Endogenous Skill Acquisition and Export Manufacturing in Mexico*

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Abstract

Studies based on firm-level data find that both exporting firms and multinational corporations pay higher wages for a given skill level. However, the literature overlooks the fact that export manufacturing firms may also change the educational choices of the workforce. In this paper, I confirm that for Mexico during the period 1986-2000, the export sector pays higher wages than other sectors, but school drop out increases with the arrival of new export jobs. By the year 2000, the workers induced to enter export manufacturing are earning less than they would have earned had the jobs never appeared and they stayed in school longer. I identify the causal effects by looking within municipalities and examining how the education of different cohorts varies with new factory openings in the municipality at key school-leaving ages. Export manufacturing attracts impatient students by paying high relative wages for unskilled workers, and offering many jobs to low-skill workers straight out of school. The magnitudes I find suggest that for every ten new jobs created, one student drops out of school at grade 9 rather than continuing on through grade 12.

JEL Codes: F16, J24, O12, O14, O19

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1 Introduction

There is a large and growing literature exploring the impact of exporting firms and multinational corporations on the labor market in developing countries. One of the most robust stylized facts to come out of studies of microlevel firm data has been that exporting firms pay higher wages.[1] This was shown for Mexico by Bernard (1995), Zhou (2003) and Verhoogen (2008).[2] From these findings, it is tempting to conclude that worker incomes must also rise with the arrival of new exporting opportunities. However, all of these studies focus on salaries paid by firms, and identify exporter or foreign firm wage premia while controlling for education levels. Meanwhile, individual incomes depend on both the education of the worker and the salary paid at each level of education. Therefore, if the arrival of export manufacturing jobs reduced the skill acquisition of some workers, then higher firm wages may not correspond to higher lifetime incomes.

This paper provides novel empirical evidence that this is indeed what occurred in Mexico. I use variation in the timing of sectoral employment changes at key school leaving ages within municipalities to show that, unlike other formal sector jobs, expanding export industries pulled workers out of school at younger ages, permanently inhibiting their skill acquisition. The booming high-tech export manufacturing industries that trade liberalization brought to Mexico did pay higher wages conditional upon education levels, but these youths eventually experienced lower incomes due to these new job opportunities. These lower incomes resulted from workers acquiring less education than they would have otherwise, and accordingly received lower salaries by the end of the sample period, commensurate with their skill level.

Mexico provides a perfect setting to study the impacts of globalization on the labor force. Over the period spanned by the data (1985-2000), Mexico turned its back on an import substitution strategy and liberalized trade, joining GATT in 1986 and NAFTA in 1994. During these years, Mexico reduced tariffs substantially and many new plants opened, often in the form of Maquiladoras, to manufacture products for export.[3] Total employment in export manufacturing rose from

[1] Bernard and Jensen (1995) first presented this fact for the US, and other authors confirmed this fact for many developing countries. Schank, Schnabel, and Wagner (2007) surveys this literature and provides references.

[2] Similarly, Aitken, Harrison, and Lipsey (1996) demonstrate that foreign firms in Mexico pay higher wages compared to domestic firms.

[3] The Maquiladora program allows duty free imports of goods for assembly and re-export. These firms were initially confined to border areas and employed mainly women, but by the year 2000 one quarter of firms were in non-border states and half the employees were male.

under 900,000 formal sector jobs at the beginning of 1986 to over 2.7 million jobs in 2000. Much of this growth was driven by multinational corporations, with nearly two thirds of manufacturing exports in 2000 originating from foreign affiliates (UNCTAD 2002). In this paper, I demonstrate that this massive expansion in export manufacturing altered the education decisions of Mexico's youth.

A simple conceptual framework guides the empirical work. I modify a Becker (1962) human capital model to include stochastic job opportunities. These stochastic job opportunities offer persistent wage premia that depend on the exact year of entry into the labor force and originate from well-documented firm and cohort-specific non-compensating wage differentials. I find that my results are consistent with such a modification.[4] This framework illustrates that new employment opportunities have two offsetting effects. On the one hand, when a new firm opens, a student may drop out of school, expecting to be better off by taking the new job rather than by chancing the job market with more education in the future. On the other hand, if the student expects that vacancies will continue to be available and these jobs will sufficiently reward skill acquisition, she may choose to stay in school longer. The net effect of these two forces depends on the wage and availability of jobs at different skill levels in that firm and the likelihood that there will also be vacancies in the future.

In this paper, I find that the characteristics of export manufacturing firms place them in the former category, in which new job arrivals induce school dropout. The magnitudes I find suggest that for every ten high-tech export jobs that arrived, one student dropped out at grade 9 rather than continuing on through grade 12. In contrast, the arrival of new non export manufacturing and service jobs induce greater skill acquisition. The most likely explanation is that, compared to the other industries, export manufacturing offers an abundance of low-skill jobs that pay relatively high wages to workers with low levels of schooling. Additonally, job vacancies in the export manufacturing industry are the least likely to persist into the future. Therefore, an influx of such jobs raises the opportunity cost of schooling for youths. Consistent with this interpretation, I find that once these industry characteristics are controlled for, new jobs in export-intensive sectors actually encourage students to stay in school relative to similar industries.[5]

[4]In a neoclassical labor market setting, job flows only affect education decisions by changing the relative demand for skill. However, I find several result that are inconsistent with the neoclassical labor market model. In this sense, the paper relates to recent work that explores the impacts of trade in non-neoclassical labor market settings. See for example, Davis and Harrigan (2007) and Helpman, Itskhoki, and Redding (2008). Frias, Kaplan, and Verhoogen (2009) provides empirical evidence on the importance of these non-neoclassical features.

