Male-Female Earnings Inequality and Divorce Decisions *

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Abstract

This paper studies the effect of male-female earnings inequality on divorce rates. I document a reduction in the male-female earnings gap in Mexico between 1997 and 2006, arising from manufacturing plant openings at the commuting zone level after the entry into force of NAFTA. In line with a simple conceptual framework, I find that a drop of 1 percentage point in the earnings gap causes an increase in the divorce rate of 2 percent with respect to the baseline. The increase in divorce rates is partly explained by an increase in the number of divorces filed by employed wives on grounds of abandonment and lack of financial support of the husband. Relative improvements in female earnings result primarily in divorces in which ex-wives obtain full custody of the children. These results are relevant for the policy debate on the benefits of trade, as well as for the debate about the male-female earnings gap and the beneficial consequences of female empowerment in developing countries.

Keywords: divorce, inequality, labour markets, Mexico, NAFTA, trade.
JEL codes: D63, F14, F16, J21, J31, O54.

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"The secular growth in wages, which contributed significantly to the growth in the labor force participation of women, especially married women, probably also contributed significantly to the growth in divorce rates" (Becker, Landes and Michael, 1977)

1 Introduction

Can reductions in male-female earnings inequality empower women to leave toxic marriages? When females do not have attractive options outside marriage, increased bargaining power of males within marriage can lead husbands to sustain abusive behaviour towards their wives and their children. If so, improving female labour market conditions would allow them to leave their husbands and stop this abusive behaviour. Although this possibility plays an important role in the gender inequality and female empowerment debate, there is surprisingly little causal evidence on the effect of male-female earnings inequality on divorce decisions.

This paper studies the effect of gender-specific shocks to labour demand on the male-female earnings gap and divorce rates in Mexico after the entry into force of NAFTA. The opening of manufacturing plants sheltering operations of US companies in industries in which female hours are an essential production input, such as textiles and electrical materials, acts as a source of differential treatment by commuting zone, which allows for the identification of the effect of male-female earnings inequality on divorce rates. These so-called *maquiladora* plants, which represented 4.2 percent of all Mexican jobs in the years following the signing of NAFTA, employ mostly females and pay wages twice as high as the average national manufacturing firm.

Armed with administrative data on all *maquiladora* plants, all major local labour markets, and all divorces in Mexico between 1997 and 2006, I use spatial and temporal variation in plant openings as part of an instrumental variables empirical strategy. Specifically, I instrument the male-female earnings gap with the number of plant openings for each commuting zone and quarter between 1997 and 2006. Two features of *maquiladora* plant openings make them a compelling instrument. First, openings are uncorrelated with time-invariant, time-specific, and time-varying characteristics of Mexican commuting zones. Second, openings are unlikely to be correlated with unobservable determinants of divorce rates.

I begin by estimating the effect that plant openings have on the earnings gap at the commuting zone level, using the administrative records of all export manufacturing plants in the country, coupled with microdata from the national labour force survey. I find that each plant opening lowers the male-female earnings gap by 0.15 percentage points (the average earnings gap across all OECD countries was 14.3 percent in 2014). Then, I utilise administrative records of the universe of divorces in the country for the same period to construct local divorce rates with a quarterly frequency. Using local *maquiladora* plant openings as an instrument, I show that a drop of 1 percentage point in the male-female earnigs gap causes a 2 percent increase in the divorce rate with respect to the baseline.

I interpret these findings in light of a simple model of the incentives governing divorce decisions of females, while I remain silent concerning the incentives governing decisions of males. This model, which constitutes a significant departure from the canonical collective household model, highlights three channels through which relative improvements in female earnings lead to increases in divorce rates. First, increases in female earnings improve private utility of females more after divorce than within marriage. Second, improvements in female earnings allow ex-wifes to command a higher share of household income towards their children and their own consumption. Third, gains in female earnings also increase bargaining power within marriage, providing a countervailing effect to the other two.

Next, I use a set of observables in the divorce administrative data to calculate the importance of these theoretical mechanisms in explaining my main empirical findings. First, I verify that relative improvements in female earnings mostly increase divorce rates of employed females. Second, I test whether the increase in divorce rates is indeed explained by divorces filed by females on grounds of abandonment and lack of monetary support of the husband, and not by divorces filed by males. Finally, I establish that the increase in divorce rates is mainly explained by divorces in which females obtain the full custody of the children.

All results are robust to the usual set of robustness checks, such as including linear-specific trends, specifying placebo treatment dates and groups, controlling for time-varying local characteristics, and removing zeros, outliers, and groups of cities from the analysis. Similarly, results from the IV specifications are robust to the sequential inclusion of covariates, and the instruments feature a strongly significant partial correlation with the outcomes in the first stage and the reduced form.

The contribution of this paper to the academic literature is threefold. First, this paper contributes to the literature on female empowerment and economic development (see Duflo, 2012). This paper fills the existing gap in the study of the relationship between labour supply and divorce decisions in developing countries, where women are usually poorly protected by the law. Specifically, the results from this paper confirm that the absence of attractive outside options for females prevents divorces in situations where males impose decisions on the household. Second, this paper contributes to the literature on the theoretical and empirical determinants of divorce decisions (see Browning et al., 2011 for a textbook treatment of the subject). At the heart of this vast area of study, pioneered by Becker, Landes and Michael (1977), is the prediction that the probability of divorce falls with household income. So far, the majority of the existing empirical studies have found supporting evidence for this prediction (see Hoffman and Duncan, 1995, Boheim and Ermisch, 2001, and Charles and Stephens, 2004). In this paper, I provide novel evidence of an asymmetry in the effect of income on divorce decisions. Namely, increases in female income allow for divorce in situations where the non-pecuniary benefits of marriage are negligible. These findings are supported related findings in developed countries of Weiss and Willis (1997), Battu, Brown and Costa-Gomes (2013), and Bertrand, Kamenica and Pan (2015). Third, this paper contributes to the literature on international manufacturing competition on labour markets. In a recent influential article, Autor, Dorn and Hanson (2018) test the effects of trade-related shocks to young men earnings on marriage, fertility and children's living circumstances in the United States. Similarly, for the specific case of Mexico, Atkin (2016) showed that the recent expansion of export-manufacturing industries in Mexico led to an increase in the high school dropout rate. In this paper, I extend the findings of the above literature by documenting the effect of female-specific shocks to labour demand on their divorce decisions.

The remaining sections of the paper are structured as follows. In section 2, I present a simple divorce model that yields light into the mechanisms explaining the consequences of changes in the male-female earnings gap on the divorce decisions of married females. In section 3, I present the data and the empirical strategy that are used in the analysis. Section 4 describes in detail the functioning of the *maquiladora* program, as well as the variables influencing plant opening and closure decisions. In section 5, present the IV empirical strategy that guides the analysis. In section 6, I present the main findings of the study. The mechanisms driving the main empirical findings are analysed in section 7. Finally, conclusions and closing remarks are presented in section 8.

2 Conceptual framework

To evaluate the theoretical consequences of reductions in male-female earnings inequality on divorce decisions, I move away from the canonical collective household model (for a complete treatment of this model see Browning, Chiappori and Weiss, 2011). The reason for this departure is that the canonical model yields the strong prediction that the probability of divorce falls with income.

Two common assumptions in the literature, namely (1) that utility is generalized quasi-linear in marriage but strictly quasi-linear after divorce and (2) that the non-pecuniary benefits of marriage enter additively into the utility function, are behind the prediction that divorce falls with income. I consider the first of these assumptions to be extremely restrictive for the analysis of the effects of large increases in female income in the context of a developing country and therefore will not be using it in my analysis.

Although existing empirical evidence largely supports the canonical prediction that divorce falls with positive income shocks (see Hoffman and Duncan, 1995, Boheim and Ermisch, 2001, and Charles and Stephens, 2004), existing empirical studies also hint an asymmetry in female divorce decision-making. Specifically, the divorce hazard increases with unexpected increases in the wife's earning capacity (Weiss and Willis,1997), as well as when the wife receives an inheritance (Battu et al., 2013). Also, Bertrand, Kamenica and Pan (2015) have emphasized the role of gender identity norms that make both partners averse to a situation where the wife earns more than her husband. Additionally, Chiappori, Radchenko and Salanié (2016) provide empirical evidence that the divorce hazard is more sensitive to the non-pecuniary dissatisfaction of the wife.

