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

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Abstract

Can temporary labor market opportunities shift developing countries to a "good equilibrium" in female education and associated outcomes? In this paper I exploit the sudden and massive growth of female factory 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 even relatively brief episodes of preferential trade preferences for export industries may have permanent effects on human capital levels and female empowerment. Focusing on a sample of provinces that established FTZs and exploiting variation in the opening of zones and age of women at the time of opening, I show that the FTZ openings led to a large and very robust increase in girls' education. The effect persists after a decline in FTZ jobs in the 2000s following the end of a trade agreement with the U.S. and an increase in competition from Asia. The reason appears to be that the increase in *some* girls' education changed marriage markets: girls whose education increased due to the FTZ openings married later, had better matches with more stable marriages, gave birth later, and had children who were more likely to survive infancy. In sum, the evidence in this paper indicates that labor markets can improve female outcomes in developing countries through general equilibrium effects in the education and marriage markets.

1 Introduction

Rapid periods of industrialization in developing countries have been characterized by increases in female labor demand in export manufacturing industries (Duflo 2012; Mammen and Paxson 2000). For instance, Heath and Mobarak (2012) suggests that in Bangladesh the increase in demand for female factory workers raised the returns to education, encouraging women to invest in human capital, delay marriage, and access the formal labor market. This paper asks whether such effects may persist even if the increase in labor market opportunities for women is only temporary. In other words, can a transitory improvement in labor

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market opportunities shift developing countries to a "good equilibrium" in female education and associated outcomes? If so, even relatively brief episodes of preferential trade preferences for export industries may have permanent effects on human capital levels and female empowerment.

This paper presents evidence that human capital investments are sustained even when labor market opportunities decrease. Specifically, using data from the Dominican Republic, I find that the expansion of the export manufacturing industry lead to a 26% decrease in female dropouts from school, an effect that is sustained up to 10 years after the removal of the main commercial tariff agreement with the US and the increase in competition from Asia. I argue that temporary increases in female factory jobs can lead to lasting improvements in female status through general equilibrium effects in the education and marriage markets. For instance, when women increase their schooling after a factory opens, they also delay marriage and have a lower chance of divorce. Thus, while individuals are initially more likely to make human capital investments because of larger economic returns, the benefits may persist because of changes to the marriage and labor market.

To study the long-term effects of female factory jobs on women's status, I exploit the sudden and massive growth in the textile industry, along with its subsequent decline. In the 1990s, textile manufacturing boomed as free trade zones (FTZs) opened.[1] Since textiles were the biggest source of formal employment for women–about 60% of workers were women–female employment rose.[2] However, in the 2000s, labor market opportunities for women decreased as the textile sector contracted due to competition from Asia, and female employment declined by about 45%; by 2008, about 70% of women who were displaced from the textile industry were still unemployed. Thus, the decline of FTZs in the 2000s provides insight into whether the effects are sustained in the long-term, even in the absence of these labor market opportunities.

This paper uses a difference-in-difference-in difference (DDD) empirical strategy. I compiled a new data set on FTZs' opening at the province level between 1986 and 2007. I use the timing and location of FTZs' opening as well as the age of women at the time of opening to isolate the impact of labor demand on education and marriage outcomes. Using only provinces that experienced an opening, this approach relies on province variation in FTZs' opening among cohorts of women who are plausibly unaffected by the openings as controls for potentially unobserved confounding factors. Thus, my estimates are identified using differences in the availability of female labor market opportunities among different cohorts of women living in the same province

[1] According to the *Consejo Nacional de Zonas Francas* (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."

[2] The share of women employed in tourism and agro-industry was only 29% and 19%, respectively (Castro et al. 1993).

and year.

I show that new opportunities for female employment led to a large and robust increase in women's educational attainment and age of marriage. The opening of an FTZ increases women's educational attainment by 0.3 years, mostly due to an increase in secondary school enrollment. In 1990, 46% of women in the Dominican Republic married before the age 18, the largest share in Latin America. In 2010, after the opening of FTZs, only 36% of women were married before the age 18. I corroborate these results with several other pieces of evidence. First, the pre-existing characteristics of women in each province do not allow one to predict the opening of FTZs. Second, I find that female labor force participation, women's educational attainment, school enrollment, and age of marriage do not have a clear trend before opening of FTZs, but increase afterwards. Third, while the opening of FTZs affects women who are less than 16 years of age at the time the FTZs opened, it does not affect older cohorts. In addition, the opening did not directly affect men's educational attainment. These estimates are robust to different data sources and to the inclusion of household fixed effects.

My results suggest that women increase their education level because additional schooling is rewarded in the labor market. The FTZs created significant demand for female labor, employing the majority of women over the period of analysis. Even though most of the jobs created by FTZs were unskilled, they were better-paying than other labor market opportunities. In equilibrium, I observe that most women working in FTZs have some level of secondary education higher than average educational attainment in other sectors. Given the better pay, women may have competed for these jobs by increasing their educational attainment. In addition, extra years of schooling may be rewarded if education works as a signal of discipline or responsibility during factory hours.

Due to a decline in the demand for textiles, the FTZ no longer provided the same job opportunities in the 2000s. When analyzing the negative shocks, I find that women still increase their educational attainment and postpone marriage in the absence of the economic returns in the labor market. While schooling and age of marriage are affected by the opening of FTZs, these outcomes do not revert back to their previous level after the negative shock. The evidence suggests that this may be because higher educational attainment among some women changes marriage markets. Due to the opening of FTZs, some women obtain more education and delay their age of marriage, changing the equilibrium in the marriage market. These women also match with a higher-quality husband, give birth later, and have children that are more likely to survive infancy.

The fact that new female factory jobs increased the share of educated women during the 1990s is particularly important to explain the persistence of effects. Even after the subsequent decline of female factory jobs, the larger share of educated women from previous period reduced women's penalty for delaying mar-

riage and increased the quality of marriage matches among educated women. In particular, women with secondary schooling or higher have a higher chance of being matched with a husband of their same education level or higher, while women with only a primary education are negatively effected in the marriage market. Therefore, even in the absence of labor market returns during the 2000s, young women still have an incentive to increase their education because of higher returns in the marriage market.

This paper contributes to the literature studying the effect of labor market opportunities on female education. In particular, my results are closely related to the literature examining how the effect of the expansion of Information Technology (IT) service jobs encouraged women to remain in school and delay marriage by increasing the economic returns to education (Oster and Steinberg 2013; Jensen 2010; Munshi and Rosenzweig 2006). To my knowledge, this paper is the first to present evidence that a temporary shock to labor markets, in this case the rise and fall of FTZs, can have a permanent effect on women's outcomes, which may be due to a change in the marriage market equilibrium. For instance, even after labor market returns decrease, women have an incentive to get more education so they can compete with the older, highly educated women already in the marriage market. Using a long panel, this paper exploits different sources of variation that are relevant for policy since they demonstrate the long-term effects for different cohorts of women.

The evidence in this paper suggests that increases in female educational attainment can produce positive externalities through the marriage market. It also provides evidence regarding the mechanisms driving these changes. In particular, delayed marriage is primarily driven by education rather than female labor force participation. Sivasankaran (2013) argues that a longer tenure in the textile industry reduces early marriage; this paper suggests that while the boom in textiles did increase women's participation, it is not the direct explanation for the delay in marriage age. This paper is also related to previous research that studied how the introduction of oral contraception in the US allowed women to remain in school and pursue longer-term careers without facing a penalty in the marriage market (Bailey 2010, 2006; Goldin and Katz 2002). Similarly, female factory jobs decreased the cost of marriage delay and altered the rankings of women as potential marriage partners, favoring those with higher levels of education.

Finally, this paper contributes to the trade literature studying the growth of export processing zones (Atkin 2012; Liberato and Fennell 2007; Schrank 2008; Raynolds 2002; Willmore 1995) by providing evidence on differential gender effects. Atkin (2012) finds evidence that the expansion of unskilled jobs at attractive wages increases school dropout rates for men of legal working age in Mexico. I come to the opposite conclusion when examining women in the Dominican Republic: access to well-paid unskilled jobs does not increase the opportunity cost of schooling for workers. This is likely because women are more prone to drop out of school

in order to get married, rather than join labor force. [3]

Overall, this paper provides the first evidence that temporary labor demand can move societies to a "good equilibrium" that persists even after job opportunities taper off. The evidence in this paper indicates that labor markets can significantly improve female outcomes in developing countries through general equilibrium effects in the education and marriage markets. While improving female labor market opportunities increases the economic returns to education and thus encourages human capital investments, other factors such as changes in the marriage market, social norms, or intergenerational effects might perpetuate these effects even in absence of economic gains. In particular, I provide substantial evidence that greater returns to education in the marriage market is an important channel for the persistence of effects. This is due to the fact that women have greater returns to education in the marriage market (and a smaller penalty for waiting to marry) if past generations also had high educational attainment.

The paper proceeds as follows: I provide information about FTZs, background on the Dominican Republic, and data in Section 2. Section 3 describes the empirical methods. Section 4 discusses the results on schooling and mechanisms. Section 5 presents the results on marriage, mechanisms, and some robustness checks. Section 6 examines the effect of negative female labor demand shocks and Section 7 concludes.

2 Background and Data

2.1 Background on Education and Early Marriage in the Dominican Republic

The Dominican Republic has historically been faced with a number of challenges pertaining female labor market participation. In particular, few women complete secondary school, often because they marry early. More recently, the prevalence of export manufacturing and the high level of female participation in this sector has made the Dominican Republic well-suited for an analysis of changes in the labor and marriage markets.[4]

The school system in the Dominican Republic is divided into three levels: 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 is compulsory, and Middle Level (Secondary education) covers students from 14 to 18 years of age, lasts 4 years and is not mandatory. According to data from the World Bank, at the secondary level, Dominican Republic is far behind other countries in Latin America. While the average gross enrollment rate for Latin

[3] In this way, the Dominican Republic is similar to the rest of Latin America–more than 70% of those who drop out of school due to labor force participation are men while 97% of those who drop out of school because of marriage, maternity or household activities are women (SITEAL 2013).

[4] 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.

America and the Caribbean was 87.2%, in the Dominican Republic it was about 60%. Moreover, only 40% of students in primary level continue to secondary education (Gajardo 2007).

One of the main reasons women drop out of school is early marriage. About 42% of women between 20 and 49 years-old married before the age of 18,[5] making the Dominican Republic the country with the highest female marriage rates for this age range in Latin America and the Caribbean.[6] Parents in the Dominican Republic often encourage their daughters to marry as a consequence of poverty and lack of labor market opportunities (ONE 2010). The social importance given to motherhood also may drive early marriages and early motherhood. 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 of the Dominican Republic have shown that young women have a higher risk of child and maternal mortality (Caceres 1998).[7]

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

2.2 History of Free Trade Zones in the Dominican Republic

In this section, I argue that the opening of FTZs was a national policy that was likely uncorrelated with province-specific female educational trends. In addition, I provide qualitative evidence that FTZs created widespread labor market opportunities for women that did not exist prior to the opening. Although most of the factory work was unskilled, it provided higher wages than other sectors. The women working in FTZs tended to be older and more educated, explaining why women increased their educational attainment even though most of the jobs were unskilled. Specifically, I examine the levels of education in FTZs, tourism and agriculture.

The process of opening FTZs started in 1969 in the province of Romana as part of a national policy that involved import substitution and export promotion.[8] 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

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

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

[7] In addition, a high percentage of married or in union women between 15 to 19 years-old in the Dominican Republic have experienced emotional, physical or sexual violence by their husband or partner (DHS 2007). Early marriage or union might also compromise their ability to negotiate the use of contraceptive methods. There is a higher incidence of HIV among women between 15 and 24 years that are married or in a union (ONE 2010).

[8] 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. firms, motivated by Asian competition and the need to reduce costs, started to establish companies for clothing assembly.

United States, such as the Caribbean Basin Initiative (Schrank 2008).[9]

In 1996, about 500 firms had factories in these zones, an average of 10 firms per FTZ (see Figure I).[10] FTZs became one of the main economic sectors, surpassing the agricultural sector. In 2001, exports from these zones accounted for 32% of the Dominican Republic total exports (Liberato and Fennell 2007). The free zones were the main generator of foreign earnings and generated 4% of GDP.[11] By 1995, more than 50% of the provinces had at least one FTZ. In 1970, there was 40,000 square feet of factory space, growing to 14 million square feet by the end of 1992.

During the period of analysis, the free zones were the main generator of employment in the country (Buitelaar et al. 1999). In 1996, employment in these zones represented 6% of the economically active population.[12] Between 1984 and 1994 employment grew at an average rate of 22% annually, creating a total of 149,185 jobs (see Figure II).[13] This rate was particularly high considering the unemployment rate was 20%.[14] For most of the workers, the alternative to working in FTZs was often unemployment or returning to village subsistence life (Madani 1999).

The development of FTZs was considered one of the primary reasons for the increase in women's labor market participation (Castro et al. 1993). About 60% of workers in the FTZs were women. This can be explained by employment in textile manufacturing, which was one of the main activities in the FTZs, employing 70% of the labor.[15] Most of these activities were labor intensive and required low-skilled workers (CNZF 2002).[16] Female jobs were concentrated in floor production positions. A survey showed that 57% of employers preferred to hire men for administrative and managerial posts (Castro et al. 1993). Nevertheless, in contrast with other FTZs in Latin America, the Dominican Republic had many supervisory positions held by women (Madani 1999).

According to Madani (1999), women became the unintended beneficiaries of FTZs, since many of them did not have access to 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%, respectively

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

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

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

[12]In contrast, the traditional manufacturing sector employed 2.6% of the economically active population.

[13]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% of the economically active population (CEPAL 1999).