[5]However, the fact that export manufacturing firms use low-skill labor intensively is not a coincidence. The Heckscher-Ohlin theorem predicts that Mexico will export products intensive in this relatively abundant factor.

A unique data set makes this analysis possible. I merge firm-level employment data for the universe of formal sector firms with 10 million schooling records from the 2000 Mexican census, matching each cohort to the job growth in their municipality at ages 15 and 16, the age at which compulsory education concludes and formal employment is first possible. Having cohort-specific schooling and local employment measures at a very disaggregated level allows me to look within 1,808 municipalities and plausibly identify the causal impacts of job availability on education decisions in Mexico.

I compare cohorts within a municipality who reached their key school leaving age at the time of substantial factory openings to slightly younger or older cohorts who did not. The main empirical difficulty is reverse causation; that local skill levels may determine formal firm employment decisions. To address this issue, I instrument for job growth with large factory openings or closings. My strategy assumes that the decision for a firm to open or close a factory in a region is not an outcome of cohort-specific changes in the local labor supply. This assumption seems reasonable as such expansions or contractions are associated with large fixed costs and are not plausibly driven by changes in the labor supply of a single cohort of youths. This is especially true in Mexico, where a large quantity of migrant and informal labor ensures that changes in the dropout decisions of a single cohort comprise a very small part of the potential labor that a firm can hire.[6]

The findings of this paper are supportive of standard models of trade with endogenous skill acquisition. Findlay and Kierzkowski (1983) incorporates human capital decisions into a Heckscher-Ohlin model and shows that trade exacerbates initial skill differences across countries by raising the return to the abundant skill—the Stolper–Samuelson effect—exactly as I find.[7] Trade can induce divergent growth paths if positive externalities to education are incorporated into such a model (Stokey 1991).

These results are consistent with the literature on trade and wages in Mexico. Trade liberalization in Mexico has been associated with a rise in the skill premium until the mid 1990's and a decline in the skill premium after that.[8] My results are driven by the fact that trade liberalization brought many new export manufacturing jobs to Mexico, most of which required minimal schooling—less than high school—while paying high formal-sector wages for unskilled labor compared to other

[6]The informal sector comprises between one third and two thirds of Mexican employment. Around 20 percent of my sample are migrants. In this paper, I focus only on non-migrants, and results pertain only to that group.

[7]Ambiguous results obtain when credit constraints are introduced to such a model (Chesnokova and Krishna 2009).

[8]This is a large literature including Cragg and Epelbaum (1996), Hanson and Harrison (1999), Feenstra and Hanson (1997), Robertson (2004) and Airola and Juhn (2005). Verhoogen (2008) finds skill upgrading within non-Maquiladora exporters in the mid 1990's.

unskilled jobs.[9] Therefore, these jobs substantially raised the opportunity cost of schooling for low skill workers. The rise in the opportunity cost of schooling can increase school drop out, even if these new firms offer higher skill premia than the existing firms, for two reasons. First, if youths are risk averse, they will weigh more heavily the benefits from the low-skill vacancies that are available with certainty today than the potential benefits from uncertain and volatile future vacancies. Second, most jobs for high skill workers in Mexico are in the service sector. Therefore, youths are likely to be trading off a job in manufacturing if they dropout of school for a job in services if they acquire more education. Therefore, increases in wages for high-skill workers in manufacturing will play only a small role in a student's dropout decision.

The results are also consistent with the findings of studies in labor economics. Several studies use panels of region or state-level unemployment rates to show that students stay in school longer during a recession.[10] In the development context, Goldin and Katz (1997) show that industrialization slowed educational growth in the early 20th century United States, while Federman and Levine (2005) and Le Brun, Helper, and Levine (2009) find industrialization increased enrollments in Indonesia and had mixed effects in Mexico.[11] Finally, a complementary recent literature looks at the educational impacts of the arrival of IT service jobs in India. Munshi and Rosenzweig (2006), Shastry (2008) and Oster (2010) all find positive enrollment impacts from the arrival of relatively high-skilled service job opportunities in India. Such opportunities raised the returns to education, and similarly, I observe that new formal-sector service jobs increase education acquisition in Mexico.

This paper improves on existing studies in several ways. First, by drawing on a richer data set to assemble a very large panel (1,808 municipalities) and by using an instrumentation strategy, I am able to control for potential reverse causality that comes from endogenous firm location choices. Second, these rich data allow me to separately identify the educational impacts of local job availability across all formal sector industries. Third, guided by my conceptual framework, I am able to separate the educational impact of periods of job declines from periods of job growth and to identify the industry characteristics that determine whether new job arrivals either encourage or

[9] 85 percent of formal sector employees in my two export industries (defined in section 3.1) have less than a high school education. The reasons why export firms may pay such high wages are discussed in section 2.

[10] See Card and Lemieux (2000) and Kahn (2007) for the US and Clark (2009) for the UK.