Moving away from the canonical collective model allows for an asymmetric treatment of males and females in the divorce decision. Specifically, the decision process of males will remain unspecified in my model, and I will focus on the female decision process.

2.1 The divorce model

2.1.1 Timing

The divorce decision is modeled in a two-period framework. In the first period, the female marries. In the second period, she learns about the quality of her husband and decides whether to remain married or divorce. I focus on the decisions made in the second period of the model and take the outcome of marriage markets as given.

2.1.2 Utility maximization if the wife remains married

Let y_h denote the income of the husband, and let G denote the male-female earnings gap. Under positive assortative matching, the total income of the couple is given by $Y_C = y_h(1-G) + y_h$. Assume that the wife has access to a share $\rho \in [0,1]$ of the household income, determined via intra-household bargaining. Additionally, assume that marriage generates a non-pecuniary benefit $\theta \sim N(0,1)$ for the wife, which is additively separable from consumption. Let $u^d : \mathbb{R}^+ \to \mathbb{R}$ denote the concave and continuously differentiable utility function for female consumption within marriage. Then, the indirect utility fuction of the wife if she remains married is given by $V^m(\rho(y_h(1-G)+y_h)) + \theta_w$.

2.1.3 Utility maximization if the wife gets a divorce

Let $u^d : \mathbb{R}^+ \to \mathbb{R}$ denote the concave and continuously differentiable utility function for female consumption after divorce. Assume that the non-pecuniary benefits of marriage become zero after divorce, and that the ex-spouses either reach an agreement or are ordered by the judge to split the total income of the couple between them. An agreement is indexed by the fraction $\beta \in [0,1]$ of total household income that the ex-wife receives. Hence, the indirect utility function of the ex-wife is given by $V^d(\beta(y_h(1-G)+y_h))$.

2.1.4 The divorce decision

A necessary and sufficient condition for divorce is given by $V^m + \theta_w \leq V^d$. Then, the probability of divorce before the realization of the non-pecuniary gain from marriage is $\Pr(\theta_w < V^d - V^m)$. Therefore, the effect of an increase in the male-female earnings gap on the divorce probability is given by:

$$\frac{\partial \Pr(\theta < V^d - V^m)}{\partial G} = \phi(V^d - V^m)\left[u^d_{c_w}\left(-\beta y_h + \frac{\partial \beta}{\partial G}Y_H\right) - u^m_{c_w}\left(-\rho y_h + \frac{\partial \rho}{\partial G}Y_H\right)\right]. \quad (1)$$

Importantly, equation 1 depends only on the income level of the husband, y_h, the male-female earnings gap, G, and the parameters of the model. Under the assumption that $\frac{\partial \beta}{\partial G} < 0$ and $\frac{\partial \rho}{\partial G} < 0$, a reduction in the male-female earnings gap will have a positive effect on the probability of divorce if and only if $\frac{u^d_{c_w}}{u^m_{c_w}}\left[\frac{-\beta y_h + \frac{\partial \beta}{\partial G}Y_H}{-\rho y_h + \frac{\partial \rho}{\partial G}Y_H}\right] > 1$.

Some valuable insights can be drawn from this inequality. First, reductions in male-female earnings inequality are more likely to increase the probability of divorce if the marginal utility of income when divorced is greater than the marginal utility of income within marriage. Reductions in inequality result in higher divorce rates whenever they improve utility in the divorce state by more than within marriage.

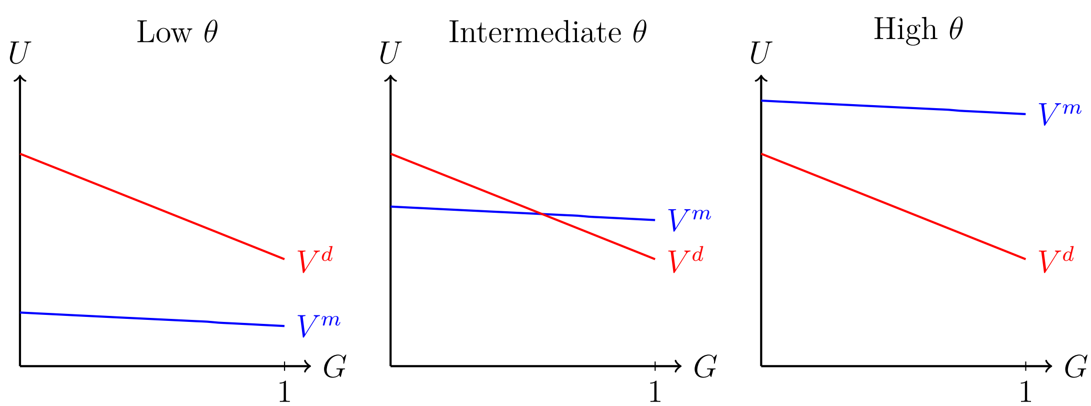
Second, higher values of β make an increase in divorce rates a more likely consequence of a relative improvement in female income. If the ex-wife is entitled to a higher share of household income after divorce, she would have an incentive to leave marriage when her income increases. Similarly, if an increase in her income allows her to command a higher share of the resources of the couple after divorce (i.e., $\frac{\partial \beta}{\partial G} < 0$), she would have an additional incentive for separation.

Third, high values of ρ would allow females to command a higher share of the household's available resources towards their own private consumption if they remain married, hence providing them with an incentive to stay. Once again, if increases in the income of the wife lead to bargaining power gains within marriage (i.e., $\frac{\partial \rho}{\partial G} < 0$), she will be more likely to remain married. Thus, this theoretical channel countervails the previous two.

2.1.5 An example: exponential preferences over consumption

In this subsection, I illustrate the divorce model under the assumption that females have exponential preferences over consumption, both within marriage and after divorce, or $u^m(c) = u^d(c) = c^x$ with $1 > x > 0$. The three panels of Figure 1 depict the indirect utility function within marriage (red line) and when divorced (blue line) as a function of the male-female earnings gap for different realizations of the non-pecuniary benefits of marriage. I have assumed that $\beta > \rho$, which intuitively means that females are able to command a higher share of household income after divorce than within marriage. Under these parametric assumptions, utility falls faster in response to an increase in male-female earnings gap when the female is divorced than when she is married because the locus of the indirect utility function in the divorce state is steeper than within marriage, implying a weakening of the incentive for separation when earnings inequality increases.

Figure 1: Illustration of the divorce model



Notes: In each panel, the blue line depicts the indirect utility functions within marriage (blue line) and within the divorce state (red line) as a function of the male-female earnings gap for different levels of the non-pecuniary benefits from marriage, θ. The indirect utility function under divorce (red line) is steeper than within marriage (blue line), implying a weakening of the incentive for separation when the male-female earnings gap increases.

In the diagram, the female with a low realization of θ is unaffected by changes in the male-female earnings gap, as the non-pecuniary aspect of her marriage is so bad that she will decide to get divorced regardless of the level of earnings inequality. Similarly, the female with a high realization of θ will be unaffected by changes in earnings inequality, as the non-pecuniary aspect of her marriage will be sufficiently good to prevent her from getting divorced when her earnings improve relative to her husband's. On the other hand, the female with an intermediate realization of θ will decide to get divorced for sufficiently low levels of earnings inequality, since she is able to improve her utility by separating from her husband and gaining command over a higher share of earnings.

The model presented above highlights the different channels through which divorce decisions may change when labour market conditions are perturbed more favourable for females than for males. In the following sections, I study the extent to which these theoretical channels are also present in the data.

3 Data

To analyse the effect of the earnings gap on divorce rates, this paper makes use of administrative records of all *maquiladora* plants in the country between 1997 and 2006, as well as of administrative records of all divorces in Mexico in the same period. I aggregate the data at the commuting zone level with a quarterly frequency and then link the resulting dataset to high-quality data from the labour force survey for all the main 45 urban commuting zones in the country.

3.1 Divorce data

The divorce data that I use consists of the complete records of all legal divorces in Mexico between 1997 and 2006. For each divorce, data includes the date of the divorce, the date of the filing of the divorce suit, the date of matrimony, the gender of the plaintiff, the cause of the divorce, the number of children in the matrimony, the gender of the custodian of the children designated by the judge, whether an alimony and child support were mandated by the judge, the gender of the alimony payee, and the duration of marriage. Additionally, for each of the parties in each divorce, data also includes age, place of residency, schooling, and information on occupation and labour market participation.