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

[15]Other industries of importance include footwear, jewelry, assembly of medical and electronic components, tobacco processing, and data services and telecommunications.

[16]For example, in 2006, blue collar workers made up 84% of the workforce. The percentage of blue collars workers among women is higher than that among men (89% and 79%, respectively). 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%.

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

(Castro et al. 1993). Moreover, wages in these other sectors were lower than in FTZs. 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 suggested that the free trade zones were an important factor explaining the decrease in female poverty and unemployment during the 1990s (Willmore 1995; ILO 2013).[18]

The average wage in FTZs was higher than the average wage outside the zones (Madani 1999; Castro et al. 1993). FTZs in the Caribbean and in Central America paid 5%-20% higher salaries than domestic firms.[19] In addition to their wages, workers in FTZs were often paid bonuses based on productivity as well as payments for overtime and piece work (Romero 1995). According to a 1991 survey, the average monthly wage in FTZs was US$176.10, higher than wages for workers in the agro-industry and tourism industry (Romero 1995; Castro et al. 1993). Moreover, in the case of the Dominican Republic, even though most of the work was low skilled, the FTZs provided training courses on English, computer use, and sewing (Buitelaar et al. 1999).

Most workers had completed primary education and secondary education. Table I presents the percentage distribution of workers based on sex, education and economic sectors in 1991. Only 3% of female workers had no education. Even though most jobs for women were unskilled, when compared with agriculture and tourism, the FTZs had a higher share of women who obtained a university degree. Moreover, many authors have argued that free trade zones include workers with higher levels of education than other formal sectors (Safa 1998; Calzada et al. 2007; UNDP 2005). By the 2000s, about 90% of women working in free trade zones had a primary or secondary education. This evidence suggests that education might have been an important requirement for getting a job in the FTZs.[20]

2.3 Data

I use the Demographic Health Surveys (DHS) for the years 1986, 1991, 1996, 2002, and 2007.[21] 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 to 49 years old) and their young children under five years of age living in ordinary residential households. DHS surveys are

[18] Female unemployment rates are particularly high in the Dominican Republic (about 24%). The official definition of unemployment in the Dominican Republic 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 either no job opportunities or too many obstacles. This distinction was made to account for women.

[19] Atkin (2012) points out that most trade literature finds higher wages and larger returns to skill among workers at exporting firms (Frıas et al. 2009; Goldberg and Pavcnik 2007; Bernard et al. 1995).

[20] Education was not as important for men attempting to get a job in FTZs. 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).

[21] This covers all available years.

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 affected by an opening move between the time of the survey and the opening of the FTZ. I cannot rule out the possibility of migration, but the evidence discussed below suggests that this type of mobility is not driving the main results. Using the number of years that each woman lived in the area, I will show that results do not change to different samples specifications (such as considering only women who never moved). This is consistent with the fact that migration in the Dominican Republic occurs across municipalities in the same province rather than across provinces. Therefore, even if women moved they may have stayed in the same province.

Table II presents descriptive statistics for the sample. A total of 55,956 observations are available for the estimation. According to the marital status data, 76% of women are married or living together with their partner. On average women first have intercourse at the age of 17, marry at the age of 18, and have their first child at the age of 20. Women are also slightly more educated than men with 7.8 years of education compared to 7.3 years of education for men. Rates of enrollment in and completion of secondary school are low (about 46% and 24%, respectively). Of the 35% of the women that work, 5% work for a family member, 65% for a non-family member, and 35% are self-employed. Most women work outside the home (76%). The main occupations are sales, services, and domestic activities. In contrast, their husbands are often working in agriculture or skilled manual activities..[22]

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 I presents the evolution of the number of FTZs over the period. In 1986 there were about 10 FTZs which increased to 54 by 2007. On average, each firm has a total of 400 employees. Figure III depicts the evolution of FTZs across provinces over time. By 2010, about 75% of the provinces had opened an FTZ. Figure IV 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. I exclude the provinces in which a FTZ opened before 1986 since there is no variation.

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

In addition, I exclude provinces that did not experience any opening (those in white color on the map). Therefore, I exploit variation in the timing of FTZ openings as well as the age of women at the time FTZs open.

2.4 Geographic Location of FTZs

In my analysis I exploit exogenous variation in the timing of openings controlling for province and year fixed effects. This identification strategy is valid if time-varying characteristics of each province are not correlated with the timing of FTZ openings. However, it is possible that the industrial free zones were opened in places where female education was growing faster. In such a scenario, women may have increased their educational attainment for reasons other than the opening of a FTZ. In this paper, I focus on export industries, which tend to locate near ports or where land and inputs are available (Madani 1999).[23] I assume that these characteristics are not associated with changes in women's years of education and age of marriage. As a first approach to test this assumption, I follow 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 between 1986, when there was a large expansion of the free industrial zones, and the year an FTZ opened in each province.[24]

Table III reports the results of cross-province regressions of this new dependent variable "time to opening" on 1986 baseline characteristics.[25] Panel A reports the results for demographic characteristics, such as the proportion of women in different age groups, the proportion of households that own farm land, 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 or salary, the proportion of women working for their 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 treating the opening of free trade zones as exogenous. I also repeat the analysis with household characteristics such as type of residence (urban or rural), whether the main source of drinking water comes from piped water, type of toilet facilities, whether 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

[23] Interviews with FTZs' administrators also suggest FTZs were located based on these factors.

[24] In the next sections I will provide further tests of these assumptions. For example, I show that the introduction of FTZs in future years does not affect current schooling.

[25] For this analysis, I did not include those provinces in which an FTZ opened before 1986.

these characteristics explain the allocation process.

Local governments may have also 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. Nevertheless, I also use data on construction licenses from 1986 to 2012 in order to identify whether FTZs opened in places that were more urbanized first. I estimate the effect of the growth in construction licenses in the past two years on the opening of a free FTZ in the province. I find that the past growth in construction licenses does not predict the presence of a FTZ.[26] Nevertheless, unobservable characteristics may still be correlated with the opening of FTZs. To mitigate this issue, I also include province time trends in the main specification and provide a cohort level analysis, an event study analysis, and a falsification test in the following sections.

3 Empirical Framework

I exploit the boom in free zones in the Dominican Republic as an exogenous shock to female labor market demand. Figure V plots the proportion of women working with respect to the year of opening. The x-axis indicates the number of years before or after the FTZ opened.[27] I observe that female labor force participation was increasing after the FTZs opened. I use two identification strategies that exploit this variation. First, I use a difference-in-difference strategy comparing educational attainment across provinces that had FTZ open at different times. Second, I exploit differences in the age of women at the time of FTZ openings using a difference-in-difference-in-difference approach. In this way, I am able to assess which age group was most affected by the policy.

3.1 Difference-in-difference (DD)

In the first approach, I use the timing of FTZs' openings to isolate the impact of labor demand on women's education and age of first marriage. The provinces chosen for analysis are all provinces in the country with at least one FTZ. I proceed to estimate the effects of FTZs with the following equation:

$$\begin{aligned} Outcome_{i,h,p,t} =& \alpha + \beta FTZ_{p,t} + \delta Province_p + \pi Year_t \\ &+ \theta Trend_p + \gamma X_{h,p,t} + \nu X_{p,t} + \varepsilon_{i,h,p,t} \end{aligned} \tag{1}$$

$Outcome_{i,h,p,t}$ is the outcome of women i in household h in province p and year t. $FTZ_{p,t}$ is a dummy variable that indicates the existence of an FTZ in province p in year t. I also include year and province

[26] Results are available upon request.

[27] The x-axis variable was constructed by subtracting the year of the opening from each year of the survey.

fixed effects, as well as province time trends. Using province fixed effects I am able to control for time-invariant characteristics of the province. $Trend_p$ are province linear time trends to control for any omitted characteristics that vary linearly over time within the province. $X_{h,p,t}$ 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. $X_{p,t}$ is the number of construction permits per province per year. Moreover, in some specifications, I also include cohort fixed effects and province cohort trends. The goal is to provide precise estimates of β, the causal effect of FTZs. In all the models, the standard errors allow for potential correlation within province and province year clusters.

3.2 Difference-in-difference-in-difference (DDD)

As a second strategy, I exploit variation in the age of women at the time of the opening using thresholds in key ages. In the Dominican Republic, basic education is compulsory for those 6 to 14 years-old. Secondary education, which is also public, is not compulsory. Assuming that the FTZs affect women who were less than 15 years of age, I can exploit variations across cohorts and across households. Alternatively, I examine those under 16 years of age, the legal working age. Moreover, these ages are when most dropouts occur and when the decision to attend high school is made. By using older individuals as a control group, common confounding factors are removed from the estimates and the effects of the FTZs are more precisely measured. In other words, this strategy compares the outcomes of women who are affected by the opening to the outcomes of women who are not affected by the opening (first difference) in provinces with an "earlier" FTZ versus provinces with "later" FTZ (a second difference) over time (the third difference). I estimate the following equation:

$$\begin{aligned} Outcome_{i,h,p,t} =& \alpha + \beta_1 FTZ_{p,t} + \beta_2 age6to16_i + \beta_3 FTZ_{p,t} \times age6to16_i + \delta Province_p + \pi Year_t \\ &+ \theta Trend_p + \gamma X_{h,p,t} + \nu X_{p,t} + \varepsilon_{i,h,p,t} \end{aligned} \tag{2}$$

Now Equation 2 is identified from joint variation in outcomes in three dimensions: i) provinces that opened FTZs relative to others, ii) after the FTZ opening relative to before and iii) cohorts most affected by the opening relative to other cohorts of young women.

This estimation strategy addresses at least three important endogeneity problems. First, there is a strong association between age and schooling. As a result, comparing the schooling of women less than 16 years old to those over it raises some concerns. This method, however, alleviates this issue because it also

compares outcomes of 16-year-old in provinces with "earlier" FTZs to outcomes of 16-year-old in provinces with "later" FTZs. Also, this approach mitigates any concern coming from differences between provinces because it compares individuals of different ages within provinces within FTZs. This technique controls for the potential endogeneity of FTZs opening by differentiating over time. As a result, permanent differences in the characteristics of provinces are taken into account.

4 How Can Female Factory Jobs Change Education for Women?

This section discusses the results of the two identification strategies, potential mechanisms for which schooling is affected by the emergence of female factory jobs and presents a framework to understand the results behind the education effects. The results imply that the increase in female factory jobs led to larger returns to education, creating an incentive for women to increase their educational attainment. While school age women are affected by the opening of FTZs, there are no statistically significant effects for women who were older than 16 years. This is consistent with the fact that most of women tend to drop out of school during high school in order to get married. In addition, I demonstrate that the results are unlikely to be driven by migration, income or government investments in education.

4.1 Main Findings

Table IV presents the results of estimating Equation 1. I find that the presence of a FTZ increases educational attainment by 0.4 years , equivalent to an increase of about 5% relative to the mean (7.8 years). This result is robust to the inclusion of province time trends and other covariates. In addition to increases in primary, secondary or university education, there also may have been an increase in job training (which may be included in educational attainment since it is a self-reported measure). Therefore, more insight into what level of education the FTZs were affecting is obtained by examining the impact on school enrollment. Columns 5 and 6 present the estimates of the effect on school enrollment and completion. Enrollment in secondary school increases by 4 percentage points. This is an increase of about a 9% relative to mean enrollment. I do not find any effect on primary school enrollment or completion.

Figure VI decomposes the effects by age and shows that most effects are driven by women who were of schooling age. About 50% of the sample was less than 16 years of age at the time of the 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 an FTZ (a 95% confidence interval is plotted with vertical lines).[28] Each dot summarizes the effect of the between-province variations for a given cohort and can be interpreted as an estimate of the

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

impact of the program on a given cohort.[29] For example, a woman aged less than 16 at the time of the opening receives 0.3 additional years of education if she is in a region with FTZs.[30] I find that most of the results decrease as the age of the woman at the time of opening increases.[31]

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 1980s was 17 years of age and most women tend to drop out of school in order to get married.

Instead of testing whether each coefficient is equal to 0 for ages that are over 16, I can impose this restriction and estimate a DDD specification. Since most of the effects are driven by women who are less than 16, the omitted group is now composed of women aged 16 or more at the time of opening. Table V presents the DDD results. Consistent with the results presented in Figure VI, the estimates in column 1 suggest that the opening of an FTZ increases the education of the youngest women by about 0.3 years. In column 2, I present the effect on school enrollment. As before, female labor market opportunities increase enrollment in secondary school by about 3 percentage points but have no effect on primary school enrollment.[32] I also find effects on primary school completion. The opening of an FTZ in a province increases 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.

In order to provide additional insight into the magnitude of these results, I also examine the effect on school dropout rates. Assuming that women between 13 and 16 years of age are at risk of dropping out, an increase of 0.3 years of education is equivalent to a 24% reduction in the dropout rates.[33] About one fourth of the young women who would have dropped out of school are induced to continue their education due to the opening of FTZs (average size of 400 workers per firm).[34]

[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. Moreover, if I add extra interaction terms with older cohorts (dummies for 30-40 and 50-60 years old) I find that effects are close to zero and non significant.

[30] This effect is slightly higher than what was found in Duflo (2001), where the effect of one school built per 1,000 children increased the education of exposed cohorts by 0.2 years. In the case of FTZs, one FTZ is equivalent to 10 jobs per 1,000 inhabitants

[31] Results are robust to FWER p-values adjustments to account for multiple hypothesis testing.

[32] These results are similar to the effect found for other developing countries. For instance, ITES centers in India increased enrollment by about 4.1 percentage points (Oster and Steinberg 2013). Jensen (2010) found an increase of 5.2 percentage point due to an increase in recruitment services for call centers that employed women. Additionally, conditional cash transfers programs increased schooling by about 3 percentage points (Schultz 2004).

