Long-term Effects of Temporary Labor Demand: Free Trade Zones, Female Education and Marriage Market Outcomes in the Dominican Republic

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In many developing countries girls drop out of school early and marry young due to a lack of higher-skill labor market opportunities. In this paper I exploit the sudden and massive growth of female jobs in free trade zones (FTZs) in the Dominican Republic in the 1990s, and subsequent decline in the 2000s, to provide the first evidence that temporary labor demand can move societies to a "good equilibrium" that persists even after job opportunities taper off. Focusing on a sample of provinces that received FTZs and exploiting only variation in the exact arrival time of zones, I show that the FTZs led to a large and very robust increase in girls' education. The effect persists even after the end of a trade agreement with the U.S. and Asian competition that led to a decline in FTZ jobs in the 2000s. The reason appears to be that the increase in (some) girls' education changed marriage markets, with the girls whose education increased due to the FTZs marrying later, matching with a higher-quality husband, giving birth later, and having children that are more likely to survive infancy. In sum the evidence in this paper indicates that higher-skill jobs can profoundly change female outcomes in developing countries through general equilibrium effects in the education- and marriage markets.

1 Introduction

Why do women in developing countries often marry young? One possible explanation can be the lack of education, but then what causes low levels of education? Social norms combined with the lack of female labor market opportunities can be important factors to explain these outcomes. Since Becker 1960s seminal paper, a large literature has showed the importance of labor markets in shaping decisions concerning human capital accumulation and marital outcomes (Oster and Steinberg [2013], Heath and Mobarak [2012], Jensen [2010], Munshi and Rosenzweig [2006]). Female labor market opportunities improve women's educational attainment by increasing the opportunity costs to drop out school and have children earlier in life. However, little is know about the impact of increasing female labor force participation in the marriage market in developing countries. On the one hand, by increasing human capital investments and age of marriage, women with greater "ability" might become more attractive marriage partners. Moreover, as women delay marriage, they might have better information at the time of marriage, reducing the likelihood of divorce. But on the other hand, in societies where young marriage is valued, labor markets may have an indirect effect on

women by increasing their marriage market cost. For instance, women who delayed marriage to increase their years of education or participate in the labor force, might have access to a worse match or never get married. The potential effects on the marriage market might be relevant to understand what happens when these job opportunities decrease.[1]

In this paper, I study the long-term effects of temporary increases on female labor demand. In particular, I stress the importance of temporary labor market opportunities not only on increasing the economic returns to education but also the marriage market returns to it. Moreover, I study how marriage market gains caused by an increase in female labor market opportunities create incentives for women to get higher educational levels even in the absence of labor market gains. I will argue that the development of female labor markets can produce a new equilibrium in which women are more educated, marriages are later, matches are "better" and children are more likely to survive infancy.

To address this issue, I exploit the sudden and massive growth of female jobs in free trade zones (FTZs) in the Dominican Republic in the 1990s, and subsequent decline in the 2000s, to provide the first evidence that temporary labor demand can move societies to a "good equilibrium" that persists even after job opportunities taper off.[2] In the late 1980's and 1990s the Dominican Republic saw an expansion of FTZs that predominantly employed female labor. About 60 percent of workers in FTZs were women. This large percentage is explained by employment in textile manufacturing, which was one of main activities. I exploit the timing and allocation of FTZs' openings to isolate the impact of labor demand on education and marriage outcomes. I will further exploit two negative national shocks to female labor demand in the 2000s to analyze if these effects persist in absence of large job opportunities.

I compiled a new data set on FTZs' opening at the province level between 1986-2007. My difference-in-differences models control for many potentially unobserved confounding factors by including not only province-year-of-opening fixed effects but also province-year-of-birth fixed effects, so that my estimates are identified by differences in the availability of female labor market opportunities among different cohorts of women living in the same province and year. One could argue that FTZs tend to open in provinces where women's status was already increasing and therefore are not a cause but an effect of increasing female education. I provide several pieces of evidence which suggest that FTZs' opening do in fact increase women's status. First, there is no evidence of pre-existing characteristics able to predict the opening. Moreover, I find that female labor force participation, women's education, school enrollment and age of marriage have no clear trend before the opening but increase afterward. Second, I do not find evidence of the impact of FTZs introduced in future years on current outcomes. Results are robust to several falsification tests as well as specifications that control for socioeconomic factors and migration patterns. Third, while the opening of FTZs affect women that were less than 16 years of age at the moment of opening it did not affect other cohorts that should not be affected since they were not in schooling ages

[1] Moreover, most of evaluations are done while the job opportunities are still existing. However, it is not only important the effects of improving female labor markets per se but also if these effects are sustained over time once the job opportunities are reduced.

[2] According to the CNFZ, the free zones are defined as "geographic areas of the country, submitted to special customs and tax regimes, established by law, which permit the installation of companies that focus their production or services towards foreign markets. Free zones are areas limited by gates or walls, where the entrance and exit of people, vehicles or cargo, is supervised by personnel of the General Customs Office. Textile is the activity that has been more developed within free zones companies, since the country is an important exporter to the United States. Other industries of importance are footwear, jewelry, assembly of medical and electronic components, tobacco processing, data services and telecommunications, among others."

or in key age thresholds. Furthermore, the opening did not affect directly men's educational attainment. Fourth, estimates using household fixed effects and comparing women inside the same household provide similar effects. Finally, estimates for education outcomes using different sources of data such as household surveys from the Inter-American Development Bank are in line with those obtained using the Demographic Health Surveys.

I find that the opening of FTZs is associated with a 0.3 increase in women's years of education, specially secondary school. In terms of magnitude this is equivalent to a 26 percent decrease in the share of women who would have dropped out school in absence of FTZs. In line with previous literature, my results suggest that women increase their education level because they expect industrial parks to reward additional schooling. Even though most of the jobs were unskilled, they were better paid than other labor market opportunities, they provided job training and were the main source of female employment over the period of analysis. Moreover, in equilibrium I observe that most women working in FTZs have some level of secondary education. In my analysis I can isolate the effect of female labor market returns from other mechanisms such as an increase in earnings, school infrastructure and high skill migration into the areas. For instance, I exploit the variation in the number of parks in each FTZ to show that there are no differential effects where more job opportunities are available. I further found an effect on schooling for those households where no women is in the labor force, suggesting that the effects are not mainly driven by an increase on women's earnings.

I also study the effects of FTZs on age of first marriage, birth and intercourse. I find a 1.6 year increase in the age of marriage and a 18 percent reduction in the probability of early marriage (before the age of 18). Moreover, I find that the younger the women was at the opening of the FTZ, the lower the probability of marriage before the age of 18. I assess two channels through which increasing labor market opportunities may delay age of marriage: years of education or the direct result of labor force participation. Results show that while the opening of FTZs increase women's labor participation, it is not the direct explanation for the delay in marriage age. The increase in age of marriage is mainly explained by women in school at the time the park opened, suggesting that one of the main channels is the increase in years of education.

In a second part of the paper, I exploit two negative national shocks to female labor demand: the emergence of Asian competition in the apparel sector and the end of one of the main commercial agreement with the United States. These two shocks reduced considerably labor market opportunities for women. Moreover, many women were displaced from their jobs in the FTZs and could not find other work in the formal sector. If the increased in years of education and delay in the age of marriage is only explained by the industrial parks' increasing the opportunity cost of marriage, I should observe that after the negative shocks the effect induced by FTZs becomes smaller or null. That is in absence of labor market gains, women should stop their studies and marry early. However, I find that women increase their years of schooling and postpone their marriage even in absence of gains in the labor market. The results induced by FTZs on schooling and age of marriage are not reverted by the presence of negative shock in latter periods.

This suggests that other mechanisms apart from future gains in the labor market play a role in women's education and age of marriage in subsequent periods. Moreover, since the cultural norm in the Dominican Republic is to have children soon after marriage, I also test whether FTZs increase the age of first birth and if this effect is reduced or null after female labor demand decreases due

to the negative shocks. I find that the increase in age of first birth is also sustained over time. One possible explanation is that women continue increasing their years of schooling because even though there are smaller gains in the female labor market, there are still gains from education in the marriage market. My results suggest that women who increase schooling due to FTZs are also more likely to have higher educated husband and less likely to divorce. This also provides evidence that women who increase their years of schooling and delay marriage did not pay a high penalty in the marriage market.

I further show that by increasing women's years of education and consequently their age of first marriage and first child, FTZs also have important effects on child outcomes. I find that FTZs increase the probability that a child is alive by 1.6 percentage points. These results are driven by women who marry after the age of 18. Finally, I explore women empowerment outcomes. A growing literature has pointed out how female labor market opportunities might increase women empowerment. While I could not find evidence that FTZs increase women's power in relevant household decisions, I find that women exposed to FTZs were less likely to find wife beating acceptable. All these positive results related to getting education and late marriage provide evidence of important increases in welfare for women due to FTZs.

This paper proceeds as follows. I discuss the related literature in the next subsection, and provide information on FTZs and background of the Dominican Republic in Sections 2 and 3. Section 4 presents a brief framework to understand the impact of free trade zones on marriage an education. Section 5 presents data while Section 6 describes the empirical methods and discusses the results and some robustness checks. Section 7 presents the mechanisms to explain marriage outcomes, Section 8 examines the effect of negative female labor demand shocks, Section 9 analyzes the consequences of early marriage and Section 10 concludes.

1.1 Literature Review

The present work is related to the literature that studies how the expansion of female related industries promotes women's educational attainment and labor force participation (Oster and Steinberg [2013], Heath and Mobarak [2012], Jensen [2010], Atkin [2009], Qian [2008], Munshi and Rosenzweig [2006]). By encouraging women to enter the labor market and increase education, female labor markets reduced marriage, early marriage and desired fertility (Sivasankaran [2013], Heath and Mobarak [2012], Jensen [2010], Jensen and Thornton [2003]). While past literature has given special attention to the impact of industrialization on women's education, I also study its impact on marriage behavior and how education can be a channel to explain it. Moreover, in this paper I study how negative labor demand shocks might affect the positive effects of FTZs. In this way, I try to shed light on whether the change in women's behavior caused by the FTZs is part of a "permanent" change or just a product of the reduction in opportunity costs due to a temporary positive shock to the female labor market.

Moreover, little is known about the impact labor market opportunities on marriage. For instance, since women increase their education and marry late they may be more likely to have children out of marriage. Moreover, they might have access to a worse match if men value young women. But also it could be the case that since women are more educated they can have access to a better match. Furthermore, these women that are more educated and delay marriage may

know better their preferences decreasing the probability of divorce. I examine the effect of FTZs on out of wedlock births, spouse quality, and divorce. In this line, my paper is close to Sivasankaran [2013], who studies how a longer tenure in the labor market affects spouse quality. She finds that women who are out of the marriage market because they need to work do not find any negative effect in the marriage market. In my case I would be analyzing the effect of women who go out of the marriage market not only because they start participating in the labor force but also because they increase their years of schooling. In this case, improving labor market might have an indirect positive effect in the marriage market by increasing women's education.

By analyzing the impact of labor market opportunities and education on the marriage market, my paper is also related to the literature that studies the effects of oral contraception on women's behavior (Ananat and Hungerman [2012], Bailey [2010], Guldi [2008], Hock [2008], Bailey [2006], Goldin and Katz [2002]). The introduction of oral contraception provided a low cost way to delay childbearing and allowed women to remain in school, pursue longer-term careers, and work more in the paid labor force. Goldin and Katz [2002] make special emphasis on how these changes were achieved without having a detrimental effect in the marriage market. They argue that contraceptives decrease the cost of marriage delay and altered the rankings of women as potential marriage partners, favoring those with good career prospects. Hock [2008] shows an indirect effect on men's education due to reductions in undesired early fertility among their wives.

This paper is also related to the literature that studies the growth of export processing zones (Atkin [2012], Liberato and Fennell [2007], Schrank [2008], Raynolds [2002], Willmore [1995]). Work by Atkin [2012] finds evidence that expansions in the export manufacturing industry in Mexico increased school dropouts. The effects are mostly driven by unskilled jobs that raise the opportunity cost of schooling for students at the margin. I add to this literature by providing evidence that the growth of the export manufacturing industries may have a different effect for women since labor force participation is not the main reason to dropout of school. In the case of the Dominican Republic, the main cause for women dropout is marriage.

My findings relate to the literature studying the effects of early marriage. Dahl [2010], using the age of marriage within U.S. states as an instrument, finds that a woman who marries young is 31 percentage points more likely to live in poverty when she is older. Field and Ambrus [2008] use data from rural Bangladesh exploiting variation in the timing of menarche as an instrumental variable for age of first marriage. Each additional year that marriage is delayed is associated with 0.22 additional years of schooling attainment. I contribute to this literature by exploring the effects of early marriage on child survival and the impact of FTZs on this outcome.

Finally, this research also relates to the literature of bargaining power within marriage. Several studies have suggested how increasing female labor market opportunities can change the relative position of women in the household (Aizer [2010], Bowlus and Seitz [2006], Farmer and Tiefenthaler [1997]). Aizer [2010] has shown that reducing gender wage gaps in the US might increase the bargaining power of women within the household and reduce their exposure to domestic violence. I find a similar negative relationship between female labor demand and domestic violence.

2 Background on Education and Early Marriage in the Dominican Republic

The Dominican Republic is the second largest country in the Caribbean with an area of 48,445 km^2 and a population of 193.6 inhabitants per km^2. There are 2.2 million women between 15 and 49 years old in the Dominican Republic (Díaz et al. [2002]). The main sectors of activity are the FTZs, tourism and agriculture. The Dominican Republic is well-suited for an analysis of female labor markets opportunities on women's behavior given the high prevalence of early marriage, the importance of export manufacturing in the country's economy and the high level of female participation in this sector.

The school system in Dominican Republic is divided in three levels: the Initial Level (Preschool) covers children up to 6 years of age; Basic Level (Primary) begins at 6, lasts 8 years (6 to 13 years old) and it is compulsory and the Middle Level (Secondary education) covers students from 14 to 18 years of age, lasts 4 years and it is not mandatory. According to data from the World Bank, at the secondary level, Dominican Republic is far behind other countries. While the average gross enrollment rate for Latin America and the Caribbean was 87.2 percent, in the Dominican Republic was of about 60 percent.[3] Moreover, only 40 percent of students in primary level continue to secondary education (Gajardo [2007]).

One of the main causes of dropping out school for women is early marriage. About 42 percent of women between 20 an 49 years old have married before the age of 18 in 2010,[4] making the Dominican Republic the country with the highest female marriage rates for this age range in Latin America and the Caribbean.[5] Parents in the Dominican Republic encourage this practice as a consequence of poverty and lack of female labor opportunities (ONE [2010]). Another reason is the social importance given to motherhood. This might be related to social norms that are rooted in households. In the Dominican Republic, early marriage and early motherhood is culturally encouraged. Many young women marry early with the intention of becoming mothers. Although these pregnancies are planned, motherhood before 20 is associated with a higher obstetric risk (Pérez and Vargas [2011]). Several previous studies done in the Dominican Republic have shown that young women have a higher risk of child and maternal mortality (Caceres [1998]).

Moreover, they tend to marry men that are older and with higher income than themselves, thus entering unequal relationships. According to data from the Demographic and Health (DHS 2007), a high percentage of married or in union women between 15 to 19 years old have experienced emotional, physical or sexual violence by their husband or partner. Data from the same survey shows that early marriage or union might also compromise their ability to negotiate the use of contraceptive methods. Moreover, there is a higher incidence of HIV among women between 15 and 24 years that are married or in a union (ONE [2010]).

Women who marry early are also characterized by low levels of education and income. While 71 percent of women with less than primary education have married before the age of 18, only 13.6 percent of women with university education did so. Moreover, data from 2010 household surveys show that 70 percent of women in the lowest quintiles of income married early (ONE, 2010). This data suggests that early marriage might be a phenomenon that especially affects low

[3] The net enrollment is about 30 percent.

[4] It has similar levels to most Asian countries, where 46 percent of women are married before the age of 18.

[5] In Latin America and the Caribbean, 29 percent of women are married by age 18.

income households.

3 History of Free Trade Zones in Dominican Republic

The process of opening FTZs started in 1969 in the province of Romana in the south east as part of a national policy that involved import substitution and export promotion.[6] However, it was not until 1984 that the industrial free zones attracted a significant number of new companies and foreign direct investment. Two national policies promoted this expansion: the transition to a free exchange rate and preferential tariff treatment from the United States like the Caribbean Basin Initiative (Schrank [2008]).[7] In 1996, about 500 firms were installed in these zones, making an average of 10 firms per FTZ (see figure 1).[8]FTZs became one of the main economic sectors, surpassing the agricultural sector. In 2001, exports from these zones accounted for 32 percent of Dominican Republic total exports (Liberato and Fennell [2007]). The free zones were the main generator of foreign earnings and their value contributed 4 percent of GDP.[9] By 1995, more than 50 percent of the provinces had at least one free trade zone. In 1970, factory space was of 40,000 square feet and by the end of 1992 that number had increased to 14 million square feet.[10]In most FTZs the local government invested in necessary infrastructure such as improvement of roads, ports, and airports near the designated zones. However, there is no qualitative evidence suggesting an increase in education, health, or housing investments near the zones.

During the analyzed period, the free zones were the main generator of employment in the country (Buitelaar et al. [1999]). In 1996, employment in these zones represented 6 percent of the economically active population. In contrast, the traditional manufacturing sector employed 2.6 percent of the economically active population. Between 1984 and 1994 employment grew at an average rate of 22 percent annually, creating a total of 149,185 jobs (see figure 2).[11] This rate was particularly high considering the unemployment rate was 20 percent.[12] For most of the workers, the alternative to the FTZs was often unemployment or return to village subsistence life (Madani [1999]).