[11] Le Brun, Helper, and Levine (2009) compare municipality education changes between the 1990 and 2000 with total manufacturing growth over that period. Manufacturing growth is associated with increased education for younger children but reduced education for girls aged 16 to 18.

discourage additional schooling.[12]

My findings have important, albeit nuanced, policy implications for Mexico and many other countries. From a macro perspective, many countries pursuing export-led growth strategies also want to upgrade the skill level of their workforce, believing that the positive externalities from education drive long-run growth rates (Lucas 1988). I show that there is a tradeoff between these two goals as the export manufacturing firms attracted by such strategies discourage skill acquisition. Therefore, to achieve both goals, policies can be put in place that ensure students' education decisions remain unaltered by the arrival of these new jobs.[13] From an individual perspective, the welfare implications of new export manufacturing opportunities are ambiguous. On the one hand, if youths simply have high discount rates or new export manufacturing jobs relax credit constraints and allow youths to make high-return investments, welfare will increase. On the other hand, recent studies from both neuroscience and economics have argued that youths are more impatient than adults, which suggests that they could make decisions that lower their welfare in the long run.[14]

The next section lays out the conceptual framework. Section 3 introduces the rich data set and discuss the methodology. Section 4 presents the basic regression results, and robustness checks are shown in section 5. Section 6 uses the conceptual framework to explain why I find that only export manufacturing jobs induce school dropout. Section 7 looks at income effects. Finally, section 8 discusses policy implications and concludes. Appendix A explores potential biases due to migration.

2 A Conceptual Framework for Understanding Educational Choices

I briefly discuss a conceptual framework that clarifies the channels through which new employment opportunities in different industries affect a student's education choice. In a standard education decision model, a student trades off the higher future wage profile available to more educated workers for the immediate income that employment today brings. If the student has a sufficiently high discount rate, she will rationally decide to drop out of school and start earning despite knowing that her wage will be lower in future. In a neoclassical labor market setting, new job arrivals will increase the demand for the types of labor that those particular jobs require and alter the relative attractiveness of the skilled and unskilled wage profiles. Thus, new job arrivals in two industries

[12] My conceptual framework suggests that such an asymmetry may be present during this time period if students correctly predicted that periods of job declines were likely to reverse, yet periods of growth were likely to continue.

[13] For example, raising minimum employment ages in export manufacturing or conditional cash transfer programs.

[14] See, for example, Spear (2000) and Oreopoulos (2007).

that demand a similar distribution of skills should have identical effects on the student's schooling decision. My empirical findings are inconsistent with this prediction. I find that new export manufacturing job opportunities encourage students to drop out of school, while new opportunities in other similarly skilled sectors encourage additional schooling. Therefore, in order to highlight the industry characteristics that can induce such heterogeneity in the response of education to new job opportunities, I outline a decision making-process in the context of stochastic job vacancies.

First, I describe a stylized decision making process. A forward-looking student must make two sequential and irreversible decisions: whether to drop out of school; and if he or she drops out of school, which industry i to enter. If a student drops out of school at t, with s years of schooling and enters industry i, she receives income $\varepsilon_{ist} y_{is,\tau-t}$ for each year τ thereafter. A stochastic year-of-entry wage premium ε_{ist} is multiplied by an historic industry wage profile, $y_{is,\tau-t}$, that does not depend on the year of entry.[15] The year-of-entry wage premium summarizes the job vacancies in the industry available to a particular student in a given year. These year-of-entry wage premia exist as only certain firms will offer a particular worker a job in any given year. If the student receives no job offers in that industry that year, then $\varepsilon_{ist} = 0$. The formal sector of employment in Mexico is characterized by firm-specific non-compensating wage differentials and job rationing.[16] Therefore, the wage a worker receives will depend on which firm hires her.[17] In a year when more firms are hiring and more vacancies are posted, a student is more likely to be able to obtain a job at a firm that pays persistently higher wages.[18,19] Accordingly, the year-of-entry wage premium is a weakly increasing function of the net new jobs, l_{it}, created in industry i that year; $\varepsilon_{ist} = \varepsilon_{is}(l_{it})$, $\varepsilon'_{is}(l_{it}) \geq 0$.

The education decision corresponds to an optimal stopping model. The student decides whether to take the best job available or to wait one more period and choose again. If she waits, she consumes the at-school income equivalent, $\overline{y}_t$, and retains the option to choose again next period

[15]The historic industry wage profile depends only on education, s, and experience, $\tau - t$.

[16]Frias, Kaplan, and Verhoogen (2009) document firm-specific wage differentials in Mexico, while Duval Hernandez (2006) finds evidence of formal sector job rationing in Mexico.

[17]These firm-specific premia may derive from efficiency wage models (Shapiro and Stiglitz 1984), fair wage considerations (Akerlof and Yellen 1990), search models where high productivity firms find vacancies more costly (Burdett and Mortensen 1998), insider bargaining (Abowd and Lemieux 1993) or external pressures from foreign consumers (Harrison and Scorse forthcoming).

[18]Oreopoulos, Von Wachter, and Heisz (2006) present evidence for year-of-entry wage premia in Canada.

