Globalization and Investments in Child Health and Family Planning: The Case of the Bangladesh Garment Industry

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Abstract

This paper examines the impact of increased female employment in garment factories in Bangladesh, spurred on by globalization, on womens health, family planning decisions and health investments in children. Since women who choose to work in the manufacturing sector may be quite different in terms of unobserved characteristics from women who choose not to work in these sectors, I use an instrument that increases the probability of working in a skilled occupation, but does not affect family planning decisions or health investments directly. I instrument for whether a women is working in a skilled occupation with the number of garment factories located within a 15 km catchment area of her house. I show that women who currently work in skilled occupations, which are primarily manufacturing factory jobs, have significantly higher rates of modern contraception use and significantly heavier children as measured by weight-for-height z-scores.

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1 Introduction

The garment industry in Bangladesh has averaged 17 percent annual growth over the last 20 years to become the dominant exporting industry in the country with over 19.9 billion (USD) in export value each year (WTO, 2012). During the 2008-2009 fiscal year the garment industry accounted for 17 percent of all exports and 14 percent of GDP (Bangladesh Bureau of Statistics, 2010). Growth in the garment sector promotes job creation, particularly for women who previously had no income opportunities other than household or informal sector jobs (Nordas, 2004). The garment industry in Bangladesh now employs over 3.5 million workers, of which 80 percent are female (BGMEA, 2013). This phenomenon is not unique to Bangladesh, as many countries in South East Asia have benefited from globalization in a similar way.

There is much speculation on the effects of increased labor market opportunities for women, however there are only a few rigorous evaluations (Jensen (2012), Oster and Millett (2010)). In the mainstream media there are numerous reports of the negative effects of factory employment on women's outcomes. Human rights groups and activists focus on the negative effects of unsafe working conditions, prolonged hours, low wages, and disregard for local labor laws. On the other hand, there is a positive focus on the increased employment opportunities for women and how this can shift her bargaining power (Majlesi, 2012). The effects of increased female employment and labor market opportunities on family planning preferences, women's health and health investments in children are not well understood, specifically in the context of Bangladesh. Given the importance of health investments in children on later life outcomes and the importance of family planning decisions on a country's development, understanding the impact of increased employment

opportunities through growth in the garment industry on these outcomes is a vital component in assessing the overall welfare impact of the rise in globalization.

In this paper, I examine how an increase in skilled employment opportunities for women affects women's family planning preferences, women's health, and health investments in their children in the context of Bangladesh. Since whether a women works or not in a skilled occupation is likely endogenous, I use an instrumental variables approach and use the rapid rise in garment sector factories between 2004 and 2011 as an instrument for skilled employment opportunities. I specifically focus on the years 2004-2011 to analyze a major period of international trade liberalization. The Agreement on Textiles and Clothing (ATC) ended in December of 2004, and subsequently preferential trade quotas for developing countries ended and trade was exclusively governed by standard WTO/GATT rules. The end of preferential trade quotas created a more competitive environment, and Bangladesh benefited due to its low labor costs. Post 2004, Bangladesh experienced large increases in the number of garment factories and employment in these factories. By using the time frame around the end of the ATC, I exploit exogenous variation in the number of garment factories and their employees to analyze the impact of working in a garment factory on individual health and family planning decisions. To address endogeneity concerns regarding women's labor market decisions, I use the number of garment factories within a 15 kilometer catchment area of the woman's household to instrument for employment in the garment industry. Garment factory location is primarily due to access to suitable buildings and roads (Heath and Mobarak, 2012), and analysis of the data used in this paper shows that factories are not locating based upon certain characteristics of the population.

Focusing on a sample of married women age 20-40, and their children, in very dense urban areas in Bangladesh, I estimate a Fixed-Effects Instrumental Variables (FE IV) regression that exploits variation in female employment in the garment industry induced by differences in the number of garment factories within a 15 km catchment area of the woman. Regressions include district year fixed effects, as well and individual community level controls. I use individual level data from the 2004, 2007, and 2011 Demographic and Health Surveys (DHS).

In this paper, I analyze how employment in a garment factory affects women and children through two channels. First, I examine the impact of working in a manufacturing environment on women's health, fertility preferences, and contraceptive use. Increased labor opportunities may alter a woman's bargaining power within the household, giving working women more decision-making authority over reproduction and their health. I specifically analyze modern contraception use, number of births in the last five years, and total number of desired children. Second, I examine how working in a skilled occupation affects health investments in children. Currently, I look at height-for-age and weight-for-height. An increase in investments in children would be consistent with Qian (2008), who finds that increasing female opportunities and status leads to an increase in investments for children, and increased survival rates for girls.

Preliminary results indicate being employed in a skilled occupation leads women to desire less children and to have a higher probability of using modern contraception. Women employed also experience health benefits in terms of higher weight-for-height z-scores. As a falsification test, I determine if height-for-age measures are affected by working in a skilled occupation, and they are not, which makes sense, as women in the sample should have already reached their full potential

height. Children of women currently employed in a skilled occupation experience health benefits in terms of their weight-for-height, but do not experience an increase in height-for-age.

Recent research on the effects of income shocks on health focuses on severe negative income shocks such as famines or conflicts (Chen and Zhou (2007), Cutler *et al.* (2010), Kagy (2013)), correlations between income and health (Case et al. 2008), or effects from government programs targeted to the poor such as conditional cash transfers (Barham (2011), Gertler (2004)). Household reallocations and behavior changes from losing income may not be the same as gaining income. To address this gap in the literature, I consider a positive economic shock that stems from substantially improved labor market opportunities for women, and updated expectations about female lifetime earnings, brought about by rapid growth in the garment industry in Bangladesh. I use this important event to examine how positive economic changes affect women's reproductive outcomes, health, and health investments in children in a context where consumption smoothing is difficult. I contribute to the literature by analyzing average impacts for a large area in Bangladesh, a country that has benefited immensely from globalization. Furthermore, by using the rich child level data in the DHS I will be able to explore health outcomes such as vaccination status, which has not been considered in the literature.[1]

The rest of the paper is structured as follows. Section 2 reviews the background literature on the effects of increasing female employment and information on the Bangladesh garment sector. Section 3 and 4 describe the data and the empirical specification. Section 5 presents preliminary results, Section 6 describes my next steps and Section 7 concludes.

[1]In this draft I do not consider children's vaccination status, I only consider height and weight measurements.

2 Background

2.1 Related Literature

Understanding the relationship between globalization and the accumulation of health and human capital for individuals is critical given our increasingly global economy. Much of the theoretical and empirical literature has focused on the relationship between globalization and labor, specifically child labor, and educational attainment.[2] In the Mexican context the arrival of high-skill jobs led people to obtain more education on average. While the arrival of jobs that require low skill labor incentivized individuals to obtain less education, thereby leaving school for the labor market (Atkin, 2010).