3.2 Maquiladora data

I use plant-level administrative records from the *maquiladora* export industry between 1997 and 2006. Although the program started operating in 1965, the first year with complete records at the plant level is 1997. Plant-level data is extremely rich and includes monthly data on the number of employees, hours worked, wages, and benefits by gender. Moreover, the data details the economic activity of each manufacturing plant, as well as the nominal value of imported inputs, operating expenses and costs, output, and profits. The data is collected by the national institute of statistics of Mexico through a monthly census to all registered *maquiladora* plants in the country.

Table 1: Summary statistics

	1997	1999	2001	2003	2005
Population (thousands)	539.9	628.3	690	733.9	781.3
	(1471.9)	(1663.7)	(1711.3)	(1813.3)	(1861.4)
Labour market characteristics					
Average monthly earnings (2016 USD)	339.1	340.6	324.6	325.1	333.2
	(68.5)	(65.3)	(59.1)	(75)	(84.9)
Male-female earnings gap (percent)	48.5	48	51.7	53.6	46.4
	(15.2)	(16.4)	(18.7)	(22.5)	(23.8)
Maquiladora					
Employees (thousands)	13.4	16.6	14.4	14	15.9
	(35.9)	(42.1)	(38.4)	(36.9)	(42.2)
Plants	39	46	44	38	38
	(104)	(120)	(117)	(96)	(98)
Divorce rates					
Total	29.6	26.9	27.8	28.7	28.5
	(17.6)	(16.3)	(16.9)	(17)	(16.7)
Female petitioner	2.8	2.2	2.2	2.8	2.9
	(2.9)	(2.3)	(2.3)	(3.2)	(3.3)

Notes: The observation unit is a commuting zone-quarter pair. Statistics correspond to the last quarter of each year.

3.3 Socio-demographic data

Aggregate socio-demographic data at the commuting zone level comes from the quarterly labour force survey levied between 1997 and 2006, which is representative for all main 45 commuting zones in the country. The raw data includes monthly earnings, occupation, hours worked, etc for all surveyed individuals. I use this data to construct: average earnings and hours worked by gender, age group, and educational attainment, as well as population counts and shares of mutually exclusive categories of labour market participation (i.e., manufacturing, non-manufacturing, unemployed, and not in labour force).

3.4 Summary statistics

For the main analysis, I construct a quarterly dataset that includes data of all main 45 commuting zones in the country, linking variables from the above-mentioned sources. Specifically, at the commuting-zone level, I construct divorce rates per 100,000 inhabitants, average earnings, the average male-female earnings gap, and the number of *maquiladora* plants and employees on a quarterly basis. Table 1 presents the means and standard deviations for the main variables under consideration, along with the corresponding statistics for other important indicators, such as population counts and the female-petitioner divorce rate.

4 Maquiladora plant openings

Since local variation in the number of *maquiladora* plant openings will be used as an instrument to identify the effect of the male-female earnings gap on divorce rates, in this section, I describe the *maquiladora* program in detail, examine the main factors influencing the opening and closures of plants, and provide descriptive statistics of the instrument under consideration.

4.1 The program

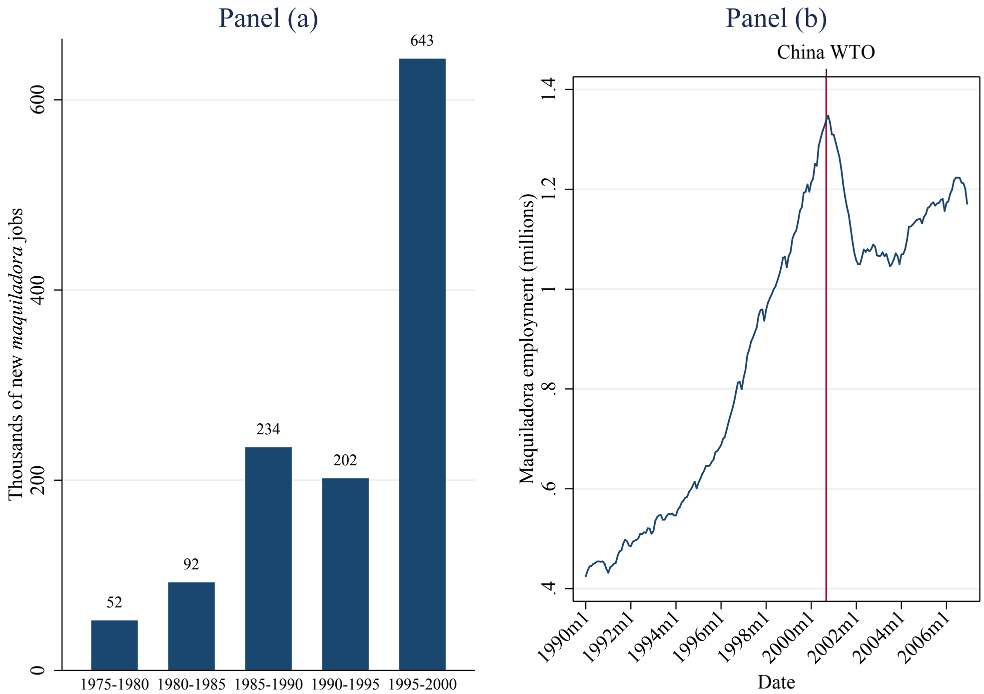
The *maquiladora* program was created in 1965 to attract the manufacturing operations of foreign companies, with the aim of strengthening trade balance, boosting employment, and transferring technology from abroad. To this end, the program offers fiscal exemptions, labour costs reductions, and a 6-day work week to large foreign companies seeking to base their manufacturing operations in Mexico. The main requisite for participation for foreign companies is to voluntarily enrol in the program by hiring a Mexican manufacturing contractor or a corporate shelter service that looks for appropriately-sized buildings to establish manufacturing operations. Participating US companies must temporarily import their inputs and export back their output to the US, guaranteeing that the operation of all *maquiladora* plants improves the balance of trade by exporting the value added by labour to the product.

Although the *maquiladora* program dates back to 1965, the entry into force of NAFTA gave notoriety to program as an important source of employment in Mexico. Panel (a) of Figure 2 shows that the number of new jobs created by the program between 1995 and 2000 is greater than the sum of the number of jobs created in all the other periods combined, most likely due to the removal of local content and local production requirements in Canada, the US, and Mexico as part of the agreement.

The entry of China to the WTO had negative consequences for *maquiladora* employment, as shown in panel (b) of the same figure. *Maquiladora* employment suffered a substantial setback on the 19th of September of 2000, the date in which the US Senate voted in favour of granting Permanent Normal Trading Rights (PNTR) rights to China. *Maquiladora* jobs represented on average 21.4% of Mexico's manufacturing jobs between 1995 and 2006, as well as 4.4% of the country's total jobs. A loss of around 244,000 *maquiladora* jobs, such as the one observed between 2001 and 2003, entails a loss of approximately 1% of the country's total employment (18.8% loss of all 1.3 million *maquiladora* jobs $\times$ 4.4%).

Concerning which economic activities take place in *maquiladora* plants, this is depicted in Figure 3. Employment in plants manufacturing electric materials, textiles, transports, and

Figure 2: Maquiladora employment over time



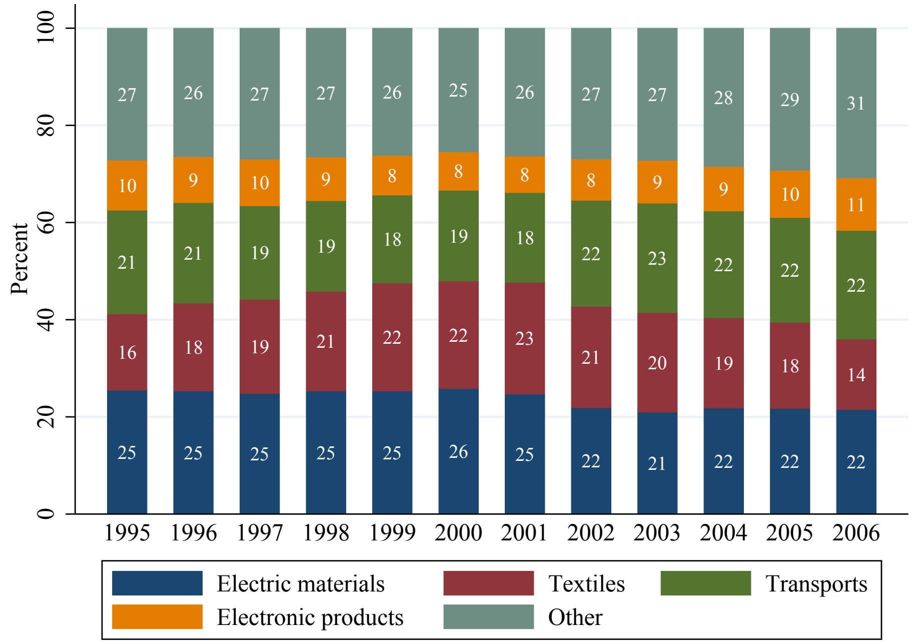
Notes: The figures show the number of *maquiladora* jobs created in each five-year period between 1975 and 2000 (panel a) and the monthly number of *maquiladora* jobs between 1990 and 2006 (panel b). The red line in panel (b) represents the 19th of September of 2000, date in which the US granted Permanent Normal Trading Rights to China.