[19]Even for a given firm, there may be wage premia that depend on the labor demand conditions during the year of entry into that firm. Beaudry and DiNardo (1991) show that, within firms, a persistant cohort-specific wage premium emerges endogenously from optimal lifetime contracts for risk-averse credit-constrained workers.Baker, Gibbs, and Holmstrom (1994) provide evidence for such "handshake" models.

with one more year of schooling, when there may also be more firms hiring.[20] The student cannot borrow or save, discounts at the rate ρ and has constant relative risk aversion utility with risk aversion parameter σ. For simplicity, I assume that the student makes a binary schooling choice of either dropping out of school at time t ($s = 0$) or completing high school at time $t + 1$ ($s = 1$):

$$s = \mathbf{I}\left[\max_{i\in I}(\varepsilon_{i0}(l_{it})^{1-\sigma}\sum_{\tau=t}^{\infty}\frac{y_{i0,\tau-t}^{1-\sigma}}{(1+\rho)^{\tau-t}}) < \overline{y}_t^{1-\sigma} + E_t[\max_{i\in I}(\varepsilon_{i1}(l_{it+1})^{1-\sigma}\sum_{\tau=t+1}^{\infty}\frac{y_{i1,\tau-t-1}^{1-\sigma}}{(1+\rho)^{\tau-t}})]\right]. \quad (1)$$

The student stays in school if the net present value of the best job available today across industries is inferior to the expected net present value of the best future job plus the utility during the year of school attendance.[21] The opportunity cost of schooling is not only the foregone earnings if the student stays at school, but also includes the potential loss from turning down a job at a firm that pays high wage premia and may not be hiring the following year.

I now explore how new job arrivals in industry i affect the schooling decision. In the simplest case, new jobs arrivals, l_{it}, weakly reduce schooling by weakly raising the best wage on offer if the student drops-out today.[22] However, the realization of net new jobs today may change the expected industry year-of-entry wage premium in the future, $E_t\varepsilon_{i1}(l_{i,t+1})$. For example, a new factory-opening brings many immediate vacancies, but students may expect the factory to hire additional workers next year or more firms to arrive in the future due to the forces of agglomeration or industry growth. If l_{it} is positively correlated with $E_t\varepsilon_{i1}(l_{i,t+1})$, both the best job available today and the expected best future job may change and the net impact on schooling will be ambiguous. The next two sections of the paper use a reduced form empirical approach to determine the sign of the net effect of new job arrivals on schooling for each industry.

The perceived serial correlation of new jobs provides an additional empirical prediction that differentiates an education decision framework in a neoclassical labor market setting from one in which vacancies are stochastic. In neoclassical labor market settings, new job arrivals in a high

[20]The at-school income equivalent depends on family support, the disutility or cost of school attendance and part-time employment opportunities.

[21]A high discount rate or low at-school income will generally reduce the desire for additional schooling as the net benefits of schooling are smaller and are discounted more heavily. Meanwhile, high risk aversion increases the probability of dropout in response to new job opportunities because the student values uncertain future vacancies relatively less than certain vacancies today.

[22]Adding a cost to job searching makes dropout more tempting when new jobs arrive since the search costs will be lower that year. Similarly, relaxing the assumption of irreversible school dropout reduces the option value of staying in school and so increases dropout when new jobs arrive. Incorporating job separations into the model reduces dropout with new jobs arrive since a student can change job in future if better opportunities arise.

skill industry should raise the returns to schooling by increasing the demand for skill and making skill acquisition more attractive. Correspondingly, job losses in this industry should reduce the demand for skill and increase the incentive to dropout. However, in a framework with stochastic vacancies, the perceived serial correlation may be a function of net new jobs. In Mexico, most years between 1986 and 2000 saw substantial formal sector employment growth. Consequently, students in Mexico over this period may have rightly believed that l_{it} and $l_{i,t+1}$ are uncorrelated if $l_{it} < 0$ but positively correlated if $l_{it} > 0$. If students have these expectations, both job arrivals and job losses in a high skill industry will encourage students to stay in school. In the latter case, jobs in the sector are unavailable today so the opportunity cost of schooling falls, but students still expect them to be available in the future. I test this conjecture in section 4.1, and find evidence in favor of an education decision framework that incorporates stochastic vacancies.

2.1 Industry Characteristics and School Dropout

There are three observable industry characteristics that determine whether new jobs at time t in industry i encourage or discourage school dropout in a framework with stochastic vacancies.

First, the lower the perceived serial correlation between new jobs arriving today, l_{it}, and new jobs arriving in future, $l_{i,t+1}$, the more likely it is that new jobs in industry i will encourage school dropout. The expected net present value of the best job in future in that industry will improve by only a small amount if students perceive a low positive serial correlation and will deteriorate for a negative serial correlation.

For the next two industry characteristics that I will describe, I assume that students expect a positive correlation between new jobs today and new jobs in future.

Second, the higher the wages for school dropouts in industry i compared to other industries, the more likely it is that one of the new jobs in industry i is the best job available to the student today, raising the opportunity cost of schooling. Conversely, the higher the wages for school graduates in industry i compared to other industries, the larger the increase in the expected best future job and the perceived returns to schooling. Therefore, the higher the ratio between these two relative wage terms, the more likely it is that new jobs in industry i encourage school dropout.[23]

Third, the higher the proportion of employees that are school dropouts in industry i compared to

[23] E.g. New jobs in industry i are more likely to encourage dropout when the wage for school dropouts relative to other industries divided by the wage for school graduates relative to other industries is large.

other industries, the more likely it is that the vacant positions do not require high school education. Therefore, a job opening in industry i is more likely to be the best job available to the student today, raise the opportunity cost of schooling and encourage school dropout. By a similar logic, the higher the proportion of vacancies that are filled by young and inexperienced workers in industry i, the more likely job openings in industry i are to encourage school dropout.