Textile manufacturing was one of the main activities in the free zones, employing 70 percent of the labor. Other industries of importance include footwear, jewelry, assembly of medical and electronic components, tobacco processing, and data services and telecommunications. Most of these activities were labor intensive and required low-skill workers (CNZF, 2002). For example, in 2006, blue collar workers made up 84 percent of the work force. The percentage of blue collars

[6]The development of FTZs was first pushed by a U.S. company that bought a local company and established the first industrial free zone near sugar plantations. Subsequently, many other U.S. companies motivated by competition from Asian companies and the need to reduce costs started to established companies for clothing assembly.

[7]Excluding Mexico, the Dominican Republic received the most of foreign direct investment in the Caribbean and Central America region.

[8]Regarding the origins of the firms, 40 percent are from the United States and 36 percent from the Dominican Republic.

[9]This number goes up to 21 percent if we consider the industrial zones value added over the manufacturing GDP.

[10]Notice that the considerable size of the industrial zones made them visible to the surrounding population. Moreover, Dominican Republicans had knowledge about the installation of free trade zones since the policy was covered by the media.

[11]This number can be larger if we also take into account the number of indirect jobs. For every 10 direct jobs created by the free zones, 2.2 indirect jobs were generated. Therefore, employment in these zones represented about 7.5 percent of the economically active population (CEPAL, 1999).

[12]Moreover it is uncertain that the in absence of the FTZs any other sector would have created this amount of jobs (Madani [1999]).

workers among women is higher than that among men (89 and 79 percent, respectively).[13]

The average wage in FTZs was higher than the average wage outside the zones (Madani [1999], Reyes Castro et al. [1993]). FTZs in the Caribbean and Central America paid 5-20 percent higher salaries than domestic firms.[14] The composition of wages was based on productivity and other incentive bonuses as well as payments for overtime and piece work (Romero [1995]). According to a 1991 survey, the average monthly wage in free trade zones was US$176.10, making it higher than those of workers in agro-industry and hotels (Romero [1995], Reyes Castro et al. [1993]). Moreover, in the case of the Dominican Republic even though most of the work was low skilled, the free trade zones provided training courses on English, computer use, and sewing (Buitelaar et al. [1999]).

The average age of workers in the trade zones was 27.4 years old.[15] Table 1 presents the percentage distribution of workers based on sex, education and economic sectors in 1991. Most workers completed primary education and secondary education. Only 3 percent of female workers had no education. Even though most jobs for women were unskilled, when compared with agriculture and tourism, the FTZs have a higher share of women who obtained a university degree. Moreover, some authors have argued that free trade zones have a tendency to exclude workers without education. In 1996, the average years of schooling in this sector reached 8.1 years and about 97 percent of the workers knew how to read and write (Guzmán et al. [2006]). While the estimated probability of employment of women with no education in free trade zones was about 0.5 percent, for women with 8 years of education it was 3.5 percent. This suggests that education might be an important requirement for getting a job in the free trade zones.[16]

The development of FTZs is considered one of the main determinants of women's participation in the labor market during the 1980s (Reyes Castro et al. [1993]). About 60 percent of workers in the free trade zones were women. The large percentage of female participation can be explained by employment in textile manufacturing, which was one of main activities in the free trade zones. Moreover, according to Madani [1999], women became the unintended beneficiaries of free trade zones, since many of them did not have any other formal market employment (with its higher salary and potential benefits).[17] For instance, the share of women employed in tourism and agro-industry was only 29 and 19 percent, respectively (Reyes Castro et al. [1993]). Moreover, wages in these other sectors were lower than in free trade zones. In the case of agro-industry, jobs were not only poorly paid but also unstable (Raynolds [2002]). Therefore, the alternatives for women were to be employed in the informal market or to stay at home. Several authors have considered the free trade zones as an important factor explaining the decrease in female poverty and unemployment during the 1990s (Willmore [1995], ILO [2013]).[18]

[13] However, there has been an increase in recent years in the proportion of white collar workers due to the development of new activities such as the assembly of medical devices and services that require more high-skilled workers than the traditional textile sector. In 2012, the proportion of blue collar workers represented a 78.6 percent.

[14] Atkin [2012] points out that most of trade literature found higher wages and rises in the returns to skill in exporting firms (Frías et al. [2009], Goldberg and Pavcnik [2007], Bernard et al. [1995]).

[15] The free trade zones included the youngest population of workers compared to tourism and agriculture sectors where the average age of workers was 30 and 33, respectively (Reyes Castro et al. [1993]).

[16] Education was not as important for men attempting to get a job in free trade zones. The level of education of women working was much higher than men. Many authors have posited that this could be due to gender discrimination in the FTZs (Isa and Cruz [2007], Guzmán et al. [2006]).

[17] Garcia Dominguez [2012] has also pointed out the lack of female labor opportunities in the Dominican Republic.

[18] Female unemployment rates are particularly high in the Dominican Republic (about a 24 percent). The official definition of unemployment in the Dominican Republic is different from the international standard and includes people without job that are available to work but did not look for a job in the last week because they think that there are no job opportunities or many obstacles. This distinction was made to account for women.

Most female jobs were concentrated in floor production positions. A survey showed that 57 percent of employers preferred to hire men for administrative and managerial posts (Reyes Castro et al. [1993]). Nevertheless, in contrast with other free trade zones in Latin America, the Dominican Republic still had many supervisory positions held by women (Madani [1999]).

4 Framework to Understand the Impact of Free Trade Zones on Marriage and Education

Consider a population of risk-neutral individuals (girls) that are symmetric in preferences and opportunities but are heterogeneous in their innate talent θ which is drawn from a cumulative distribution function $F(\theta)$ defined over $\Theta = [\theta_L, \theta_H] \subset \mathbb{R}_+$, with probability density function $f(\theta) > 0$ for all $\theta \in \Theta$.[19] Each individual at time t can influence her marriage prospects and lifetime earnings by investing in schooling. I assume that at each time t a new generation of individuals have to decide their years of schooling. To put things simple, I assume that each individual of each generation/time (t) has to decide between two levels of schooling $s \in [1; 2]$ which I refer to basic education or high education.

Lifetime earnings of individual i from generation t in the labor market, w_{it}^L , are increasing in the individual's *effective* talent, η_{it} – that is, I assume $w_{it} = w(\eta_{it})$, with $w' > 0$. For simplicity, I consider $w(\cdot)$ to be linear in η_{it}:

$$w_{it}^L = w(\eta_{it}) = \omega_t + W_t \theta_{it} s_{it} \tag{1}$$

where $\omega_t, W_t > 0$ are known constants, and W measures the sensitivity of earnings to effective talent. Effective talent is a function of the individual's innate talent and her schooling level.

Then effective talent of an individual from generation t is given by $\eta_{it} = \theta_{it} s_{it}$.[20]For instance, if the individual choose basic education ($s = 1$), then effective talent coincide with innate talent. Note that in my framework education is complementary to ability, and will ensure that high-ability individuals are "positively selected" into schooling.

I assume that there are frictions in labor market so, when each generation of individuals take their schooling decision, they are uncertain about the opportunities of finding a job in the future. In particular, I assume that an individual from generation t finds a job and gets lifetime earnings according to equation (1) only with probability p_t and with probability $(1 - p_t)$ she stays out of the market earning zero profits. On this score, expected payoffs in labor market are given by:

$$UE_{it}^L = p_t(\omega_t + W_t \theta_{it} s_{it})$$

Once the individual finished all levels of pre-marital formal education (s), the individual can participate in the marriage market. Hence, investing in schooling ($s = 2$) delays the age at which she is able to find a husband. As previously discussed, it is not evident how investing in schooling

[19]The main conclusions remain unchanged if the individuals are risk-averse.

[20]This formulation is akin to that of Gibbons and Waldman (1999), who use $\eta_i = \theta_i h(x_{iT})$, where $h' > 0$ and $h'' \leq 0$. I adopt a linear specification for h for simplicity.

affects marriage prospects. On the one hand, conditional on age, girls with higher effective ability might be able to find better matches. On the other hand, girls who invest in schooling arrive later to the marriage market so they may have less candidates. Despite the fact that I only model wife arm of marriage-market, payoffs are associated with husband side exogenous decisions. In particular, I assume that the payoff of getting married for a girl from generation t is given by:

$$m_{it} = m_t s_{it} \theta_{it} - \frac{P_t s_{it}}{n(\theta^*_{t-1})}$$

As in Chiappori et al (2006), in our framework investment in schooling generates returns in marriage-market given by $m_t > 0$ because education can help women to find a better husband and thus extract more utility from marriage. However, those women that investment in pre- marital education face a penalty in marriage market for arriving late that reduce the total payoff by $\frac{P}{n(\theta^*_{t-1})} \geq 0$ with $P > 0$. In particular, $n(\theta^*_{t-1})$ is a function of the share of women with high level of education at previous generation and $\frac{\partial n(\theta^*_{t-1})}{\partial \theta^*_{t-1}} < 0$ where θ^*_{t-1} is an endogenous variable that represents the type of individual that is indifferent between high education or basic education. $\frac{\partial n(\theta^*_{t-1})}{\partial \theta^*_{t-1}} < 0$ captures that in societies with higher levels of average education, investment in schooling becomes also important to get a good match in marriage market. To keep things simple, we will assume whenever it is necessary an explicit form for $n(\theta^*_{t-1}) = \theta^{*-k}_{t-1}$ with $k > 0$.

4.1 Investing in Schooling decision

At generation t, individuals have to decide if they invest or not in schooling. The expected utility for individuals that decide $s = 1$ (low education) is given by:

$$EU(s=1)_{it} = p_t(\omega_t + \theta_{it} W_t) + m_t \theta_{it} - \frac{P_t}{n(\theta^*_{t-1})}$$

The expected utility of individuals that decide to invest in schooling ($s = 2$) is given by:

$$EU(s=2)_{it} = p_t(\omega_t + 2\theta_{it} W_t) + 2m_t \theta_{it} - \frac{2P_t}{n(\theta^*_{t-1})}$$

Hence, it is optimal for an individual i from generation t to invest in schooling if and only if the following condition holds:

$$UE(s=2)_{it} = p_t(\omega_t + 2\theta_{it} W_t) + 2m_t \theta_{it} - \frac{2P_t}{n(\theta^*_{t-1})} \geq UE(s=1)_{it} = p_t(\omega_t + \theta_{it} W_t) + m_t \theta_{it} - \frac{P_t}{n(\theta^*_{t-1})}$$

or, put differently, if her innate talent is high enough:

$$s = 2 \Longleftrightarrow \theta_{it} \geq \theta^*_t = \frac{P_t}{(W_t p_t + m_t).n(\theta^*_{t-1})} \tag{2}$$

Where, as mentioned before, I define with $\theta_{it} = \theta^*_t$ an individual from generation t who is just indifferent between investing in schooling or not. With this, the proportion of girls who invest in

high education at generation t is given by: $1-F(\theta_t^*)$. One important feature of this decision rule is that a greater skill premium in labor market as captured by W, more job opportunities as captured by p, or a greater skill premium in marriage market as captured by m, will encourage schooling.[21] In the appendix I analyze the equilibrium stability.

4.2 Theoretical predictions on the magnitudes of interest

Proposition 1 ("Too young to marry") *The proportion of girls that invest in schooling in generation t is increasing in the probability of finding a job at that period (p_t).*

Implication 1 *The opening of a free trade zone that increases the opportunities of finding a job has a positive impact on girls' pre-marital education and delays the age at which they marry.*

Proof. The proof to the proposition follows from the fact that θ_t^* is decreasing in p ($\frac{\partial \theta_t^*}{\partial p} < 0$) . ■

Intuitively, when there are frictions in labor market, less gifted individuals have much more to gain if they quit their career to arrive first to the marriage market. On the other hand, more talented individuals take the risk and invest in schooling to get higher lifetime earnings. If individuals perceive a FTZ as a source of opportunities in labor market, then less talented individuals are also willing to take the risk and invest in schooling.

Proposition 2 ("Marriage Market Spillover") *An increase in labor market opportunities or labor market skill premium at period t generates long run positive spillovers over girls education in future generations. In particular, the initial increase in the share of girls with high education might also cause a reduction in the penalty for arriving late to marriage market increasing the incentives to invest in schooling further.*

Proof. Assume that there is a permanent shock in period t that reduce θ_t^*.

Since $\frac{\partial \theta_{t+1}^*}{\partial n(\theta_t^*)} < 0$ and $\frac{\partial n(\theta_t^*)}{\partial \theta_t^*} < 0$, all else equal, $\theta_{t+1}^* < \theta_t^*$. ■

Implication 2 *The marriage market spillover might guarantee that if the economy faces a transitory negative shock (i.e.: job opportunities decrease to pre-FTZ values for two years), female educational levels remain high.*

Intuitively this may be due to the fact that in a society where more women invest in schooling, women have greater returns to education in the marriage market and less "waiting" penalty.

This simple framework illustrates how the opening of FTZs may have affected women's schooling and marriage behavior. First, the increase of labor market opportunities change the perceived returns to education. Now women have higher chances to get a job and wages in the FTZs are larger than in the traditional sectors. Moreover, the greater number of women investing in schooling and thus delaying marriage reduced the penalty for early marriage. The key empirical predictions of this framework are that the opening of FTZs might have increased women years of schooling (in particular secondary or higher levels) and age of first marriage or union. Persistence of this behavior even in the presence of negative shocks in the post-opening period should also have occurred. This might be due to a possible permanent change in the perceived returns to education in combination with lower penalties in the marriage market for delaying marriage. I will elaborate more on this second prediction in section 8.

[21] If $P_t = 0$ there is no penalty and thus everyone invest in schooling. Even though they cannot get a job, they can be educated and married.

5 Data

I use the Demographic Health Surveys (DHS) for the years 1986, 1991, 1996, 2002, and 2007.[22] These surveys provide information on important health, nutrition, and demographic indicators for the Dominican Republic. The target population for DHS is defined as all women of reproductive age (15-49 years old) and their young children under five years of age living in ordinary residential households. DHS surveys are nationally representative population-based surveys with large sample sizes. The indicators are presented in terms of national-level statistics and for population subgroups such as those defined by age, education, marital status, economic status, urban/rural residence and region of the country. DHS surveys provide weights that were used in all analysis to make sample data representative of the entire population.

One important limitation of the DHS data is that I observe the province of residence at the time of the survey rather than when FTZs opened. Thus, I am forced to assume that the actual province of residence is the same as when the FTZ opened. This assumption can be problematic if women randomly change location between the ages that are most affected by the opening and the time of the survey. I cannot rule out the possibility of migration, but I will discuss evidence below that this type of mobility is not driving the main results. Moreover, most of migration in Dominican Republic occur across municipalities in a same province and not across provinces.

Table 2 presents descriptive statistics for the sample. A total of 55,956 observations are available for the estimation. According to the marital status data, 76 percent of women are married or living together with their partner. I found that on average women marry at the age of 18, have their first child at the age of 20, and first have intercourse at the age of 17. Women are also slightly more educated than men with 7.8 years of education compared to 7.27 years of education for men. Enrollment in secondary school and it's completion is low (about 0.46 and 0.24 respectively). With respect to the labor market, 35 percent of the women reported working.[23] Only 5 percent work for a family member, 65 percent for a non-family member, and 35 percent are self-employed. Most women work outside the home (76 percent). The main occupations are sales, services, and domestic activities. In contrast, their husbands are often working in agriculture or skilled manual activities.

In order to obtain industry data in the Dominican Republic, I use data from the "Consejo Nacional de zonas francas," which provides information on the date of opening of each FTZ and the number of female and male employees in each zones. There are a total of 54 FTZs with around 500 firms. Figure 1 presents the evolution of the number of FTZs over the years of our sample. It started in 1986 with about 10 industrial parks and increased to 54 by 2007. On average, each park has a total of 3,000 employees. Figure 3 depicts the evolution of FTZs across provinces over time. By 2010, about 75 percent of the provinces had opened a FTZ. Map 1.0 and 1.1 shows the spatial distribution of free trade zones by province and opening year. The largest growth in free zones was between 1986 and the 2000s. There is a large degree of variation across provinces and years in the openings. In this paper, I make use of the variation in the opening of FTZs between the years 1986 and 2007, when most new zones opened. From my sample, I eliminate those provinces that opened before 1986 since I do not have variation over time in the zones's opening. Moreover, I eliminate from the sample those provinces that did not experience any opening (those in white color in the map).

[22] Available years.

[23] The average age of working women is 32.

6 Empirical Framework

I exploit the boom in the free zones in the Dominican Republic as an exogenous shock to female labor market demand. By the end of the 1980 and during the 1990s the country experienced an expansion of FTZs which became an important source of demand for female labor. I propose to use the timing of FTZs' openings to isolate the impact of labor demand on women's education and age of first marriage. Figure 4 plots the proportion of women working with respect to the year of opening. For example, the variable -1 in the x-axis indicates female labor force participation one year after the opening.[24] I observe that female labor force participation was increasing with the year the industrial park opened. I proceed to estimate the effects of FTZs in the following equation:

$$\begin{aligned} Outcome_{ihcpt} = \alpha + \beta_1 FTZ_{pt} + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} \\ + \rho Cohort_c + \mu Province * YearBirth_{pc} + \gamma X_{hpt} + \nu X_{pt} + \varepsilon_{ihcpt} \quad (1) \end{aligned}$$

$Outcome_{ihpt}$ is the outcome of women i in cohort c in household h in province p and year t. FTZ_{pt} is a dummy variable that indicates the existence of FTZ in province p in year t. I also include year and province fixed effects, as well as province time trends. Using province fixed effects I am able to control for time-invariant characteristics of the province. Province linear time trends control for any omitted characteristics that vary linearly over time within the province. X_{hpt} is a vector of covariates that controls for socioeconomic variables at the level of household h such as the type of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), if the household has electricity, main floor material, main wall material, age of respondent and number of household members. X_{pt} is the number of construction permits per province per year. Moreover, in some specifications, I also include cohort fixed effects and province cohort trends. Model (1) is identified from joint variation in outcomes in three dimensions: i) provinces that opened industrial parks relative to others, ii) after opening of industrial park relative to before and iii) cohorts most affected by the opening relative to other cohorts of young women. The goal is to provide precise estimates of β_1. In all the models, the standard errors allow for potential correlation within province clusters.