electronic products represented between 69 and 75 percent of overall *maquiladora* employment between 1995 and 2006. The remaining employment share corresponds to *maquiladora* plants manufacturing food, shoes, furniture, chemical products, heavy machinery, toys, and other products. Importantly, the fraction of employment in labour intensive plants dedicated to manufacturing textiles and electric materials fell after 2001, in favour of the fraction of plants dedicated to manufacturing transports and electronic materials.

4.1.1 *Maquiladora* gender-specific labour demand

A specially attractive feature of *maquiladora* plants for the study of the effect of male-female earnings inequality on divorce rates is that manufacturing plants usually have gender-specific labour demand. In this subsection, I formally show that female hours are more productive than male hours across most *maquiladora* industries. To prove that females are more productive than males in *maquiladora* plants, I estimate the following nested CES production function for each industry, a follow a commonly used approach in the literature (see for example Katz and Murphy, 1992 and Heckman, Lochner and Taber, 1998). Specifically, consider

Figure 3: *Maquiladora* employment shares by industry



Notes: The bar "Other" represents employment in plants manufacturing food items, shoes, furniture, chemical products, heavy machinery, toys, and other products.

the following functional form for the production function of the representative *maquiladora* plant:

$$F(K,F,H) = \left(a_K K^{\frac{r-1}{r}} + (1-a_K)\left[\left(a_F F^{\frac{s-1}{s}} + (1-a_F)H^{\frac{s-1}{s}}\right)^{\frac{s}{s-1}}\right]^{\frac{r-1}{r}}\right)^{\frac{r}{r-1}},$$

where a_K denotes the capital share of output, K is the capital stock, r is the elasticity of substitution between capital and labour, a_F is the labour share of female hours, F and H are the number of female and male hours in production, respectively, and s is the elasticity of substitution between female and male hours.

Let W_i denote the wage of each gender $i \in \{F, H\}$, and let r denote the rental rate of capital. Under perfect competition, the payment to each factor of production is equal to its marginal productivity. One can easily show that taking logs of the ratio of female wages to the male wages results in the following equation:

$$\log\left(\frac{W_F}{W_H}\right) = \log\left(\frac{a_F}{1-a_F}\right) - \frac{1}{s}\log\left(\frac{F}{H}\right) + \epsilon.$$

Above, ϵ is a mean zero error term, which by construction is uncorrelated with the ratio

Table 2: CES production function parameters by industry

	All	Textiles	Transports	Heavy machinery	Electrics	Electronics	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female productivity (a_F)	.6 ***	.67 ***	.56 ***	.33 ***	.56 ***	.54 ***	.62 ***
	(.01)	(.03)	(.01)	(.05)	(.03)	(.01)	(.01)
Elasticity of substitution (s)	4.26 ***	3.5 ***	2.55 ***	6.76 *	-51.39	17.09	2.74 ***
	(.78)	(.78)	(.43)	(3.78)	(205.25)	(15.64)	(.43)
Time trend × 100	-.09 ***	-.13 ***	-.06 ***	.08 **	-.07 ***	-.04 ***	-.12 ***
	(.01)	(.02)	(.01)	(.04)	(.02)	(.01)	(.01)

Notes: N=120 months. Standard errors are robust to heterokedasticity. The estimation method is OLS.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

of female to male hours. Therefore, OLS estimation of the above equation should yield consistent estimates of the production function parameters.

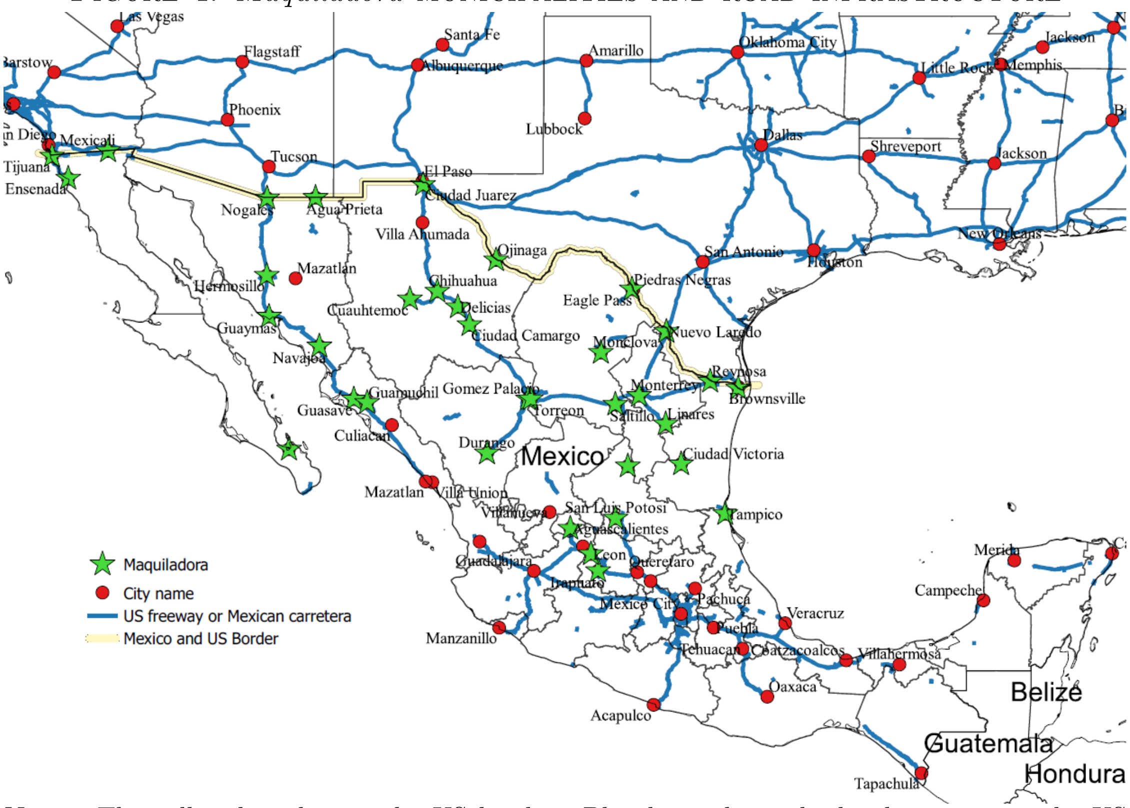
Table 2 presents the parameters resulting from estimating the above equation via OLS separately for each *maquiladora* industry. The observation unit in each OLS regression is the aggregate or representative plant, and the obsevation frequency is monthly between 1997 and 2006. Three of findings are worth mentioning. First, estimates of the elasticity of subsitution, s, in textile, transports, and other industries reveal a greater degree of substitutability between male and female hours than with a Cobb-Douglas production function. Second, the time trend parameter, which is usually interpreted as capturing aggregate shifts in the relative demand for female and male hours, is negative and strongly significant. Third, the parameter estimates of female productivity, a_F, reveal that female hours are more productive than male hours across all industries, except for heavy machinery. The estimates also reveal that females are relatively more productive in the the textile industry than in the transports, electric materials, and electronics industries.

By CES algebra, textile plant openings will shift the demand for female hours relatively more than the demand for male hours under the assumption that, within commuting zones, male-female relative wages for non-college workers are the same across all industries. Guided by this assumption, in subsequent sections of the paper, I will use plant openings in all industries as a source of variation to determine the effect of shocks to female labour demand on divorce rates. Alternatively, one could relax this assumption and use plant openings for each industry as a separate instrument.