In summary, whether a new job arrival in a particular industry does discourage education acquisition will depend in part on the three industry characteristics: the serial correlation of new job openings, the relative wage premia paid to different skill levels and the availability of jobs at different skill levels. Only the last of these characteristics matters in a standard neoclassical labor market setting. In section 6, I evaluate the importance of these three characteristics in explaining the heterogenous educational effect of new jobs that I find across industries.

3 Empirical Implementation

3.1 Data

I use two sources of data in this paper to examine how the education of different age cohorts in a municipality varies with new job opportunities in different industries. The education data are from a 10.6 percent subsample of the 2000 Mexican decennial census collected by the National Institute of Statistics, Geography, and Informatics (INEGI).[24] The 10.1 million person records cover all 2,443 municipalities in Mexico. I cannot, unfortunately, use family background data for the individuals, as many of the older cohorts I study have left their parental homes by the time of the census.

The employment data originate from the Mexican Social Security Institute (IMSS), and cover the complete universe of formal private-sector establishments, including Maquiladoras. IMSS provides health insurance and pension coverage and all employees must enroll. I construct the main employment variable, net new jobs, from annual changes in employment by industry within each municipality.[25] The data cover 2.2 million firms between 1985 and 2000, with annual employment recorded on December 31st of each year. Sample means for both data sources are shown in table 1.

As this paper focuses on the impact of export-oriented manufacturing, I break the manufactur-

[24]The census, XIII Censo General de Poblacion y Vivienda 2000, is publicly available from IPUMSI Minnesota Population Center (2007). I obtain the annual working-age municipality population by linearly interpolating INEGI population data for ages 15-49 from 1990, 1995 and 2000.

[25]The aggregations from the firm to municipality level were carried out at ITAM, where the data is held securely. Kaplan, Gonzalez, and Robertson (2007) contains further details on the IMSS data.

ing sector into export and non export industries. The IMSS data assigns each firm to an industry category, but does not indicate whether it exports or not. Therefore, I define a firm as an exporter if it belongs to a 3-digit ISIC classification (Rev. 2) industry where more than 50 percent of output was exported for at least half the years in the sample.[26] The conceptual framework suggests that new jobs in high-skill and low-skill industries may produce quite different educational outcomes. Therefore, I split the very heterogenous export manufacturing and service sectors by the average education of the 3-digit industry's employees in the 2000 census.

The composition and sizes of the five industry groupings are as follows:[27] Non Export Manufacturing (1,087,457 jobs in Metals, Minerals, Glass, Plastics, Chemicals, Paper, Publishing, Food, Beverage and Tobacco), Low-Tech Export Manufacturing (898,592 jobs in Textiles, Apparel, Shoes, Leather, Wood and Furniture), High-Tech Export Manufacturing (1,396,645 jobs in Electrical, Electronic, Transport and Scientific Equipment; Toys, Clocks and Ceramics), Commerce and Personal Services (3,066,358 jobs in Communications, Rental, Food, Lodging, Domestic, Recreational and Transport Services) and Professional Services (1,733,037 jobs in Professional, Technical, Medical, Educational, Administrative and Financial Services). The skill distribution of workers in these industries in 2000 is shown in figure 2.[28] The low-tech export manufacturing sector is substantially less skilled than the two other manufacturing sectors, which in turn are less skilled than the service sectors.

While not all of the jobs in the industries that I classify as high and low-tech export manufacturing are in firms that export, the overwhelming majority are. Of the approximately 2.3 million jobs in these two industries in 2000, about 1.2 million are in Maquiladoras. Maquiladoras can import intermediates duty free, and are required to export most of their production. This type of firm accounted for more than half the employment growth over the period. A large number of the remaining 1.1 million jobs are also in exporting firms. In the 1990 Encuesta Industrial Anual, which only covers large non-Maquiladora firms, half of the 417,000 jobs in these two industries were in firms that exported. This proportion is likely to have increased further as Mexican manufacturing

[26]The industry categories used by IMSS, the 2000 Census and the 3-digit ISIC classification (Rev. 2) were matched by hand. The export and output data come from the Trade, Production and Protection 1976-2004 database (Nicita and Olarreaga 2007). Results are robust to using other export industry groupings.

[27]The size is the total employment in the year 2000 from the IMSS database, excluding the Mexico City metropolitan area.

[28]The education distribution is calculated using IMSS insured workers in the year 2000 census.

became more export oriented over the 1990's. Figure 1 provides more details about the manufacturing firm groupings. Firms in the two export manufacturing sectors export a much larger fraction of their total output and are more likely to be Maquiladoras or foreign owned.[29] In section 6, I explore whether new Maquiladora jobs affect education choices differently than other new jobs. To do this, I approximately identify the Maquiladora firms in my sample by matching firm level employment data to INEGI aggregate statistics on Maquiladoras by industry, state-industry and municipality.[30]

I combine the education and employment data using the 1985 municipal boundaries. In order for each location to represent a single labor market, I merge any municipalities classified by INEGI as metropolitan zones or where more than 10 percent of the working population commute to a nearby municipality.[31] I exclude the Valle de México metropolitan zone (that includes Mexico City) as this single observation would be very heavily weighted in my results and the area is too large to expect youths to be affected by new factory openings on the other side of the 8,000 square km zone.[32] These adjustments result in a panel of 13 cohorts across 1,808 municipalities.[33]

Finally, I restrict the sample to non-migrants, defined from the census as those people born in the same state they are currently living in who also lived in their current municipality in 1995. Including in-migrants confounds the impact of local job opportunities on education, since the census does not ask where they lived at ages 15 and 16. Therefore, my estimates are only representative of the non-migrants who comprise 80 percent of the full census sample. In section 5.1, I address potential biases related to migration.