One main concern regarding the validity of the identification strategy is the fact that the geographical location of FTZs may not be random. It is possible that the industrial free zones were opened in places where female education was growing faster. In such a scenario, it is possible that women in these places increase their educational attainment not as a consequence of the increase in labor market opportunities but because there was an increasing trend in education. In this paper, I am focusing on exporting industries, which are in general located in places near a port or where large plots of land or inputs are available (Madani [1999]). I assume that these variables are not associated with changes in women's years of education and age of marriage. As a first approach to test this assumption, I provide a test following Bailey [2006] by generating province-level characteristics from the 1986 DHS survey. For each province, I construct a dependent variable that indicates the years elapsed from 1986, when there was a large expansion of the free industrial zones, until the year they opened in a particular province.[25]

[24] The variable in the x-axis was constructed by subtracting from each year of the survey, the year of opening.
[25] In the next sections I will provide further tests in order to deal with this concern.

Table 3 reports the results of cross-province regressions of this new dependent variable "time to opening" on 1986 baseline characteristics.[26] Panel A reports the results including demographic characteristics such as the proportion of women in different age groups, the proportion of households that own the land worked, and the proportion of households living in rural areas. Panel B includes social characteristics such as the mean years of education of women and men and the rate of literacy as a proportion of married or in-union women, mean age at first marriage, and mean age at first birth. Finally, Panel C presents the results for labor market characteristics such as the proportion of women working, the proportion of women earning wages/salary, the proportion of women working for family, and the proportion of women working before and after marriage. None of the characteristics are statistically significant. Moreover, the low R-squared and the fact that FTZs do not seem to be correlated with female education lends credibility to the identification strategy that treats the opening of free trade zones as exogenous. I also repeat the analysis with household characteristics such as type of residence (urban or rural), if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), if the household has electricity, radio, television, refrigerator and car, main floor material, main wall material, and number of household members. I find that none of these characteristics explain the allocation process.

I also use data on construction licenses from 1986-2012 in order to identify if places that were more urbanized were the ones that got the FTZs first. I estimate the effect of the growth in construction licenses in the past two years on the opening of a free industrial park in the province. I find that the past growth in construction licenses does not predict the presence of an industrial park.[27] Nevertheless, in case of unobservable characteristics that might not be captured by table 3, I also include province time trends in the main specification and I provide an event study analysis in the following sections.

.

6.1 The Effect of FTZs on Education

Table 4 presents the results of estimating equation (1). I find an increase of 0.4 years of education and the result is robust to different specifications. This represents an increase of about 5 percent from its mean (7.82). While years of education might be a good measure of primary, secondary and university education it might also include any job training. Therefore, more insight into what level of education the FTZs were affecting is obtained by examining the impact in school enrollment. Table 4.1 present the estimates of the effect on school enrollment and completion. Enrollment in secondary school is increased by 4 percentage points indicating an increase of about a 9 percent with respect to the mean of the dependent variable. I do not find any effect on primary school enrollment and completion.

Figure 5 decomposed the effects by age at opening. Each dot in the solid line is the coefficient of the interaction of a dummy for being a given age at the time of opening and a dummy for a FTZ (a 95 percent confident interval is plotted by vertical lines).[28] Each dot summarizes the effect

[26] For this analysis, I did not include those provinces in which an FTZ opened before 1986. Moreover, in order to have more power for the estimation, I do the same regressions at the municipality level.

[27] Results are available upon request.

[28] The omitted category is a dummy for being more than 30 years old at the time of the opening.

of the between-province variations for a given cohort and can be interpreted as an estimate of the impact of the program on a given cohort.[29] For example, a woman aged less than 16 at the time of the opening received 0.3 additional years of education if she was in a region with FTZs.[30] I find that most of the results decrease the older the woman was at the time of the opening. As expected, the FTZ did not have an effect on the education of cohorts not exposed to it and it had a positive effect on the education of younger cohorts. The increase in years of education and enrollment in secondary school is mostly driven by women who were less than 16 years of age at the time of opening. This is consistent with the fact that the average age of marriage in the 1980's was 17 years of age and most women tend to drop out school in order to get married.

Instead of testing whether if each coefficient is equal to 0 for ages that are over 16, I can impose this restriction. That is, since most of the effects are driven by women that are less than 16, the omitted group can be now formed by women aged more than 16 at the time of opening. By including cohort fixed effects, I am able to compare women who were less than 16 years of age at the time the park opened with women that were less than 16 years of age in places where the park did not open.

Table 4.2 presents the results of the restricted estimation. Using women that were more than 16 years of age as control group provides slightly smaller results. Consistent with the results presented in Figure 5, the estimates in column (1) suggest that the opening of a FTZ increases the education of the youngest women by about 0.3 years. This implies that at its mean value, the free trade zones caused an increase in education of 3 percent. In column (2), I present the effect in school enrollment. As before, female labor market opportunities increase enrollment in secondary school by about 3 percentage points but not primary school.[31]I also find effects on primary completion. The opening of a FTZ in a province increase primary completion by 2 percentage points. To sum up the results on education, FTZs have affected the proportion of women who complete primary school and those who enroll and complete secondary education.

To give a magnitude and economic relevance of the results, I can analyze the effects on education in terms of women who would have drop out school in absence of free trade zones. Assuming that most affected women are those in the margin (the ones who are between 13 and 16 years of age at the time of the opening), an increase of 0.3 in years of education is equivalent to a reduction 24 percent in their dropout rates. About one fourth of women who would have dropped out school in these ages now stay due to labor market opportunities. This is comparable with the results found by Oster and Steinberg [2013], where about 26 percent of out-of-school children are enrolled as a result of IT centers introduction. [32]

These results are consistent with the framework presented in section 4. FTZs had an impact on schooling by increasing the probability of getting a job in the future (p) or via increasing the wage

[29]Ideally, I would like to estimate a coefficient for each age less than 16 but due to the lack of statistical power I rely on age bins.

[30]This effect is slightly higher to the one found in Duflo [2001], where the effect of one school built per 1,000 children increased education of exposed cohorts by 0.2 years.

[31]My results are comparable to the effects found in the literature in developing countries. For instance, ITES centers in India increased about 4.1 percentage point enrollment rates (Oster and Steinberg [2013]). Jensen [2010] found a similar increase of 5.2 percentage point due to an increase in recruitment services for call centers for women. In the same line, programs on conditional cash transfers increased schooling by about 3 percentage points (Paul Schultz [2004]).

[32]This calculation was done summing up: the number of women who drop out in their 7th grade multiplied by 5 (the potential years of education to finish secondary school), those in 8th grade multiplied by 4, the number of drop out women in their 9th grade multiplied by 3 and the number of drop out in 10th grade multiplied by 2 years.

premium (W). Another direct mechanism that could explain the increase in educational outcomes is through an income effect. Since now women have access to the labor market, they have more earnings and thus they can increase the education levels of their children. However, after controlling by socioeconomic variables in table 4, the magnitude of the coefficient does not change suggesting that the earnings' channel alone might not be driving the results. Table A1 presents the results taking onto account other potential mechanisms to explain the effects on schooling. I check if the effects are driven by larger FTZs and the coefficient on size is statistically insignificant, suggesting that income alone cannot be explaining the results (column 1). I also find an increase on schooling and marriage for those households where no women is working (column 3). These results are consistent with the context of the Dominican Republic where education is public and the main reason for women to not pursue higher levels of education is marriage and not the lack of earnings to pay school expenditures (ONE [2009]). Nevertheless, in the robustness check section, I will use other surveys that have data on income to control directly through this channel. I also test whether improvements on infrastructure could be leading the results. It could be that provinces with FTZs saw an expansion on the number of schools. To the best of my knowledge, the opening of FTZs was not accompanied by an effort by the government in favor of education. Nevertheless, I control for construction permits as a proxy for school's construction and results do not change (column 2 table A1).

My prefer interpretation based on results and qualitative evidence is that women increased their years of education in secondary school because they expected industrial parks to reward additional schooling.[33] Even though most of the jobs were unskilled, they were better paid than other labor market opportunities and provided the main source of female employment over the period of analysis. Competition for this type of jobs is a possible explanation for the found education effect. Moreover, if education increases marginal productivity or provides a signal for beneficial abilities such as discipline or responsibility, women will be encouraged to educate themselves in order to increase their chance of obtaining a job in this industry. Furthermore, a large portion of wages was based on workers' performance likely making education important.

In table 1 I showed that effectively most women working in FTZs had some level of secondary education. I further check in my sample if the gap in labor force participation between high educated women and non educated ones increased after the FTZs opened. I find that the probability of being working given more than 8 years of education is greater after the FTZs opened. Before the FTZs opened, about 33 percent of high educated women were working in contrast to 43 percent after the opening. In relation to the type of jobs, after the FTZs opened there is a greater proportion of women working in professional, managerial, technical and skilled manual positions than before the opening. This suggests that the returns to education increased after FTZs opened by providing higher chances to get an employment and also a better occupation.

This mechanism is in line with previous literature that suggests that the introduction of new local job opportunities changed the perceived returns to schooling (Oster and Steinberg [2013], Jensen [2010]). Most of this literature show that higher labor market returns is the main mechanism behind the gains in education and marriage. Notice that although most of this literature focuses on high skill jobs, Heath and Mobarak [2012] also provide evidence that the garment industry expansion in Bangladesh increased schooling for women, suggesting an increase in perceived returns to education

[33] It is important to note that my argument is not that infrastructure investments and changes in income do not explain the results on schooling but rather that they explain an small part.

even if female labor opportunities include lower skill jobs. In the case of FTZs, even though high skill jobs were provided in an small proportion they could have affected the returns to education.

6.2 The Effect of FTZs on Age of Marriage

I start by estimating equation (1) using as dependent variable $AgeMarriage_{ihcpt}$ which is the reported age at first marriage or unions. Table 5 presents results indicating the age of marriage increases by approximately 1.3 years due to the opening of free zones in the province. This result is robust to the inclusion of province time trends; the effect increases to 1.6 but is still significant at the 1 percent level. The baseline age of marriage is 17 in 1986, representing a change of 8.8 percent. As before, controlling for socioeconomic characteristics and construction permits make the estimates slightly higher.[34]

I also estimate (1) after replacing the dependent variable with a dummy that takes the value of 1 if the woman was married before age 18.[35] I find that the probability of early marriage is reduced by 27 percentage points at a 1 percent significance level.[36] Figure 6 plots the coefficients of the interaction of treated provinces with age at opening dummies. I find the same results as for educational outcomes, most of the effects are driven by younger cohorts that were in their schooling ages. This might suggest that one possible mechanism by which women increase their age of marriage is by staying at school longer. I will explore the mechanisms to explain the increase in age of marriage in the following sections.

Table 5.1 presents the restricted estimation using as control group those women that were more than 16 years of age at the time of opening. Results are similar to the non-restricted estimation and to the ones presented graphically in figure 6. I find and increase in 1.6 years in the age of marriage. In the case of early marriage, results are smaller than basic estimates. I find that the probability is reduced by 18 percentage points for the youngest cohorts representing a change of 40 percent from baseline. This percent is similar to the one found by Sivasankaran [2013]. She found that for women who had worked about one year and a half, the probability of early marriage is reduced by more than 50 percent.

6.3 Robustness Checks

In order to check the robustness of the results, I estimate the effect of the industrial park openings on a group that should not be affected: women who were already married by the time of the opening. Table A2 in the appendix shows that there no statistically significant effect for this sample of women. Moreover, since the FTZs also employed men it could be the case that women marry late because men are now part of the labor force. Also FTZs might have increased the earnings of

[34] I eliminate all women from the sample that were already married before the FTZ opened. If I include this group of women, I still find an statistically significant positive effect on the age of marriage but the coefficient is reduced. Moreover if I include this group of women as part of the control group, I find similar effects than if I do not include them.

[35] In this case, I am not censoring the data for married women since I am measuring the proportion of married women before the age of 18 among all women in the sample.

[36] This result is also robust to the same specifications that were used on *AgeMarriage*. Moreover, it is also robust if I restrict to the sample of women who are more than 21 years old at the time of the survey (those who already made their decision of marrying early or not).

the areas covered by it and thus increase overall schooling levels. I estimate if men's education is affected by the free trade zones opening and I find no direct effect (table A3). Moreover, this provides further evidence that the effect found in education is not mainly driven by an increase in earnings.

As another robustness check, I include quadratic trends to model (1) and results do not change. Moreover, limited dependent variable models yield nearly identical results.[37] I also exclude from the analysis provinces that contain the main cities such as the National District, Santo Domingo and Santiago. I do this to verify that my results are not driven by these provinces where many factories are located. Table A4 in the appendix presents the results and estimates are unchanged.[38]Finally, using data of educational attainment from the Inter-American Development Bank surveys for the years 2000-2012, I rerun the restricted estimations.[39] Figure A1 in the appendix presents the results. I find the same results as using the DHS a positive significant effect only for younger cohorts. About an increase of 0.25 on years of education.[40] Moreover, once I control directly for labor income of the household and results are similar (see table A5).

6.4 Possible Concerns

The three main concerns regarding the validity of the identification strategy are that the geographical location of FTZs may not be random, the endogenous mobility of women who move after the opening and the possibility of other investments in education that might be moving at the same time of the openings.

6.4.1 Migration

My results could be biased due to selective migration into the provinces after the opening of a FTZ (inside migration). Although most of the FTZs tend to hire local women and most migration in Dominican Republic occur at the municipality level (not at province), it is still possible that at least some of my results are explained by the endogenous mobility of women. It could be the case that migrants who moved to the free industrial zones differ in ways that would bias results. For example, if movers are more educated, this could be overestimating the main parameter. To address this concern, I restrict the sample by eliminating those that moved to the province after the free industrial zones opened. Results are presented in table 6, column 1 and do not change under this new specification, suggesting that selective migration is not be an important concern. Notice that this sub-sample represents about 73 percent of the whole sample, suggesting that most of the original sample corresponds to non-movers.

One could also argue that people moved to other provinces where they were expecting factories to open. If women who moved were also more educated, this could bias the results. In order to address this concern, I eliminate from the analysis those who moved to the province within two years of the opening. In contrast with the above specification presented in column 1, column 2

[37] Results are available upon request.
[38] Results are also unchanged if I do the analysis by cohort as presented in figure 5 and 6 and tables 5.1 and 6.1.
[39] More description about the procedure of these survey is provided in the Appendix.
[40] Notice that the significance of the results is smaller because I am only exploiting variation of openings that occur in the 2000s.

presents the results for the whole sample but just taking out the recent movers. Again the results hold under this new specification.

Also, instead of restricting the sample, I add a dummy variable for women who had moved. I find that the dummy coefficient is negative and significant at a one percent level. However, the effect of the opening of industrial parks remains the same in magnitude and in significance, suggesting that migration is not a concern. Moreover, since movers are less educated, this could only downward bias the results.

Another test of the validity of the identification strategy is to estimate the effects for those women that were more than 16 years of age. If the identification strategy is valid, then labor market of opportunities before the age of 16 should have a larger effect on woman's education than opportunities when she is past the usual age of secondary school attendance and age of marriage. Conversely, if educated women with more than 16 years of age move to the provinces with free trade zones, then openings at 16 or older should be stronger predictors of a woman's educational attainment. Results of this estimation were presented in figure 5 and 6 and I find smaller and non significant effects for women who were 16 or older at the time of the opening.

Moreover, if migration would be leading the results I should find greater effects on the outcomes of interest in places where more jobs were available. In order to check for this I rerun all my specifications including as control variable the number of parks in each province. I find that not only that the magnitude and significance of results do not change but also that the number of parks is not a significant predictor of the outcomes (see table A1).

Finally, I construct migration rates for each year from 1986 to 2007 using the year of arrival to each province. A household is considered a mover when the year of arrival is equal to the year of the sample. Most migrants are married at younger ages, less educated, have fewer members in their family, and have worse facilities in their place of dwelling. This suggests that if migration is a concern, it leads to underestimation of the results. Nevertheless, I estimate whether the industrial parks affected migration. I use the following equation:

$$Migration_{pt} = \alpha + \beta_1 FTZ_{pt} + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} + \gamma X_{pt} + \varepsilon_{pt} \quad (2)$$

where $Migration_{pt}$ is the proportion of women that move in year t in province p. Table 6.1 presents the results. Column 1 presents the results without socioeconomic controls. I find an effect of 0.17 percentage points at the 10 percent level of statistical significance. This means that out of 1,000 women, an industrial park opening caused fewer than 2 migrants to move. This suggests that the economic significance of the effect is close to zero. Moreover, once I include socioeconomic controls, I find that the opening of industrial parks has no effect on migration rates.

Overall, migration results suggest that even in FTZs affect migration rates, this is not the main mechanism for which they are affecting education and marriage.[41]

[41] All the results of this section hold if we use as dependent variable $EarlyMarriage$ and if I provide the restricted estimates. Moreover, under the restricted estimates there is no significant effect of migrants on the outcomes of interest.

6.4.2 Pre-existing Trends

As already discussed above, the central threat to the validity of my estimates is the possibility that free trade zones anticipates educational attainment increases rather than causing them. For instance, free trade zones could be targeting future female force and be located in places where education is increasing more quickly. In this section I explore three approaches to check that results are not driven by any pre-existing trend in the places where the industrial parks opened first. First, I construct falsification tests. Second, I look at whether education and age of marriage appears to be increasing in provinces with FTZs prior to the openings. If openings determine the main outcomes rather than viceversa, I should find little evidence of a pre-trend in the outcomes of interest prior to the free trade zone opening. Third, I compare women that belong to the same household using age thresholds.