4.2 Supply and demand factors influencing opening and closure decisions

Plant openings and closures are largely determined by *maquiladora* plants supply and demand factors. According to some of the main corporate shelter services in Mexico, supply factors determining the location decisions of foreign companies include the availability of amenities such as access to roads, proximity to the US border, local infrastructure, availability of buildings that meet the volumes and specifications required to assemble the products of a variety of companies, and the safety of the commuting zone. Figure 4 makes patent the importance of proximity to the US border and access to roads as factors influencing *maquiladora* plants location decisions. Supply factors also include common shocks across all foreign companies, such as the signing of NAFTA and the entrance of China to the WTO.

FIGURE 4: *Maquiladora* MUNICIPALITIES AND ROAD INFRASTRUCTURE



Notes: The yellow line depicts the US border. Blue lines above the border represent the US freeway system, whereas blue lines below the border represent Mexican *carreteras* of 2 lanes or more. Every red dot on the map accounts for a different city. The green stars denote municipalities exposed to the *maquiladora* program between 1990 and 2006.

On the other hand, factors determining the demand of commuting zones for *maquiladora* plants relate to the supply of unskilled males and females in working age, as well as to the industry composition, unemployment rate, and average earnings. Demand factors also include common shocks across all commuting zones, such as the passage of new labour market legislation.

5 Empirical strategy

5.1 IV model

For each commuting zone z and quarter t, let $D_{z,t}$ denote the divorce rate per 100,000 inhabitants. I instrument the male-female earnings gap in percentage terms, $G_{z,t}$, with the number of *maquiladora* plant openings or closures in the same quarter, $\Delta M_{z,t}$. The IV model is a system of two equations:

$$G_{z,t} = \kappa + \phi \Delta M_{z,t} + \theta X_{z,t} + \mu_z + \eta_t + \nu_{z,t} \tag{2}$$

$$D_{z,t} = \alpha + \beta G_{z,t} + \lambda X_{z,t} + \gamma_z + \delta_t + \epsilon_{z,t}, \tag{3}$$

where both μ_z and γ_z are commuting zone fixed effects, η_t and δ_t are time effects, $\nu_{z,t}$ and $\epsilon_{z,t}$ are error terms, and $X_{z,t}$ is a large vector of time-varying covariates in commuting zone z. Above, equation 2 is the first stage, and equation 3 is the second stage.

The role of the commuting zone fixed effects is to control for time invariant unobservables at the municipal level, whereas the role of the time effects is to control for unobservable common shocks across commuting zones. I include two types of time-varying controls to make sure that the results below do not follow from time-varying observables at the commuting zone level. The first type of controls are those expected to correlate with the decisions of foreign firms concerning where to locate manufacturing activities, detailed in section 4.2. The second type of controls are the variables expected to correlate with divorce rates. To identify such controls, I rely on contributions from the sociological literature regarding the social correlates of divorce (see for instance Landis, 1963; Glenn and Supancic, 1984; and Larson and Holman, 1994). Divorce rates are usually correlated to the ratio of males to females, the population share of males and females in reproductive age, and the socio-economic attributes of the communtting zone, including average years of schooling. A third group of divorce correlates are potentially affected by the instrument and are therefore not controlled for in the regressions. This latter group includes the ratio of married to nonmarried, inmigration rates, average income levels, poverty, inequality, and unemployment.

5.2 Assessing the instrument

The IV strategy adopted for the study of the effect of the male-female earnings gap on the divorce rate is particularly attractive because the timing of plant openings that are relatively intensive in the use of female hours is unlikely to co-vary with the correlates of divorce. To

Table 3: Variance decompostion of maquiladora plant openings into time-invariant, time-specific, and time-varying characteristics

	Time-invariant (1)	Time-specific (2)	Time-varying (3)
Raw	.012	.072	.011
Correlated	.015	.084	.002
Uncorrelated	.011	.06	.002
Balanced	.005	.078	.003

Notes: All variance shares were derived using the definitions in Gibbons, Overman, and Pelkonen (2012).

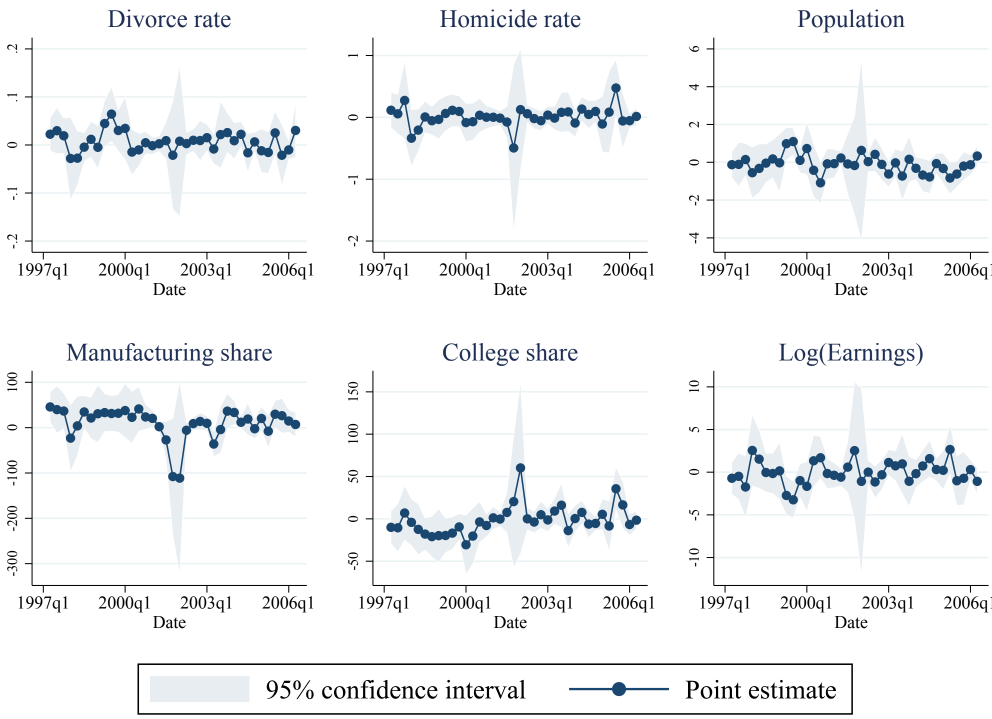
demonstrate this, I examine (1) the correlation between plant openings and time-invariant, time-specific, and time-varying observables, and (2) the correlation between plant openings and observables at baseline. Additionally, I assess whether a correlation between plant openings and unobservables might substantially bias my estimation results.

I begin by decomposing the variation in the number of plant openings, into the shares explained by time-invariant, time-specific, and time-varying observable characteristics of the commuting zone. Table 3 shows the results from conducting some of the most common variance decompositions in the literature (see Gibbons, Overman and Pelkonen, 2012). In general, results from all decomposition exercises indicate that only a small fraction of the variation in the instrument is explained by time-invariant characteristics, such as distance to the US border, or by time-varying characteristics, such as the ratio of females to males in the commuting zone. On the other hand, a greater share of the variation in plant openings is explained by common shocks across all commuting zones, although the lion's share of the variance in plant openings remains mostly unexplained by the observables.

Next, I examine the relationship between the baseline observable characteristics of the commuting zone and the timing of *maquiladora* plant openings, by regressing plant openings on commuting-zone dummies and interactions of a large vector of covariates at baseline with quarter dummies. Figure 5 plots the coefficients for these interactions along with the corresponding 95% confidence intervals. Each panel shows the coefficients for a different covariate as a function of time. Results indicate no relationship between plant openings and divorce rates, crime rates, the manufacturing share, log population counts, educational attainment, or average log earnings.

Turning to the correlation between the instrumental variable and time-varying unobservables, I examine the bias that would arise from the empirical strategy under the assumption that selection on unobservables follows the same pattern as selection on time-varying observables, using the test by Altonji, Elder and Taber (2005). Results from this test indicate that the use of plant openings as an instrument is not likely to result in severely biased estimates. If anything, the test suggests a small positive bias arising from estimation, which will tend to understate the effect of interest.