There is an emerging literature that considers the effect of changes in labor market opportunities for women on adult female outcomes and investments in children. These papers find improved labor market conditions lead to improvements in child height (Atkin 2009), increased bargaining power Majlesi (2012), changes in fertility and marriage decisions (Jensen (2012), Heath and Mobarak (2012)) and increased educational attainment (Jensen (2012), Heath and Mobarak (2012), Oster and Millett (2010)). Jensen (2012) conducts a randomized control trial in India, and finds reliable estimates of the effect of increased labor market opportunity for women on educational attainment, fertility and marriage decisions. However, this experiment was for a small region of the country and concern remains regarding the external validity of the estimates. Heath and Mobarak (2012) look specifically at the case of Bangladesh and the growth of the garment industry. Using data for a small region outside of the capital city Dhaka, they find that growth in the garment industry

[2]See Edmonds and Pavcnik (2005); Edmonds and Pavcnik (2006); Edmonds *et al.* (2010); Findlay and Kierzkowski (1983); Dinopoulos and Zhao (2007); Atkin (2010)

is associated with increased educational attainment for girls relative to boys, and also a delay of marriage and childbearing.[3]

My research fills a gap in the literature by looking at how globalization has affected women's health, fertility preferences, and contraceptive use and health investments in children for a large area of Bangladesh, something which has not been done before.[4] By using a natural experiment in the form of an exogenous macroeconomic shock, I am able to obtain causal estimates of the effect of growth in the garment industry on health outcomes.

2.2 The Garment Industry in Bangladesh

Over the last thirty years Bangladesh has experienced rapid industrialization, and economic development driven in part by the growth in manufacturing exports, 75 percent of which are from the garment industry (Berg *et al.*, 2011). According to the World Trade Organization, Bangladesh is currently the third leading exporter of clothing in the world with 19.9 billion (USD) in export value (WTO, 2012). There are currently over 5,000 factories employing 3.5 million workers, of which 80 percent are female (BGMEA, 2013).

Preference for female labor in the manufacturing industry is often attributed to women having greater agility and better fine motor skills (Vivian and Miller, 2002). These skills are highly valued since most garment workers engage in sewing. Likewise, women are often preferred because they are believed to be more patient and compliant (Paul-Majumder and Begum (2000); Siddiqi (2000)). So while employment opportunities for men and women have increased, they have increased

[3]Upon discussion of these results with one of the authors at a recent conference, there was apparently a mistake in their code and the results are now inconclusive.

[4]I currently look at height and weight for children, but plan on looking at vaccination status.

substantially more for women relative to men given women's previous options.

The characteristics of female employees working in the garment factories vary based upon the factory. Employees are required to have some formal education if they work at a factory inside an Export Processing Zone (Zohir, 2009). Jobs at factories inside the Export Processing Zones are highly coveted as they have good working conditions (Zohir, 2009). However, most factories are not inside these zones. Factories outside of these zones hire a mixture of educated and non-educated workers, however opportunities for advancement are limited for non-educated and illiterate workers (Paul-Majumder and Begum, 2000).

Garment factory location within Bangladesh is not random. Most factories are within a 60km catchment area of either Dhaka or Chittagong, the two major cities in Bangladesh. Since the industry is export oriented, the goods must be easily transported out of the country. Dhaka and Chittagong provide the best means of transport in terms of airport, river and road infrastructure. Within Dhaka and Chittagong the two most important determinations of factory location are suitable access to roads and access to buildings (Heath and Mobarak, 2012). Due to imperfections in the property market, having access to a building is a primary concern for factory owners (Heath and Mobarak, 2012). Where factories choose to locate depends primary on these concerns and not on the characteristics of the surrounding population.

The Agreement on Textiles and Clothing (ATC) played a major role in the rapid globalization of the garment industry in Bangladesh. The ATC governed garment trade in Bangladesh for a period of ten years between 1995 and 2004, at the end of which the special quotas for textiles and clothing ended and trade was regulated by normal World Trade Organization rules (Nordas, 2004).

It was anticipated that Bangladesh would not fare well at the end of the ATC (Joarder *et al.* (2010), Mlachila *et al.* (2004)). However, Bangladesh garment exports became stronger, which can been seen in Figure 1. After the end of the ATC Bangladesh experienced an increase in garment exports, the number of garment factories, and the number of garment factory employees EPB (2013).

Figure 1 plots the number of garment factories and number of garment factory employees for the last 30 years, using Bangladesh Garment Manufacturing and Exporters Association (BGMEA) data. The industry in Bangladesh first started in the late 1970s and has been steadily growing. In 2005, we can see a change in the number of employees working in garment factories. For a few years leading up to the end of the ATC, there were roughly 2 million garment factory employees. After 2005, the number of employees steadily increased to over 3.5 million workers today.

Figure 2 presents the volume of trade and the unit price of woven garments for the time period fiscal year 2001-2002 through fiscal year 2006-2007. The volume for woven garments, shows an upward trend, with a change in slope in 2005 when the ATC ended. Since 2005 the volume of trade has steadily increased to over 130 million dozen exports for fiscal year 2006-2007. Conversely, the price per dozen for woven garments decreased over this same time period due to an increasingly competitive global market for garments. In 2005, there is a change in slope of the unit price, indicating the end of the ATC did increase global competition for garments. The same general trend can be seen for knitwear.

Export statistics for a variety of goods are presented in Table 1. The table covers fiscal year 2001-2002 through fiscal year 2006-2007. For each good the volume, unit price and value in million USD is reported. Comparing the trends seen for woven garments and knitwear, goods that were

not affected by the end of the ATC, such as frozen shrimp and chemical fertilizer do not experience a sharp increase in volume after 2004 or a sharp decrease in the unit price.

By focusing on the period around the end of the ATC, I am able to analyze a period of major trade liberalization that affected the textile industry. Since this was an international policy it helps provide an exogenous shock that changed the number of garment factories and the number of people they employ.

2.3 Mechanisms

Increased female employment may change family planning decisions, individual health and health investments in children through three channels. First, there is a potential positive income shock leading to expanded resources that all household members could benefit from. Prior literature finds women have a greater preference for expenditures on children than men (Lundberg *et al.* (1997); Duflo (2000)). If health investments in both children and the women themselves are normal goods, then the amount invested will increase. Second, women now potentially have more bargaining power and status within the household and can exert greater influence over decisions such as health investments in children (Strauss and Thomas (2008); Majlesi (2012)). Third, by increasing female labor force participation in a skilled occupation women's expectations about future earnings for their children may change. In particular, there may be updated expectations about the potential earnings of female children, which may lead to a change in health investments in children.

3 Data

I use individual-level cross sectional data covering Bangladesh in conjunction with information on garment factory locations to investigate how growth in the garment industry in Bangladesh, and subsequent female employment, has impacted health, family planning and investments in children. Utilizing Demographic and Health Surveys (DHS) for 2004, 2007, and 2011, I create a pooled cross-sectional dataset, for both women and children. The data covers only married women age 15 - 49 and their children under 6 years of age. The DHS data includes information on current employment, reproductive health histories, contraceptive use, fertility preferences, anthropometric measures, and anthropometric measures for children. It also includes the latitude and longitude of the DHS sampling clusters.[5] I use this data to create two measures of fertility preferences: a woman's desired number of children and current modern contraception use, as well as height-for-age and weight-for-height z-scores for women and children. All z-scores are calculated using an internationally weighted DHS reference population.

The DHS employment occupation codes are not detailed enough to specifically determine if a woman is working in a garment factory. To proxy for if a woman is working in a garment factory, I group women into skilled and non-skilled occupations. The skilled occupations include factory workers, tailors, and business owners, but I am not able to distinguish between these occupations. The non-skilled occupations include agricultural workers, construction workers and domestic labors. Using this method I have a consistent definition of skilled and non-skilled occupations across each

[5]The DHS does not provide geographic information for exact households for confidentiality reasons. However, households are reported to be within 2 kilometers of the GPS coordinates of the cluster. There are over 300 DHS clusters for each wave of the survey. I use Geographic Information Systems (GIS) to map the locations of all clusters in the DHS in Bangladesh.

wave of the survey. In 2011 there is a specific occupation code for factory workers, these workers make up 70 percent of the skilled occupants. Suggesting that the broad category of skilled occupations is capturing mostly factory workers.