Falsification Tests My first approach to deal this concern is to construct falsification tests. First, I pretend the free trade zones opened one, two or three years after the real opening in the same place and then only use post-treatment data. Second, I pretend the free trade zones opened one, two or three years before the real opening in the same place and then only use pre-treatment data. I rerun model (1) using this false treatments and none of them have significant effects on the outcomes of interest.[42]

Event Study Analysis The estimates presented suggest that the FTZs' effect is identified by the discrete jump after the year of opening and its impact on the outcome of interest. In particular, I showed in the previous analysis that results are not sensitive to the inclusion of province time trends and province birth cohort trends. Moreover, in table 3, I have showed that the year of opening is not correlated with baseline characteristics. However, there still might be a concern that our results are driven by trends in province education and marriage outcomes that are correlated with the opening of industrial parks in a way that province linear trends do not capture. This proposition can be evaluated more directly in an event study analysis. Formally, I will estimate the following regression:

$$Outcome_{ihcpt} = \alpha + \sum_{i=-4}^{5} \beta_i(\tau_{pt} = i) + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} + \rho Cohort_c + \mu Province * YearBirth_{pc} + \varepsilon_{ihcpt} \quad (3)$$

where τ_{pt} denotes the event year, defined so that $\tau = 0$ for the year the industrial park began operations in that province, $\tau = 1$ for one year after the industrial park began operation, and so on. For $\tau \leq -1$, households were untreated by the industrial park (marriages before the program started). The coefficients are measured relative to the omitted coefficient ($\tau = -1$). I also include province, year, and province-specific linear time trends.[43] Figure 7 plots the event and year coefficients from estimating equation (3) on age of marriage, years of education and secondary

[42] Results are available upon request.

[43] The dummy for $\tau = 5$ is a dummy that takes the value of one for more than five years after the industrial park began operations. The same for $\tau = -4$ for more than 4 years before the park began operations.

enrollment. The results provides evidence of the validity of the identification strategy. It shows an absence of a strong pretrend and evidence of a trend break in the year the industrial park was opened, increasing the years of education and age of marriage for women. This suggests that potential confounders would have to mimic the timing of the industrial parks' expansion extremely closely. Results hold if I use *EarlyMarriage* as the dependent variable.

To check the plausibility of these effects, I proceed to use only women that are on the relevant margin. Assuming that most women tend to dropout at the age of 16, I repeat the analysis using only women who were in school but close to finishing. First, I define the year in which each women in the whole sample was 16 years of age and then I subtract from it the year in which the FTZ opened. For instance, if the new variable takes the value of 1 it means that women were 15 years old when the FTZ opened and therefore, she had only one year of treatment (since after 16 should not be treated). If the variable takes the value of -1 it means they were 17 years of age when the FTZ opened and therefore, they should not be affected. Figure 8 presents the results. The estimates are consistent with the restricted estimation, I found on average an increase of about 0.3 for those women that were less than 16 years of age at the time of opening.

The Difference-in-Difference-in-Differences I redefine the main independent variable using the thresholds in key ages: 15 and 16 years. In the Dominican Republic, basic education is compulsory and covers the 6-14 years age group. Secondary education is not compulsory, but it is public. Assuming that the FTZs affect women that were less than 15 years of age more, I can exploit variations across cohorts and across households. In the same way, I can use the legal working age (16). Moreover, 15 and 16 years are when most dropouts occur and when the decision to attend high school is made. This is consistent with the previous analysis that showed only effects for those cohorts of women who were less than 16 years of age. Since the DHS surveys covers all women in the household that are between 15 to 49 years of age, I can include household fixed effects. By doing so, I can compare women inside the same household that were less than 16 years of age against those that were more than 16 years old. Results from this specification should be interpreted with caution since women from the same household that are older than 16 might be different to those that are younger in variables that might be correlated with the outcome of interest. Nevertheless, these results might work qualitative.

I find that results do not change under this new specification. By using household fixed effects, the results on early marriage are consistent with the previously findings– the industrial parks reduced the probability of early marriage, they increased the years of education and they increased the enrollment and completion in secondary school (see table 6.2). However, they are higher and the results on age of marriage are insignificant. Qualitative, the results of estimating this specification using household fixed effects nevertheless lead to similar conclusions as for education and early marriage. The FTZs seem to have affected the years of education and probability of early marriage, the estimates do not change to the inclusion of control variables and the estimates for the falsification tests are close to zero.[44]

Overall, results from different approaches (differences in differences, restricted estimates using age at opening, event study analysis and difference-in-difference-in-differences) provide strong evidence that the effect of female labor market opportunities created by industrial parks on schooling

[44] I did the same analysis using as threshold the age of 15 and results do not change. These results are available upon request.

and marriage is causal. In the following section, I will explore the potential mechanisms for the increase in age of marriage.

7 Is Education Increasing the Age of Marriage?

I assess the importance of two channels through which the opening of industrial parks may have increased the age of marriage: participation rate of women in the labor force and education.

On the one hand, one could argue that when women perceive an increase in their labor demand, they will postpone their marriage because the opportunity cost of marriage is higher and thus they will prefer to work (opportunity cost channel). That is, given the option to work, women will not view marriage as a way to escape from poverty. If this mechanism is correct, the proportion of women working should increase due to the opening of FTZs. Table 7, column 4 presents the results of estimating equation (1) but now the dependent variable is a dummy variable that indicates if the women is working at the time of the survey. The opening of parks increased the proportion of women working. Moreover it increased the proportion of women working outside their home by 3 percentage points. However, if I estimate the model of equation (1) while including the proportion of women who work as a control variable, we see that the coefficient on an industrial park opening does not vary much (see table 7, column 3). This suggests that changes in women's labor force participation is not the main channel driving the results.

Another possible channel in which the FTZs might have delayed the age of marriage is through education. On the one hand increasing the years of education might have a mechanical effect on age of marriage. On the other hand, better educated women might change their behavior and invest more in their careers. Notice that both mechanisms require that women who invest in education delay marriage. This assumption seems plausible given the context of the country where women drop out school to get married. I examine the age of marriage of women for different levels of schooling and I find a positive correlation between higher years of education and the age of marriage (Figure A2 in the appendix). While the average age of marriage for a woman with no education is 16, for those with secondary education or higher is 20. This suggests that marrying early and getting higher years of schooling might not go together. This is consistent with past literature studying the impact of the birth control pill on schooling and marriage. Goldin and Katz [2002] has shown that women who invested in their career are in general those who also delay marriage.

In order to test this mechanism, I add years of education as a control variable in my main specification. I find that the coefficient on opening becomes smaller. [45] This suggests that the education channel is responsible for delaying the age of marriage. If I use the opening of FTZs as an instrument of years of education, I find that one extra year of education is associated with an increase of about 0.7 years in the age of marriage. Moreover, the fact that I find that the opening of parks affects the proportion of women working might also be partially explained by this education channel. As I discussed previously, most of women who are working are also more educated.[46]

[45] As a robustness check, I estimate all the specifications of this section using $EarlyMarriage$ and using as control group women who were older than 16 years of age and results are similar. By increasing their years of education, women are less likely to marry before the age of 18.

[46] Notice that I am not ruling out other mechanisms that can explain the increase in labor force participation.

I check this relationship and I find that one extra year of education increases the probability of working by 2 percentage points, which is significant at the 1 percent level.

In order to further check whether education is the mechanism driving the change in age of marriage, I check for differential effects for women still obtaining education. First, I construct the year in which each woman in the sample stops her education based on the reported number of years of education. Using this variable I identify women who are not at school at the time of the park opening as those that stopped their education before the year of opening of the park. About 60 percent of women in the sample were not in school at the time of the openings.

Table A6 in the appendix presents the results; [47]For those women who were still in school, the opening of the park reduces the probability of early marriage by about 0.26 while for those that were not in school there is no effect. This is consistent with the results presented in figure 6 where I find that most results are driven by younger cohorts. This provides further evidence of the importance of education as the main channel.[48]

The smaller results for women who are not at school at the time the FTZs opened could be expected given Dominican Republic's context. Data from 2002 census shows that marriage is the main variable explaining dropout rates among women under the age of 18 (ONE [2009]). Therefore, it's difficult for FTZs to have a large effect on age of marriage for those who have dropped out of school since they are usually already married. Moreover, those that were not at school at the time the park opened tend to marry soon after they stop their education. From those that were not at school at the time of the opening about an 80 percent married within 2 years after stopping their studies. I also check the robustness of these results by estimating the effect for different sub samples of women based on their education level. I find that most of the increase in age of marriage is driven by women who were enrolled in secondary school. To summarize, women might be delaying their age of marriage because of an increase in demand for education. In particular, women increased the level of secondary school education.

8 The Effect of Negative Female Labor Demand Shocks

In this section I study whether the effects found in education and marriage revert due to the presence of negative female labor demand shocks. In particular, I study the effect of the growth competition coming from Asian countries in 2000 and the end of the preferential tariff treatment from United States (Multifiber Arrangement) in 2005.[49]Due to these shocks there was a large decrease in manufacturing textile activities in FTZs between 2000 and 2007. Before 2000, total exports from this sector represented 53 percent of total production, however, in 2006 they represented only 35 percent. These shocks had a larger negative effect on industrial parks with a large apparel sector than those with a large service sector. The textile sector employment was reduced by about 45 percent (see figure 9). Figure 10 presents a decrease in female unemployment in the 1990s followed by an increase in the 2000s.

[47]I compare women that were still in school when the park opened against those women that were in areas where the park had not opened yet. I did not include those that were not at school in areas where the park opened as part of the comparison group.

[48]As a robustness check, I estimate the effects on years of education for those who were not at school at the time of the opening and I find no effect.

[49]This commercial agreement granted shares of preferential market access to the United States.

One could argue that even if the textile industry reduced female labor demand, other sectors might have been promoted. However, the evidence shows that new sectors expanded the most after the period of the analysis. Moreover, national female unemployment rates remained high several years after the negative shocks suggesting that new sectors were not able to absorb the extra female labor in the FTZs (ILO [2013], Isa and Cruz [2007]). According to a survey done on displaced workers in 2008, 70 percent of women who were displaced from the textile industry due to these shocks were still unemployed.

Since these shocks affected the textile sector the most, I will use this variation across sectors in industrial parks to analyze the effect of reducing female labor demand. Therefore, I estimate the following equation:

$$Outcome_{ihcpt} = \alpha + \beta_1 FTZ_{pt} + \beta_2 Shock_{pt} + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} + \varepsilon_{ihcpt} \quad (4)$$

where $Shock_{pt}$ is a variable that takes the value of 0 in province p in year t before the year 2000 (the year when the shock started) and a value equal to the proportion of firms in the textile industry before 2000 for each province p in year t after the year 2000. In this way, I will be able to distinguish the effect of the park opening and the effect of the negative shock.

Another way is to interact the variable FTZ_{pt} with $Affected\ by Shock_p$ which is a variable that takes the value of zero in province p in the year 2000 and onwards if that province has more than 50 percent of firms in the textile industry in 1996. Formally, I estimate the following model:

$$Outcome_{ihcpt} = \alpha + \beta_1 FTZ * AffectedbyShock_{pt} + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} + \varepsilon_{ihcpt} \quad (5)$$

If results are persistent to the negative shock I expect β_1 in (4) and (5) to be similar in magnitude to the effects found in the main specification (1). Table 8 column 1, 3 and 4 presents the results of estimating equation (4). It is found that, conditional on the negative shock, the opening of an industrial park still has a positive effect on women's age of marriage and educational attainment. Moreover, the magnitude is similar to that found previously. Column 2, 3 and 6 shows the estimates of equation (5) and the results still hold. Even in the presence of the negative shock women keep increasing their schooling by 0.3 years and delaying their age of marriage by 1.5 years.[50]

There are two possible concerns with this methodology. First, the negative shock could be affecting a different type of women than the one affected by the positive shock (FTZs opening). In the case that compliers (those women that change their behavior due to the shock) are different under the two different treatments (FTZs opening and negative shock), the presented results would not be reflecting a persistence of effects. For instance, one could argue that while the opening of FTZs considerably affects those women with high socioeconomic status (SES), the negative shocks do not affect this same group of women. Second, another concern is that there are FTZs openings after 2000 and thus results can be driven by those women that were affected by post-shock openings. Moreover, even if a woman was affected by the shock, she might be affected in her key ages by the opening. Therefore in this case results might be driven by women who already choose to get educated when there were jobs available.

To address the first concern and check if women affected by the FTZs are similar to those affected by the negative shocks, I estimate the following model:

[50] I find the same results with 2005 shock.

$$Outcome_{ihcpt} = \alpha + \beta_1 FTZ_{pt} + \beta_2 SES_{hpt} + \beta_3 FTZ * SES_{pt} + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} + \varepsilon_{ihpt} \quad (6)$$

$$Outcome_{ihcpt} = \alpha + \eta_1 Shock_{pt} + \eta_2 SES_{hpt} + +\eta_3 Shock * SES_{pt} + \delta Province_p + \pi Year_t + \theta Province * Year_{pt} + \varepsilon_{ihpt} \quad (7)$$

where SES_{hpt} is an index of SES.[51] By interacting the shock with SES_{hpt}, I can analyze if there exists a differential effect between the positive and negative shock based on an index of socioeconomic status. If compliers are similar, β_3 should not differ from η_3. I find the same interacted effect for both shocks. Therefore, a positive shock is affected in the same way by socioeconomic status as a negative one. [52]

To address the second issue I eliminate from the sample women who were affected by post-shock openings (any opening after 2000). Moreover, to rule out the possibility that I am estimating the effects for women who already choose their education when jobs were available, I estimate the effects of FTZs for those women who were in key ages (6-16) at the moment of the negative shock. I further restrict the sample to those women who were exposed more than two years during key ages to the negative shock (women who are at least less than 14 years of age at the time of the shock so that they can be affected more than two years until they get 16). Table 8.1 presents these results. Column (1) shows the same effect, women who were in areas where FTZs opened and who were in their key ages at the moment of the negative shock also increase their education by 0.3 years. Column (2) also eliminates from the sample women who were in key ages at the time of any post shock opening and results are the same. Results are also robust to restricting the analysis to women who were at least exposed 2 years to the negative shock during their key ages (column (3)).

8.1 Robustness Checks

In this section I will provide two pieces of evidence that suggest that the negative shock did not negatively affect women behavior in places with FTZs. First, I will do an analysis comparing those cohorts that were over 16 at the time of the negative shock (which means that they were less than 16 at the time of expansion of FTZs in the 1990s) against those that were less than 16 years of age at the time of the negative shock. In other words, I will be comparing cohorts of women who were affected in the 1990's by the opening of FTZs against cohorts that were affected by the negative shocks. For instance a woman who was 17 in the year of the negative shock (2000) was affected only by the positive shock in her key ages (since she was less than 16 at the time of openings in 1990's).

Second, I exploit a sample of provinces which was not included in none of my previous analysis: provinces that did not experience a FTZs opening at any point in time. Since the 2000 and 2005 were national shocks, I make use of provinces with no FTZs as control group. In this way I will compare the change in outcomes of places that have FTZs with those that never experience an opening before and after the shock.

[51] The SES index is composed by household indicators that indicates if the walls and floors are finished, if they have electricity, water, if they live in a rural or urban area and if they are literate.

[52] Results are available upon request.

In figure A3 I estimate the effect of the negative shock by cohort for those provinces affected by openings that occur during the 1990s. Since the negative shock is national I am not able to include time fixed effects. The omitted category is age 15. I find some evidence of a decrease on years of schooling for those women that were less than 16 years of age at the time of the negative shock. However, these effects are non significant. This suggests that there is no evidence that cohorts affected by the negative shock changed their behavior.[53]

In table A7 I present the results of the second test, I compare the years of schooling of provinces with FTZs against those that never experienced an opening before and after the negative shock. I find no significant effect on schooling.[54] Moreover, I test if there are differential effects based on the proportion of textile factories in free trade zones and I find that even in those places where the proportion of textile factories was high (more than 50 percent), there was no effect of the negative shock compared to the control group. The key assumption for any difference-in-differences strategy is that the outcome in treatment and control group would follow the same trend in the absence of treatment. In figure A4 I show that there is no evidence of different trends before 2000. Moreover after 2000 if there is a difference it is positive suggesting an increase after the shock. I observe the same pattern with age of marriage. However, this difference is not significant.

These results suggest that first, there are long-term effects of temporary improving female labor demand and second, that the persistency of the effects might be driven by another mechanisms separate from change in the opportunity cost of marriage.[55] That is, with the opening of FTZs, women face an increase in labor market opportunities due to the expansion of an industry that is female labor intensive, such as the textile industry. If this positive shock in a certain period only reduces early marriage through an increase in the opportunity cost, the competitive model would predict that women again marry early after a negative shock takes away the labor market returns to education. But this is not what we observe in the data.

Notice that one important feature to understand the mechanisms behind the long-term effects is whether these negative shocks are of the same size as the positive shocks created by FTZs openings. In figure 10 I examine unemployment rates in the period of analysis and although the negative shocks were large, still unemployment rates were not as large as before the FTZs opening. This might indicate that the negative shocks were not of the same magnitude as the opening of FTZs. In the theoretical framework presented in section 4, this would translate into a reduction in p but not to the same levels as before the FTZ opened. In the following section I will expand on the framework presented in section 4 and provide other different explanations for the persistence of results.

8.2 Spillovers in the Marriage Market

One possible way to interpret the previous results is through marriage market gains. The idea behind is that the opening of FTZs created incentives for high type women to increase their schooling education and invest in their careers. By doing so FTZs created two indirect effects, a reduction in

[53] Notice that one problem with this analysis is that the age dummies are collinear with time fixed effects. Other possibility is to compare the outcomes for those women who were affected by the openings in the 1990s and the negative shock with those that were affected only by the openings in the 2000s. I find a positive difference in favor of those affected by the negative shock. However, this difference is non significant.