Figure 5: Regressing plant openings on commuting-zone baseline characteristics interacted with time dummies, 1997-2006



Notes: Each panel presents the point estimates and confidence intervals of the coefficients from a regression of plant openings on a large set of baseline characteristics interacted with quarter dummies, controlling for commuting-zone fixed effects.

These results together indicate that *maquiladora* plant openings are a valid instrument for the male-female earnings gap in my model.

6 The effect of the male-female earnings gap on divorce rates

6.1 Graphical evidence

Figure 6 breaks down the empirical relationship between divorce rates and the male-female earnings gap into the first stage and the reduced form. Panel (a) provides evidence of a strong

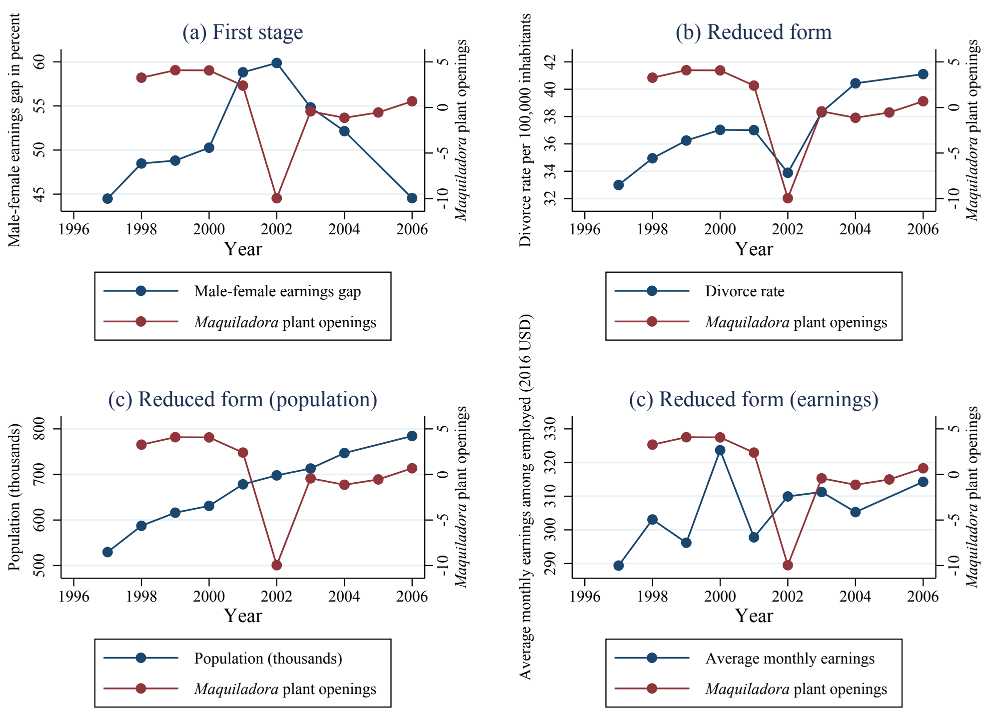
Table 4: AET bias estimates

Effect	$\frac{\text{var}(\Delta M_{z,t})}{\text{var}(\Delta \tilde{M}_{z,t})}$	$\frac{\text{var}(\hat{\epsilon}_{z,t})}{\text{var}(\hat{\lambda} X_{z,t})}$	$\frac{\text{cov}(\Delta M_{z,t},\hat{\lambda} X_{z,t})}{\text{var}(\Delta M_{z,t})}$	$\hat{\phi}$	Bias
(1)	(2)	(3)	(4)	(5)	(6)
-.732	.948	.912	-.017	-.146	.101
(.272)					

Notes: All estimates are conditional on commuting-zone and quarter fixed effects. The estimate $\hat{\lambda}_{z,t}$ is obtained under the null that the effect of the male-female earnings gap on divorce rates is zero.

first stage relationship. Specifically, this panel shows how male-female earnings inequality rises the most in 2002, the year following to the accession of China to the WTO, and the year with the the lowest number of plant openings. The figure also reveals a reduction of the male-female earnings gap in the years with a higher number of plant openings. Similarly, panel (b) also provides compelling evidence of a reduced-form relationship between the divorce rate and the number of plant openings. In 2002, a pronounced drop in divorce rates coincides with the lowest number of plant openings in the period under consideration, whereas divorce rates are increasing over time for the rest of the years. In contrast, panels (c) and (d) show that the instrumental variable displays no apparent relationship with other variables, such as population counts or average earnings among employed individuals.

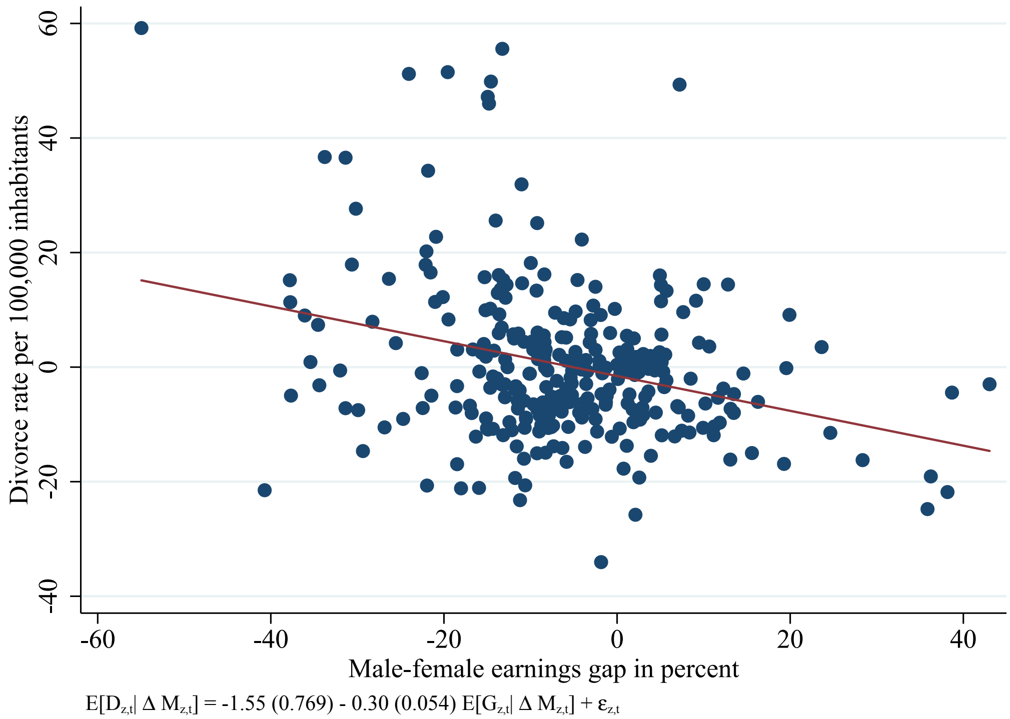
Figure 6: Illustration of the IV strategy



Notes: Each dot presents the average value of a variable in the first quarter of the year across all 45 commuting zones in Mexico. *Maquiladora* plant openings display a negative time series correlation with the male-female earnings gap and a positive correlation with the divorce rate, but no correlation with population or average earnings.

Figure 7 provides a visual representation of the IV model. This figure shows the average divorce rate per 100,000 inhabitants by quarter and number of plant openings, against the male-female earnings gap in the same cells after removing commuting zone and quarter fixed effects. The slope of the line through the points is a rough estimate of the reductions in divorce rates due to increases in the male-female earnings gap. Specifically, I find that an increase of 1 percentage point in the male-female earnings gap results in a significant reduction in the divorce rate by 0.3 divorces per 100,000 inhabitants. In subsequent sections of this paper, I will show that this is a fairly accurate initial approximation to the actual effect of the earnings gap.

Figure 7: Visual IV graph



Notes: Each blue dot depicts the average divorce rate per 100,000 individuals and the male-female earnings gap by cells of year and number of plant openings. The sample includes all 45 main commuting zones in Mexico between 1997 and 2006.

6.2 Main results

Table 5 reports the main results from IV estimation. The baseline specification including only commuting-zone effects and time effects is shown in column (1). A first stage estimate of -0.15, significant at the 5 percent level, indicates that the opening of a *maquiladora* plant causes a reduction of 0.15 percentage points in the male-female earnings gap. Importantly, the F-test for the excluded instrument rejects the null with 10 percent significance. In the reduced form, plant openings feature a strong correlation with divorce rates. Specifically, when a manufacturing plant opens, the divorce rate increases by 0.09 divorces per 100,000 inhabitants. Turning to the second stage estimate, a coefficient of -0.61, significant at the 1 percent level, indicates that a reduction in the male-female earnings gap of 1 percentage point causes 0.61 divorces per 100,000 inhabitants.

