV present a negative and statistically significant effect on earnings. An important contrast is that the coefficients for economic and emotional DV are lower than the coefficients for physical abuse even when no instrument is used. However, the most relevant finding is the large effects that all types of domestic abuse exert on earnings when following this approach. Column (4) indicates that women who have experienced physical IPV earn on average 22.4 percent less than women never physically abused by their husbands. Also, lower earnings are observed for married women exposed to economic and emotional violence, with a reduction on earnings of 16.4 and 14.5 percent, respectively. These high magnitudes are not unexpected, given the limited definition of violence implemented (abused at least once against never abused)[53] and reflect the importance of a more flexible definition of DV as the index suggested in this paper, in order to have a more accurate and reliable assessment of the effect of violence on women's earnings. Next, I consider how to reconcile the results obtained from these two different approaches more fully.

[52] A notable difference between Table 3.5 and Table 3.10 is that specification in column (2), when using the binary variable, is estimated applying the Heckit model because the variable that captures the abuse is no longer truncated.

[53] They are also according to findings for other studies that use similar definitions of DV (Vyas 2013; Morrison and Orlando 1999).

**Table 3.10** Traditional results – Domestic violence binary variable

| | **OLS BV (1)** | **HECKIT BV (2)** | **IV BV (3)** | **IV – SS BV (4)** |
|---|---|---|---|---|
| Economic violence | -0.040*** | -0.050*** | -0.113*** | -0.164*** |
| | (0.0087) | (0.0088) | (0.0284) | (0.0298) |
| Emotional violence | -0.033*** | -0.048*** | -0.098*** | -0.145*** |
| | (0.0076) | (0.0078) | (0.0248) | (0.0264) |
| Physical violence | -0.069*** | -0.087*** | -0.155*** | -0.224*** |
| | (0.0111) | (0.0114) | (0.0392) | (0.0408) |
| Domestic violence | -0.033*** | -0.046*** | -0.096*** | -0.142*** |
| | (0.0073) | (0.0074) | (0.0243) | (0.0257) |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. In columns (1), (2) and (3) robust standard errors in parentheses. In column (4) bootstrapped standard errors in parentheses (10 000 replications). All regressions include a constant term and education, experience, experience squared, area, ethnic group, children and year of survey control variables. ***Statistically significant at the 99% confidence level.

Table 3.11 presents the results from an exercise that allows a feasible comparison. Using the coefficients obtained in Table 3.5 and Table 3.10, Equation (2) is evaluated under two scenarios. Column (1) shows the earnings of a hypothetical woman experiencing the highest level of each type of IPV according to the index of domestic violence created. Column (2) reports the earnings for the same hypothetical case but measuring DV as a binary variable. Column (3) and column (4) replicate these two scenarios respectively, when causality is not addressed. For a woman experiencing the highest level of abuse that can be captured following these two different approaches, earnings are clearly lower in all cases if the index of IPV is used.

The implications of these findings are meaningful. For instance, using the traditional definition of DV, estimations for a woman facing the highest level of physical abuse indicate monthly earnings around 4 534 Mexican pesos. However, a substantial reduction is observed if the index proposed in this paper as a measure of DV is implemented. Earnings are reduced in 46.9 percent, indicating monthly earnings around 2 407 Mexican pesos as a maximum. These results reveal that the negative effect of domestic violence on women's earnings has been traditionally underestimated and highlight the importance to develop more precise measures of intimate partner violence.

**Table 3.11** Women's earnings – Highest level of domestic violence

| | IV - SS (1) | IV - SS BV (2) | OLS - SS (3) | HECKIT BV (4) |
|---|---|---|---|---|
| Economic violence | 3 815 | 4 850 | 4 911 | 6 258 |
| Emotional violence | 3 814 | 5 024 | 4 772 | 6 318 |
| Physical violence | 2 407 | 4 534 | 4 675 | 6 030 |
| Domestic violence | 3 631 | 5 057 | 4 627 | 6 333 |

Source: National Survey on the Dynamics of Household Relationships (ENDIREH) 2016 and 2006. Exercise considering a hypothetical woman with average years of education (11.6) and experience (21.7), living in an urban area, not belonging to an ethnic group, with children and interviewed in 2016. Maximum levels of domestic violence: Economic-7.0, Emotional-8.0, Physical-12.6 and Domestic violence-9.2. Earnings are expressed in real prices. Base year 2016.