[54] I estimate the following model $Outcome_{ipt} = \alpha + \mu FTZ_p + \lambda Shock_t + \gamma(FTZ_p * Shock_t) + \epsilon_{ipt}$, where FTZ_p is a dummy which is equal to 1 if woman i is in a province with free trade zone, $Shock_t$ is a dummy equal to 1 if the observation is from 2000 (post). The coefficient of interest is γ (the difference-in-differences estimate).

[55] I refer to opportunity cost channel to the one coming from labor market's rewards.

the penalty for delaying marriage for future generations and also access to better matches for these type of women.

Let's illustrate the idea in a simple framework where men regard education as a signal of high type. Suppose that we have three periods. In $t = 0$ before the FTZs open, there are no expectations in labor markets (low p) and therefore no women invest in higher levels of schooling and they all marry young. In this case men know that there is a fifty percent chances that a woman will be high type and fifty percent that she will be low type. In $t = 1$, the FTZs open and there is an increase in p. Now high type women (those with $\theta \geq \theta^*$) have incentives to obtain higher years of education since now they expect future gains in the labor markets. In this case high type women will increase their years of schooling no matter what happens in the marriage market because their perceived future labor market gains are sufficiently high. Therefore in this period, there exists an equilibrium where only the high type women obtain higher years of schooling and marry high type men. This equilibrium is sustained by the belief that if a man observes a non educated women he knows she is low type and thus if a woman decides to not get educated she will get a low type husband for certain. In $t = 2$, the FTZs suffer a negative shock that creates a reduction in p but not to the original levels as in the first period. The expectation in future gains in the labor market are still higher than in period one but lower than in the second period. In this scenario, although the new generation of high type women experience a lower labor market return to education (since p is reduced), the reduction in the penalty of late marriage caused by the proportion of educated women coming from the previous periods, create incentives for them to continue increasing their years of schooling. Therefore, we are still in the equilibrium where high type women increase their years of schooling. Thus if a woman does not choose to educate herself, she will get a low skill husband with certainty. Notice that we do not get back to the equilibrium where no women pursue education as in $t = 0$, because in $t = 2$ there was a change of expectations and also the penalty for late marriage for the new generation of women is reduced (since $\frac{\partial n(\theta^*_{t-1})}{\partial \theta^*_{t-1}} < 0$). The penalty is reduced because there is a proportion of women from the past generation that choosed to pursue higher levels of education.[56]

This simple framework illustrates that FTZs not only increased the perceived labor market returns to education but also the marriage market returns by reducing the penalty of delaying marriage. Another related empirical prediction is that positive assortive mating on education also increased. After the FTZs opened high educated women tend to be match with high educated men.

There are many other possible ways to interpret these results. One direct explanation could be a change in beliefs. The idea is that if the opening of FTZs affects women through a change in beliefs, then in the face of a negative shock in the following period, the high educational attainment and late marriage phenomenon should not be reverted. That is, even if labor market opportunities for women are decreased, this should not affect women's education and marriage age since a new belief or social norm has been formed within the community (e.g better educated women are a signal of other abilities such as childcare). Notice that my argument is not that these other mechanisms do not explain the persistence of results but rather that marriage market gains can explain an important part.

[56] This model of education as signaling might work in Dominican Republic where labor markets do not have other mechanisms to distinguish different type of abilities other than from educational attainment.

8.3 Marriage Outcomes

In order to explore the gains in the marriage market, I test to what extent increasing women's years of education and age of marriage, (due to the opening of FTZs) can affect the quality of their match. The presented framework predicts that more educated women will have access to a better matches in the marriage market. Moreover, by delaying their age of marriage they might be able to better understand their preferences and reduce the chance of divorce.[57] I identify as divorced women those that had more than one union at the time of the survey. I find that for women affected by FTZs, the probability of divorce is reduced. Moreover, most of the results in divorce are driven my women that have completed secondary school and marry after the age of 18. Since my framework predicts that by increasing the years of education, women receive gains in the marriage market, I use the opening of the FTZs as as an instrument for women's years of education. In this case, conditional on women's participation in the labor market and other socioeconomic variables, I find that one year of education reduces the probability of divorced by 6 percentage points. However, if I rerun using as control group those women that were more than 16 years of age, the coefficient is reduced by half but still negative.

Another outcome to explore is the quality of women's match as measured by their husband's education. While the FTZs did not have a direct effect on men's education, it might be affected by increasing female educational attainment. First, I estimate the effect of female labor demand on husband's years of education but for the sub-sample that married after the age of 18. Second, I use the opening of the FTZs as as an instrument for women's years of education and analyze the effect on husband education. Overall, I find that the FTZs increase the husband's years of education by one year for those that marry late and has no significant effects for those that marry before the age of 18. Using the FTZs as an instrument for women's years of education, I find that as women who are more educated have access to more educated husbands (see table 9).

These two results provide further evidence that FTZs have increased the marriage market gains of women by increasing their education and delay of marriage. Moreover, these results are maintained even if we restrict to women that are not working at the time of the survey. This suggests that FTZs affect women behavior by other mechanisms apart from labor force participation.[58]

I also check the effects of FTZs on other measures of husband's quality such as the probability that he stays at home, the difference in age between husband and wife and type of husband job (whether it is skill or not).[59] Table A8 in the appendix presents the results and give the expected signs: for those women that were affected by the opening of FTZs, the probability that the husband stays at home increases, the difference in age decreases and the probability that the husband has an skilled job increases. I further use women that are more than 16 years of age as control group and results are similar as exception for whether the husband lives at her home.

One important limitation with this analysis is that I cannot rule out if women have access to a better match due to an increase in years of education per se or because by increasing their years of education they also delay their age of marriage.

[57] Goldin and Katz [2002] have also suggested how women that delay their first marriage might have higher-quality matches if preferences are not fully formed at younger ages.

[58] Moreover, results are robust to using the restricted estimates using as control group those that were more than 16 years of age at the time of the opening.

[59] I define skilled work as those that include professional, managerial, clerical and manual skilled positions.

9 Consequences of Improving Schooling and Delaying Marriage

In this section, I explore how FTZs by decreasing the chances of early marriage and increasing education might affect health outcomes. As already discussed in the introduction, women that marry before the age of 18 are more likely to engage in unhealthy behaviors compare to unmarried women. This practice might have important negative consequences. It has been suggested that early marriage reduces women's chances of getting higher levels of education and increases the probabilities of early pregnancies, child mortality and domestic violence (Jensen and Thornton [2003], Singh and Samara [1996], Senderowitz [1995]). Past literature has shown that women under age 18 are 30 percent more likely to have a premature delivery when compared to women between the ages of 26 and 29 (Royer [2004]). Moreover, an important literature has pointed out the role of education as a key determinant of fertility and infant health. From a theoretical perspective, education increases women's permanent income and thus changes her optimal number of children towards fewer children but of higher quality(Becker and Lewis [1973], Willis [1973], Mincer et al. [1963]). Furthermore, education may increase women's knowledge and ability to process information about healthy pregnancy behaviors (Grossman [1972]).

9.1 Age of First Birth, Age of First Intercourse and Fertility

In most of developing countries, early marriage typically coincides with childbearing at a young age. Many first births occur within the first two years of marriage (Singh and Samara [1996]). In the Dominican Republic, qualitative evidence suggests that most women get married to become mothers. Since I find that FTZs delay the age of marriage, I should also find an effect for age at first birth. Table 10 presents the results from estimating equation (1) but using the age at first birth as a dependent variable. The results are similar to those for age of marriage– the opening of FTZ is associated with a one year increase in the age of first birth. If I redefine the dependent variable as the probability of having the first child before the age of 18, I find that the park reduces the probability of teenage births by 17 percentage points. This result is especially important since past research showed large negative consequences of teenage birth (Jensen and Thornton [2003]). I also repeat the analysis in equation (4) and (5) for age at first birth and I find that results are maintained in the presence of negative shocks.

I also check if the presence of a FTZ affects the number of desired children and the probability of having a child out of marriage. I find a decrease on reported desired fertility during their lifetime of about 7 percent from the baseline (3 children).[60] I measure out-of-wedlock births as those that occur before the year of marriage or among never married women. I find no effects on this outcome. This is consistent with the fact that in general women get married to become mothers. I estimate the effects on the age at which women first have intercourse and I find a one year increase in the age of first intercourse. [61]

[60] This estimate is comparable to the 11 percent decrease in desired fertility caused by BPO recruiting services for women in India (**Jensen [2010]**).

[61] All the results of this section are similar if we use the restricted estimates (defining the control group as those that were more than 16 years of age at the time of the opening).

9.2 Child Outcomes

I study the effect of FTZs on the probability that the first child is alive at the time of the survey.[62] In our sample, late marriage is positively correlated with the probability that the first child will be alive.[63]Therefore, by increasing women schooling and age of marriage, improving labor markets for women also increases child survival. Table 11 presents the results. Basic estimates using only the variation on the time of opening of FTZs show an increase of about 3 percentage points on child survival. Moreover, I find no effect for those women who married early. Column 4 presents the restricted estimates. Although results are smaller, there are still positive and significant effects on the probability of child survival. FTZs increase the chances that a child is alive by 1.6 percentage points even after controlling for female labor force participation and the socioeconomic characteristics presented in equation (1). This represents about a 22 percent decrease in the probability of having a child who do not suvive infancy.[64]

9.3 Women Empowerment

Several studies have suggested how increasing women's opportunities in the labor market can change their relative position in the household. In this section, I analyze how the opening of free trade zones affected outcomes such as domestic violence and women's control over how to spend earnings and women's participation in decision making such as deciding about her own health care, visiting relatives, and food purchase. It is not clear whether improving the labor market might have an effect on domestic violence through its impact on years of education and thus, early marriage. There is some evidence that improving women's labor market might directly reduce domestic violence by improving women's outside option in the household. [65]Since I only have data on domestic violence and women's decision outcomes for 2002 and 2007 and can only exploit variation across cohorts based on key age thresholds. I analyze the effect of the FTZs on the following outcomes: $Spend_{ihct}$ which indicates whether the respondent decides how to spend the money in the household; $FinalSay_{ihct}$ which indicates whether the respondent has the final say on her own health care, visits to relatives and food purchase; and $Violence_{ihct}$ which indicates whether she justifies wife beating.[66] While I could not find evidence that FTZs increase women's power in relevant household decisions, I find that women are less likely to justify wife beating (see table A9).

10 Conclusions

The existence of multiple equilibria combined with the lack of female labor market opportunities can situate societies in a "bad" equilibrum where women drop out school to marry young. In this

[62]I restrict the analysis for those that have their first child after the park opened.

[63]Late marriage increases by 1.2 percentage points the probability that the first child is alive. I estimate the effect of early marriage on the probability that the first child is alive conditional on province, time and cohort fixed effects, province time trends, years of education and socioeconomic variables.

[64]I define infancy as those that are less than 5 years.

[65]Aizer [2010] has shown that reducing gender wage gaps in the US might increase the bargaining power of women within the household and thus, reduces their exposure to domestic violence.

[66]One problem with these measures is that there are self reported and they might not be objective since there is a high degree of non-random under-reporting.

paper, I exploit the sudden growth of FTZs in the Dominican Republic in the 1990's as an exogenous shock to female labor market opportunities. I find that a FTZ in a province has important effects on education and age of marriage. Moreover, I find that the FTZs effects persist even in the presence of these exogenous negative shocks. In particular, female educational levels remain high, indicating a movement to a new equilibrum and not just an increase in labor market opportunities themselves. I argue this may be due to the fact that women still have high returns to education in the marriage market. Moreover, I find that women who increased their years of education due to the FTZs married better educated husbands and are less likely to divorce. I further show that by increasing the years of education, free trade zones also affected age of marriage and first birth. The opening of a free trade zone reduced the probability of early marriage by about 18 percentage points, leading to important consequences on maternal and child health outcomes. I find that the decrease in early marriage caused by the FTZs increased by 1.6 percentage points the probability of survival of the first child. This provides evidence of an important increase in welfare for women due to the shift to new equilibrum.

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Tables and Figures

Figure 1:

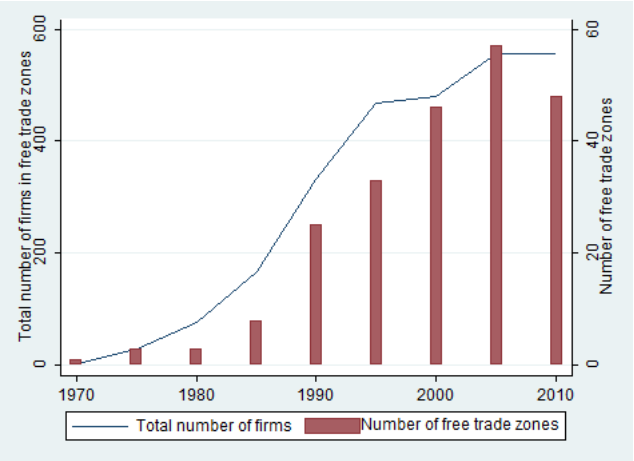


Figure 2:

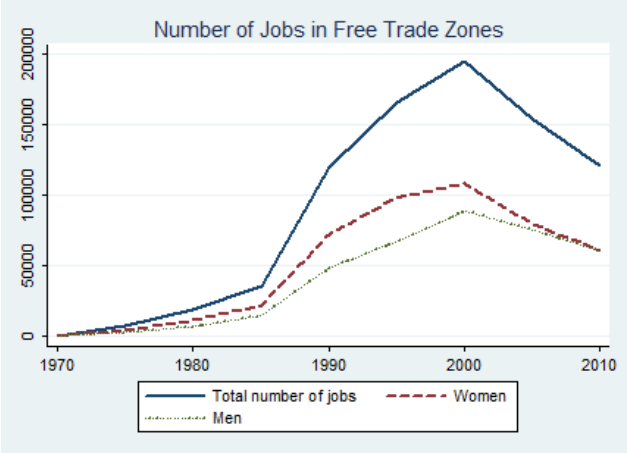
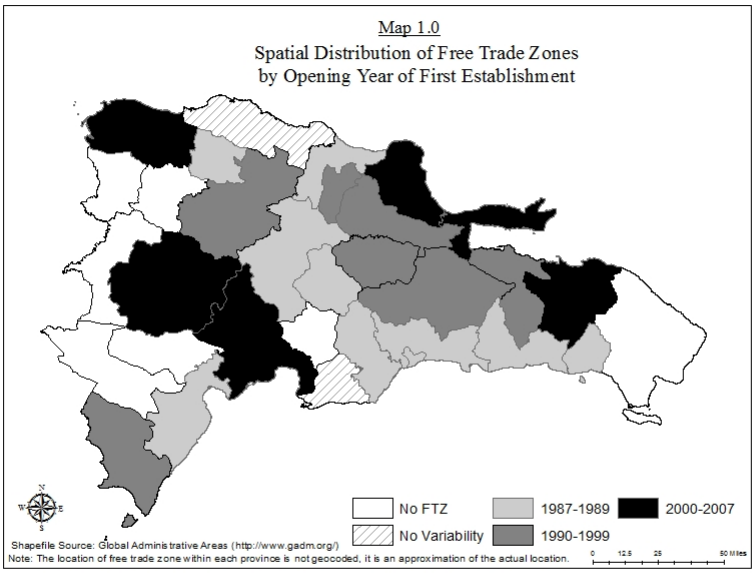


Figure 3:


Map 1.0
Spatial Distribution of Free Trade Zones
by Opening Year of First Establishment
No FTZ
1987-1989
2000-2007
No Variability
1990-1999
Shapefile Source: Global Administrative Areas (http://www.gadm.org/)
Note: The location of free trade zone within each province is not geocoded, it is an approximation of the actual location.
0 12.5 25 50 Miles