Table 5: Effect of the male-female earnings gap on the divorce rate

Dependent variables: male-female earnings gap as percentage of male earnings (first stage) and divorce rate per 100,000 inhabitants (second stage)

	Baseline specification			Time trends		Covariate interactions	
	No controls	Weights	Covariates	Linear	Quadratic	Time trend	Time FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Second stage							
Earnings gap	-.61 ***	-.5 ***	-.57 ***	-.58 ***	-.56 ***	-.55 ***	-.3 **
	(.22)	(.11)	(.11)	(.1)	(.17)	(.11)	(.14)
Reduced form							
Plant openings	.09 ***	.09 **	.1 ***	.12 ***	.07 ***	.1 **	.07 *
	(.03)	(.04)	(.03)	(.03)	(.02)	(.04)	(.04)
First stage							
Plant openings	-.15 **	-.18 **	-.18 ***	-.2 ***	-.12 **	-.19 ***	-.25 ***
	(.07)	(.08)	(.06)	(.07)	(.06)	(.06)	(.04)
F-test p-value (instr.)	.051	.023	.005	.008	.049	.002	0

Notes: N=1597 (35 quarters $\times$ 45 commuting zones - 23 missing values). Standard errors are clustered at the commuting zone level and are robust to heterokedasticity. All regressions include commuting-zone effects and time effects.

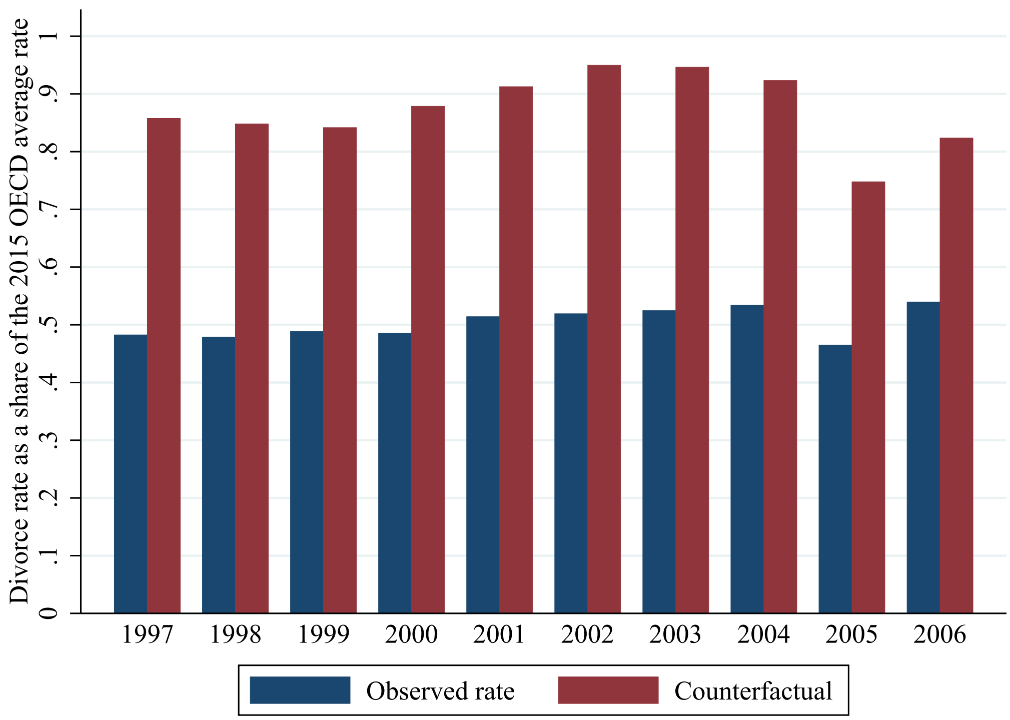
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Columns (2) through (7) test the robustness of the baseline estimates to the inclusion of several groups of covariates described in subsection 5.1. In column (2), I weight observations by the population of the commuting zone at baseline to make sure that the effect is not driven by drastic changes in divorce rates in relatively small metropolitan areas where divorce is uncommon. In column (3), I add the time-varying controls to make sure that the effect is not driven by time-varying observable factors. Columns (4) and (5) control for linear- and quadratic-specific trends to make sure that the effect is not driven by underlying trends in divorce across commuting zones, which could simply happen to be correlated with plant openings. Furthermore, column (6) includes interactions of the covariates at baseline with a linear time trend as controls to make sure that the effect is not driven by time trends in divorce rates that depend on the characteristics of the commuting zones. In a similar spirit, column (7) controls for interactions of the covariates at baseline with time dummies. Across all specifications, the first stage remains significant at the 5 percent level, and the instrument variable remains strong, since the p-value of the F-test never goes above the value of 0.1. In turn, the reduced-form effect a plant opening remains stable around 0.1 new divorces per 100,000 inhabitants, whereas the second-stage effect of a 1 percentage point drop in the earnings gap on the divorce rate remains stable around 0.5 new divorces per 100,000 inhabitants.

6.3 Economic significance

To provide a sense of the relative importance of the male-female earnings gap in explaining why the divorce rate in Mexico is so low relative to the OECD average, I calculate the counterfactual divorce rate that would have occurred if the male-female earnings gap were equal to the 2014 OECD average gap of 14.3 percent. In each year, the counterfactual divorce rate of each commuting zone is estimated by applying the IV estimate to the difference between the average OECD gap of 14.3 percent and the observed gap in the commuting zone and then adding the resulting number to the actual divorce rate.

Figure 8: Divorce rate as a share of the 2015 average in OECD countries



Notes: The blue bars present the observed divorce rate per 100,000 individuals as a share of the 2015 average divorce rate in OECD countries, whereas the red lines present a counterfactual divorce rate, constructed by assuming that, for commuting zones and quarters under consideration, the male-female earnings gap is equal to the 2014 OECD average gap and then applying the IV parameter.

Results indicate that the earnings gap explains a substantial share of the of the difference between divorce rates in Mexico and the rest of the OECD. Figure 8 plots both the observed and counterfactual aggregate divorce rate in Mexico relative to the 2015 OECD average divorce rate of 210 per 100,000 individuals. While the observed aggregate divorce rate in Mexico is around 50 percent of the OECD average for all years under consideration, the counterfactual rate is around 80 percent. In other words, the male-female earnings gap

Table 6: Robustness checks and placebo tests of the IV model

Dependent variables: male-female earnings gap as percentage of male earnings (first stage) and divorce rate per 100,000 inhabitants (second stage)

					Placebo	
	Baseline	No outliers	No zeros	No cities	Outcome	Instrument
	(1)	(2)	(3)	(4)	(5)	(6)
Second stage						
Divorce rate$_t$	-.61 ***	-.5 ***	-.61 ***	-.69 **		-.65 ***
	(.23)	(.16)	(.23)	(.3)		(.24)
Divorce rate$_{t-5}$					-.17	
					(.21)	
First stage						
Plant openings$_t$	-.15 **	-.16 **	-.15 **	-.13 *	-.15 **	-.14 *
	(.07)	(.07)	(.07)	(.08)	(.07)	(.08)
Plant openings$_{t+5}$						-.03
						(.04)

Notes: N=1597 (35 quarters × 45 commuting zones - 23 missing values). Standard errors are clustered at the commuting zone level and are robust to heterokedasticity. All regressions include commuting-zone effects and time effects.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

explains more than half of the difference in divorce rates between Mexico and the rest of the OECD.

6.4 Robustness analysis

In this section, I present the results from additional robustness checks to the main empirical finding of this paper, namely that reductions in male-female earnings inequality cause higher divorce rates.

In Table 6, I conduct a set of robustness checks to verify that the estimates from the baseline specification in column (1) are robust. As shown in column (2), the results barely move when removing divorce-rate outliers from the second stage regression. In column (3), I present the results from estimating the IV model after removing divorce rates of zero. Once again, the size and significance of the coefficients in the empirical model remain largely unaltered. When removing the 3 largest commuting zones from the estimating data, significance also remains unaltered, as shown by column (4). If anything, the magnitude of the effect of the male-femae earnings gap on the divorce rate increases in absolute value.