[33] 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.

[34] This is comparable with the results found by Oster and Steinberg (2013), where about 26% of out-of-school children are enrolled one year after the introduction of IT centers.

4.2 Mechanisms Behind the Increase in Education

I examine three mechanisms by which FTZs increase the years of education: income, infrastructure investments, and labor market economic returns. First, female factory jobs may generate a direct income effect: as women have access to the labor market, they have more earnings and thus they can increase the education levels of their children. Second, FTZs may have promoted government investments in infrastructure and thus, an expansion in the number or size of schools.

A third possible explanation is that women increased their secondary school attainment because they expected FTZs to reward additional schooling (returns to education channel). Even though most of the FTZ' s 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 these jobs is a possible explanation for the found education effect. 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.

Table VI presents the results. I provide evidence that infrastructure investments and changes in income explain only a small fraction of the increase in schooling. Column 1 shows that larger FTZs are not associated with larger educational effects, suggesting that income alone cannot be explaining all the results. I also find an increase in schooling even when there are no women is working in the household (column 3). Given that education is public in the Dominican Republic, lack of income to pay for the cost of school is not a major issue. These results are consistent with other research suggesting that women do not continue their schooling due to marriage and childbirths (ONE 2009). Nevertheless, in the robustness check section, I will use other surveys that have data on income to directly control for this channel. In column 2, I find that the results are robust to adding controls for construction permits, which serve as a proxy for government investments in education. In addition, I also check whether there is an effect for men who were of schooling age. If the results are driven by investments in the number of schools or any other improvement in education, male educational attainment should also be affected. I test this using other surveys that contain information about men's education and find no increase in male educational attainment.[35]

Finally, I check the increase in economic returns to education channel by analyzing whether the gap in labor force participation between women with high education and women with low education increases after the FTZs open. I find that there is a greater probability of working when women have more than 8 years of education after the FTZs open. Before the FTZs open, about 33% of highly educated women were working in contrast to 43% after the opening. In relation to the type of jobs, after the FTZs opened there is a greater

[35]In Appendix A I provide more information about these other surveys.

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 more employment choices. Moreover, in equilibrium, I observe that most women working in FTZs had some level of secondary education. Furthermore, previous evidence shows that a large portion of wages was based on workers' performance likely making education important.[36]

This mechanism is in line with previous literature that suggests that the introduction of new local job opportunities changes the perceived and actual returns to schooling (Oster and Steinberg 2013; Jensen 2010).[37] Although most of this literature focuses on high-skilled jobs, Heath and Mobarak (2012) also provide evidence that the garment industry expansion in Bangladesh increased schooling for women, suggesting an increase in returns to education even if the female labor opportunities are low-skill.[38]

4.3 Theoretical Framework

This section illustrates how female factory jobs may have affected women's schooling and marriage behavior. First, the increase of labor market opportunities due to the opening of a FTZ changes the perceived returns to education. Consequently, the greater number of women investing in schooling and thus delaying marriage may reduced the penalty for early marriage. The key empirical predictions of this model are that female factory jobs increase educational attainment (in particular secondary or higher levels) and age of first marriage or union.

Consider a population of risk-neutral women 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 $\theta \in \Theta$.[39] Each woman 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 women have to decide their level of schooling. For simplicity, I assume that each woman of each generation/time(t) has to decide between two levels of schooling $s \in [1; 2]$ which I refer to as basic education or high education.

Lifetime earnings of woman i from generation t in the labor market, w_{it}^L , are increasing with the woman'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

[36]Interviews with workers at FTZs also suggest that these jobs demanded female workers with high levels of education. One reason stated is that education is associated with discipline and responsibility.

[37]Due to the lack of data on the exact location of households, I cannot assess whether the effects are local and therefore driven by women who lived close to the factories. In addition, I cannot disentangle whether effects are driven by better information about jobs opportunities. Nevertheless, given that FTZs were big and provinces in the Dominican Republic are small, it is likely that the effects will extend to a larger geographical area such as a province level.

[38]The returns to education channel may come from parental and student responses. In the case of young girls (especially those in primary school), the increase in female factory jobs may have changed parent's behavior and caused them to enroll their daughters at school. In the case of older girls (13-16 years of age) it may have changed female student's behavior.

[39]The main conclusions remain unchanged if women are risk-averse.

in η_{it}:

$$w_{it}^L = w(\eta_{it}) = \omega_t + W_t \theta_{it} s_{it} \tag{3}$$

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 woman's innate talent and her schooling level. Then effective talent of a woman from generation t is given by $\eta_{it} = \theta_{it} s_{it}$.[40] For instance, if women choose basic education ($s = 1$), then effective talent coincides with innate talent. Note that in my framework education is complementary to ability, and will ensure that high-ability women are "positively selected" into schooling.

I assume that there are frictions in the labor market such that, when each generation of women make their schooling decision, these women are uncertain about their chances of finding a job in the future. In particular, I assume that a woman from generation t finds a job and receives lifetime earnings according to Equation 3 only with probability p_t. With probability $(1 - p_t)$ she stays out of the market earning zero profits. Expected payoffs in the labor market are given by:

$$UE_{it}^L = p_t(\omega_t + W_t \theta_{it} s_{it}) \tag{4}$$

Once she finishes all levels of pre-marital formal education (s), she 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 affects marriage prospects. On the one hand, conditional on age, women with higher effective ability might be able to find better matches. On the other hand, women who invest in schooling access the marriage market later and may have a reduced list of candidates from which to choose. Despite the fact that I only model the wife arm of the 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:

$$m_{it} = m_t s_{it} \theta_{it} - P_t s_{it} \tag{5}$$

As in Bourguignon et al. (2009), investments in schooling generate returns in the marriage market given by $m_t > 0$ because education can help women find a better husband and thus extract more utility from marriage. However, the women that invest in the pre-marital education face a penalty in the marriage market for arriving late that reduces the total payoff by $P_t > 0$. Notice that, up to this point, decisions in each generation t are independent of previous decisions. We will relax this assumption in Section 6 to model

[40] 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.

persistence.

At generation t, women have to decide whether to invest or not in schooling. The expected utility for women that decide not to invest $s = 1$ is given by:

$$EU(s=1)_{it} = p_t(\omega_t + \theta_{it}W_t) + m_t\theta_{it} - P_t \tag{6}$$

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

$$EU(s=2)_{it} = p_t(\omega_t + 2\theta_{it}W_t) + 2m_t\theta_{it} - 2P_t \tag{7}$$

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

$$EU(s=2)_{it} = p_t(\omega_t + 2\theta_{it}W_t) + 2m_t\theta_{it} - 2P_t \geq UE(s=1)_{it} = p_t(\omega_t + \theta_{it}W_t) + m_t\theta_{it} - P_t \tag{8}$$

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

$$s = 2 \iff \theta_{it} \geq \theta_t^* = \frac{P_t}{(W_t p_t + m_t)} \tag{9}$$

where I define $\theta_{it} = \theta_t^*$ as an individual from generation t who is indifferent between investing in schooling or not investing. The proportion of women 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 the labor market W, more job opportunities p, or a greater skill premium in marriage market m, will encourage schooling.[41] In Appendix D I analyze the stability of the equilibrium.

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

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 the labor market, less gifted women have much more to gain if they quit their career and arrive first to the marriage market. On the other hand, more talented individuals 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 will also be willing to invest in schooling.

The empirical results examining the effect of FTZ on educational attainment are consistent with this framework: FTZs may impact schooling decisions by increasing the probability of getting a job in the future

[41] 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.

(p) or by increasing the wage premium (W).[42] Not only do years of education increase after FTZs open, but there also are more women enrolled in higher levels of formal education in line with Proposition 1 of the model.

5 What Are the Effects of Female Factory Jobs on Marriage?

One implication of the framework presented in the previous section is that the opening of free trade zones have a positive impact on girls' pre-marital education and delay the age at which women marry. In this section, I provide evidence that female factory jobs increase the age of marriage and reduce the probability of marriage before the age of 18. In addition, I show that the same cohort of women that increase their educational attainment also marry later. Furthermore, the results in the marriage are not driven by an increase in female labor force participation. In particular, women increase their educational attainment before marrying and participating in the labor market. Finally, I provide evidence that delaying marriage has positive effects on both infant and mother health including lower child mortality and less domestic violence.

5.1 Main Findings

I start by estimating Equation 1 by age groups using $AgeMarriage_{i,h,c,p,t}$ as the dependent variable, which is the reported age at first marriage or unions. Figure VII plots the coefficients of the interaction of treated provinces with age at opening dummies. As for the education outcomes, most of the effects are driven by younger cohorts. This suggests that one possible mechanism by which women increase their age of marriage is by staying in school longer. The lack of results for women who are not at school at the time the FTZs open is consistent with the context of the Dominican Republic. Data from 2002 census shows that marriage is the main variable explaining dropout rates among women under the age of 18 (ONE 2009). About 80% of women married within 2 years after stopping their studies. This is consistent with a framework where increasing educational attainment is equivalent to marrying at an older age. I examine the mechanisms explaining the increase in age of marriage in the following section.

Table VII presents the DDD and the results are similar to the ones presented graphically in Figure VII. I find that FTZs increase the age of marriage by 1.2 years for those not married before the FTZ opened. I also estimate a similar model replacing the dependent variable with a dummy that takes the value of 1

[42] While I do not have data on wages, I test whether those women who increased their years of education (in the affected cohorts) have a higher probability of getting a job in the future and I find an increase of about 4 percentage points. In addition, Jensen (2010) shows that the mean earnings of workers who complete secondary school are over 40% greater than those of workers who only complete primary school in the Dominican Republic.

if the woman was married before age 18.[43] I find that the probability of early marriage declines by 10 percentage points for the youngest cohorts, representing a change of 21% from baseline. This result is especially important in the context of the Dominican Republic given the high rate of early marriage.

5.2 Mechanisms behind the effect on marriage

I assess the importance of two channels through which the opening of FTZs may have increased the age of marriage: women's labor market participation and education. One could argue that women postpone marriage in the presence of better labor market opportunities because the opportunity cost of marriage is higher. 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 VII, column 7 presents the results from estimating equation 2, but now the dependent variable is a dummy variable that indicates whether the woman is working at the time of the survey. For younger cohorts, the opening of factories increased the probability of being employed after finishing their studies by 3.5 percentage points. Therefore, women who were of schooling age at the time of the opening are also more likely to be employed in the future.

In addition, I checked which cohort of women responded to the labor market demand in the period immediately after the opening of factories. The results demonstrate that women who were older than 25 at the time of the opening increased their labor force participation in the short run.[44] Therefore, it does not seem to be the case that younger cohorts drop out of school in order to participate in the labor market and then get married when they are older. In addition, the fact that there is no effect on marriage for older cohorts (who are the ones that work in the factories at the time of the opening) suggests that labor force participation is not the main mechanism for the delay in the age of marriage.

I also estimate a similar model to Equation 2 that includes the proportion of women who work as a control variable. The coefficient on female factory jobs does not vary much (see Table VII, column 2). This suggests that changes in women's labor force participation are not the main channel driving the change in early marriage.

Another possible channel through which the FTZs might have delayed the age of marriage is through education. On the one hand, increasing educational attainment 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 of school to get married.

[43] 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.

[44] I do this by interacting the treated province dummy with age at opening dummies.

I examine the age of marriage of women with different levels of schooling and I find a positive correlation between higher years of education and the age of marriage (Figure A4 in Appendix C). While the average age of marriage for a woman with no education is 16, for those with secondary education or higher it is 20. This suggests that marrying early and obtaining 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) have shown that women who invest in their career also tend to 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 FTZs becomes smaller.[45] This suggests that the education channel is responsible for delaying the age of marriage. Moreover, the fact that I find that the opening of FTZ affects the proportion of women working might also be partially explained by this education channel. As I discussed previously, most women who are working are also more educated.[46] 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.

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.

5.3 Robustness Checks

This subsection checks the robustness of the results by estimating the effects for populations that should not be affected by the opening, such as women who were already married women by the time of the opening (Table A1) and men (Table A2). Moreover, it shows that results are robust to other specifications including quadratic time trends as well as different samples. Finally, it shows that results are robust to using other data sources (Figure A2).

Table A1 in Appendix A shows that there is no statistically significant effect for women who were already married. This is consistent with the previous results that find FTZs only affected women who were younger than 16 and most women marry after this age. Since the FTZs also employed men, it could be the case that women marry later because men are now part of the labor force or also increasing their educational attainment. Also FTZs may have increased earnings in the overall province and thus increase not only female education but also overall schooling levels. I estimate whether men's education is affected by the opening of FTZs and find no direct effect (Table A2). Moreover, this finding provides further evidence that the effect

[45] As a robustness check, I estimate all the specifications of this section using $EarlyMarriage$ and using the DD specifications and results do not change. By increasing their years of education, women are less likely to marry before the age of 18. Using the DD specification I find larger effects on female labor force participation than when I estimate the DDD. This is expected given that women who were older than 25 were the ones responding to the increase in female factory jobs during the first years after the opening.

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

found in education is not mainly driven by an increase in earnings in these areas.

As another robustness check, I include quadratic trends when estimating equation 1, and the results do not change. Moreover, limited dependent variable models yield nearly identical results.[47] I also exclude from the analysis provinces that contain the country's major cities, such as the National District, Santo Domingo and Santiago. I do this to verify that my results are not driven by provinces where many factories are located. Table A3 in Appendix A presents the results and estimates are similar.[48] Finally, using data on educational attainment from the Inter-American Development Bank surveys for the years 2000-2012, I rerun the estimations.[49] Figure A2 in Appendix C presents the results. I find consistent estimates: FTZs increased educational attainment by about 0.25 years for younger cohorts. Additionally, when controlling directly for labor income of the household, and results are similar (see Table A4). Again, this is consistent with the fact that in many developing countries it is not the lack of income that prevents women from pursuing higher levels of education, but rather other factors that do so.