To link individuals to labor market opportunities in the garment industry, I use a dataset of Bangladesh Garment Manufacturers and Exporters Association (BGMEA) members and their factory locations to determine the number of garment factories at a certain point in time in a specific area.[6] The list of BGMEA members includes over 5,000 members, their factory name, address, year of establishment, and number of current employees. I gathered factory geographic data by finding the latitude and longitude of all factories in Bangladesh. Currently, each factory is matched to the latitude and longitude of their neighborhood, not their exact street address. There are 325 neighborhoods that have a garment factory.[7] Thus, for each neighborhood I know the number of garment factories currently operating there at different points in time based upon the factory's year of establishment.

I link the DHS data to the factory data using GIS. I then create a 15 kilometer catchment area around each DHS cluster, for a given year, and determine the number of garment factories currently in operation in the catchment area. In the analysis, in order to make the most appropriate comparisons I restrict the data to locations that have at least one garment factory before 2004. Thus, the analysis is restricted to dense urban areas. I also restrict the analysis to women age 20 40 for the analysis, since a women's level of education below age 20 may be endogenous affected by

[6]BGMEA members account for 100 percent of all woven exports and 90 percent of all knitwear exports. So while this list may not include all garment factories in Bangladesh, it is a sufficient proxy.

[7]When I could not find the location of the neighborhood, I found the GPS coordinates of the exact location.

the rise in garment industry.[8]

3.1 Summary Statistics

Garment Factories

All garment factories are within a 60 kilometer radius of either Dhaka or Chittagong, the two major cities in Bangladesh. Dhaka is the capital city and has access to major rivers and airports as a means of transporting goods. Chittagong is the second largest city in Bangladesh, and is the largest port in Bangladesh.

Table 2 describes the number of garment factories with in a 15 km catchment area of an individual. In 2004, the average number of garment factories within a 15km catchment area of an individual was 905 factories. This number grew to 1,384 by 2011.

Figure 3 and 4 map the garment factories and DHS cluster sites. While there are DHS clusters all over the country for each year of the survey, I only use data for communities where there is at least 1 garment factory within 15km as of 2004. I restrict the sample to ensure that the areas being compared are as similar as possible along observable and unobservable characteristics.

Figure 3 presents Dhaka and Chittagong together, while Figure 4 represents only small area of Dhaka. While these figures do not show the number of factories for each location, they provide an estimate of the geographic variation available. Figure 4 provides a representation of how the instrument is calculated. A 15km catchment area is drawn around a woman's residence and then the number of factories within the catchment area are counted.

Individual Characteristics

[8]Results do not differ if I include married women under the age of 20.

Table 3 details the percent of women and their husbands in skilled-occupations over time. This data and all subsequent tables restricts the data to dense urban areas that have at least one garment factory prior to 2004 and only considers married women age 20-40. In 2004 the number of working women who worked in skilled occupations was 51 percent, and in 2011 this number had grown to 81 percent. Information on the occupation of the husband is also presented, using the same occupation categories. The increase in the percent of men working in skilled-occupations as rose from 73 percent in 2004 to 88 percent in 2011. This is to be expected as growth in the garment industry spurred employment for men as well as women.

Summary statistics for women in the sample are presented in Table 4, differentiated by their occupation status. From this table it is evident that women working in skilled occupations are most similar to women who are not working, in terms of education, age of marriage, height and weight. Women in skilled occupations have on average 4.5 years of education in 2004 and 5.7 years of education in 2011. Over this time period women in skilled occupations reduced the average number of births in the last 5 years from 0.62 to 0.38. For the analysis I pool together women working in non-skilled occupations and women not currently working as the comparison to women working in skilled occupations.

Table 5 describes characteristics of children age 0-5 by their mother's occupation. Children of mothers who work in skilled occupations or who do not work are better off in terms of their height and weight measurements than children of mothers who work in non-skilled occupations. In 2004, children of mothers who worked in skilled occupations had an average height-for-age z-score of -1.79 indicating they are 1.79 standard deviations shorter than the international norm for their age. By

2011, the average height-for-age of children whose mothers work in skilled occupations decreased to -1.28, indicating a 0.51 standard deviation increase in the average height of children age 0-5 of mothers who work in skilled occupations. Children of mothers, who do not work, experienced a 0.40 standard deviation increase in their average height over this same time period. Children of mothers who worked in non-skilled occupations experienced a 0.36 standard deviation increase in their average height of this same time period. These results suggest that children of women who worked in skilled occupations improved their height for age measurements the most over time.

4 Estimation Strategy

I am interested in identifying how female labor force participation in the garment industry affects family planning preferences, women's health and health investments in children. Measuring the differences between women working in a skilled occupation (which proxies for garment factory work) and women not working in a skilled occupation will likely result in a biased estimate, since these women are likely to differ along unobservable dimensions. To address this endogeneity concern I instrument for skilled occupation employment with the number of garment factories within a 15km catchment area of a womans household. For this to be a valid instrument the number of garment factories in a 15km catchment area of an individual must directly affect the chance of a women working in a factory, but only affect the outcomes of interest, family planning preferences, womens health and child investments, through actually working in a factory. Threats to the validity of the instrument are discussed in the next section.

I estimate the following Fixed-Effects Instrumental Variables (FE IV) regression using Limited

Information Maximum Likelihood.[9]

$$SkilledOccupation_{icy} = \delta ln(FactoryDensity_{cy}) + \mu_{dy} + AgeFE_i + X_i^{'}\theta + Y_c^{'}\gamma + \epsilon_{icy} \quad (1)$$

Where i is the individual, c is the DHS cluster and y is the year. Where factory density represents the number of garment factories within a 15 km catchment area of a woman's residence. The specification includes district-year fixed effects, μ_{dy}, age fixed effects $AgeFE_i$, individual controls such as completed years of education and religion, $X_i^{'}\theta$, and community level controls such as access to piped water and a shop to buy family planning methods, $Y_c^{'}\gamma$. I cluster the error terms by DHS cluster, which I also refer to as community.

Three different specifications of the first stage are presented in Table 6. The results indicate that the number of factories within a 15 km catchment area of a woman is a good predictor of her being employed in a skilled occupation. A one percent increase in the number of factories increases the probability that she will work in a skilled occupation by 2.6 percent.

Second Stage: Effect of women's employment in skilled occupation on outcomes

$$Y_{icy} = \beta \widehat{SkilledOccupation}_i + \mu_{dy} + AgeFE_i + X_i^{'}\theta + Y_c^{'}\gamma + \epsilon_{icy} \quad (2)$$

The second stage regression exploits variation in female skilled occupation status induced by differences in factory density. The coefficient of interest, β, measures the treatment effect of a

[9]Limited Information Maximum Likelihood preforms better under potential weak instruments. Results are also run using 2SLS and are similar in magnitude and sign.

woman working in a skilled occupation. This is the Local Average Treatment Effect (LATE) and represents the effect on women who were induced to enter into a skilled occupation because of the number of factories in her 15 km catchment area. This estimate does not accurately represent the effects for women who would have gone into manufacturing anyways despite the number of factories in her catchment area. The specification includes the same fixed effects and controls as the first stage. The district year fixed effects controls for time varying affects at the district level. The age fixed effects compare the effects on women of the same age.