I also conduct two placebo tests. The first of these replaces the current divorce rate in the second stage regression with the same variable from 5 quarters before, while maintaining current plant openings as the instrument in the specification. A significant coefficient of the male-female earnings gap in the second-stage regression would indicate that the instrument is correlated with unobserved commuting zone-specific trends in the divorce rate, since current plant openings should not have an effect on past divorce decisions. Column (5) of the table presents the results from this exercise. The effect of the male-female earnings gap on previous

Table 7: Effect of plant openings on log population counts by demographic group

Dependent variable: log population counts × 100

	All	Gender		Education		Age group		
		Male	Female	Non-college	College	Age 16-29	Age 30-49	Age 50-69
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Log(population count)	.01	.02	.01	.01	.08	.01	.02	.01
	(.02)	(.03)	(.02)	(.02)	(.06)	(.02)	(.02)	(.04)

Notes: N=1597 (35 quarters × 45 commuting zones - 23 missing values). Standard errors are clustered at the commuting zone level and are robust to heterokedasticity. All regressions include commuting-zone effects, time effects, and linear- and quadratic-specific trends.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

divorce rates is small and undistinguishable from zero.

In a second placebo test, I maintain current plant openings as an instrument but include plant openings from 5 quarters before as an additional instrument in the first stage regression. A significant coefficient for the lagged instrument would mean that some omitted variable is causing both plant openings and divorce rates. Results from this exercise are presented in column (6) of the table. The coefficient for current plant openings in the first stage remains highly significant, but the effect of the lagged instrument is non-significant and very close to zero. A formal Wald test rejects the null of coefficient equality at the 1 percent significance level.

Another potential concern is that migration across commuting zones drives the results. Divorce-prone females might select into manufacturing jobs and move into the *maquiladora* municipalities when plants open. I test for this possibility by regressing the log population counts for different demographic subgroups on plant openings, while controlling for commuting-zone, quarter fixed effects, and commuting zone-specific trends. Results from this exercise are presented in Table 7. The effect of plant openings on overall population is small and insignificant. When turning to the effect by demographic subgroup, I find that plant openings do not have an effect on the population count by gender, education, and age group. Thus, migration across commuting zone does not appear to drive the results.

7 Mechanisms

In this section, I evaluate the relative importance of the theoretical mechanisms highlighted in section 2 in explaining the effect of male-female earnings inequality on divorce rates. First, I exploit micro-data on divorce characteristics contained in the national administrative records to verify that the observed effect of relative improvements to female earnings on divorce rates arises as a consequence of either a decision of the ex-wife or by mutual agreement, but not

Table 8: Effect of female labour force participation on divorce rates by gender of the petitioner

Dependent variable: divorce rates per 100,000 individuals

		By the gender of the petitioner				By participation of the wife in the labour force	
	All	Husband	Wife	Both	Judge	Employed	NILF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Earnings gap	-.61 ***	0	-.15 **	-.5 **	.04	-.33 **	-.28 **
	(.23)	(.03)	(.06)	(.23)	(.07)	(.14)	(.14)
Outcome mean at baseline	33	2.37	2.83	26.84	.96	18.55	14.44

Notes: N=1592 (35 quarters × 45 commuting zones - 28 missing values). Standard errors are clustered at the commuting zone level and are robust to heterokedasticity. All regressions include commuting-zone effects and time effects.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

from a decision of the ex-husband. Table 8 presents the results of applying the baseline IV strategy to the divorce rates by gender of the petitioner. Column (3) of this table indicates that the effect of earnings inequality reductions on female-petitioner divorce rates is positive and significant, implying that ex-wifes file for divorce and ask the judge to determine both the post-divorce household income allocation and the custody of children. Column (4) shows that the effect of relative improvements to female earnings on mutual consent divorce rates is also positive and signficant, implying that the divorce decision also arises as a consequence of efficient bargaining concerning the post-divorce allocation between both members of the couple. Columns (2) and (5) of the table shows that the effect of female employment on male-petitioner and judge-mandated divorce rates is non-significant.

Table 9: Effect of female labour force participation on the female petitioner divorce rate by separation cause

Dependent variable: divorce rates per 100,000 individuals

Separation cause	All	Abandonment	Violence	Money	Adultery	Other
	(1)	(2)	(3)	(4)	(5)	(6)
Earnings gap	-.151 **	-.107 ***	-.006	-.024 *	-.005	-.009
	(.06)	(.037)	(.007)	(.013)	(.004)	(.011)
Outcome mean at baseline	2.831	2.018	.302	.179	.138	.195

Notes: N=1592 (35 quarters × 45 commuting zones - 28 missing values). Standard errors are clustered at the commuting zone level and are robust to heterokedasticity. All regressions include commuting-zone effects and time effects.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Second, I evaluate whether the relative improvement of female labour market conditions is indeed the main causal mechanism underlying the increase in the divorce rate. An alternative theory would suggest that, due to subsistence reasons, only females not participating in the labour force at the moment of the plant opening had an incentive to “escape” their marriage once *maquiladora* jobs became available. I evaluate whether reductions in the male-female earnings gap cause hikes in divorce rates both for wifes that report being employed at the moment of the plant opening and for wifes that report not participating in the labor force

Table 10: Effect of a reduction in the male-female earnings gap on divorce rates by gender of the custodian and number of children

Dependent variable: divorce rates per 100,000 individuals

Divorce type	All	By children in marriage		By gender of the custodian		
		No children	One or more	Father	Mother	Both
	(1)	(2)	(3)	(4)	(5)	(6)
Earnings gap	-.61 ***	-.09	-.53 **	-.01	-.51 **	-.01
	(.23)	(.08)	(.21)	(.02)	(.21)	(.03)
Outcome mean at baseline	33	12.64	23.59	1.39	20.33	1.79

Notes: N=1592 (35 quarters × 45 commuting zones - 28 missing values). Standard errors are clustered at the commuting zone level and are robust to heterokedasticity. All regressions include commuting-zone effects and time effects.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

until the plant opened. Results from this exercise are also reported in Table 8. Column (6) shows that a drop in the earnings gap of 1 percentage point causes a hike of 0.33 new divorces among employed females per 100,000 inhabitants, whereas the same reduction in earnings inequality causes 0.28 new divorces for wifes not participating in the labour force when the plant opened.

Furthermore, Table 9 disaggregates the effect of female employment on female-petitioner divorce rates by separation cause. The purpose of this exercise is to verify whether ex-wifes indeed file for divorce when either the non-pecuniary benefit of marriage or their bargaining power within marriage are sufficiently low. Results from this exercise indicate that females file for divorce on the grounds of abandonment and of lack of monetary support of the husband within marriage.

Finally, one of the theoretical possibilities contemplated in the model presented in section 2 is that females could derive different utility levels from children's well-being within marriage and after divorce. Specifically, a widely utilized modelling assumption (see Chiappori, Iyigun and Weiss, 2015) is that the utility derived from children's well-being might change for the parent that does not have full custody. To address this theoretical possibility, in Table 10, I evaluate whether drops in male-female earnings inequality lead to reductions in the utility derived from children's well-being after divorce, by applying the baseline IV strategy to the divorce rates by gender of the member of the couple that obtains full custody of the children. Results from this table indicate (1) that reductions in earnings inequality have a positive effect on divorce rates for couples with children, and (2) that this effect is only significant for divorces in which the ex-wife obtains full custody of the children. This latter finding implies that it is the utility derived by the father from children's well-being , not the utility derived by the mother, that changes after divorce.

8 Conclusion

This paper studies the effect of reductions in male-female earnings inequality in Mexico on divorce rates between 1997 and 2006, using exogenous variation in female labour demand arising from manufacturing plant openings at the commuting zone level after the signing of NAFTA. In line with a simple theoretical framework, I find that relative improvements in female earnings cause increases in divorce rates, and that higher divorce rates arise indeed as a consequence of female decisions. The effect is particularly important for marriages that yield small pecuniary and non-pecuniary benefits for wifes, and the opening of manufacturing plants causes divorces in which wifes also obtain the full custody of the children. These results inform the policy discussion on the male-female earnings gap debate and the discussion on female empowerment in developing countries. Additionally, this paper contributes to the literature documenting the benefits and costs of free trade. Free trade has been successful raising female labour force participation, reducing male-female earnings differentials, and facilitating divorce decisions that were previously unfeasible for females.

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