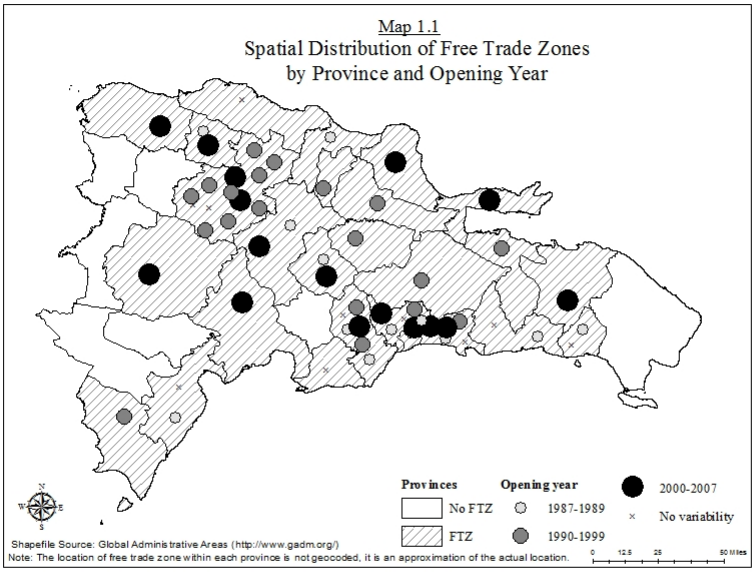
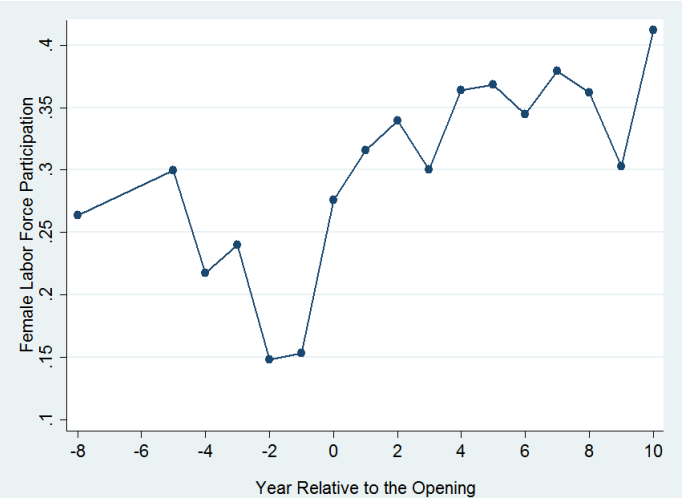
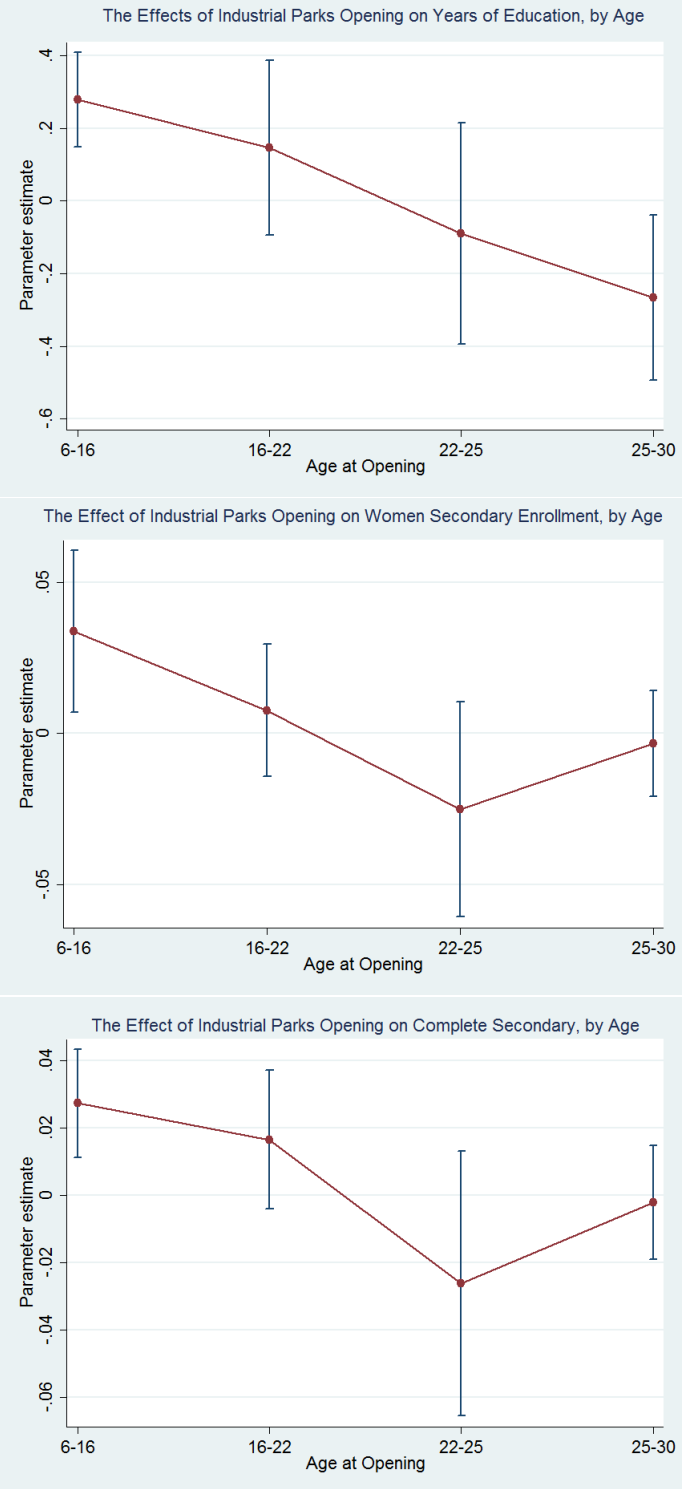

Map 1.1
Spatial Distribution of Free Trade Zones
by Province and Opening Year
Provinces
Opening year
No FTZ
FTZ
1987-1989
1990-1999
2000-2007
No variability
Shapefile Source: Global Administrative Areas (http://www.gadm.org/)
Note: The location of free trade zone within each province is not geocoded, it is an approximation of the actual location.
0 12.5 25 50 Miles

Figure 4:



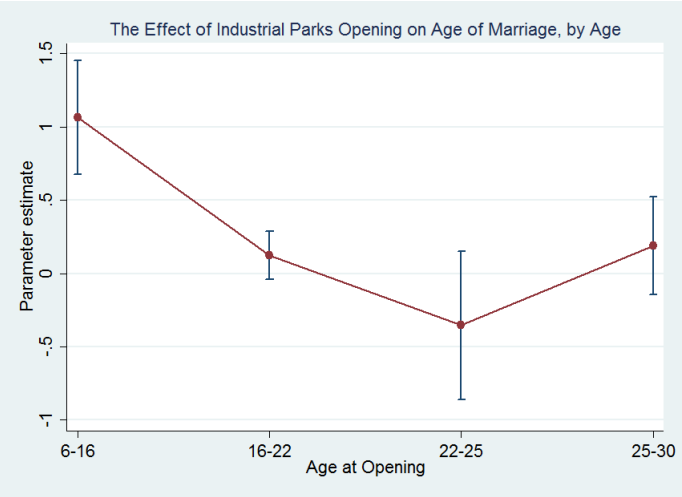
Notes: Figure 4 is unadjusted figure plotting female labor force participation by the year of survey relative to the FTZ opening.

Figure 5:



Notes: These graphs plot the coefficients obtained from a regression of the corresponding outcome on the interaction between the treated province dummy and age at opening dummies. The regressions control for province, year, province time trends, cohort fixed effects, province of birth trends and socioeconomic variables. The Y-axis shows the estimated coefficients and the X-axis shows the age at opening. Standard errors are clustered at the province level.

Figure 6:



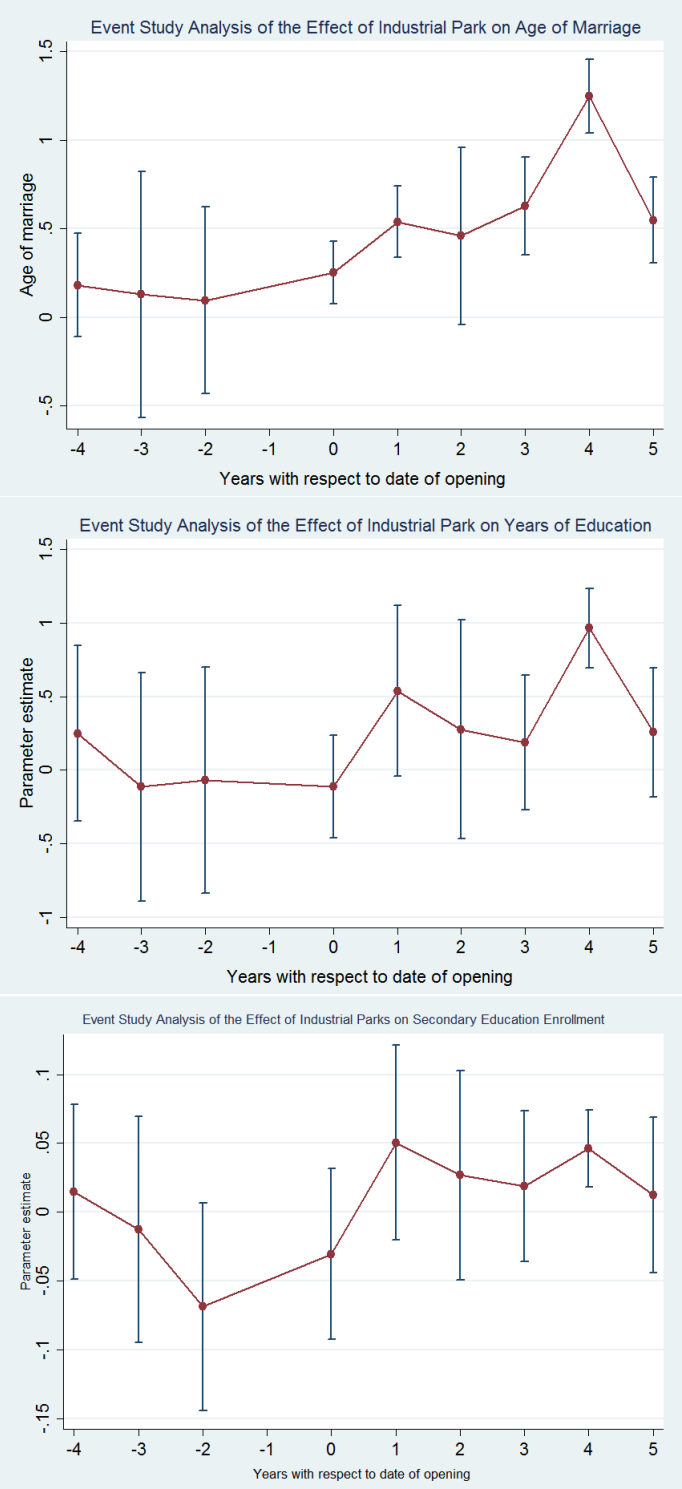
Notes: These graphs plot the coefficients obtained from a regression of age of marriage on the interaction between the treated province dummy and age at opening dummies. The regressions control for province, year, province time trends, cohort fixed effects, province of birth trends and socioeconomic variables. The Y-axis shows the estimated coefficients and the X-axis shows the age at opening. Standard errors are clustered at the province level.

Table 1. Education based on sex and sectors (%)

	Free trade zones		Tourism		Agro-industry	
	Men	Women	Men	Women	Men	Women
No education	2.3	3.4	2.1	1.0	4.2	1.2
Incomplete primary	10.4	7.3	7.9	12.9	17.8	14.3
Complete primary	8.1	7.8	12.5	2	17.8	14.3
Incomplete secondary	23.1	18.9	25	15.8	23.2	16.7
Complete secondary	16.7	16.6	20	23.8	11.3	9.5
Tecn. Secondary	2.7	5.3	3.8	7.9	4.2	10.7
Tecn. University	5	8.7	5.4	7.9	3.1	8.3
Incomplete university	16.7	15.5	14.5	19.8	10.5	19
Complete university	14.9	16	8.8	8.9	8.5	9.5
Other	0.1	0.6	0	0	0.8	6

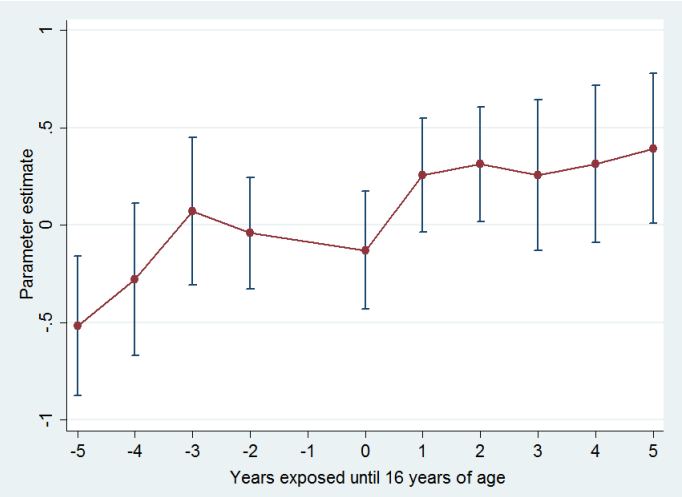
Source: Reyes Castro et al. (1993) based on *Encuesta Nacional de Mano de Obra* (ENMO'91). BID-FUNDAPEC

Figure 7:



Notes: These graphs plot the coefficients obtained from a regression of the outcome on the interaction between the treated province dummy and year dummies. The regressions control for province, year and province time trends. The Y-axis shows the estimated coefficients and the X-axis shows the years. Standard errors are clustered at the province level.

Figure 8:



Notes: This graph plots the coefficients obtained from a regression of the outcome on dummies of years exposed until 16. I define year exposed until 16 by subtracting from the year of opening the year when each woman was 16 years of age. The regressions control for province, year and province time trends. The Y-axis shows the estimated coefficients and the X-axis shows the years. Standard errors are clustered at the province level.

Figure 9:

Figure 10:

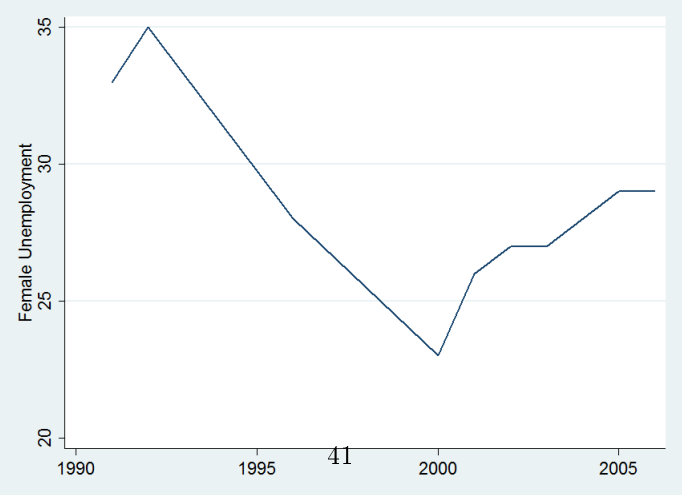


Table 2. Summary Statistics

DHS (1986, 1991, 1996, 2002 and 2007, Women aged 15-45)

Variable	Obs	Mean	Std. Dev.	Min	Max
Age of Respondent	55,956	29.15	9.88	15	49
Women Years of Education	55,894	7.83	4.38	0	22
Number of HH members	55,956	5.26	2.35	1	22
Current Marital Status	55,955	0.76	0.42	0	1
Age of Marriage	42,784	17.94	4.1	8	47
Age at First Intercourse	33,190	17.31	3.66	8	46
Age at First Birth	39,711	20,00	4.08	10	46
Working (=1)	55,850	0.36	0.48	0	1
Ever attended only primary school (=1)	30,445	0.9	0.3	0	1
Ever attended only secondary school (=1)	55,953	0.46	0.5	0	1
Complete only primary school (=1)	42,490	0.40	0.49	0	1
Complete only secondary school (=1)	55,959	0.24	0.43	0	1
Age of Husband*	27,095	38.14	10.85	15	95
Husband Years of Education	38,269	7.28	4.68	0	20

*only available from 1996, 2002, 2007 surveys

Occupation Status (DHS 1991, 1996, 2002 and 2007)

	Women's Occupation			Husband's Occupation		
	Freq.	Percent	Cum.	Freq.	Percent	Cum.
Members of the executive and legislative bodies and executives of government and business	661	3.58	3.58	1,642	6.86	6.86
Scientific and intellectual professionals	1,783	9.66	13.24	821	3.43	10.29
Middle level technicians and professionals	3,144	17.04	30.28	2,097	8.76	19.05
Office workers	2,48	13.44	43.72	3,424	14.31	33.36
Services and sales	3,074	16.66	60.38	2,457	10.27	43.62
Agriculture	1,028	5.57	65.95	3,297	13.77	57.40
Officers, operators, artisans (mine workers, machinery mechanics and adjusters, etc)	734	3.98	69.93	4,12	17.21	74.61
Plant and machine operators	584	3.16	73.09	3,573	14.93	89.54
Unskilled Manual (domestic hh, manufacturing laborers, street sellers)	4,966	26.91	100.00	2,504	10.46	100.00
Total	18,454	100.00		23,935	100.00	

Table 3. Predictors of Free Trade Zones Opening 1986

(A) Demographic Characteristics	
Proportion of Women in Age15-21	2.660
	(12.08)
Proportion of Women in Age22-30	-4.237
	(11.57)
Proportion of Women in Age31-45	5.300
	(11.36)
Proportion of Households in Urban Areas	-1.054
	(1.765)
Proportion of Owners of Land Worked	0.219
	(2.539)
R-squared	0.023
(B) Social Characteristics	
Average Years of Education for Women	-0.681
	(0.805)
Proportion of Literate Women	0.671
	(6.890)
Average Years of Education for Men	1.888
	(5.890)
Average Age of First Marriage	2.369
	(2.493)
Average Age of First Birth	0.967
	(0.979)
Proportion of Married Women	7.296
	(5.897)
Average Age of First Intercourse	-3.681
	(2.924)
R-squared	0.100
(C) Labor Characteristics	
Proportion of Women Earning a Salary	0.344
	(2.783)
Proportion of Women Working for Non Family Member	-2.201
	(2.686)
Proportion of Women Working Before Marriage	2.319
	(5.628)
Proportion of Women Working After Marriage	-4.475
	(6.157)
Proportion of Women Working	-8.053
	(8.371)
R-squared	0.030

Note: the dependent variable is the year in which the industrial park opened in each province minus 1986, the year of the beginning of greatest expansion. Results from including all regressors variables in a single regression do not change. Robust standard errors are reported in parenthesis. There are a total of 100 observations in each regression.