I present Ordinary Least Squares Fixed Effect (OLS FE) estimates for each regression as a comparison to the FE IV model, where the OLS model is the second stage regression presented above. Each table presents Kleibergen-Paap F-statistics, which accounts for clustering in the first-stage. The results indicate the IV is a sufficiently good predictor of a woman working in a skilled occupation, as the F-statistics are all above 8.9 (Stock *et al.*, 2002). The child level analysis utilizes the same method. The mother's anthropometrics are now used as additional individual level controls when looking at child anthropometric outcomes. Child age fixed effects are also included in the regressions.

4.1 Threats to validity of the IV

In order for the IV FE results to be valid, the instrument must satisfy several conditions. First, the instrument must have sufficient predictive power on the endogenous regressor. In this case, I need the number of factories in a 15 km catchment area to be strongly correlated with whether or not a woman works in a skilled occupation. Table 6, presents the first stage results for a number of specifications and the instrument has predictive power in all specifications.

Second, the instrument must satisfy the exclusion restriction. The first part of the exclusion restriction is that the instrument must be as good as randomly assigned given all of the controls in the reduced form equation. This means the location of firms must not be endogenously placed based upon the characteristics of the population that are not controlled for. As previously noted, factories make placement decisions based primarily upon access to roads and access to sufficient building structures (Heath and Mobarak, 2012). Broad district-level changes are accounted for with the district year fixed effects. Furthermore, by restricting the sample to only within a small radius of Dhaka and Chittagong and to areas that already had a garment factory prior 2004, I am comparing very similar areas. Additionally, the end of the ATC provides an increase in the number of factories and the number of people employed that is exogenous to the characteristics of the population. Firms decided to locate in Bangladesh because of low labor costs.

To gain some incite into the exclusion restriction, I test whether or not garment factories are choosing to locate in specific areas because of characteristics of the population. I use 2004 DHS and garment factory location data to calculate the number of garment factories in 2004 in a 15km catchment area of a cluster. I then use the same geographic data point and calculate the number of garment factories in 2007. I regress the change in the density of factories on the 2004 characteristics of women in that cluster, to determine if factories are choosing to locate based upon certain attributes. Table 7 presents these results. From the table it appears that controlling for completed years of education of women and whether or not a cluster has access to piped water is important. Women's age of marriage is also correlated with the change in factory density. However the other outcomes I am considering do not affect garment factory density changes.

The second part of the exclusion restriction requires that the effect of factory density on family planning preferences, women's health and children's health, be mediated only through a woman having a skilled occupation. In the analysis, I control for community level characteristics such as access to piped water, which proxies for local infrastructure and development, and access to a store that sells family planning. However, there may be spillover effects of a factory currently locating in a certain area that are not mediated through a woman having a skilled occupation.

Satisfying the second part of the exclusion restriction is a serious concern and may warrant the exploration of a different instrument such as the number of factories in the catchment area when a woman was 15, as a measure of her exposure to the industry at a time when she is making labor market decisions.

5 Preliminary Results

Women Outcomes

Tables 8 and 9 present preliminary results on the effect of a woman working in a skilled industry on her ideal number of children, modern contraception use and number of births in the last five years. Each table presents the FE OLS and IV FE results for three different specifications. The first specification does not include individual or cluster controls. The second specification includes individual level controls for years of education and religion, and the third specification includes controls for access to piped water and family planning services. While the individual and community controls may at some level be endogenous including both of them is the preferred specification as it helps reduce the worry that spurious results are being attributed to a woman working in a skilled

occupation.

Table 8 looks at the effect on use of modern contraception and number of births. The OLS results show that there is no change in modern contraception use based upon if a woman is working in a skilled occupation or not. However, the FE IV models show a consistently large effect of working in a skilled occupation on modern contraception use. Using the most robust specification, working in a skilled occupation increases the probability that a woman uses modern contraception by 61 percent.

When considering the effect of working in a skilled occupation on the number of births a woman has had in the last 5 years, there is a substantial decrease of 0.94 children using the most robust IV specification. Similarly, FE IV results show a woman's ideal number of children falls dramatically by 1.07 children when working in a skilled occupation, which can be seen in Table 9.

The OLS results are smaller than the FE IV results for all outcomes indicating a negative bias. The direction of this bias is consistent with a negative selection and suggests women from disadvantaged backgrounds are more likely to sort into the new skilled occupation jobs. This negative selection story is consistent with Atkin (2009). Recalling from the summary statistics, the share of the women who are currently working remains steady over the sample period, but there is movement from the non-skilled occupations to skilled occupations. This characteristic of the data is consistent with negative selection.

The large effects on these outcomes warrant further explanation. As noted in the Methodology section, the FE IV estimates are the local average treatment effects and thus only apply to women who were induced to work in a skilled occupation because of the number of garment factories

within a 15km catchment area of her residence. Most likely, the effects would be much smaller for women who would have gone into a skilled occupation regardless of the number of garment factories within a 15km catchment area of her residence. Finding such large results is not uncommon in the literature. Atkin (2009) finds that a mother working in a manufacturing job, instrumented for by the number of factory openings in her municipality at the time she was 16, has a 1.92 standard deviation increase in a childs height.

As a falsification test, I consider a womans height-for-age measurement as an outcome measure. These results are presented in Table 9. Since all of these women are 20 years of age or older, their height should not change as a function of their employment in a skilled occupation. The OLS and IV results show no statistically significant effect on the height-for-age z-score of women.

Children Outcomes

To look at the effect of a mother working in a skilled occupation on a child's health I consider two outcomes: weight-for-height and height-for-age. Table 10 presents results for weight-for-height. The OLS results show a significant positive relationship between a mother working in a skilled occupation and their child's weight-for-height z-score. The FE IV results show that the OLS results are negatively biased, as a mother working in a skilled occupation increases a child's weight-for-height by 1.56 standard deviations on average when controlling for mother's education and her weight-for-height z-score. While this is a substantial increase in weight-for-height, this does not represent a negative investment in health as these children are severely underweight to begin with.

Table 10 also considers the impact on a child's height-for-age measurements. There is no

significant impact on height-for-age measurements based upon a mothers current employment status in a skilled occupation. This is not surprising given that height is a long term measure of health and may not change immediately given the mother's current employment.

6 Next Steps

To check the robustness of the estimates I would like to include more spatial information on infrastructure, such as measures of road and major river access for each community. I am working on incorporating this information into GIS. I would also like to further control for access to health care, and am working on obtaining spatial information on the location of hospitals. I am also continuing to work with BGMEA to obtain employment data for each year that I am considering.

7 Conclusion

This paper contributes to our understanding of the relationship between globalization and women's health, health investments in children and reproductive outcomes in the context of poor country. It examines how a woman working in a skilled occupation (which proxys for working in a garment factory) in Bangladesh, affects her fertility preferences and health investments in her children. Growth in low-skill manufacturing and increased female labor force participation is not unique to Bangladesh, as much of the developing world has seen this expansion in the last 50 years (Mammen and Paxson, 2000). This paper focuses specifically on the period 2004-2011 as this was a period of major trade liberalization and globalization in Bangladesh. I find that working in a skilled occupation significantly increases a woman's probably of using modern contraception while decreasing the

number of children she wants. Her children also experience increased health investments in terms of their weight-for-height measurements.