[29] These data cover the whole of Mexico and originate from Banco de Mexico, Nicita and Olarreaga (2007) and Ibarraran (2004). The measure of output used by Nicita and Olarreaga (2007) does not properly account for all the imported intermediate components that typify the Mexican export production, hence the major export assembly industries show export ratios of over 100 percent.

[30] These data come from http://dgcnesyp.inegi.gob.mx/cgi-win/bdieintsi.exe. I am able to roughly identify Maquiladoras by classifying a firm as a Maquiladora when the number of firms or employees in a given aggregate cell is equal in the INEGI data to the number of firms or employees in the IMSS dataset. The fact that each of these firms appear in several overlapping aggregates allows me to iterate this process until convergence. Due to the highly clustered nature of Maquiladora production in Mexico, I am able to classify all the potential Maquiladoras in 4 iterations.

[31] I make this correction as if workers commute to nearby municipalities, the error terms will be spatially correlated. When a municipality sends workers to two different municipalities that do not send workers to each other, two synthetic municipalities are created, with both containing the sending municipality (but with its relative weighting halved).

[32] The metropolitan zone contains 18 million people across three state. Unfortunately a further breakdown is not possible because the IMSS classification within Mexico City is proprietary and cannot be matched to the INEGI codes used in the Census. In the robustness checks, I also exclude Monterrey and Guadalajara.

[33] To calculate changes in employment, I lose the first year of data, 1985. Since the census was collected in February 2000, only firm data through 1999 is relevant. This leaves 14 years of data, but the two-year exposure window reduces the length of the panel to 13 cohorts.

3.2 Empirical Specification

The school dropout equation 1 suggests that the impact of new job opportunities on educational attainment is ambiguous. Accordingly, I first estimate a reduced form equation. I then use the conceptual framework to explore why new job opportunities encourage education in some industries and discourage it in others. I regress school attainment on net new jobs by industry as follows:

$$S_{mc} = \sum_i \beta_i l_{mci} + \delta_m + \delta_{rc} + \varepsilon_{mc}. \tag{2}$$

S_{mc} is the average total years of schooling obtained by February 2000 for the cohort born in year c in municipality m. The labor demand measure, l_{mci}, is the net new formal jobs per worker in one of my five industries, i, in municipality m (Δemployment$_{mi}$\working-age population$_m$), in the years that the cohort turned age 15 and 16.

The β_i coefficients for the two export sectors estimate the change in the school attainment of workers that results from new export-oriented manufacturing jobs arriving during the key school-leaving years. I include municipality fixed effects, δ_m, and a full set of state-time dummies, δ_{rc}, where r indexes the state. These state-time dummies, which subsume national time dummies, are identical to state-cohort dummies as each cohort is exposed at a different year. As a robustness check, I also include municipality linear time trends. The state-time dummies control for the fact that education trended upwards during the period, but at different rates across Mexico.[34] Therefore, I am comparing a cohort within a municipality who was heavily exposed to new factory openings at their key school leaving age to other cohorts in the same municipality who did not have such a shock to their employment opportunities at these ages, flexibly controlling for time effects using the cohorts of key school-leaving age in nearby municipalities where factories did not open. In section 3.3, I discuss potential reverse causation and omitted variable bias in detail, and present a novel instrumentation strategy.

The main specification focuses on new jobs arriving at ages 15 and 16, although I will also examine other exposure ages. Compulsory schooling in Mexico ends with Secundaria (grade 9), and most children complete this grade at either 15 or 16 depending on their birth date. The compulsory

[34] The state-time dummies also remove trends that arise because younger cohorts have had less time than older cohorts to complete their education, and the degree of measurement error for younger cohorts will vary with the education level of the state.

schooling law only dates from 1992 and enforcement is rare (Behrman, Sengupta, and Todd 2005). However, ages 15 and 16 are still the two most common school leaving ages and the age at which the decision to attend high school is made. Additionally, formal sector jobs first become a direct alternative to school at this age, as the minimum formal sector working age is 16.[35][36]

3.3 Empirical Methodology and Threats to Identification

With a conceptual framework in place and the basic specification introduced, I now address the three main econometric concerns: omitted variables, measurement error and reverse causality. Omitted variables will bias coefficients if a third factor affects both a municipality's education level and its attractiveness as a location for a firm.[37] Using the panel dimension of my data, I am able to sweep out time-invariant features of the municipality using municipality fixed effects. Similarly, the flexible state-time dummies control for any omitted variable that changes over time within the 32 states of Mexico. These dummy variables will be insufficient if there are omitted variables correlated with employment changes over time within municipalities. The most obvious confounding factors are complementary investments at the time of a new factory opening. For example, a factory may agree to build a school when it opens. However, such complementary investments will affect all cohorts, with younger cohorts exposed for more years and likely to see larger effects. However, I find disproportionate effects on the cohorts of school leaving age (see figure 4). Additionally, Helper, Levine, and Woodruff (2006) look at school building decisions in Mexico and find that these decisions were made at the national level prior to 1992 and at the state level afterwards, with little municipality say in either time period.