5.4 Possible Concerns

The two main concerns regarding the validity of the identification strategy are the endogenous mobility of women who move after the opening and the possibility of pre-existing trends in education in the places where the FTZs opened first. In this section, I provide evidence that migration is not the main mechanism driving the results and that there was no increasing trend in female education and marriage in the period before the openings.

The main results could be biased due to selective migration into the provinces after the opening of an FTZ. Although most of the FTZs tend to hire local women and most migration in the Dominican Republic occurs at municipality (rather than the province) level, it is still possible that at least some of the 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, the main parameter could be overestimated. To address this concern, I restrict the sample by eliminating those individuals that moved to the area after the free industrial zones opened. Results are presented in Table A5, column 1 and do not change under this new specification, suggesting that selective migration is not an important concern.

There also may be concern that people moved to provinces where they were expecting factories to open. In order to address this, I did not include those who moved to the area within two years of the opening in

[47] Results are available upon request.

[48] Results are also unchanged if I estimate the DDD specification.

[49] More description about the procedure of these survey is provided in Appendix A. Using these surveys I also estimate the effect of FTZs on men who were at schooling ages at the time of the opening and I find no effect.

my sample. In contrast with the above specification presented in column 1, column 2 presents the results for the sample excluding recent movers. Again the results hold under this new specification.

Rather than restricting the sample, I add a dummy variable for women who move. I find that the dummy coefficient is negative and significant at a one percent level. However, the effect of opening FTZs remains consistent with the baseline estimates, suggesting that migration is not a concern. Moreover, since movers are less educated than non-movers in my sample, this could only bias the results downward.

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 a woman's education than opportunities she has 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 FTZs, then openings at 16 or older should be stronger predictors of a woman's educational attainment. Results of this estimation were presented in Figures VI and VII and I find smaller and non significant effects for women who were 16 or older at the time of the opening.

Moreover, if migration is driving the results I would find greater effects on the outcomes of interest in places where more jobs were available. In order to check for this bias I rerun all my specifications, including the number of industrial parks as a control variable in each province. I find not only does the magnitude and significance of the results not change but the number of industrial parks is not a significant predictor of the outcomes.

Finally, I construct migration rates for each year from 1986 to 2007 using the year that individuals migrated to the 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 housing facilities. Thus, if migration is a concern, it leads to underestimation of the results. Nevertheless, I estimate whether the FTZs affected migration. I estimate Equation 1 but using $Migration_{p,t}$, the proportion of women that move in year t in province p, as the dependent variable. 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 FTZ opening caused fewer than two migrants to move. This finding suggests that the economic significance of the effect is close to zero. Moreover, once I include socioeconomic controls, I find that the opening of FTZs has no effect on migration rates. Overall, migration results suggest that even if FTZs affect migration rates, this factor is not the main mechanism affecting education and marriage.[50]

As already discussed above, another central threat to the validity of the estimates is the possibility that

[50]All the results of this section hold if using *EarlyMarriage* as the dependent variable. They also hold using the DDD specification. Moreover, under the DDD estimates there is no significant effect of migrants on the outcomes of interest.

FTZs anticipate educational attainment increases rather than causing them. For instance, FTZs may have located in areas that were expected to have a highly educated female workforce. In this section I use three approaches to check that the results are not driven by pre-existing trend in the places where the FTZs opened first. First, I construct a 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 vice versa, I should find little evidence of a pre-trend in the outcomes of interest prior to the FTZ opening. Third, I compare women that belong to the same household using age thresholds. Using the three different approaches, I find no evidence of pre-existing trends in education.

My first approach to deal with this concern is to construct falsification tests. First, I pretend the FTZs opened one, two, or three years after the real opening in each province and then use only post-treatment data. Second, I pretend the FTZs opened one, two or three years before the real opening in the same place and then only use pre-treatment data. I rerun Equation 1 using these false treatments and find no significant effects on the outcomes of interest.[51]

The estimates presented in previous sections suggest that the effect of FTZs 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 III, I have showed that the year of opening is not correlated with baseline characteristics. However, there still may be a concern that the results are driven by trends in province education and marriage outcomes that are correlated with the opening of FTZs 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:

$$\begin{aligned} Outcome_{i,h,p,t} =& \alpha + \sum_{i=-4}^{5} \beta_i(\tau_{p,t} = i) + \delta Province_p + \pi Year_t + \theta Trend_p + \rho Cohort_i \\ &+ \mu Province * Cohort_p + \varepsilon_{i,h,p,t} \end{aligned} \tag{10}$$

where τ_{pt} denotes the event year, defined so that $\tau = 0$ for the year the FTZ began operations in that province, $\tau = 1$ for one year after the FTZ began operation, and so on. For $\tau \leq -1$, households were untreated by the FTZ (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.[52] Figure VIII plots the event and year coefficients from estimating Equation 10 on age of marriage, years of education and secondary enrollment. The results support the validity of the identification strategy, showing

[51] Results are available upon request.

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

an absence of a strong pretrend and evidence of a trend break after FTZs opened, increasing the years of education and age of marriage for women.[53] This evidence suggests that potential confounders would have to mimic the timing of the FTZs' expansion extremely closely.[54] In addition, the similar timing of effects on education and marriage provides further evidence that women might be delaying their age of marriage by increasing their years of schooling.

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 woman in the whole sample was 16 years of age and then I subtract the year in which the FTZ opened. For instance, if the new variable takes the value of 1 it means that a woman was 15 years old when the FTZ opened and therefore had only one year of treatment (since after 16 should not be treated). If the variable takes the value of -1 it means the woman was 17 years of age when the FTZ opened and therefore should not be affected. Figure IX presents the results. The estimates are consistent with the DDD estimation: I found an increase of about 0.3 for those women that were less than 16 years of age at the time of opening.

Finally, since the DHS surveys cover 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 who were less than 16 years of age with those who were more than 16 years old.

I find that results do not change under this new specification. By using household fixed effects, the results are consistent with the previous findings – the FTZs reduce the probability of early marriage, increase educational attainment, and increase enrollment in and completion of secondary school (see Table A6). Although estimates are higher due to potential differences between women of the same households (such as differential parenting behavior) and changes in the sample (it only considers households were there is more than one woman), the estimation results using this specification are similar to previous estimates.

Overall, results from different approaches (differences in differences, difference-in-difference-in-differences using age at opening, event study analysis, and household fixed effects) provide strong evidence that the effect of female labor market opportunities created by FTZs on schooling and marriage is causal.

5.5 Consequences of Improving Schooling and Delaying Marriage

In the previous analysis I provided causal evidence that FTZs' opening affected schooling and marriage. In this section, I explore how FTZs affect health outcomes by decreasing the chances of early marriage

[53] This is consistent with Oster and Steinberg (2013) who find effects on school enrollment an year after the introduction ITES centers in India. In a similar way, the rapid response in schooling could be explained by older girls (those who were in high school).

[54] Results hold if I use $EarlyMarriage$ as the dependent variable.

and increasing education. Early marriage increases the probabilities of early pregnancies, child mortality, and domestic violence (Royer 2004; Jensen and Thornton 2003; Singh and Samara 1996; Senderowitz 1995). Additionally, the literature has also stressed the role of education as a key determinant of infant health. From a theoretical perspective, education increases permanent income, decreasing the optimal number of children and increasing investments in each child (Becker and Lewis 1973; Willis 1973; Mincer et al. 1963). Furthermore, education may increase women's knowledge and access to information about healthy pregnancy behavior (Grossman 1972).

Table VIII presents the results from estimating Equation 2 using age at first birth as the dependent variable. The results are similar to those for age of marriage – the opening of an 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 FTZ reduces the probability of teenage births by 9 percentage points. This finding is particularly important in Latin America and the Caribbean, which is the only region of the world where the rate of early births has risen over the past 30 years. In addition, recent research suggests that most of these early pregnancies were planned and young women did not have interest in furthering their education (Nslund-Hadley and Manzano 2011).

I also check whether the presence of an FTZ affects the number of desired children and the probability of having a child out of marriage. I find that a FTZ decreases the desired fertility by about 4% from the baseline (3 children). I measure out-of-wedlock births as those that occur before the year of marriage or among never-married women. I find no statistically significant effects on this outcome. This finding is consistent with the fact that women generally get married to become mothers. I also find that the FTZs increase the age women first have intercourse by 0.7 year.

Next, I study the effect of FTZs on the probability that the first child is alive at the time of the survey.[55] In the sample, late marriage is positively correlated with the probability that the first child will be alive.[56] Therefore, by increasing women's schooling and age of marriage, improving labor markets for women might decrease child mortality. Basic estimates using only the variation in the timing of FTZs' openings implies that child mortality decreases by about 3 percentage points. In addition, I find no effect for those women who married early. Column 7 presents the DDD estimates. Although results are smaller, they are still positive and statistically significant . The opening of FTZs increases the chances that a child is alive by 1.3 percentage points even after controlling for female labor force participation and the socioeconomic characteristics.

Finally, several studies have suggested that increasing women's opportunities in the labor market can

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

[56] Late marriage increases the probability that the first child is alive by 1.2 percentage points. 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.

change a woman's relative position in the household. It is not clear whether improving the labor market opportunities 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 the women's outside options in the household.[57] I analyze the effect of the FTZs on the following outcomes: $Spend_{i,h,c,t}$, which indicates whether the respondent decides how to spend the money in the household; $FinalSay_{i,h,c,t}$, which indicates whether the respondent has the final say on her own health care, visits to relatives, and food purchase; and $Violence_{i,h,c,t}$, which indicates whether she justifies domestic violence.[58] While I did not find evidence that female factory jobs increase women's power in relevant household decision-making, I did find evidence that women are less likely to justify domestic violence (see Table A7 in Appendix B).

6 Are these Effects Long Lasting?

In this section I study whether the education and marriage effects reverted in the presence of negative female labor demand shocks. The growth competition from Asian countries in 2000 and the end of the preferential commercial agreement with the US led to a decline in the importance of FTZs.[59] Using this as an exogenous negative shock, I find that even when labor market opportunities decrease, educational attainment increases are sustained.

During the 2000s demand for female labor collapsed. The commercial agreements granting preferential market access to the United States ended in 2005. At the same time, China entered the World Trade Organization and competition coming from Asian countries grew.[60] These shocks caused a large decrease in textile manufacturing activities in FTZs between 2000 and 2007. Before 2000, total exports from this sector represented 53% of total production; however, in 2006 they represented only 35%. These shocks had a larger negative effect on FTZs that produced apparel. Textile sector employment was reduced by about 45% (see Figure A1). As a result, female unemployment rose in the 2000s following a decade of decline, 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 on displaced workers in 2008, 70% 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 FTZs to

[57] 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.

[58] One problem with these measures is that they are self-reported and may be biased since there is a high degree of non-random under-reporting. However, the panel nature of the data may reduce this concern.

[59] This commercial agreement granted quotas of preferential market access to the United States. During the 2000s the imports of textile products coming from the Dominican Republic were reduced by 50%.

[60] In addition to these shocks, the appreciation of the exchange rate reduced the competitiveness of the sector.

analyze the effect of reducing female labor demand. Therefore, I estimate the following equation:

$$\begin{aligned} Outcome_{i,h,p,t} =& \alpha + \beta_1 FTZ_{p,t} + \beta_2 Shock_t + \beta_3 Textile_p + \beta_4 Shock_p \times Textile_t + \delta Province_p + \pi Year_t \\ &+ \theta Trend_p + \gamma X_{h,p,t} + \nu X_{p,t} + \varepsilon_{i,h,p,t} \end{aligned} \tag{11}$$

where $Shock_t$ is a dummy variable for after 2000 and $Textile_p$ is the proportion of firms in the textile industry before 2000 in province p. The interaction of both variables controls for the effect of the negative shock. In this way, I will be able to distinguish the effect of the FTZ opening and the effect of the negative shock.[61]

Another way is to interact the variable $FTZ_{p,t}$ with a variable that takes the value of zero in province p in the year 2000 and onwards if that province has a large share of firms in the textile industry before the shock. Formally, I estimate the following model:

$$\begin{aligned} Outcome_{i,h,p,t} =& \alpha + \beta_1 FTZ \times (1 - 1_{\{Year \geq 2000 \ \& \ Textile \geq 0.5\}})_{p,t} + \delta Province_p + \pi Year_t \\ &+ \theta Trend_p + \gamma X_{h,p,t} + \nu X_{p,t} + \varepsilon_{i,h,p,t} \end{aligned} \tag{12}$$

where $(1 - 1_{\{Year \geq 2000 \ \& \ Textile \geq 0.5\}})$ takes the value of 0 after the year 2000 if the province has more than 50% of firms in the textile industry in 1996.[62]

If the results persist in the presence of the negative shock I expect β_1 in Equations 11 and 12 to be similar in magnitude to the effects found in the main specification presented in Equation 1.

I find that, even in the presence of the negative shock, women educational attainment increases by 0.3 years. Table IX columns 1, 3 and 4 in Panel A presents the results of estimating Equation 11. Conditional on the negative shock, the opening of a FTZ still has a positive effect on women's educational attainment. Moreover, the magnitude is similar to that found previously. Columns 2, 3 and 6 show the estimates of Equation 12; and the results still hold. I also estimate a difference-in-difference-in-differences model to check whether younger cohorts are affected by the negative shock. Table IX Panel B presents the results. I find that women who were between 6 and 16 years of age increase their educational attainment by 0.3 years even after controlling for the negative shock.[63]

In addition, I find that different generations of women are still increasing their years of education even in the absence of economic returns. I check whether the negative shock has any differential effect for those between 6 and 13 and those between 13 and 16 years of age at opening and I find that results are similar after controlling for the negative shock. To also rule out the possibility that I am estimating the effects for only women who had already chosen their education when jobs became available in the past, I also estimate

[61] For example, if a province has a 60% of the firms in the manufacturing industry, the variable shock is equal to 0 for the years before 2000 and 60% after 2000.