Table 4. The Effect of FTZs on Years of Education

	(1)	(2)	(3)	(4)
FTZ (=1)	0.408***	0.386***	0.359***	0.436*
	(0.141)	(0.131)	(0.127)	(0.211)
Mean of Dependent Variable	7,82	7,82	7,82	7,82
Observations	55.894	55.894	55.894	51.949
R-squared	0,075	0,076	0,124	0,188
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province Time Trends	NO	YES	YES	YES
Cohort FE	NO	NO	YES	YES
Province Year of Birth Trends	NO	NO	YES	YES
Socioeconomic Controls	NO	NO	NO	YES

Notes: Socioeconomic controls include type of place of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), main floor material, main wall material, age of respondent, number of household members and number of construction permits per province. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 4.1 The Effect of FTZ on School Enrollment and Complete Levels of Education

	Enrollment		Complete Education	
	Primary	Secondary	Primary	Secondary
	(1)	(2)	(3)	(4)
FTZ (=1)	0,00711	0.0464**	0,00961	0.0368**
	(0.0223)	(0.0173)	(0.0209)	(0.0133)
Mean of Dependent Variable	0.9	0.46	0.4	0.24
Observations	27.975	51.991	39.244	51.993
R-squared	0,043	0,154	0,145	0,118
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES
Province Year of Birth Trends	YES	YES	YES	YES
Socioeconomic Controls	YES	YES	YES	YES

Notes: Dependent variable in (1) and (2) are dummy variable that indicate if women have ever attended primary and secondary school. Dependent variable in (3) is a dummy variable that takes the value of one if women reported more than 8 years of education. Dependent variable in (4) is a dummy variable that takes the value of one if women reported more than 12 years of education. Socioeconomic controls include type of place of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), main floor material, main wall material, age of respondent, number of household members and number of construction permits per province. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 4.2 The Effect of FTZ on Schooling (restricted estimates)

	Years of Education	Enrollment		Complete Education	
		Primary	Secondary	Primary	Secondary
	(1)	(2)	(3)	(4)	(5)
FTZ(=1)	0.262**	-0.00846	0.0284**	0.0232**	0.0247***
	(0.122)	(0.00933)	(0.0130)	(0.0102)	(0.00865)
Mean of Dependent Variable	7,82	0.9	0.46	0.4	0.24
Observations	46026	23.784	46.067	34503	46069
R-squared	0.174	0.042	0.142	0.131	0.118
Province FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES
Province Year of Birth Trends	YES	YES	YES	YES	YES
Socioeconomic Controls	YES	YES	YES	YES	YES

Notes: The independent variable is a dummy that takes the value of one if women were less than 16 years of age at the time of opening. Dependent variable in (2) and (3) are dummy variable that indicate if women have ever attended only primary and only secondary school respectively. Dependent variable in (4) is a dummy variable that takes the value of one if women reported more than 8 years of education. Dependent variable in (5) is a dummy variable that takes the value of one if women reported more than 12 years of education. Socioeconomic controls include type of place of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), main floor material, main wall material, age of respondent, number of household members and number of construction permits per province. Sample restrictions: I eliminate those women who were more than 30 years of age at the opening. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 5. The Effect of FTZ on Age of Marriage

	Age of Marriage			Early Marriage (=1)
	(1)	(2)	(3)	(4)
FTZ (=1)	1.336***	1.561***	1.484***	-0.274***
	(0.280)	(0.235)	(0.440)	(0.033)
Mean of Dependent Variable	17.94	17.94	17.94	0.46
Observations	25940	25940	20681	31287
R-squared	0.025	0.027	0.055	0.164
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province Time Trends	NO	YES	YES	YES
Socioeconomic Controls	NO	NO	YES	YES

Notes: Socioeconomic controls include type of place of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), main floor material, main wall material, age of respondent, number of household members and number of construction permits per province. Sample restrictions: I eliminate from the sample those that were already married at the time of opening. If I include this group in the sample results are similar. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 5.1 The Effect of FTZ on Age of Marriage (restricted estimates)

	Age of Marriage	Early Marriage (=1)
	(1)	(3)
FTZ (=1)	1.666***	-0.182***
	(0.223)	(0.0259)
Mean of Dependent Variable	17.94	0.46
Observations	25620	32528
R-squared	0.148	0.059
Province FE	YES	YES
Year FE	YES	YES
Province Trends	YES	YES
Cohort FE	YES	YES
Province Year of Birth Trends	YES	YES

Notes: the independent variable is a dummy that takes the value of one if women were less than 16 years of age at the time of opening. Socioeconomic controls include type of place of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), main floor material, main wall material, age of respondent, number of household members and number of construction permits per province. Sample restrictions: I eliminate from sample those women who were older than 30 at the time of opening. Results in age of marriage are slightly smaller if we include this group of women but results in early marriage are larger. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 6. The Effect of FTZ on Women's Years of Education and Age of Marriage by Migration Status

	(A) Years of Education			
	(1)	(2)	(3)	(4)
FTZ(=1)	0.423**	0.385***	0.488***	0.350**
	(0.164)	(0.127)	(0.160)	(0.127)
Movers (=1)				-0.761***
				(0.108)
Mean of Dependent Variable	7,82	7,82	7,82	7,82
Observations	41985	54778	40869	55894
R-squared	0.157	0.125	0.159	0.131
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES
Subsample of Non-Migrants	YES		YES	
Subsample without Just Movers		YES	YES	

	(B) Age of Marriage			
	(1)	(2)	(3)	(4)
FTZ (=1)	1.323***	1.276***	1.332***	1.337***
	(0.209)	(0.247)	(0.224)	(0.245)
Movers (=1)				-0.330***
				(0.0855)
Mean of Dependent Variable	17.29	17.29	17.29	17.29
Observations	17732	25714	17506	42784
R-squared	0.039	0.026	0.038	0.018
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES
Subsample of Non-Migrants	YES		YES	
Subsample without Just Movers		YES	YES	

Notes: Dependent variable in panel A is the years of education reported by women in year t in province p and in panel B is the age of marriage reported by women in year t in province p. Independent variable is the opening of the industrial park. Column 1 presents estimates using only a subsample of non-migrants. Column 2 eliminates from the whole sample those households that moved to the province just before the industrial park opens. Column 4 adds a dummy that takes the value of 1 if the household households moved to the province just before the industrial park opened and 0 otherwise. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6.1. The Effect of FTZs on Migration

	Migration	
	(1)	(2)
FTZ (=1)	0.00170*	0.00183
	(0.000973)	(0.00110)
Mean of Dependent Variable	0.01783	0.01783
Observations	528	528
R-squared	0.624	0.647
Province FE	YES	YES
Year FE	YES	YES
Province Trends	YES	YES
Socioeconomic Controls	NO	YES

Notes: Dependent variable is the proportion of migrants in year t in province p. Independent variable is the opening of the industrial park. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6.2 The Effect of FTZs Using Age Thresholds

	Years of Education	Secondary School Enrollment	Complete Secondary	Age of Marriage	Early Marriage (=1)
	(1)	(2)	(3)	(4)	(5)
FTZ (=1)	0.563***	0.0615***	0.0951***	-0.322	-0.275***
	(0.182)	(0.0220)	(0.0221)	(0.273)	(0.0125)
Mean of Dependent Variable	7,82	0.46	0.24	17.94	0.46
Observations	22611	22630	22630	14121	24317
R-squared	0.677	0.637	0.577	0.793	0.527
Province FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES
Household FE	YES	YES	YES	YES	YES
Age	YES	YES	YES	YES	YES

Notes: the independent variable is a dummy that takes the value of one if women were less than 16 years of age at the time of opening. There are a total of 9500 households with more than one women inside. Household clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 7. The Effect of FTZs on Age of Marriage Controlling by Possible Channels

	Age of Marriage			Working(=1)	Outside Home (=1)
	(1)	(2)	(3)	(4)	(5)
FTZ (=1)	1.561***	0.586***	1.729***	0.0530**	0.0332**
	(0.235)	(0.190)	(0.216)	(0.0201)	(0.0125)
Women Years of Education		0.420***			
		(0.0184)			
Working (=1)			1.557***		
			(0.216)		
Mean of Dependent Variable	17.94	17.94	17.94	0.24	0.7
Observations	25940	25913	25897	39044	14878
R-squared	0.027	0.183	0.056	0.110	0.030
Province FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES

Notes: Dependent variable is the average age of marriage in year t in province p. Independent variable is the opening of the industrial park. Column 2 includes years of education of women and Column 3, the proportion of women working. Results are robust using as dependent variable Early Marriage (whether she married before the age of 18). Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8. The Effect of Negative Shocks on Years of Education, Age of Marriage and Early Marriage

	Years of Education		Age of Marriage		Early Marriage (=1)	
	(1)	(2)	(3)	(4)	(5)	(6)
FTZ (=1)	0.322**		1.507***		-0.315***	
	(0.136)		(0.245)		(0.0232)	
Shock	-80.07		-36,93		-13,81	
	(47.86)		(39.85)		(8.632)	
FTZ*Affected by Shock (=1)		0.341**		1.559***		-0.305***
		(0.128)		(0.234)		(0.0238)
Observations	55.894	55894	25940	25940	39112	39112
R-squared	0.125	0.125	0,027	0,027	0,03	0,03
Province FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES	YES

Notes: In column (1) and (3) Shock is a variable that takes the value of 0 in province p in year t before the year 2000 (the year when the shock started) and a value equal to the proportion of firms in the textile industry before 2000 for each province p in year t after the year 2000. In this way, I am able to distinguish the effect of the opening a park and the effect of the negative shock. In column (2) and (4), I interact the variable FTZ with Affected by Shock which is a variable that takes the value of zero in province p in the year 2000 and onwards if that province has more than 50 percent of firms in the textile industry in 1996. Results are robust to the inclusion of cohort fixed effects, socioeconomic variables and to restricted estimates. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 8.1. The Effect of FTZ for Women Affected by Negative Shocks in Key Ages

	Years of Education		
	(1)	(2)	(3)
FTZ (=1)	0.308***	0.332***	0.312***
	(0.0196)	(0.0260)	(0.0229)
Observations	8990	8165	7415
R-squared	0.149	0.147	0.148
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Cohort FE	YES	YES	YES
Province Year of Birth Trends	YES	YES	YES
Province Trends	YES	YES	YES

Notes: Column (1) presents the same estimation presented in equation (1) using only the subsample of women who were less than 16 years of age at the time of the negative shock. Column (2) further restricts the sample, eliminating women who were less than 16 years of age at any opening that occur after the negative shock. Column (3) also restricts the sample to those women who were exposed to the negative shock at least two years. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table 9. The Effect of FTZ on Divorce and Husband's Education

	Divorce(=1)	Husband's Education
FTZ (=1)	-0.134***	0,952
	(0.0434)	(0,701)
Mean of Dependent Variable	0.36	5.6
Observations	21981	19.876
R-squared	0.050	0,347
Province FE	YES	YES
Year FE	YES	YES
Province Trends	YES	YES

Notes: In column (1) the dependent variable is a dummy that indicates if woman had more than one union or marriage. In column (2) the dependent variable is the husband's years of education. The independent variable is the opening of the industrial park in year t in province p. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The Effect of Education on Divorce and Husband's Education Using as IV the FTZs Opening

	Divorce(=1)	Husband's Education
Years of Education	-0.0650*	1.039***
	(0.0337)	(0,311)
Observations	21.958	19.846
R-squared	0.012	0,197
Province FE	YES	YES
Year FE	YES	YES
Province Trends	YES	YES
Socioeconomic Controls	YES	YES

Notes: In column (1) the dependent variable is a dummy that indicates if woman had more than one union or marriage. In column (2) the dependent variable is the husband's years of education. The independent variable is women's years of education. The instrumental variable is the free trade zone opening. Socioeconomic controls include working status, type of place of residence, literacy rates, if the main source of drinking water comes from piped water, type of toilet facilities (if they use flush or pour flush toilet), if the household has electricity, radio, television, refrigerator and car, main floor material, main wall material and number of household members. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 10. The Effect of FTZs Opening on Early Birth, Intercourse and Fertility

	Age of First Birth	Early Birth (=1)	Age of First Intercourse	Early Intercourse (=1)	Out-of-Wedlock Birth (=1)	Desired Fertility
FTZ (=1)	1.065***	-0.175***	1.316***	-0.199***	0,0166	-0.211***
	-0,276	-0,0181	-0,367	-0,034	-0,0172	(0.0646)
Mean of Dependent Variable	19.31	0.24	26.82	0.39	0.036	3.2
Observations	23342	39112	21652	39112	23127	39002
R-squared	0,025	0,021	0,018	0,031	0,009	0.072
Province FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES	YES

Notes: Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts)

Table 11. The Effect of FTZs Opening on Child Survival

	Whole Sample Child Survival	Married Before 18 Child Survival	Married After 18 Child Survival
FTZ (=1)	0.0355**	0.0316	0.0263*
	(0.0161)	(0.0273)	(0.0151)
Mean of Dependent Variable	0.9	0.9	0.9
Observations	22979	11451	11528
R-squared	0.030	0.040	0.022
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Province Trends	YES	YES	YES

Notes: The dependent variable is a dummy that indicates if the first child is alive at the time of the survey. In column (1) I estimate the effects using the whole sample of women. In column (2) I estimate the effects using only women that married before the age of 18 and in column (3) only women that married after that age. The independent variable is the opening of the industrial park in year t in province p. All models include age of the child as control. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix

Potential Mechanisms to Explain Schooling Effects: Women's Earnings and Investments on Infrastructure

Table A1

Testing Other Mechanisms Behind Schooling Effects

	Non-restricted Estimates						Restricted Estimates					
	Years of Education			Enrollment in Secondary			Years of Education			Enrollment in Secondary		
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
FTZ (=1)	0.385***	0.398***	0.375**	0.0378**	0.0393**	0.0390**	0.259**	0.262**	0.236**	0.0296**	0.0284**	0.0205*
	(0.131)	(0.134)	(0.135)	(0.0145)	(0.0141)	(0.0155)	(0.122)	(0.122)	(0.103)	(0.0123)	(0.0130)	(0.0101)
Number of Parks	0.0374			0.00117			0.0860			0.00477		
	(0.0394)			(0.00431)			(0.0569)			(0.00380)		
Number of Construction Permits		-0.00225***			-0.000267***			-0.000993			-0.000133*	
		(0.000437)			(6.92e-05)			(0.000907)			(7.72e-05)	
Subsample of Non-Working Women	NO	NO	YES	NO	NO	YES	NO	NO	YES	NO	NO	YES
Observations	55894	51949	35796	55953	51991	35830	49660	46026	29808	49716	46067	29831
R-squared	0.076	0.101	0.088	0.057	0.054	0.067	0.178	0.174	0.207	0.144	0.142	0.162
Province FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cohort FE	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
Province Year of Birth Trends	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES

Notes: In this table I show that the effect of free trade zones on schoolings is driven by other mechanism apart from an increase on women's wealth and school infrastructure. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Robustness Checks

Table A2

The Effect of FTZs (using women that were already married at the time of opening)

	Years of Education	Enrollment in Secondary School	Complete Secondary	Age of Marriage	Early Marriage
	(1)	(2)	(3)	(4)	(5)
FTZ (=1)	-0.145	-0.0202	0.00437	0.203	-0.00249
	(0.228)	(0.0203)	(0.0162)	(0.165)	(0.0249)
Mean of Dependent Variable	7.82	0.9	0.46	17.94	0.46
Observations	22709	22.735	22.737	20867	20867
R-squared	0.073	0.053	0.043	0.112	0.082
Province FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES

Notes: I estimate the effect of the industrial park openings on a group that should not be affected: women who were already married by the time of the opening. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A3

The Effect of FTZs Opening on Husband's Years of Education

	(1)	(2)	(3)
FTZ (=1)	0.436*	0.192	0.499*
	(0.211)	(0.283)	(0.263)
Observations	51949	35552	35523
R-squared	0,188	0.157	0.176
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Province Time Trends	YES	YES	YES
Cohort FE	YES	YES	YES
Province Year of Birth Trends	YES	YES	YES
Socioeconomic Controls	YES	YES	YES

Notes: Column (1) presents the effect of FTZ's opening on women's years of education. Column (2) on their husband's education. Column (3) presents the effects on women's years of education using the sample of women who reported husband's education. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Table A4

The Effect of FTZs Opening (excluding Santo Domingo and Santiago)

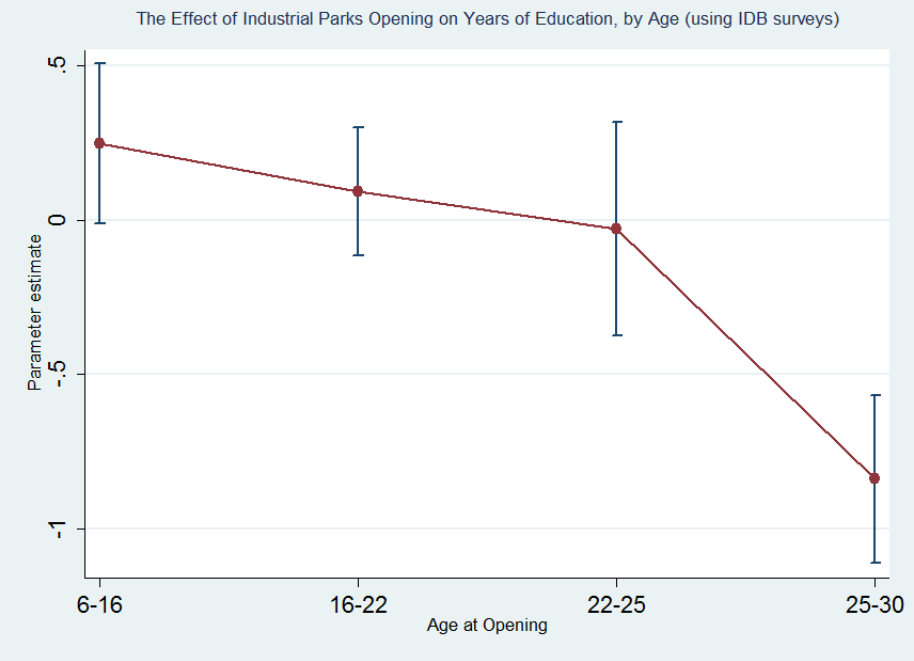
	Years of Education	Enrollment in Secondary	Complete Secondary	Age of Marriage	Early Marriage
	(1)	(2)	(3)	(4)	(5)
FTZ (=1)	0.436*	0.0464**	0.0368**	1.530***	-0.331***
	(0.211)	(0.0173)	(0.0133)	(0.458)	(0.0229)
Mean of Dependent Variable	7.82	0.9	0.46	17.94	0.46
Observations	51949	51991	51993	16863	25868
R-squared	0.188	0.154	0.118	0.060	0.071
Province FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES
Socioeconomic Controls	YES	YES	YES	YES	YES

Notes: I rerun the model presented in equation (1) but excluding from the analysis provinces that contain the main cities such as the National District, Santo Domingo and Santiago. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Results Using Other Surveys

In order to check the robustness of the results I rely on other household surveys assembled by the Inter-American Development Bank. These surveys cover the period 2000-2011 and are part of the Program for the Improvement of Surveys and the Measurement of Living Conditions (MECOVI), sponsored by the Inter-American Development Bank, the UN Economic Commission for Latin America and the Caribbean, and the World Bank. The variables I use to measure education outcomes are similar to the ones used in the DHS: reported number years of schooling, last type of studies pursue and school enrollment. With these variables, I construct enrollment and attainment measures that are age-specific. This data has some disadvantages. First, similar as DHS they are self-declared reports and households could over-estimate the years of schooling. However, Urquiola and Calderon [2006] notice that estimates coming from these surveys in general are smaller than from official statistics. Second, these surveys only contain information for my schooling outcomes. Third, the surveys only cover the period 2000-2012 and therefore I can only use variation in the opening of free trade zones that occur in this decade. Nevertheless I will be able to use the variation in age at opening and make use of the variation coming from openings that occur before 2000.