A second issue is measurement error in employment changes. IMSS registration defines firm formality. However, some firms existed informally prior to registering with IMSS, thus, they appear as new firms when they register. Measurement error will attenuate the coefficients, although in this context it could also bias the coefficients in a particular direction if an omitted variable both

[35]The specification accommodates grade slippage, since job arrivals at ages 15 or 16 affect all students as formal sector work is now possible. In the sample of students currently at school who had completed 9 years of school in February 2000, 32 percent were older than 16.

[36]The actual minimum working age is 14, however children under 16 require parental consent and medical documentation. Additionally they cannot work overtime, in certain hazardous industries, beyond 10pm or more than 6 hours a day (Bureau of Economic and Business Affairs 2001). Accordingly, the minimum working age in the formal sector is usually taken as 16. While there is much child labor in Mexico, most of this is in the informal sector.

[37]For example, the neoclassical growth model predicts that poorer municipalities will converge with richer municipalities, with both education and the number of firms increasing due to high returns to low human and physical capital. A cross-section analysis will incorrectly attribute the schooling increases to the arrival of these firms.

encouraged firms to register and affected cohort education choices.

The final threat to identification is reverse causality. Differences in wages across skill groups drive firm location and employment decisions, and depend on the local distribution of educational attainment.[38] If new factories do lower education and low schooling levels attract factories, $\hat{\beta}_i$ will be biased in an ambiguous direction. My methodology compares cohorts over-time within a municipality, and allows me to relax the restriction that municipality education levels do not affect current firm employment decisions—a restriction that would be required in a cross-section. Instead, reverse causality will not bias the coefficients in a panel setting if a single cohort deviation in (state) detrended education does not affect firm employment decisions in the past, present or future. Therefore, while a firm may wish to locate in a highly skilled location, or in a state where skills are increasing rapidly over time, the firm's decision to open in a particular locality must not be influenced by the fact that the youths of age 15 and 16 in the locality have an unusually strong desire for education.

In order to deal with these last two identification concerns, I use an instrumental variable approach. I instrument for net new jobs per worker, l_{mci}, with the net new jobs per worker generated by large single-firm expansions and contractions (positive or negative changes of 50 or more employees in a single year at a single firm). The instrument is highly correlated with net new jobs per worker, as large single firm changes comprise a substantial component of the total change in employment. For the instrument to be exogenous to the error term in equation 2, I require that firms respond to changes in the education decisions of the local youths only through the small expansions and contractions that are excluded from my instrument.

The exogeneity assumption seems reasonable. There are very large fixed costs associated with large single-firm expansions, and large contractions are extremely costly to reverse. An unusually high dropout rate for a particular cohort of youths is unlikely to drive these large firm investment decisions for two reasons. First, a single cohort is a very small component of the local skill distribution and so will have only a minor influence on the labor pool from which the firm can hire. This assumption is especially plausible for Mexico, which has a large number of both informal and migrant workers. As many of these workers are also seeking formal sector employment in the municipality, they ensure that the total labor supply is unresponsive to small annual changes in lo-

[38] Bernard, Robertson, and Schott (2004) show that factor prices are not equalized across Mexico, resulting in an inverse relationship between relative wages and relative skill levels.

cal dropout rates.[39] Second, entrepreneurs must obtain cohort-varying information about the skill level in a municipality, which is not readily available. Instead these large expansions are most likely driven by external demand factors interacted with stable municipality characteristics (distance to US border, size of local market etc.). Therefore, these firm employment changes are unlikely to be the result of the schooling decisions of the current cohort aged 15 and 16.

For the assumption of strict exogeneity to be valid, I require that these large firm expansions and contractions are also not influenced by future or past cohort schooling deviations. Future deviations in cohort education are unknown at the time of the firm decision and so presumably will not affect firm decisions. However past schooling deviations may affect firm decisions, since the skill level of all these workers, having already entered the job market, are observable. If, for example, a particularly bad teacher joins a local school and many students start to drop out, this may have a non-negligible effect on the local unskilled wage after multiple cohorts have been exposed. Two factors limit the size of the bias that such a situation will cause. First, any correlation between past schooling deviations and firm location decisions will be divided by the number of cohorts in my panel (thirteen). Second, older cohorts have progressively smaller impacts on the pool of local labor a firm can hire as many will no longer be looking for new employment. Additionally, I include a municipality linear time trend as a robustness check in section 5 in order to pick up persistent trends in schooling deviations.

I require substantially weaker conditions for identification if I am able to interpret my instrumentation strategy as a variant of the fuzzy regression discontinuity design (e.g. Angrist and Lavy 1999). The lumpy changes in the industry job environment that come from large expansions and contractions are discontinuous. Therefore, whatever the origin of these firm employment changes, I can compare cohorts who were at key schooling leaving ages when these changes occur with those in adjacent age cohorts. For this approach to be valid, I only require that adjacent cohorts have identical distributions of pre-determined characteristics and that my time dummies and trend terms are able to characterize the evolution of schooling in the absence of new factory shocks.[40] Therefore, taking into account both interpretations, my instrumental variable strategy plausibly deals with the issue of reverse causation.

[39]There is a shortage of formal sector employment opportunities in Mexico. Duval Hernandez (2006) provides evidence of formal sector job rationing and segmentation between the informal and formal sectors.