Figure 1: Garment Factories and Employment by Year

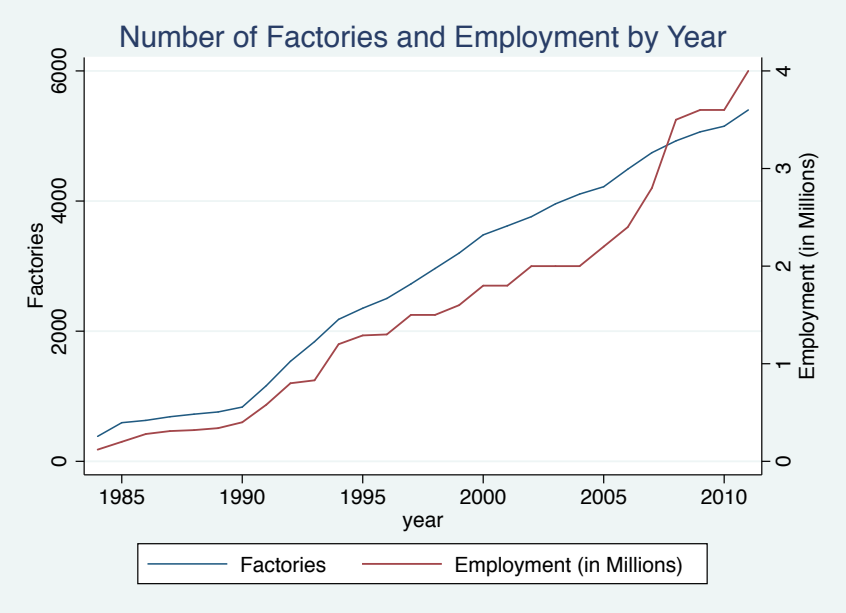

Figure 2: Export Price and Volume: Woven Goods

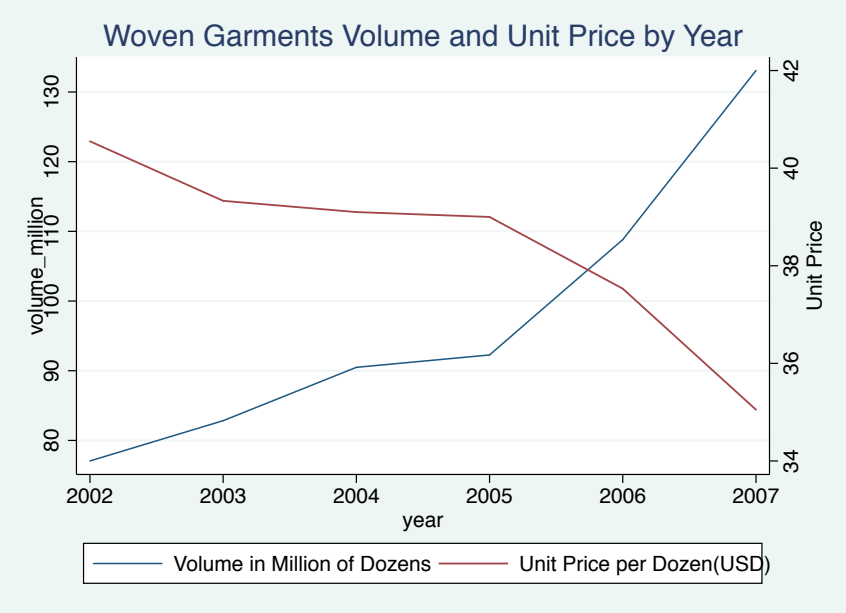

Figure 3: Dhaka and Chittagong, DHS Sampling Cluster and Factory Location

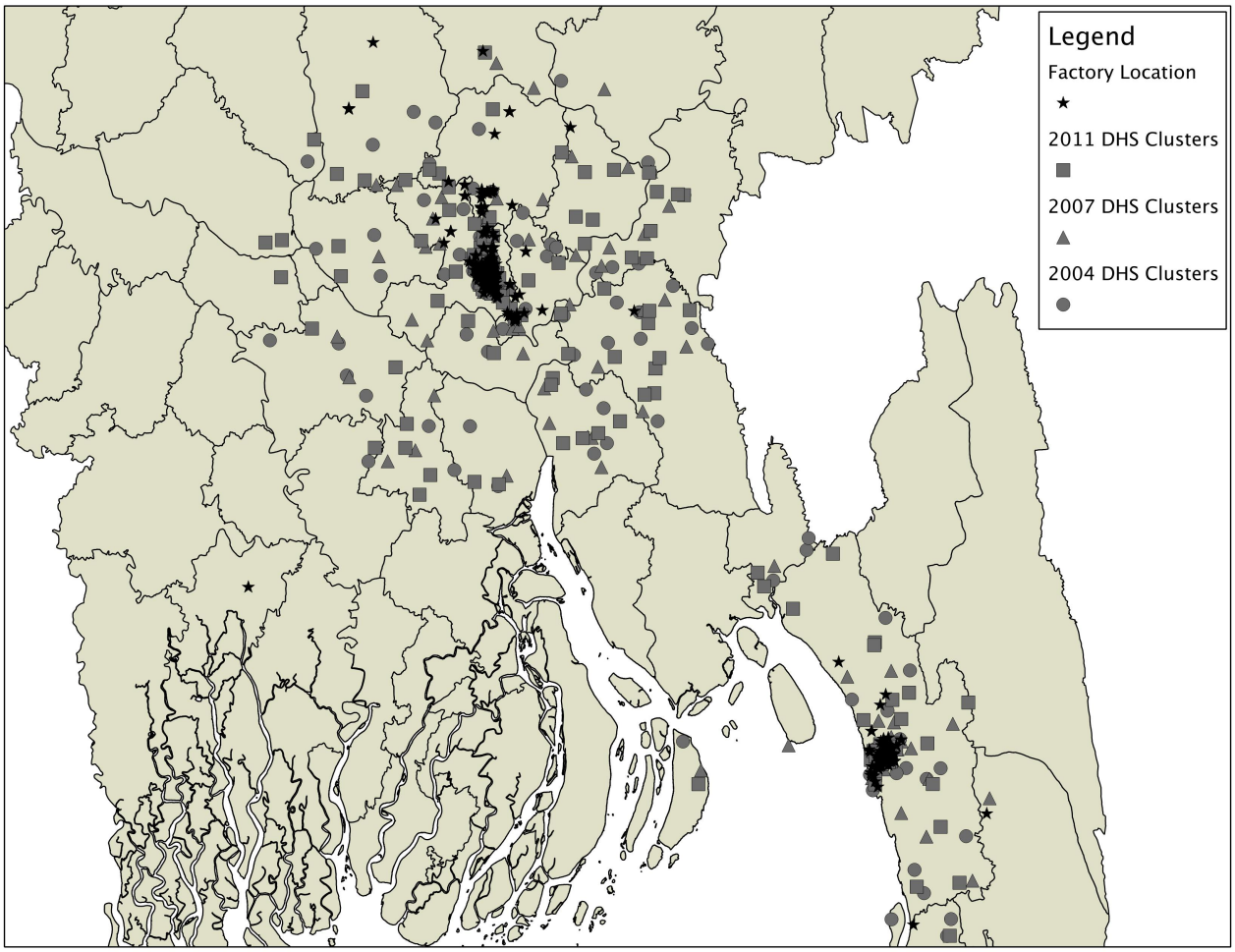

Figure 4: Example of 15km Catchment Area in Dhaka

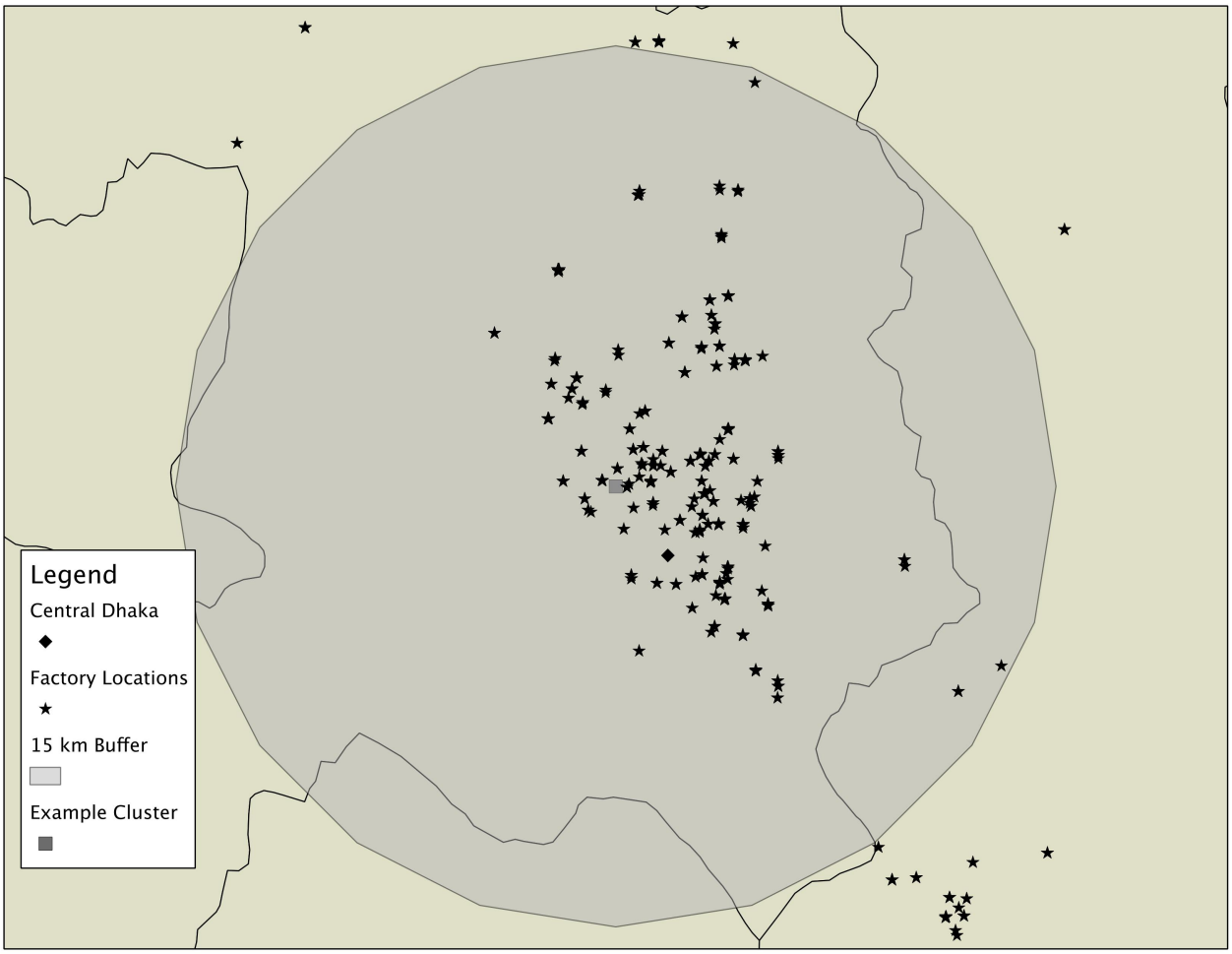

Table 1: Export Volume and Value by Good and Year

	2002-2003			2003-2004			2004-2005			2005 - 2006			2006 - 2007		
Good	**Volume**	**Unit Price**	**Value**	**Volume**	**Unit Price**	**Value**	**Volume**	**Unit Price**	**Value**	**Volume**	**Unit Price**	**Value**	**Volume**	**Unit Price**	**Value**
Raw Jute (Bales)	1996	41.32	82.46	1878	42.43	79.7	2269	42.4	96.19	3413	43.44	148.27	43.44	43.4	147.15
Tea (Kgs)	10350	1.49	15.47	12290	1.29	15.81	11060	1.43	15.84	8740	1.36	11.89	4840	1.44	6.94
Frozen Shrimp, Fresh Fish (Lbs)	73570	4.37	321.81	84480	4.62	390.25	96110	4.38	420.74	107860	4.26	459.11	112150	4.59	515.32
Woven Garments (Dozen)	82835	39.33	3258.27	90488	39.1	3538.07	92262	39	3598.2	108815	37.53	4083.82	133075	35.05	4657.63