[62] I only have information for the year 1996 on the number of firms in the textile industry per province.

[63] I find similar results using the 2005 shock and using as age of marriage and birth as the dependent variables.

the effects of FTZs for women who were in key ages (6-16) at the time of the negative shock and I find that these women are not affected by the shock.[64]

Finally, I estimate the previous specifications for only the years after the shock (2000-2007). I find positive and slightly larger effects. This finding suggests that even after the end of the preferential trade agreement, women continue investing in education.

6.1 Robustness Checks

In order to analyze the robustness of these results, I provide two additional pieces of evidence that suggest that the negative shock did not the educational attainment gains for subsequent cohorts in places with FTZs. First, I find that the increase in educational attainment is similar for cohorts of women affected by the opening of FTZs in the 1990s and cohorts that were affected by the negative shocks in the 2000s. I compare 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) with those that were less than 16 years of age at the time of the negative shock. 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 the 1990s).

In Figure A5 I estimate the effect of the negative shock by cohort for provinces affected by the openings of FTZs during the 1990s. Since the negative shock affected the entire country, I am not able to include time fixed effects. The omitted category is age 15. I find some evidence of a decrease in educational attainment for those women who were less than 16 years of age at the time of the negative shock. However, these effects are not statistically significant. This suggests that there is no evidence that cohorts affected by the negative shock changed their behavior.

I also find that the negative shocks had no schooling effects in provinces with FTZ compared to provinces that never had an FTZ. I exploit a sample of provinces which was not included in none of my previous analysis: provinces that did not experience an FTZs' opening at any point in time. In Table A8 I present the results of the second test, I compare the years of schooling in provinces with FTZs against provinces that never experienced an opening before and after the negative shock. I find no significant effect on schooling.[65]

[64] One possible concern with this methodology is that the negative shock could be affecting a different type of women than the one affected by the positive shock. If the compliers (those women that change their behavior due to the shock) are different under the two different treatments (FTZs' opening and negative shock), the results should be interpreted differently. 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. To address the this concern I analyze if there exists a differential effect between the positive and negative shock based on an index of socioeconomic status. 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. Results are available upon request.

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

Moreover, I test if there are differential effects based on the proportion of textile factories in FTZs and I find that even in those places where the proportion of textile factories was high (more than 50%), 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 VI I show that there is no evidence of different trends before 2000. Moreover after 2000 if the difference is positive suggesting an increase after the shock. I observe the same pattern with age of marriage. However, this difference is not significant.

First, these results suggest that there are long-term effects from a temporary increase in female labor market demand. Second, the persistence of the effects may be driven by mechanisms other than the labor market. If a temporary increase in female labor demand reduces early marriage and increases schooling through labor market gains, the competitive model would predict that that educational attainment and early marriage would revert back to previous levels when there is no longer labor market returns to education. However, this is not what is observed in the data.

Of course, the negative shocks may not be of the same magnitude as the positive shocks created by FTZs' openings. Figure A1 demonstrates that although the negative shocks were large, the unemployment rate was not as large as before the opening of FTZs.[66] In the following section I will expand on the framework presented in Section 4 and provide different explanations for the persistence of the results.

6.2 Mechanisms behind the Effect of Negative Labor Demand Shocks: Spillovers in the Marriage Market

In order to interpret why educational attainment does not decrease for new cohorts in the absence of economic gains in the labor market, I propose that the persistence of results can be partially explained by marriage market gains. Women may face a lower penalty for delaying marriage if a previous generation of women had been educated. I provide a simple framework that 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.

The idea is that the opening of FTZs created incentives for high type women to increase their education and invest in their careers. By doing so FTZs created two indirect effects, a reduction in the penalty for delaying marriage for future generations and also access to better matches for these type of women. Consider a similar framework as the previous section but now assume that the penalty P_t is a function of the share of women with high level of education in the previous generation. In particular, $P_t = \frac{Pt}{n(\theta^*_{t-1})}$ where $\frac{\partial n(\theta^*_{t-1})}{\partial \theta^*_{t-1}} < 0$

[66] Most of the recovery of FTZs started in 2009 and it was driven by industries in which male employment is predominant.

and θ^*_{t-1} is an endogenous variable that represents the type of individual that is indifferent between high education and basic education in the previous period. The fact that P_t is decreasing in the share of women with high level of education implies that in societies with higher levels of average education, investment in schooling becomes more important for a good match in the marriage market. For simplicity, I assume an explicit form for $n(\theta^*_{t-1}) = \theta^{*-k}_{t-1}$ with $k > 0$ when necessary. Substituting $P_t = \frac{Pt}{n(\theta^*_{t-1})}$ into the framework of Section 4, the indifferent individual between the two levels of education is given by:

$$s = 2 \Longleftrightarrow \theta_{it} \geq \theta^*_t = \frac{P_t}{(W_t p_t + m_t).n(\theta^*_{t-1})} \tag{13}$$

Proposition 2 ("Marriage Market Spillover") *An increase in labor market opportunities or the labor market skill premium at period t generates long run positive spillovers in the form of higher education for future cohorts. In particular, an initial increase in the share of girls with high education causes a reduction in the penalty for arriving late to marriage market, thus increasing the incentives for current cohorts to invest in education.*

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 *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 attainment remains high for future cohorts.*

Intuitively this is due to the fact that women have greater returns to education in the marriage market (and less waiting" penalty) if past generations had high educational attainment. For example, one can assume that men have two periods to find a match in the marriage market but they are uncertain about each woman's ability. Naturally, the probability of finding a more educated woman in the second period is increasing in the proportion of women that invested in schooling. Hence, whenever the proportion of girls with high educational attainment increases, men have a larger incentives to wait until the last period to match. This reduces the penalty of delaying marriage for women. The importance of women's education in the marriage market can be thought of as a relative concept. As the average level of schooling of women increases, men's cost of not marrying a high educated women outweighs the cost of waiting for the match. Hence, after schooling, women have more men waiting for them.

Another potential explanation for the reduction in the marriage market penalty is that schooling investment works as a signal in marriage market. 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 free trade zones open, there are labor markets expectations(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 free trade zones open and there is an increase in p. Now high type women (those with $\theta \geq \theta^*$) have incentives to increase their educational attainment since they now 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 in which only the high type women obtain higher years of schooling. This equilibrium is sustained by the belief that if a man observes a non educated women he knows she is low type. Similarly, if a woman decides to not get educated she will get a low type husband for certain. At $t = 2$, the provinces suffer a negative shock that creates a reduction in p. This shock may not completely reverse the increase in p due to the FTZs. 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 lower), the reduction in the penalty for 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 $t = 2$ the new generation of women observe a high proportion of women that are educated and therefore they choose to educate themselves. Education acts as a signal for high skill.[67]

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 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 free trade zones 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 decrease, it 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 education signals other abilities such as childcare). Another possibility is that women continue increasing their schooling because their mothers were previously affected by the openings. I check if this is the case and do not find that that this is driving the results.[68] Although these

[67]This model of education as signaling might work in Dominican Republic where labor markets do not have other mechanisms to distinguish high ability from low ability other than educational attainment.

[68]I do this by interacting the main treatment variable with an indicator whether the mother was affected by the opening.

explanations may play a role, I argue that gains in the marriage market are the most important cause for the persistence of effects.

6.3 Female Factory Jobs and Match Quality

In order to explore the gains in the marriage market, I test to what extent increases in educational attainment and age of marriage (due to the opening of FTZs) can affect the quality of marriage matches. The framework above predicts that more educated women will have access to 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 (Goldin and Katz 2002). I identify divorces by examining women that had more than one union at the time of the survey. I find that women affected by FTZs have a lower probability of divorce. For those women who were younger than 16 at the time of the opening, the probability of divorce is reduced by 2.5 percentage points.[69]

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. I find that the FTZs increase the husband's years of education by 0.6 years for only those women who increase their schooling. Therefore, women who are increasing their years of education and marrying after the age of 18 due to FTZs are the ones who are seeing a reduction in divorce rates and a husband with greater education.

I also analyze whether marriage patterns are different for those with different education levels by comparing those affected by FTZ with those not affected. I find that wives with only a primary school education affected by FTZs have a lower probability of marrying up than wives with the same level of education who were not affected.[70] While wives with secondary schooling or higher now have a high chance of being matched with a husband of their same education level or higher. In the case of husbands, I observe a similar pattern suggesting an increase in positive assortive matching (see Figure A7 in Appendix C). Moreover, for each education category, I estimate the probability that women are married to a husband with a given level of education. I find that women with only a primary education are negatively effected in the marriage market. They are about 4 percentage points less likely to be married with someone with a higher education status after the opening of a FTZ.

These two results provide further evidence that FTZs increase the marriage market gains of women by

[69]Since my framework predicts that by increasing educational attainment, women receive gains in the marriage market, I also use the opening of the FTZs 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 3.5 percentage points.

[70]I also repeat the analysis just comparing women who were between 13-16 years of age versus women who were 17-21 and I find the same pattern.

increasing education attainment and delaying marriage. These results are maintained even if we restrict the sample to women that are not working at the time of the survey. This suggests that FTZs affect women's behavior through mechanisms apart from labor force participation. In addition, results are driven by younger cohorts (6-16). I also repeat the analysis using only the observations after the negative shock and find similar results.

I also examine alternative measures of husband quality. These include the probability that the husband resides at home with the wife, the difference in age between husband and wife and the skill level of the husband's job.[71] Table X presents the results which are of the expected sign: for those women who 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 a skilled job increases. In addition, I use women who are more than 16 years of age as control group and find similar results with the exception of husband lives at wife's home.

7 Conclusions

Economic development has lad to more female empowerment by expanding job opportunities for women Duflo (2012). Historically, industrialization and the rise of factory work suitable for women increased demand for female labor. More recently, the rise of service sector jobs due to outsourcing has done the same. Little is known, however, about the long-term effects of female labor demand on women's educational attainment and marriage outcomes. This paper exploits the sudden and massive growth of female jobs in FTZs in the Dominican Republic in the 1990s, and subsequent decline in the 2000s, to provide the first evidence that temporary improvements in female labor demand can move societies to a "good equilibrium" that persists even after job opportunities taper off.

Using a difference-in-difference-in-difference empirical strategy, I find that the opening of a FTZ increases educational attainment by about 0.3 years, equivalent to a 24% decrease in the dropout rate. This persists even in the presence of a subsequent negative shock. The evidence suggests that the increase in (some) girl's education during the expansion of FTZs changes marriage markets. I find that women who increase their educational attainment and delay marriage due to the FTZs marry better educated husbands and are less likely to divorce. I further show that by increasing the years of education, FTZs also affect women's age of marriage and first birth. The opening of a FTZ reduces the probability of early marriage, leading to important consequences for maternal and child health outcomes. I find that the decrease in early marriage caused by the FTZs increases the probability of survival for the mother's first child.

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

While most of the previous literature has studied the effects of female labor markets during periods of expansion, I provide evidence that even temporary improvements in female labor demand can have long-term effects on girls' schooling and early marriage. Although I cannot rule out if the persistence of effects might be driven by a change in social norm caused by a possible permanent jump on expectations due to an FTZs' opening, I provide evidence that marriage market gains might be an important factor to explain women's higher levels of education during contractions. For instance, even after labor market returns decrease, women have an incentive to get more education so they can compete with the older highly educated women already in the marriage market.

From a policy perspective, these results suggest that even relatively brief episodes of preferential trade treatment for export industries have long-term positive effects on female schooling and health outcomes. Given that young women in the Dominican Republic face similar issues as those in other Latin American and Caribbean countries, these results may be generalizable. While it is often believed that women drop out of school because of credit constraints or the need to financially support their family, a recent survey in Latin America shows that many women do not believe further education will better their life (IDB 2013). In addition, since most teenage pregnancies are planned and are the result of early marriage, information about healthier behaviors or access to contraceptives may not be an adequate policy solution. In the context of such beliefs, policy interventions that raise women's labor market expectations and encourage them to envision a better future, even if it is only temporarily, are more likely to be effective.

While this paper has shown suggestive evidence of important interactions between labor markets and marriage markets, more work remains to identify and characterize the spillovers involved. Given that womens expectations about labor market returns and expectations about marriage market returns are both important, additional research is needed on how these joint expectations form and whether information is enough to change behavior.