# 7 Conclusion

Married working women facing domestic violence not only suffer the physical and mental consequences of the abuse at home. In addition, their levels of productivity at the workplace are affected, leading to lower earnings. This study provides the first empirical evidence on the causal effects of intimate partner violence, when the levels and the frequency of abuse are considered. An index for domestic violence is created to capture the variation observed, challenging the traditional use of a binary variable within this context. This new approach allows to incorporate into the analysis useful information which is readily available but typically ignored in other studies.

Evidence is found indicating that women exposed to higher levels of IPV, economic, emotional or physical, struggle with lower salaries. After a smaller association initially observed between earnings and DV, the true causal effects are revealed when the estimations are performed using the instrumental variables technique. The husband's random irritability is the instrument used, readdressing the analysis to a group of even more vulnerable abused married working women, captive by unpredictable rushes of anger from husbands. Physical violence is found to be the type of abuse with the largest negative incidence on earnings, followed by economic and emotional abuse. The estimated effects show higher harmful impacts of domestic violence on women's earnings when the indicator proposed in this study is implemented compared to the effects obtained when the traditional measure of IPV is adopted.

Mexico has a low female labour market participation and high gender-based violence rates. This study aims to draw attention to the importance of these topics and to stimulate research and public polices in the country to improve the position of women in the Mexican society.

Next steps should be addressed to develop better measures of domestic violence to establish more precise estimations on the impact of intimate partner violence over many other aspects affecting women's lives.

# Appendix C

**Table C.12** Current relationship – During the last year how often has your husband…

| **Physical violence** |
|---|
| 1. pushed you or pulled your hair? |
| 2. tied you up? |
| 3. kicked you? |
| 4. thrown any object to you? |
| 5. hit you with his fist or any object? |
| 6. tried to choke you? |
| 7. assaulted you with a knife or blade? |
| 8. shot you with a firearm? |
| 9. demanded you to have sex, even if you do not want? |
| 10. forced you to do things you do not want when having sex? |
| 11. physically forced you to have sex? |
| **Emotional violence** |
| 12. embarrassed, offended, belittled or humiliated you? |
| 13. ignored or not given you affection? |
| 14. accused you of having affairs? |
| 15. made you feel fear? |
| 16. threatened about leaving/abandoning you, hurt you, take away the children or get you thrown out of the house? |
| 17. locked you in, forbidden you from going out or being visited? |
| 18. spied, followed you when leaving home or suddenly appears in places that you are at? |
| 19. threatened you with a weapon or that he will burn you? |
| 20. threatened to kill you, himself or the children? |
| 21. destroyed, thrown away or hidden things belonging to you or the household? |
| 22. stopped talking to you? |
| 23. manipulated your children or relatives against you? |
| 24. been very angry because the housework is not done, the food is not prepared the way he likes it or he believes you are not fulfilling your duties? |

| Economic violence |
|---|
| 25. forbidden you to work or study? |
| 26. appropriated possessions from you? |
| 27. spent money needed for household expenditures? |
| 28. not provided money needed for household expenditures or threatened you he will not provide it? |
| 29. having money, refused to provide enough for the household expenditures? |
| 30. complained about the way you spend the money? |

**Table C.13** Male and female roles in the household – Do you believe…

| 2016 | 2006 |
|---|---|
| 1. men should earn higher salaries than women? | 1. women have the same ability as men to earn money? |
| 2. women should be equally responsible as men as financial providers? | 2. men should be the financial providers? |
| 3. men should equally share with women the domestic responsibilities, take care of the children, the elderly and the sick? | 3. good wives should always obey their husbands? |
| 4. women should have the right to go out alone at night to have fun? | 4. women can choose their friends even if their husbands dislike them? |
| 5. women should dress modestly to prevent harassment from men? | 5. husbands can beat their wives if they do not fulfill their duties? |
| 6. married women should have sex with their husbands whenever men want? | 6. women should have sex with their husbands even if they do not want to? |