Knitwear (Dozen)	69178	23.91	1653.83	91600	23.45	2148.02	120131	23.47	2819.47	165023	23.12	3816.98	199544	22.82	4553.6

Source: Bangladesh Export Statistics 2006 - 2007

Notes: Value is in Million USD. Volume is in thousands of units. Fiscal year is July 1st - June 30th.

Table 2: Garment Factory Summary Statistics

Year	Number of Factories Geocoded	Number of Garment Factories within a 15 km Catchement			
		Mean	SD	Min	Max
2004	3,280	905	937	1	2513
2007	3,797	1141	1160	1	2914
2011	4,503	1384	1314	1	3477

Note: Data comes from the Bangladesh Garment Manufactuers Exporting Association member list.

Table 3: Labor Outcomes for Men and Women

	2004		2007		2011	
	Mean	SD	Mean	SD	Mean	SD
Woman is Currently Working (=1)	0.28	0.45	0.30	0.46	0.27	0.45
Woman who is currently working is in Skilled Occupation (=1)	0.51	0.50	0.54	0.50	0.81	0.39
Husband who is currently working is in skilled occupation (=1)	0.73	0.45	0.74	0.44	0.88	0.33

Notes: Data come from2004, 2007 and 2011 Bangladesh DHS surveys. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40. Skilled occupations include factory workers, tailors and business owners. Non-skilled occupations include agricultural workers, construction workers and domestic labors.