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Tables and Figures

Figure I: Number of FTZ and Firms between 1970-2010

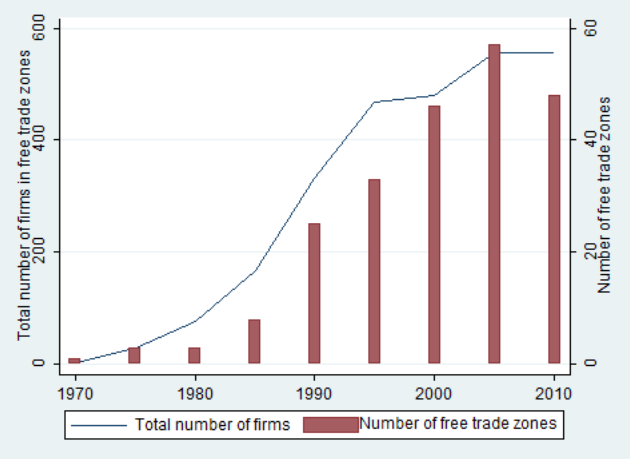


Figure II: Number of Jobs in FTZ between 1970-2010

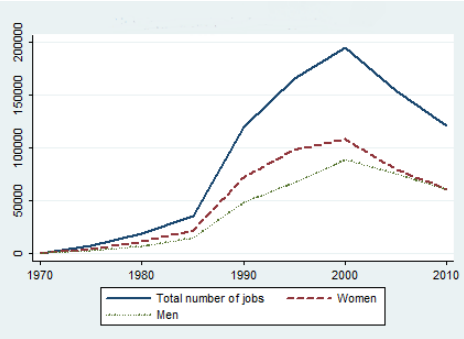


Figure III: Provinces with FTZ between 1970-2010

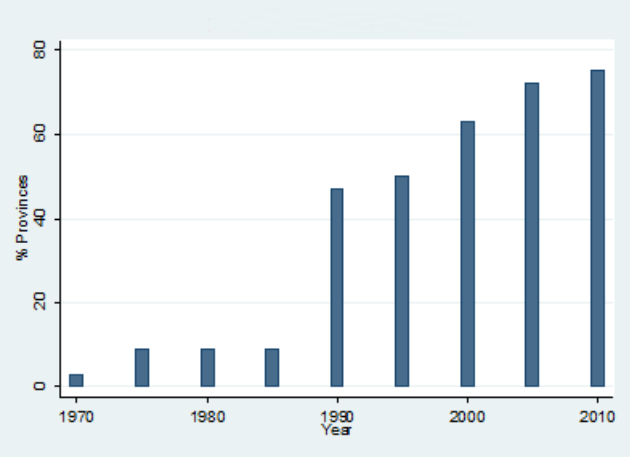


Figure IV: FTZs Distribution between 1970-2010

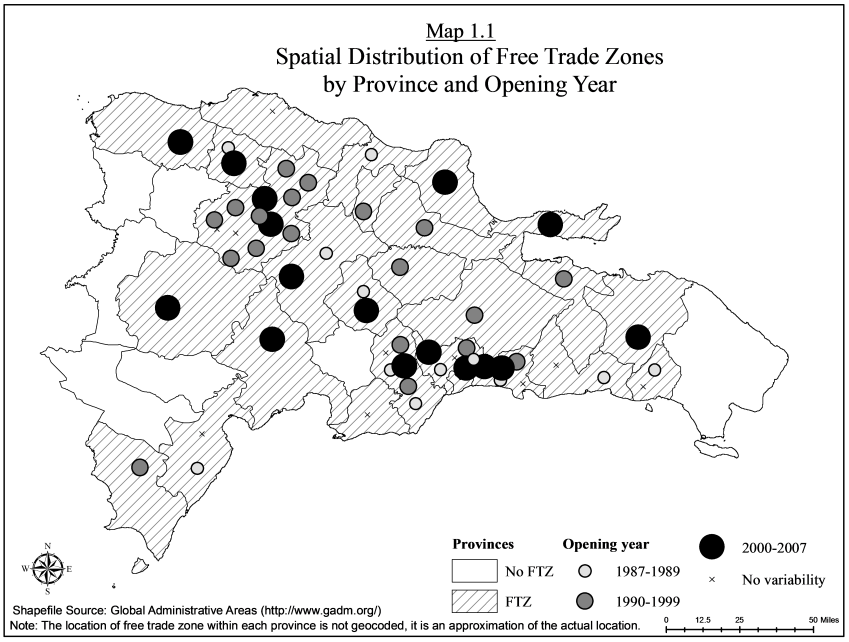
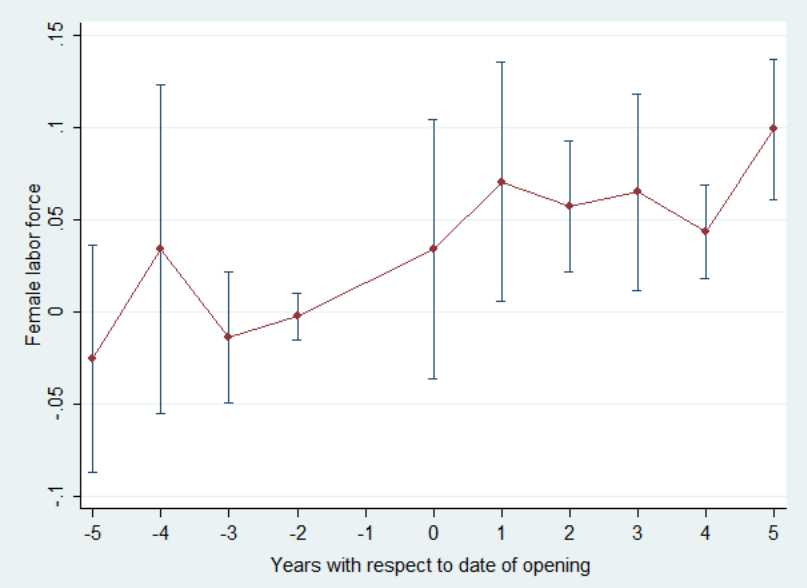
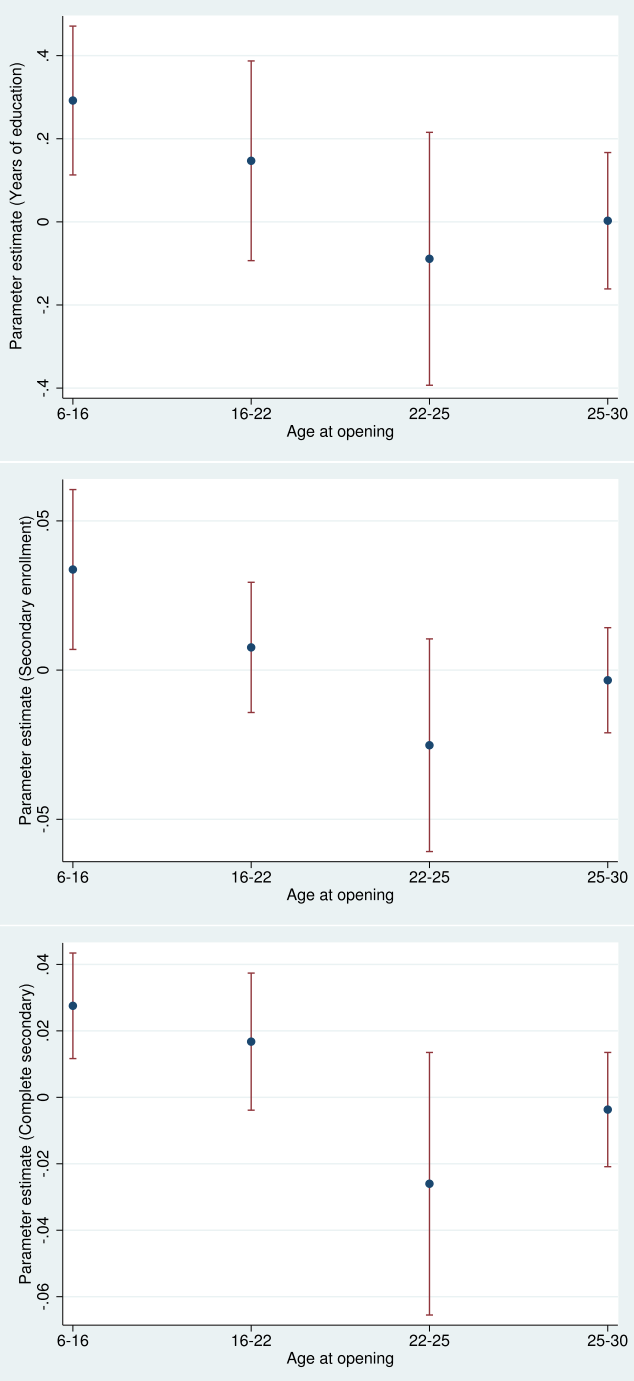


Figure V: Timing of Female Labor Force Participation



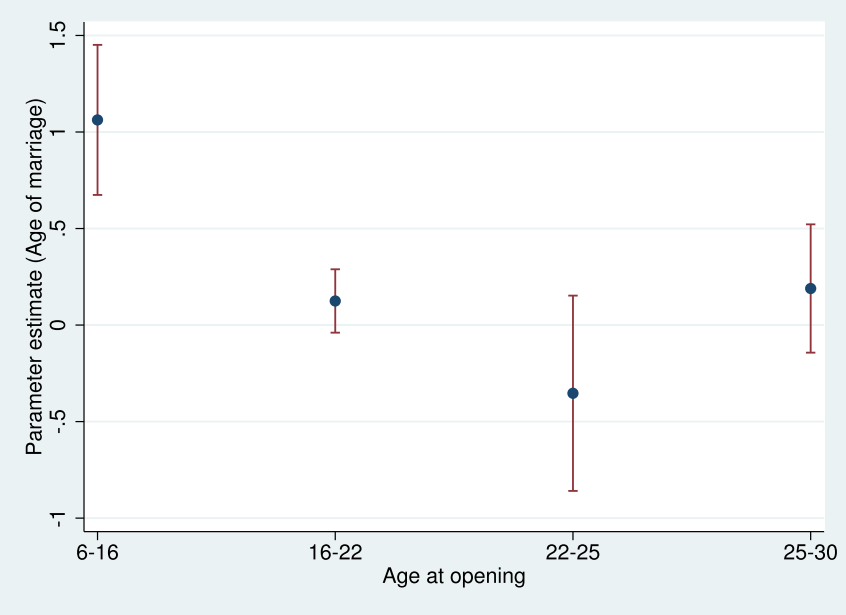
Notes: This graph plot the coefficients obtained from a regression of the outcome on the interaction between the treated province dummy and year dummies. The regressions control for province, year and province time trends. The Y-axis shows the estimated coefficients and the X-axis shows the years. Standard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

Figure VI: Schooling by Age at Opening



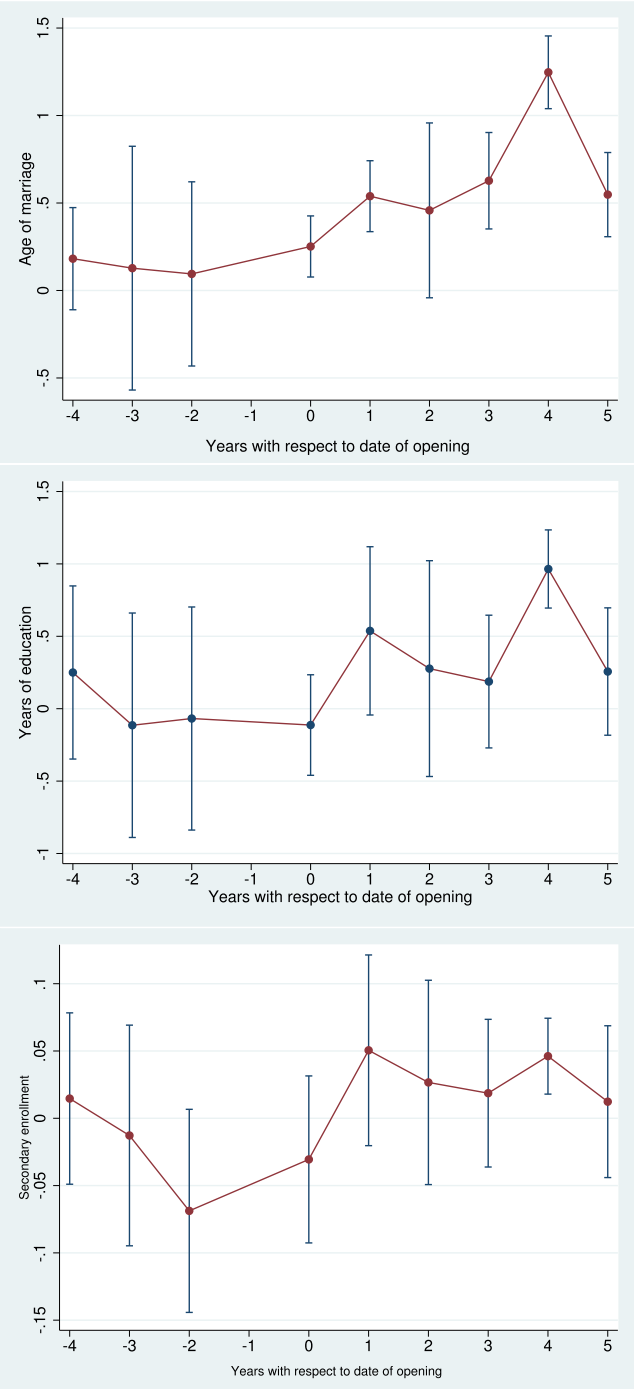
Notes: These graphs plot the coefficients obtained from a regression of the corresponding outcome on the interaction between the treated province dummy and age at opening dummies. The regressions control for province, year, province time trends, cohort fixed effects, province of birth trends and socioeconomic 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 VII: Marriage by Age at Opening



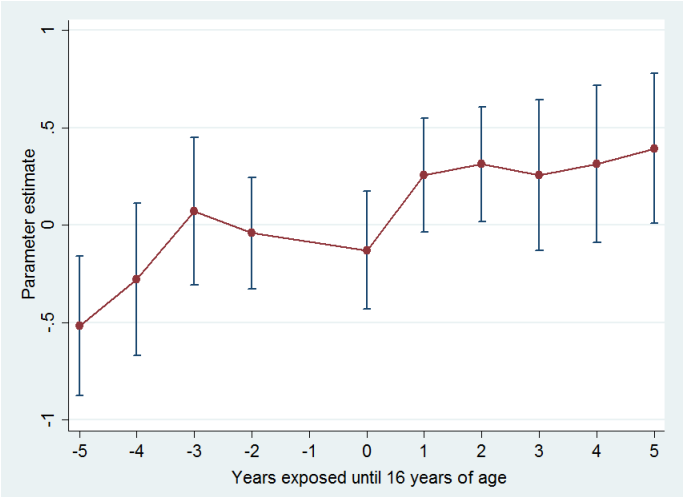
Notes: These graphs plot the coefficients obtained from a regression of age of marriage on the interaction between the treated province dummy and age at opening dummies. The regressions control for province, year, province time trends, cohort fixed effects, province of birth trends and socioeconomic 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.