Figure A1



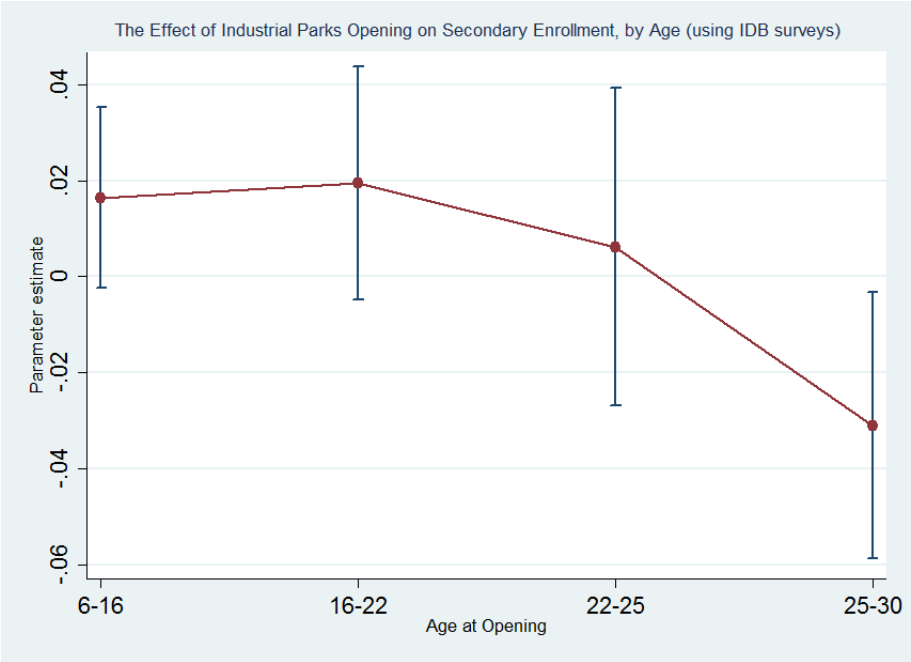


Table A5

The Effect of FTZs Opening on Years of Education (Restricted Estimates Using IDB surveys)

	(1)	(2)
FTZ (=1)	0.229*	0.249*
	(0.123)	(0.125)
Household Income		5.81e-05***
		(1.85e-06)
Observations	110968	110706
R-squared	0.394	0.425
Province FE	YES	YES
Year FE	YES	YES
Province Trends	YES	YES
Cohort FE	YES	YES
Province Year of Birth Trends	YES	YES

Notes: In this table I show that the effect of free trade zones on schoolings is driven by other mechanism apart from an increase on household's earnings. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

Potential Mechanism to Explain Early Marriage Results: Years of Schooling

Figure A2

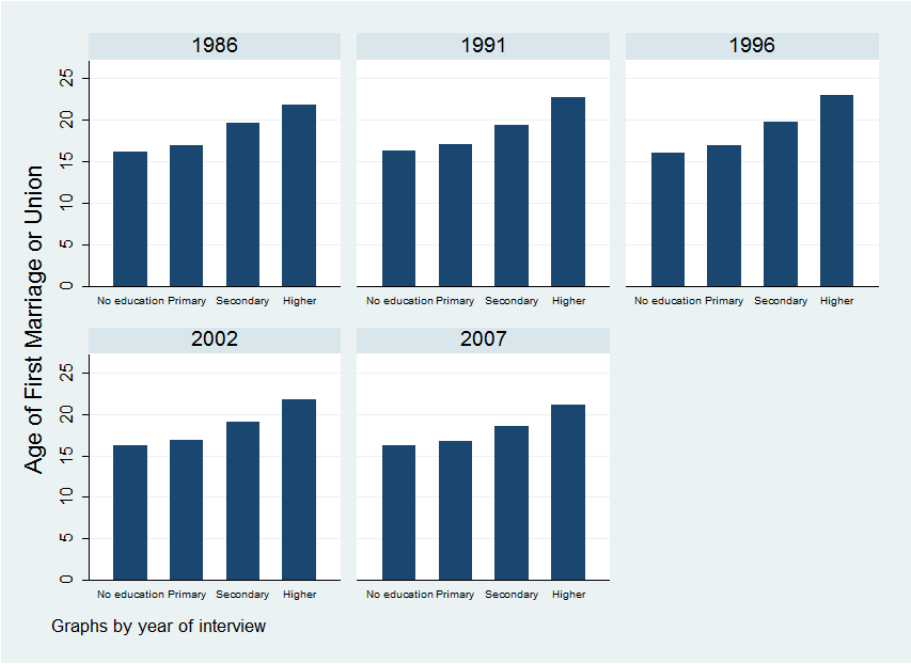


Table A6

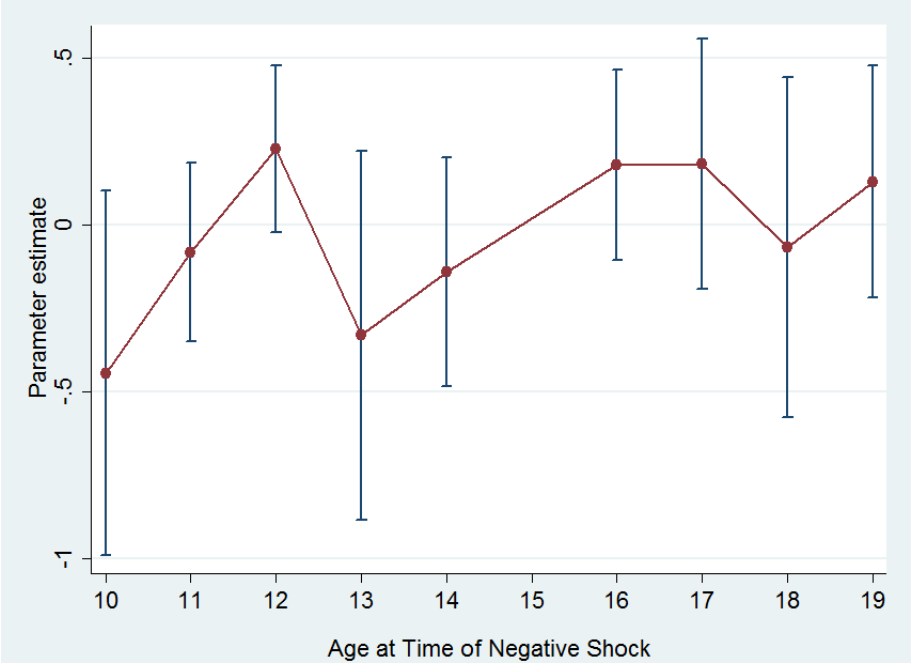
The Effect of FTZs on Early Marriage by School Status

	At School	Outside School
FTZ (=1)	-0.269***	0.0102
	(0.0240)	(0.0135)
Observations	21935	28526
R-squared	0.070	0.043
Province FE	YES	YES
Year FE	YES	YES
Province Trends	YES	YES
Cohort FE	YES	YES
Province Year of Birth Trends	YES	YES
Socioeconomic Controls	YES	YES

Notes: Dependent variable is dummy indicating early marriage (married before the age of 18) in year t in province p. Column (1) presents the effect of the industrial park using the subsample of women at school. Column (2) the same but for those women that were not at school at the time the free trade zone opened. I identify the women that are not at school at the time of the park opening as those that stopped their education before the year of opening of the park. Based on this measure, about of 60 percent of women in the sample were not at school at the time of opening. Standard errors are clustered per province. *** p<0.01, ** p<0.05, * p<0.1

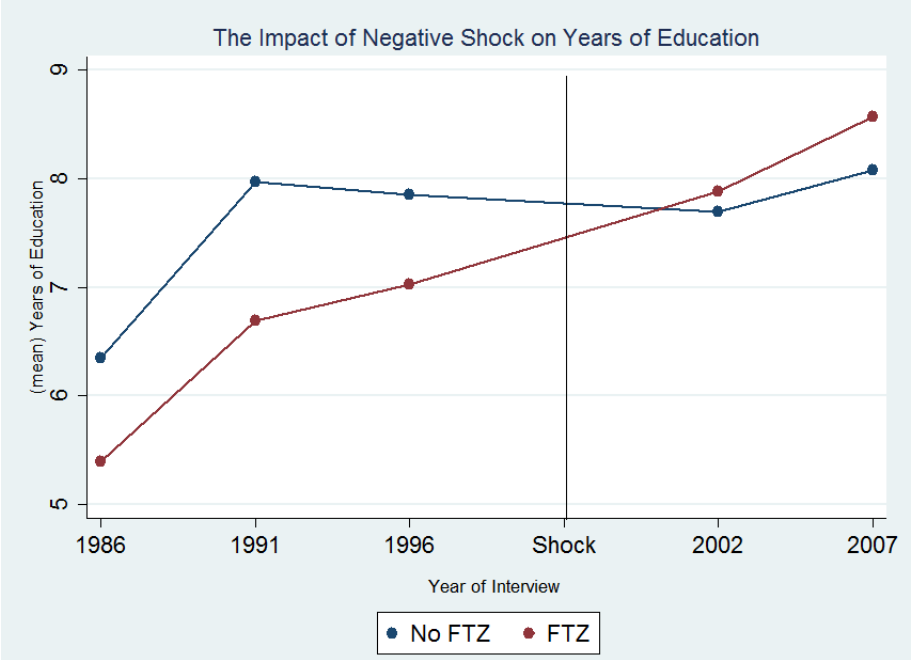
Robustness Checks for Negative Shocks Analysis

Figure A3



Notes: This graph plot the coefficients obtained from a regression of years of education on age at the time of the negative shock dummies, controlled by province time trends. The Y-axis shows the estimated coefficients and the X-axis shows the age at the time of the shock. Standard errors are clustered at the province level.

Figure A4



Notes: This graph plots the average years of education in each year of the survey before and after the negative shock. It shows that there is no evidence of different trends in schooling before 2000. The same pattern is also find if I plot average age of marriage.

Table A7

The Effect of Negative Shocks (including provinces with no FTZs)

	Years of Education	Age of Marriage	Early Marriage
	(1)	(4)	(5)
FTZ_p*$Shock_t$ (=1)	0.224	0.0277	0.0107
	(0.218)	(0.191)	(0.0210)
FTZ_p (=1)	0.0224	0.0462	-0.0214
	(0.150)	(0.151)	(0.0176)
$Shock_t$(=1)	0.213	-0.840***	0.0726***
	(0.186)	(0.152)	(0.0163)
Observations	65053	49337	65121
R-squared	0.235	0.109	0.061
Socioeconomic Controls	YES	YES	YES

Notes: I exploit a sample of provinces which was not included in none of my previous analysis (provinces that did not experience a free trade zones opening in any point in time). Since the negative shock was national and occur at one moment in time (in the year 2000), I make use of provinces with no free trade zones as control group. In this way I will compare the change in outcomes of places that have free trade zones with those that never experience an opening before and after the shock. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The Effect of FTZs Opening on Other Spouse Quality Measures

Table A8

The Effect of FTZ's Opening on Spouse Quality

	Lives at Home (=1)	Skilled Husband (=1)	Age Gap
FTZ (=1)	0.0807***	0.0929*	-1.036**
	(0.0139)	(0.0460)	(0.492)
Mean of Dependent Variable	0.92	0.4	6.4
Observations	14645	20144	15896
R-squared	0.016	0.210	0.042
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Province Trends	YES	YES	YES
Socioeconomic Controls	YES	YES	YES

Notes: Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

The Effect of FTZs Opening on Women Empowerment

The Effect of FTZs Opening on Women Empowerment Using Age Threshold

	Final Say (=1)	Violence (=1)	Spend (=1)	Earns More (=1)
FTZ (=1)	0.00200	-0.0324***	-0.0182	0.0980
	(0.0747)	(0.0111)	(0.0557)	(0.0806)
Observations	12178	39136	15794	5394
R-squared	0.027	0.042	0.178	0.036
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province Trends	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES

Notes: Independent variable is the opening of the industrial park that takes the value of 1 if the park opened when she was less than 16 years old. Province clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Results are robust to other group clustering (households, province*year and cohorts).

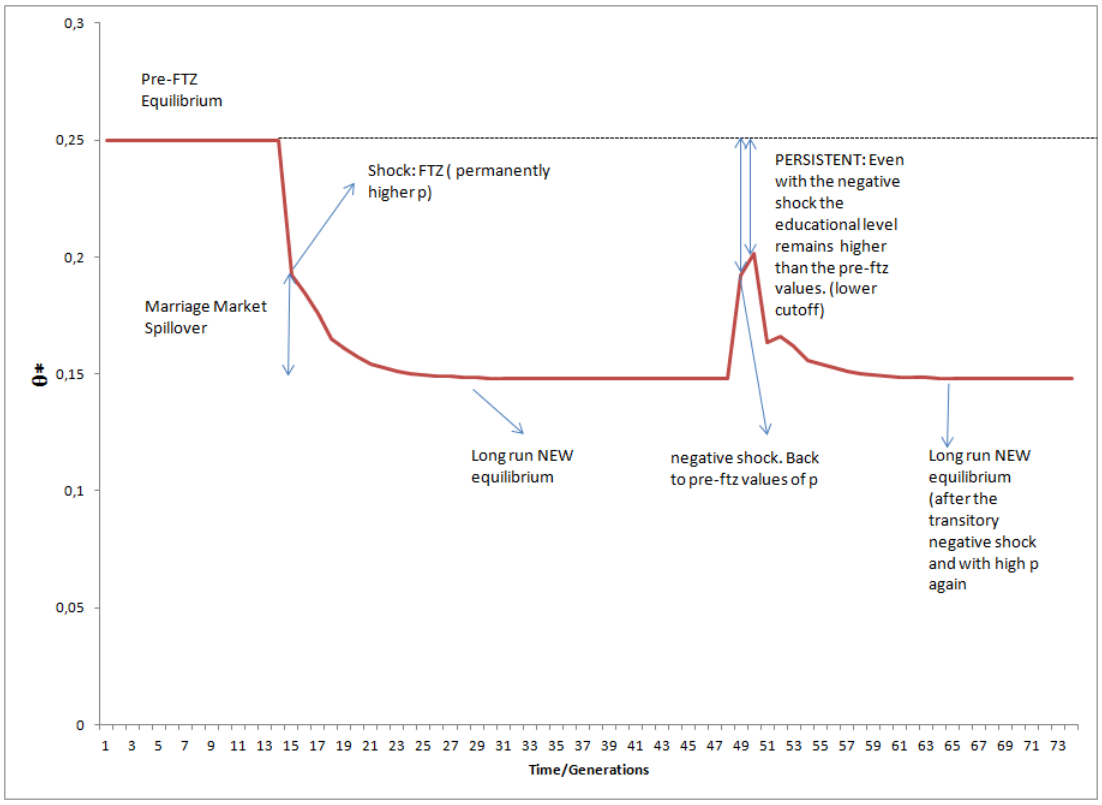
Theoretical Appendix

Equilibrium stability

So far I analyze the invest decision at every generation t. Since θ_t^* depends on θ_{t-1}^* it is important to analyze if after the economy is hit by a shock of any of the exogenous variables, the trajectory explodes or converges to a new equilibrium.

First, a equilibrium is defined by a level $\hat{\theta}$ (and thus $F(\hat{\theta})$) such that the proportion of high educated girls remains unchanged along generations. In particular, the economy is in equilibrium if $\theta_{t-1}^* = \theta_t^* = \hat{\theta}$. Taking P, W, p and m as exogenously given, the equilibrium is given when $\hat{\theta} = \left[\frac{P}{Wp+m}\right]^{1/(1-k)}$. For our purpose an important feature of this equilibrium is that a permanent increase in the probability of finding a job (p) yields the economy to a long run equilibrium with more girls investing in schooling ($\frac{\partial \hat{\theta}}{\partial p} < 0$).

Stability of equilibrium:

The equilibrium $\hat{\theta}$ is stable if and only if the parameter $k \in (0,1)$ and is unstable if $k > 1$. Hence, if $k \in (0,1)$, after a shock the trajectory of θ^* converges asymptotically to the new equilibrium $\hat{\theta}$.

$$\left|\frac{\partial \theta_t^*}{\theta_{t-1}^*}\right|_{\hat{\theta}} = \left|\frac{P}{(Wp+m)}.k(\hat{\theta})^{k-1}\right| = \left|\frac{P}{(Wp+m)}.k\left\{\left[\frac{P}{Wp+m}\right]^{1/1-k}\right\}^{k-1}\right| = k$$