Table 4: Characteristics of Women by Occupation and Year

	2004									2011								
	Woman works in Skilled Occupation			Woman works in Non-Skilled Occupation			Woman not Currently Working			Woman works in Skilled Occupation			Woman works in Non-Skilled Occupation			Woman not Currently Working		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
Woman Characteristics																		
Age	29.39	5.80	176	30.02	5.83	179	29.02	5.91	897	28.65	5.60	356	29.02	5.89	80	29.07	6.01	1152
Age of Marriage	15.91	3.62	176	14.62	2.21	179	15.67	3.15	897	16.82	3.94	356	15.26	2.51	80	16.54	3.20	1152
Age at first birth	17.72	3.78	160	16.99	2.59	173	17.79	3.18	845	18.38	3.93	313	17.39	3.07	74	18.49	3.35	1076
Completed Years of Education	4.47	4.95	176	1.49	2.46	179	4.29	4.30	897	5.71	4.84	356	2.90	3.37	80	6.37	4.30	1152
Ideal Number of Children	2.36	0.73	174	2.44	0.80	176	2.41	0.76	880	2.03	0.48	356	2.11	0.60	80	2.12	0.58	1147
Number of Births in the last 5 years	0.62	0.71	176	0.61	0.69	179	0.77	0.75	897	0.38	0.55	356	0.44	0.57	80	0.58	0.65	1152
Currently Using Modern Contraception	0.47	0.50	176	0.47	0.50	179	0.51	0.50	897	0.55	0.50	356	0.55	0.50	80	0.56	0.50	1152
Weight for Height Z-Score	-1.10	1.12	172	-1.59	0.99	176	-0.93	1.22	887	-0.79	1.10	339	-0.77	1.25	74	-0.36	1.19	1115
Height for Age Z-Score	-2.18	0.89	173	-2.23	0.97	178	-2.21	0.89	891	-2.25	0.90	342	-2.35	0.81	75	-2.17	0.89	1121
Community Characteristics																		
Cluster has piped water (=1)	0.36	0.48	176	0.27	0.45	179	0.31	0.46	897	0.64	0.48	356	0.59	0.49	80	0.48	0.50	1152
Cluster has shop that sells Family Planning Methods (=1)	0.80	0.40	176	0.67	0.47	179	0.63	0.48	897	0.90	0.30	356	0.78	0.42	80	0.78	0.42	1152

Notes: Data come from2004, 2007 and 2011 Bangladesh DHS surveys. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40. Skilled occupations include factory workers, tailors and business owners. Non-skilled occupations include agricultural workers, construction workers and domestic labors.

Table 5: Characteristics of Children Age 0 - 5 by Mothers Occupation and Year

	2004									2011								
	Mother works in Skilled Occupation			Mother works in Non-Skilled Occupation			Mother not Currently Working			Mother works in Skilled Occupation			Mother works in Non-Skilled Occupation			Mother not Currently Working		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Child Characteristics																		
Age (in months)	31.04	17.09	85	33.89	16.69	94	30.38	16.86	624	38.53	14.60	113	35.54	14.17	34	29.36	17.65	650
Female (=1)	0.54	0.50	85	0.47	0.50	94	0.51	0.50	624	0.43	0.50	113	0.56	0.50	34	0.51	0.50	650
Weight for Height Z-Score	-0.67	0.98	77	-1.12	1.02	90	-0.86	0.97	593	-0.80	1.45	102	-0.98	0.89	33	-0.75	1.23	591
Height for Age Z- Score	-1.79	1.34	77	-2.08	1.40	90	-1.65	1.26	593	-1.28	1.51	102	-1.72	1.28	33	-1.25	1.35	591
Cluster Characteristics																		
Cluster has piped water (=1)	0.23	0.42	85	0.25	0.43	94	0.28	0.45	624	0.65	0.48	113	0.62	0.49	34	0.44	0.50	650
Cluster has shop that sells Family Planning Methods (=1)	0.76	0.42	84	0.63	0.48	94	0.62	0.48	612	0.90	0.30	111	0.80	0.40	33	0.81	0.39	600

Notes: Data come from2004 and 2011 Bangladesh DHS surveys. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40 who have a child under 6 year of age. Skilled occupations include factory workers, tailors and business owners. Non-skilled occupations include agricultural workers, construction workers and domestic labors.

Table 6: First Stage

Dependent Variable: Woman Works in Skilled Occupation

	(1)	(2)	(3)
ln(Number of Factories in 15 km radius)	0.0289***	0.0294***	0.0264***
	(0.00425)	(0.00427)	(0.00462)
Observations	3,855	3,852	3,852
R-squared	0.046	0.048	0.056
F-Stat	46.13	47.50	32.63
District Year Fixed Effects	Y	Y	Y
Age Fixed Effects	Y	Y	Y
Individual Controls	N	Y	Y
Community Controls	N	N	Y

Notes: Data come from 2004, 2007 and 2011 Bangladesh DHS and the Bangladesh Garment Manufactures Exporting Association. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40. Individual controls include years of completed education and religion. Cluster controls include access to piped water and a shop that sells family planing methods.

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Changes in Factory Density from 2004 - 2007 on 2004 Woman and Cluster Characteristics

Dependent Variable: ln(Change in Factory Density from 2004 - 2007)	(1)
Completed Years of Education	0.033**
	(0.015)
Ideal Number of Children	-0.125
	(0.086)
Number of Births in Last 5 Years	-0.019
	(0.089)
Height-for-Age Z-Score	0.006
	(0.046)
Age at Marriage	-0.038*
	(0.021)
Age at First Birth	0.036
	(0.022)
Currently Using Modern Contraception (=1)	0.106
	(0.090)
DHS Cluster has piped water (=1)	0.959***
	(0.283)
DHS Cluster has shop that sells family planning (=1)	0.035
	(0.392)
Constant	3.558***
	(0.536)
Observations	1,146
R-squared	0.728

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Regression includes district fixed effects and standard errors are clustered at the DHS cluster level. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40.

Table 8: Effect of Woman Working in Skilled Occupation on Modern Contraception Use and Number of Births in Last 5 Years

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Currently Using Modern Contraception						
Woman Works in Skilled Occupation	-0.00901	-0.0110	-0.0110	0.692***	0.634***	0.613**
	(0.0211)	(0.0209)	(0.0208)	(0.250)	(0.236)	(0.247)
Observations	3,855	3,852	3,852	3,855	3,852	3,852
R-squared	0.035	0.038	0.043	-0.302	-0.255	-0.237
Kleibergen-Paap F-Stat				14.63	14.79	10.20
Panel B: Number of Births in Last 5 Years						
Woman Works in Skilled Occupation	-0.169***	-0.167***	-0.172***	-0.854**	-0.827**	-0.941**
	(0.0249)	(0.0252)	(0.0260)	(0.372)	(0.355)	(0.416)
Observations	3,855	3,852	3,852	3,855	3,852	3,852
R-squared	0.206	0.208	0.211	-0.173	-0.160	-0.219
Kleibergen-Paap F-Stat				14.63	14.79	10.20
District Year Fixed Effects	Y	Y	Y	Y	Y	Y
Age Fixed Effects	Y	Y	Y	Y	Y	Y
Individual Controls	N	Y	Y	N	Y	Y
Community Controls	N	N	Y	N	N	Y

Notes: Data come from2004, 2007 and 2011 Bangladesh DHS surveys. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40. Skilled occupations include factory workers, tailors and business owners. Non-skilled occupations include agricultural workers, construction workers and domestic labors.