Figure VIII: Timing of Schooling and Marriage Effects



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 IX: Schooling Effects for Women at the Margin



Notes: This graph plots the coefficients obtained from a regression of the outcome (years of education) 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.

Table I: Education Based on Sex and Sectors (%)

	FTZ		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	23.1	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.

Table II: Descriptive Statistics, 1986-2007

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 for 1996, 2002, 2007 surveys

Table III: Predictors of FTZ's Openings 1986

(A) Demographic Characteristics	
Proportion of Women in Age 15-21	2.660
	(12.08)
Proportion of Women in Age 22-30	-4.237
	(11.57)
Proportion of Women in Age 31-45	5.30
	(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 Literated 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 a Non-Family Member	-2.201
	(2.686)
Proportion of Women Working Before Marriage	2.319
	(5.628)
R-squared	0.03

Notes: the dependent variable is the year in which the FTZ 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.

Table IV: Schooling and Female Factory Jobs (DD), 1986-2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Years of education				Enrollment in primary	Enrollment in secondary	Complete primary	Complete secondary
FTZ	0.408***	0.386***	0.359***	0.436*	0.007	0.046**	0.010	0.038**
	(0.141)	(0.131)	(0.127)	(0.211)	(0.022)	(0.017)	(0.021)	(0.013)
Mean of dependent	7,82	7,82	7,82	7,82	0.9	0.46	0.4	0.24
N	55,894	55,894	55,894	51,949	27,975	51,991	39,244	51,949
R^2	0.075	0.076	0.124	0.188	0.043	0.154	0.145	0.118
Province FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Province trends		YES	YES	YES	YES	YES	YES	YES
Cohort FE			YES	YES	YES	YES	YES	YES
Province year of birth trends				YES	YES	YES	YES	YES
Covariates				YES	YES	YES	YES	YES

Notes: each cell represents a separate regression. Other covariates control for household and province characteristics. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table V: Schooling and Female Factory Jobs (DDD), 1986-2007

	(1) Years of education	(2) Enrollment in primary	(3) Enrollment in secondary	(4) Complete primary	(5) Complete secondary
FTZ×age6to16	0.262**	-0.008	0.028**	0.023**	0.025***
	(0.122)	(0.009)	(0.013)	(0.010)	(0.009)
Mean of dependent	7,82	0.9	0.46	0.4	0.24
N	46,026	23,784	46,067	34,503	46,026
R^2	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
Covariates	YES	YES	YES	YES	YES

Notes: each cell represents a separate regression. 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. Other covariates control for household and province characteristics. The control group consists of women between 16 to 30 years of age. Sample restrictions: I eliminate those women who were more than 30 years of age at the opening. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table VI: Mechanisms Behind the Schooling Effects

	(1) Years of education	(2) Years of education	(3) Years of education	(4) Enrollment in secondary	(5) Enrollment in secondary	(6) Enrollment in secondary
FTZ× age6to16	0.259**	0.262**	0.236**	0.030**	0.028**	0.021*
	(0.122)	(0.122)	(0.103)	(0.012)	(0.013)	(0.010)
N^o parks	0.085			0.005		
	(0.057)			(0.004)		
N^o construction permits		-0.001			-0.000*	
		(0.001)			(0.000)	
N	46,026	46,026	29,808	49,716	46,067	29,831
R^2	0.174	0.174	0.207	0.144	0.142	0.162
Province FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province trends	YES	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES	YES
Province year of birth trends	YES	YES	YES	YES	YES	YES
Subsample of non-working women			YES			YES

Notes: each cell represents a separate regression. Other covariates control for household and province characteristics. The control group consists of women between 16 to 30 years of age. In this table I show that the effects on schooling is driven by other mechanism apart from an increase in women's earnings and school infrastructure. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table VII: Early Marriage and Female Factory Jobs (DDD), 1986-2007

	(1) Age of marriage	(2) Age of marriage	(3) Age of marriage	(4) Early marriage	(5) Early marriage	(6) Early marriage	(7) Female labor
FTZ×age6to16	1.214***	0.882***	1.197***	-0.103***	-0.068***	-0.101***	0.035**
	(0.196)	(0.127)	(0.191)	(0.018)	(0.012)	(0.018)	(0.015)
Years of education		0.429***			-0.046***		
		(0.016)			(0.001)		
Female labor			0.598***			-0.064***	
			(0.133)			(0.008)	
Mean of dependent	17.94	17.94	17.94	0.46	0.46	0.46	0.24
N	33,897	33,863	33,839	46,069	46,026	45,987	45,987
R^2	0.123	0.298	0.128	0.056	0.189	0.060	0.107
Province FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Province trends	YES	YES	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES	YES	YES
Province year of birth trends	YES	YES	YES	YES	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES	YES

Notes: each cell represents a separate regression. Other covariates control for household and province characteristics. The control group consists of women between 16 to 30 years of age. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table VIII: Early Birth, Child Health and Female Factory Jobs (DDD), 1986-2007

	(1) Age at first birth	(2) Early birth	(3) Age at first intercourse	(4) Early intercourse	(5) Desired fertility	(6) Out-of-wedlock birth	(7) Child survival
FTZ×age6to16	0.924***	-0.093***	0.725***	-0.046***	-0.111***	0.008	0.013**
	(0.143)	(0.015)	(0.113)	(0.014)	(0.030)	(0.005)	(0.006)
Mean of dependent	19.31	0.24	17.31	0.39	3.2	0.036	0.9
N	31,151	46,069	26,779	46,069	46,069	31,151	29,184
R^2	0.138	0.038	0.110	0.049	0.087	0.017	0.017
Province FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Province trends	YES	YES	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES	YES	YES
Province year of birth trends	YES	YES	YES	YES	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES	YES

Notes: each cell represents a separate regression. Other covariates control for household and province characteristics. The control group consists of women between 16 to 30 years of age. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table IX: Are Schooling and Marriage Effects Long Lastings?

	(1)	(2)	(3)	(4)	(5)	(6)
	Years of education		Enrollment in secondary		Complete secondary	
FTZ	0.329**		0.036**		0.030**	
	(0.156)		(0.015)		(0.012)	
Shock×textile	-0.075		-0.016		-0.006	
	(0.243)		(0.022)		(0.019)	
$FTZ\times(1-1_{\{Year\geq 2000\ \&\ Textile\geq 0.5\}}$		0.341**		0.028***		0.0214***
		(0.128)		(0.009)		(0.007)
N	55,894	55,894	55,894	55,894	55,894	55,894
R^2	0.124	0.125	0.104	0.104	0.079	0.079
FTZ×age6to16	0.268**		0.029**		0.025***	
	(0.126)		(0.013)		(0.008)	
Shock×textile ×age6to16	0.201		0.030		0.023	
	(0.494)		(0.039)		(0.038)	
$FTZ\times$age6to16$\times(1-1_{\{Year\geq 2000\ \&\ Textile\geq 0.5\}}$		0.274**		0.029**		0.026***
		(0.111)		(0.011)		(0.008)
N	46,026	46,026	46,026	46,026	46,026	46,026
R^2	0.174	0.174	0.142	0.142	0.117	0.117
Province FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province trends	YES	YES	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES	YES	YES
Province year of birth trends	YES	YES	YES	YES	YES	YES

Notes: $Shock_t$ is a dummy variable for after 2000 and $Textile_p$ is the proportion of firms in the textile industry before 2000 in province p. The interaction between both variables control for the effect of the negative shock. $(1-1_{\{Year\geq 2000\ \&\ Textile\geq 0.5\}})$ takes the value of 0 after the year 2000 if the province has more than 50% of firms in the textile industry in 1996 (before the negative shock). Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table X: Marriage Market Gains and Female Factory Jobs

	(1)	(2)	(3)	(4)	(5)
	Divorce	Husband's education	Husband in high skilled job	Difference in age	Husband stays at home
FTZ×age6to16	-0.025**	0.672***	0.033**	-0.724**	0.003
	(0.013)	(0.168)	(0.014)	(0.310)	(0.012)
Mean of dependent	0.365	7.278	0.436	6.133	0.898
N	34,576	31,224	19,020	21,598	23,544
R^2	0.05	0.174	0.074	0.044	0.02
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

Notes: each cell represents a separate regression. Other covariates control for household and province characteristics. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Empirical Appendix

Appendix A Robustness checks

Table A1: Schooling, Marriage and Female Factory Jobs (Unaffected Women)

	(1) Years of education	(2) Enrollment in secondary	(3) Complete secondary	(4) Age of marriage	(5) Early marriage
FTZ	-0.145	-0.020	0.004	0.203	-0.002
	(0.228)	(0.020)	(0.016)	(0.165)	(0.025)
N	22,709	22,735	22,737	20,867	20,867
R^2	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: each cell represents a separate regression. I estimate the effect of FTZs on a group of women who should not be affected: women who were already married by the time of the opening. Other covariates control for household and province characteristics. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table A2: Husband's Education and Female Factory Jobs

	(1) Women's years of education	(2) Men's years of education	(3) Women's years of education (men sample)
FTZ	0.359***	0.208	0.439***
	(0.127)	(0.167)	(0.143)
N	55,894	38,269	38,227
R^2	0.124	0.089	0.104
Province FE	YES	YES	YES
Year FE	YES	YES	YES
Province trends	YES	YES	YES
Cohort FE	YES	YES	YES

Notes: each cell represents a separate regression. Column (1) presents the effect of FTZ on women's years of education. Column (2) the effect on their husband's education. Column(3) presents the effects on women's years of education using the sample of women who reported their husband's education. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table A3: Schooling, Marriage and Female Factory Jobs (Excluding Main Cities)

	(1) Years of education	(2) Enrollment in secondary	(3) Complete secondary	(4) Age of marriage	(5) Early marriage
FTZ	0.436*	0.046**	0.037**	1.039***	-0.073***
	(0.211)	(0.017)	(0.013)	(0.168)	(0.014)
N	51,949	51,991	51,993	24,905	33,829
R^2	0.188	0.154	0.118	0.150	0.085
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
Covariates	YES	YES	YES	YES	YES

Notes: each cell represents a separate regression. I estimate the model in Equation 1 but excluding from the analysis provinces that contain the main cities such as the National District, Santo Domingo and Santiago. Standard errors are corrected for clustering at the province level. Significant at *** 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.

Table A4: Schooling and Female Factory Jobs (Using IDB Surveys)

	(1) Years of education	(2) Years of education
FTZ×age6to16	0.229*	0.249*
	(0.123)	(0.125)
Household income		5.81e-05***
		(1.85e-06)
N	110,968	110,706
R^2	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: each cell represents a separate regression. In this table I show that the effect of FTZs on schooling is robust to the use of different surveys and it is also driven by other mechanism apart from an increase in earnings.Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table A5: Migration and Female Factory Jobs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Years of education	Years of education	Years of education	Years of education	Age of marriage	Age of marriage	Age of marriage	Age of marriage
FTZ	0.423**	0.385***	0.488***	0.350**	1.323***	1.276***	1.332***	1.337***
	(0.164)	(0.127)	(0.160)	(0.127)	(0.209)	(0.247)	(0.224)	(0.245)
Movers				-0.761***				-0.330***
				(0.108)				(0.0855)
Mean of dependent	7,82	7,82	7,82	7,82	17.94	17.94	17.94	17.94
N	41,985	54,778	40,869	55,894	17,732	25,714	17,506	25,940
R^2	0.157	0.125	0.159	0.131	0.039	0.026	0.038	0.0276
Province FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Province trends		YES	YES	YES	YES	YES	YES	YES
Non-migrants	YES		YES		YES		YES	
Without just movers		YES	YES			YES	YES	

Notes: columns (1) and (5) presents estimates using only the subsample of non-migrants. Columns (2) and (6) eliminates from the whole sample those who moved to the area just before the FTZ opened. Columns (4) and (8) adds a dummy that indicates whether the household moved before the FTZ opened. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table A6: Schooling, Marriage and Female Factory Jobs (Including Household Fixed Effects

	(1) Years of education	(2) Enrollment in secondary	(3) Complete secondary	(4) Age of marriage	(5) Early marriage
FTZ×age6to16	0.609**	0.067*	0.0715*	1.428**	-0.091**
	(0.276)	(0.036)	(0.039)	(0.726)	(0.038)
N	15,890	14,667	14,648	9,971	14,668
R^2	0.795	0.773	0.737	0.822	0.706
Province FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province year of birth trends	YES	YES	YES	YES	YES
Relationship	YES	YES	YES	YES	YES
Household FE	YES	YES	YES	YES	YES
Age	YES	YES	YES	YES	YES

Notes: in columns (1)-(3) there are approximately 7,000 households with more than one women inside and in columns (4)-(5), 5,000 households. Standard errors are corrected for clustering at the province birth level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Appendix B Additional tables

Table A7: Women Empowerment and Female Factory Jobs

	(1) Final say	(2) Violence	(3) Spend	(4) Earns more
FTZ×age6to16	-0.067	-0.013**	-0.0148	0.093***
	(0.228)	(0.0047)	(0.018)	(0.032)
Mean of dependent	0.511	0.08	0.796	0.28
N	9,695	32,760	12,854	4,612
R^2	0.025	0.037	0.174	0.035
Province FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province year of birth trends	YES	YES	YES	YES
Cohort FE	YES	YES	YES	YES