# Conclusion

This thesis provides important new empirical evidence to address three relevant questions within the economics of the family framework. Efforts are addressed in Chapter 1 to determine if education is a mechanism helping to prevent divorce. Literature does not show a generalized consensus regarding a positive or negative effect from education on marital decisions. Marriages between highly educated individuals have greater gains because of the spouses' high levels of market and nonmarket skills. On the contrary, they have lower gains because they typically involve less specialization between spouses, since higher educated individuals participate more in the labour force. Chapter 2 explores if the adoption of unilateral divorce in the context of a developing country, has an impact on divorce rates. According to the Becker–Coase theorem, modifications to divorce legislation should have no effect on the total number of divorces and the adoption of a no-fault divorce regime should have no consequences on divorce rates. The effect of domestic violence on women's earnings is examined in Chapter 3. From a theoretical perspective, despite the ambiguous effect that domestic violence exerts on women's labour force participation, the mechanism through which DV affects earnings is very straightforward. Women suffering intimate partner violence are more likely to experience depression, substance abuse, female reproductive disorders, sexually transmitted infections, low back pain, headaches, gastroesophageal reflux disease, amongst others; conditions that seriously compromise job performance for those in the labour market.

Applied microeconometrics methods are implemented, including instrumental variables and difference-in-differences approaches, to explore the three research questions: Is education one of the mechanisms to prevent divorce? Do changes in divorce legislation have an impact on divorce rates in a developing country? Is it possible to estimate more accurately the effects of domestic violence on women's earnings? Each chapter provides substantial and original contribution to the family economics literature. Education and its multilevel impact on several economic outcomes is an important topic for economists and many other social scientists. Yet, no previous research exists disentangling the causal effect of education on marital outcomes. Chapter 1 represents the first attempt in the economics discipline, analysing from a causal perspective, the influence of education on marriage stability.

The second chapter in this thesis deals with a problem that has been previously addressed for other countries. As it might be expected, it has taken longer for developing countries to start modifying their legislations in terms of divorce, and unilateral divorce began to be adopted in Mexico almost forty years after the "no-fault revolution" started in the United States. Nonetheless, to analyse the impact on divorce rates when the divorce legislation is changed in a Latin American country is important. In particular, given the cultural differences between developed and developing countries, Chapter 2 shows, for the first time in the literature, if the introduction of unilateral divorce affects divorce rates in a region where divorce is less socially acceptable, where it continues to have a strong social stigma and where most couples are taught to avoid divorce and remain together regardless of the circumstances.

In Chapter 3, the causal effect between domestic violence and women's earnings is explored by incorporating in the analysis an index of domestic violence. Typically, economic research on intimate partner violence does not distinguish between different levels of violence exerted and a woman that has experienced violence only one time is identified as abused, as well as a woman that has been constantly victimized. As a contribution to this third study in the thesis, a new indicator of domestic abuse is designed to have a more flexible measure of intimate partner violence. In addition, the husband's random irritability is presented as an innovative instrument for domestic violence.

Several important findings can be drawn from the results obtained. First, higher levels of education are an undeniable trait observed in non-broken marriages, but it is not education by itself one of the mechanisms leading to better marriages. Second, the adoption of unilateral divorce has led to a rise on divorce rates in Mexico, proving that despite the cultural differences between developed and developing countries, changes in divorce legislation are an effective tool to modify the structure of the families, at least in the short and medium term. And thirdly, women suffering domestic violence, in any of its forms, economic, emotional or physical, also struggle as a direct consequence with lower salaries. Among the three types of violence analysed, physical abuse has the stronger negative effect, possibly because it is the most difficult abuse to cover.

The three essays are conducted using Mexican data, they present novel findings for this country and it is expected they will stimulate additional research in Mexico and the Latin American region, focused on the economics of the family.

This thesis also provides the opportunity for additional work. It would be a valuable contribution to evaluate the causal effects of education on marital outcomes by gender,

when a more suitable dataset becomes available. In addition, it would be interesting to estimate the long-term consequences of unilateral legislation on divorce rates in the country, once all states have considered the adoption of no-fault divorce and sufficient time has passed.

As it has been shown in this thesis, Mexico has experienced the worldwide changing trends in terms of marriage and divorce, especially over the last decades. Taken together, the three essays presented aim to explain some of the main drivers for these tendencies and to add knowledge to the strand of literature on the economics of the family. It is my hope as well, that a better understanding of the structure of the families in my country can help us to overcome the social and economic challenges we are facing while trying to shape a better Mexico.

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