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Effect of Woman Working in Skilled Occupation on Ideal Number of Children She Wants and Height-for-Age Z-Score

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Ideal Number of Children						
Woman Works in Skilled Occupation	-0.0994***	-0.0981***	-0.0943***	-1.458***	-1.183***	-1.073**
	(0.0249)	(0.0233)	(0.0233)	(0.535)	(0.445)	(0.492)
Observations	3,855	3,852	3,852	3,855	3,852	3,852
R-squared	0.113	0.146	0.156	-0.708	-0.466	-0.373
Kleibergen-Paap F-Stat				14.63	14.79	10.20
Panel B: Height-for-Age Z-Score						
Woman Works in Skilled Occupation	-0.0358	-0.0236	-0.0207	0.379	0.0102	0.306
	(0.0385)	(0.0370)	(0.0375)	(0.425)	(0.364)	(0.479)
Observations	3,786	3,783	3,783	3,786	3,783	3,783
R-squared	0.014	0.050	0.055	-0.032	-0.000	-0.020
Kleibergen-Paap F-Stat				15.77	15.81	11.05
District Year Fixed Effects	Y	Y	Y	Y	Y	Y
Age Fixed Effects	Y	Y	Y	Y	Y	Y
Individual Controls	N	Y	Y	N	Y	Y
Community Controls	N	N	Y	N	N	Y

Notes: Data come from2004, 2007 and 2011 Bangladesh DHS surveys. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40. Skilled occupations include factory workers, tailors and business owners. Non-skilled occupations include agricultural workers, construction workers and domestic labors.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Effect of Mother Working in Skilled Job on Child Height and Weight

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Weight-for-Height Z-Score						
Mom Works in Skilled Job	0.117	0.161*	0.160*	1.804*	1.103*	1.561*
	(0.0832)	(0.0957)	(0.0952)	(0.972)	(0.602)	(0.890)
Observations	2,106	1,557	1,520	2,106	1,557	1,520
R-squared	0.097	0.147	0.146	-0.280	-0.082	-0.182
Kleibergen-Paap F-Stat				9.476	21.33	9.156
Panel B: Height-for-Age Z-Score						
Mom Works in Skilled Job	0.0567	-0.0703	-0.0611	1.763	0.394	-0.289
	(0.0969)	(0.0942)	(0.0918)	(1.275)	(0.650)	(0.806)
Observations	2,106	1,566	1,529	2,106	1,566	1,529
R-squared	0.122	0.194	0.198	-0.192	-0.015	-0.004
Kleibergen-Paap F-Stat				9.476	20.54	8.768
District Year Fixed Effects	Y	Y	Y	Y	Y	Y
Mom Age Fixed Effects	Y	Y	Y	Y	Y	Y
Child Age Fixed Effects	Y	Y	Y	Y	Y	Y
Individual Controls	N	Y	Y	N	Y	Y
Community Controls	N	N	Y	N	N	Y

Notes: Data come from 2004, 2007 and 2011 Bangladesh DHS surveys. Data is restricted to areas that have at least 1 garment factory prior to 2004 and women age 20 - 40. Skilled occupations include factory workers, tailors and business owners. Non-skilled occupations include agricultural workers, construction workers and domestic labors.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

References

Atkin, D. 2009. Working for the future: female factory work and child health in Mexico. *Unpublished Manuscript, Yale University*.

Atkin, D. 2010. Endogenous Skill Acquisition and Export Manufacturing in Mexico. Working Papers id:2506, eSocialSciences.

Bangladesh Bureau of Statistics 2010. Foreign Trade Statistics of Bangladesh: 2008-09.

Barham, T. 2011. A healthier start: the effect of conditional cash transfers on neonatal and infant mortality in rural Mexico. *Journal of Development Economics 94*(1), 74–85.

Berg, A., S. Hedrich, S. Kempf, and T. Tochtermann 2011. Bangladesh's ready-made garments landscape: The challenge of growth. *Apparel, Fashion and Luxury Practice*.

BGMEA 2013. Bangladesh Garment Manufacturers and Export Association: About Garment Industry.

Chen, Y., and L.-A. Zhou 2007. The long-term health and economic consequences of the 1959-1961 famine in China. *Journal of Health Economics 26*(4), 659–681.

Cutler, D., W. Fung, M. Kremer, M. Singhal, and T. Vogl 2010. Early-life malaria exposure and adult outcomes: Evidence from malaria eradication in India. *American Economic Journal: Applied Economics 2*(2), 72–94.

Dinopoulos, E., and L. Zhao 2007. Child Labor and Globalization. *Journal of Labor Economics* **25**, 553–579.

Duflo, E. 2000. Child Health and Household Resources in South Africa: Evidence from the Old Age Pension Program. *American Economic Review 90*(2), 393–398.

Edmonds, E. V., and N. Pavcnik 2005. The effect of trade liberalization on child labor. *Journal of International Economics 65*(2), 401–419.

Edmonds, E. V., and N. Pavcnik 2006. International trade and child labor: Cross-country evidence. *Journal of International Economics 68*(1), 115 – 140.

Edmonds, E. V., N. Pavcnik, and P. Topalova 2010. Trade Adjustment and Human Capital Investments: Evidence from Indian Tariff Reform. *American Economic Journal: Applied Economics 2*(4), 42–75.

EPB, B. 2013. Export Promotion Bureau, Bangladesh Ministry of Commerce.

Findlay, R., and H. Kierzkowski 1983. International Trade and Human Capital: A Simple General Equilibrium Model. *Journal of Political Economy 91*(6), 957–78.

Gertler, P. 2004. Do conditional cash transfers improve child health? Evidence from PROGRESA's control randomized experiment. *The American Economic Review 94*(2), 336–341.

Heath, R., and A. M. Mobarak 2012. Does Demand or Supply Constrain Investments in Education? Evidence from Garment Sector Jobs in Bangladesh.

Jensen, R. 2012. Do Labor Market Opportunities Affect Young Women's Work and Family Decisions? Experimental Evidence from India. *The Quarterly Journal of Economics 127*(2), 753–792.

Joarder, M. A. M., A. N. Hossain, and M. M. Hakim 2010. Post-MFA Performance of Bangladesh Apparel Sector. *International Review of Business Research Papers 6*(4), 134–144.

Kagy, G. 2013. Long Run Impacts of Famine Exposure: A Study of the 1974 - 1975 Bangladesh Famine. *Working Paper*.

Lundberg, S. J., R. A. Pollak, and T. J. Wales 1997. Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. *Journal of Human Resources*, 463–480.

Majlesi, K. 2012. Labor Market Opportunities and sex-specific investment in Children's Human Capital: Evidence from Mexico. *Working Paper*.

Mammen, K., and C. Paxson 2000. Women's work and economic development. *The Journal of Economic Perspectives 14*(4), 141–164.

Mlachila, M., Y. Yang, et al. 2004. *The end of textiles quotas: a case study of the impact on Bangladesh*. Number 2004-2108. International Monetary Fund Washington, DC.

Nordas, H. K. 2004. The Global Textile and Clothing Industry post the Agreement on Textiles and Clothing. *Discussion Paper No 5*.

Oster, E., and M. B. Millett 2010. Do Call Centers Promote School Enrollment? Evidence from India. Working Paper 15922, National Bureau of Economic Research.

Paul-Majumder, P., and A. Begum 2000. The gender imbalances in the export oriented garment industry in Bangladesh. *The World Bank, Development Research Group/Poverty Reduction and Economic Management Network, Washington, DC*.

Qian, N. 2008. Missing women and the price of tea in China: The effect of sex-specific earnings on sex imbalance. *The Quarterly Journal of Economics 123*(3), 1251–1285.

Siddiqi, D. M. 2000. Miracle worker or womanmachine? Tracking (trans) national realities in Bangladeshi factories. *Economic and Political Weekly*, L11–L17.

Stock, J. H., J. H. Wright, and M. Yogo 2002. A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics 20*(4).

Strauss, J., and D. Thomas 2008. *Health over the Life Course*, Volume 4 of *Handbook of Development Economics*, Chapter 54, pp. 3375–3474. Elsevier.

Vivian, J. M., and C. Miller 2002. *Women's Employment in the Textile Manufacturing Sectors of Bangladesh and Morocco*. United Nations Research Institute for Social Development.

WTO 2012. International Trade Statistics 2012.

Zohir, S. C. 2009. Gender Balance in the EPZ: Socio-Economic Study of Dhaka Export Processing Zone in Bangladesh.