Notes: dependent variable in column (1) indicates whether the respondent has the final say in households decisions. Dependent variable in column (2) indicates whether the respondent justifies domestic violence. Dependent variable in column (3) is a dummy that indicates whether the respondent decides how to spend money. Dependent variable in column (4) indicates whether the respondent earns more than her husband. Women empowerment variables are only available in 2002 and 2007 surveys. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Table A8: The Effect of Negative Shocks on Education and Marriage

	(1) Years of education	(2) Age of marriage	(3) Early marriage
$FTZ_p \times shock_t$	0.224	0.028	0.011
	(0.218)	(0.191)	(0.021)
N	65,053	49,337	65,121
R^2	0.235	0.109	0.061

Notes: I exploit a sample of provinces which was not included in none of my previous analysis (provinces that never experience an opening). I make use of this provinces with no FTZs as control group. In this way I am able to compare the change in outcomes of places that have FTZs with places that never experienced an opening before and after the negative shock. Standard errors are corrected for clustering at the province level. Significant at *** p<0.01, ** p<0.05, * p<0.1

Appendix C Additional Figures

Figure A1: Unemployment

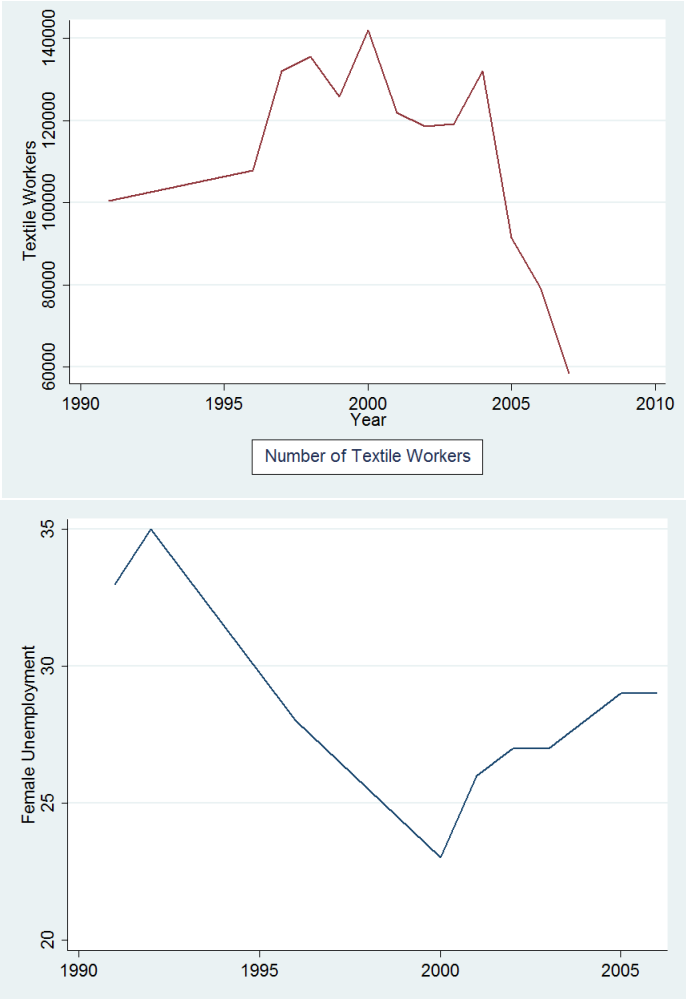


Figure A2: Educational Attainment by Age at Opening (Using IDB Surveys)

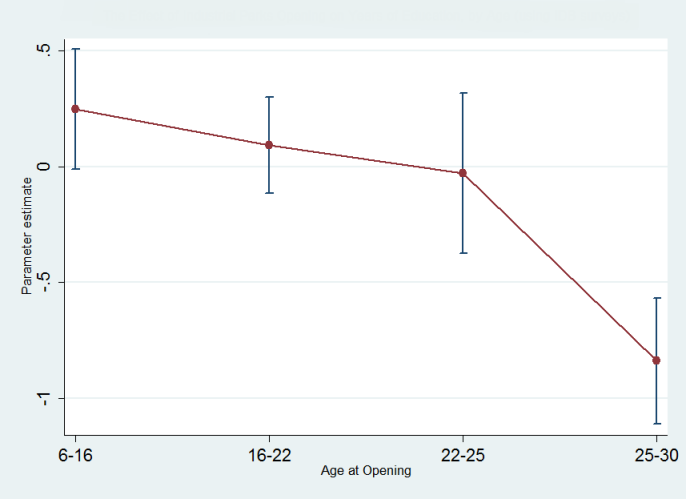


Figure A3: Enrollment in Secondary School by Age at Opening (Using IDB Surveys)

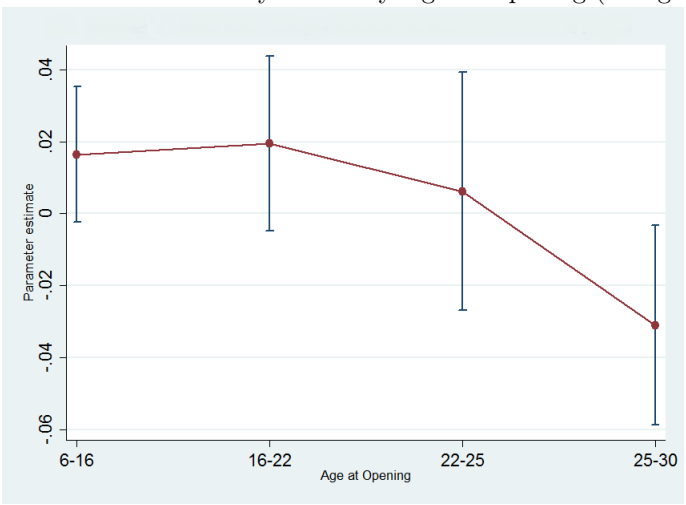


Figure A4: Age of Marriage by Educational Levels

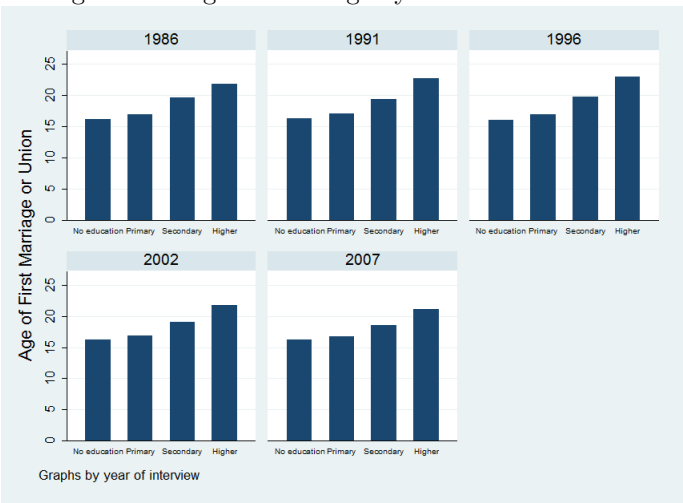
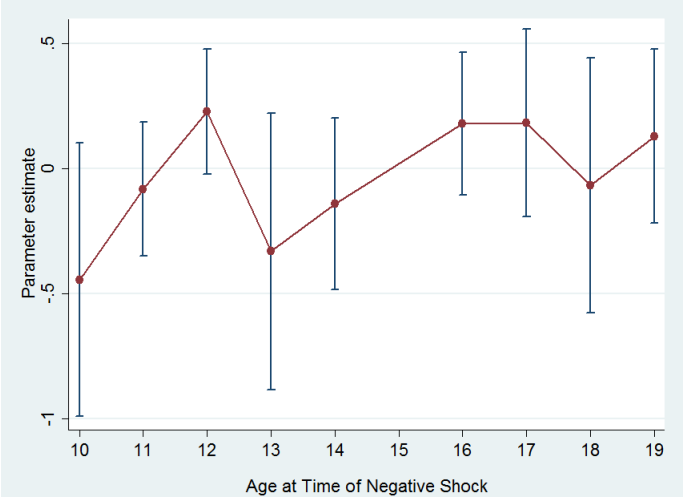


Figure A5: The Effect of Negative Shocks on Education by Age at the Time of the Shock



Notes: This graph plots 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 A6: Average Years of Education Before and After the Negative Shocks (Using as Control Group Prvinces with No FTZ)

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.

Figure A7: Spouse Education by Own Education, Ages 25-49, Non-Exposed Cohorts

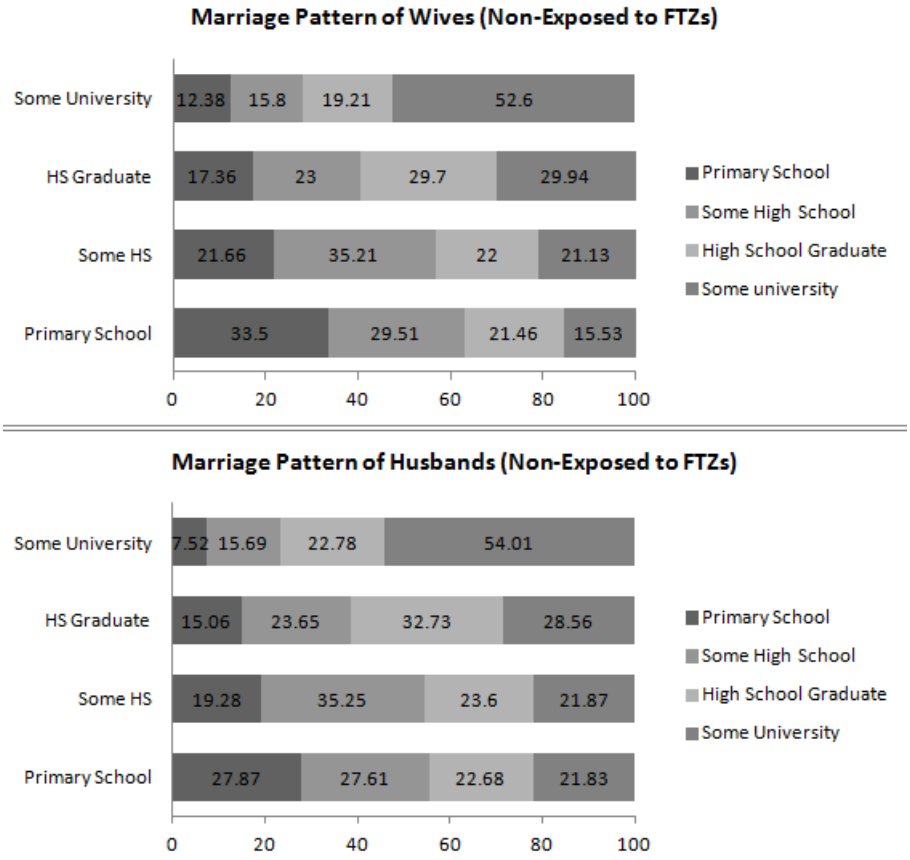
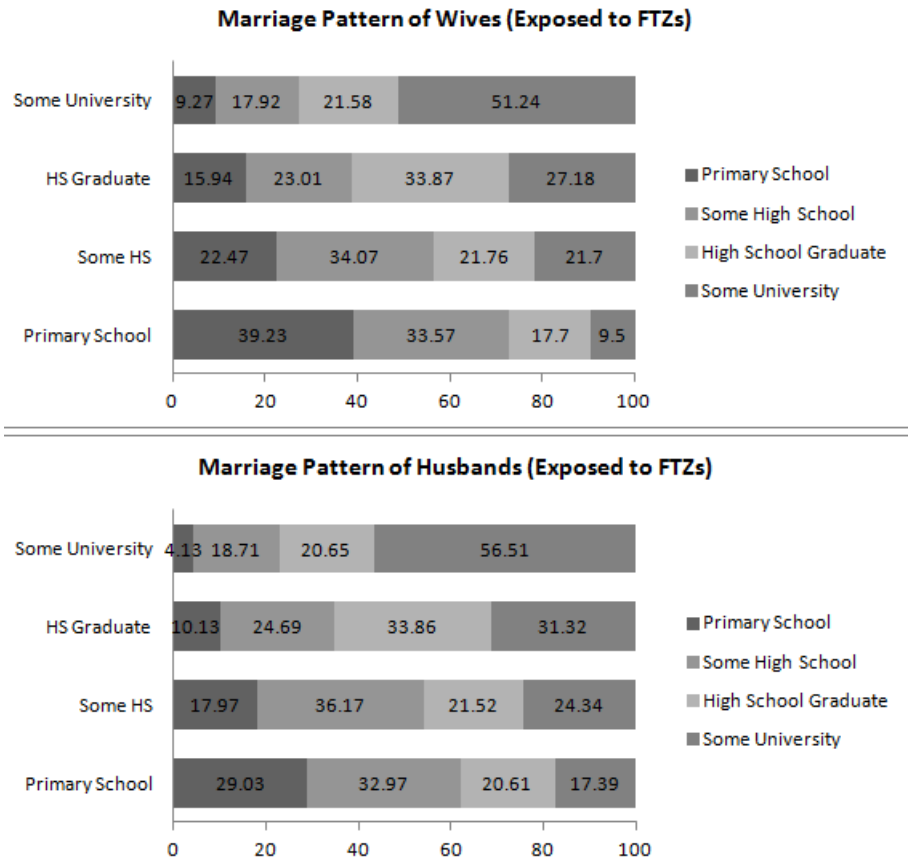


Figure A8: Spouse Education by Own Education, Ages 25-49, Exposed Cohorts



Appendix D 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 $\hat{\theta}$.

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