[40]Since these discontinuities are functions of year of birth, if different cohorts have heterogenous treatment effects, $\hat{\beta_{1i}}$ is an average treatment effect weighted by the ex-ante likelihood that a cohort is near one of these discontinuities. The trends are state-time dummies and, in the robustness section, a municipality linear time trend.

The instrumental variable strategy also mitigates the problem of measurement error due to the registration of previously informal firms. My instrument focuses only on large single-firm employment changes. These large changes can only occur in larger firms, which could not have avoided registration with IMSS

I provide a second instrumental variable strategy to mitigate a particular concern. My state-time dummies will not adequately control for schooling trends if firms decide to locate in a particular state for statewide factors (geography, state level governance etc.) and then choose the precise municipality based on local education trends. Therefore, I follow the widely used methodology of Bartik (1991) to isolate labor demand shocks. I instrument for net new jobs per worker in a particular industry and municipality by the growth rate of that industry in the whole state, interacted with the total number of jobs per worker in the previous year in that municipality.[41] This instrumental variable strategy will produce coefficients that are not biased by firm employment decisions that take this particular form.

Finally, I cluster all standard errors at the municipality level to prevent misleading inference due to serial correlation in the error term across years within a municipality (Bertrand, Duflo, and Mullainathan 2004). The large number of groups (1808 municipalities) mitigates concerns regarding spurious correlation (Baltagi and Kao 2000). All the regressions use the survey weights from the 2000 Census to make them representative of Mexico, excluding the capital city metropolitan area.[42] I now present the results.

4 Basic Results

Figure 3 shows the basic identification strategy for the 20 municipalities that received the largest total number of net new jobs per worker in high-tech export manufacturing. The figure plots the residuals over time after regressing both schooling and net new jobs per worker in high-tech export manufacturing on the remaining terms in equation 2. As one example, in Matamoros, which lies at the US border, cohorts who were exposed to a particularly substantial number of new factory openings in high-tech export manufacturing attained fewer years of schooling than the adjacent cohorts.

[41]This variable will serve as a valid instrument for net new jobs per worker as long as state-industry growth rates are not correlated with labor supply shocks in the municipality. This is equivalent to including national time trends and identifying off the interaction of the state level industry mix and national industry growth rates, as is common in the US literature, for example Bartik (2006). There are an average of 58 municipalities in each state in my sample.

[42]Specifically, I weight each cohort in each municipality by the number of individuals that the cell represents.

The panel regression, equation 2, essentially aggregates these effects over all 1808 municipalities.

Table 3 shows the results from the basic specification, regression 2. Column 1 contains the OLS results. Column 2 contains the results of instrumenting for net new jobs per worker with the net new jobs per worker attributable to changes of 50 or more employees in a single firm in a single year. Column 3 contains the reduced form results from regressing schooling on my instrument. The arrival of new formal sector jobs in both export manufacturing sectors significantly increases school dropout ($\beta_i < 0$). In contrast, employment growth in professional services significantly increases education acquisition. Skill acquisition depends on the local availability of jobs at ages 15 and 16, and only employment growth in export manufacturing industries reduces educational attainment.

The results across the three columns are very similar except in commerce and personal services where the positive coefficient falls considerably in the IV specification.[43] The first stage of the IV is extremely significant, as expected. The second instrumentation strategy, instrumenting for net new jobs with the predicted value of net new jobs if the municipality grew at the state-industry growth rate, is shown in column 4 of table 3. The results are similar although larger in magnitude for several sectors, suggesting that reverse causation is not biasing my results downwards and leading to spurious negative coefficients. However, the second instrument is much weaker than the first and so the estimates are more imprecise.[44] Accordingly, for the remainder of the paper, I focus on the first instrumentation strategy.

The magnitude of these coefficients in table 3 imply large effects on educational attainment. As a concrete example, a 90th percentile positive shock to high-tech export manufacturing (0.01 net new jobs per worker over the two year exposure period) results in the cohort who were 16 at some point that year obtaining 0.07 years less school on average. Alternatively, such a coefficient would be obtained if for every ten high-tech export manufacturing job arrivals, one student changed their education decision and dropped out at grade 9 rather than continuing on to grade 12.[45]

[43] This result is perhaps unsurprising. Firms in this sector are generally small, and therefore this industry is particularly likely to make small employment adjustments in response to changes in the supply of school leavers.

[44] The first stage F-stat is just over 10 compared to an F-stat of 558 for the first IV strategy.

[45] To calculate this number, I assume that a new factory only affects the educational choices of youths who drop out to work in the factory and that a single cohort comprises 5 percent of the Mexican population aged 15-49. If each student who dropped out of school to take a factory job obtained 3 years less education, and enough new jobs arrived to employ the entire cohort, the cohort would obtain 3 years less schooling on average. If only one in ten of the new factory jobs were offered to youths in that cohort, the average cohort schooling decline falls to $3/10$. If enough new jobs arrived for each worker in the municipality, then the effects would be 20 times larger and β_i would approximately equal 6 ($3/10 * 20$) as I find. Of course, if some students leave school to work in these new export manufacturing jobs, but would have dropped out anyway, the cohort can obtain a higher percentage of the new jobs.

4.1 Are Years of Hiring and Firing Symmetric

I now explore whether job arrivals and job losses have symmetric effects on school dropout. The conceptual framework suggested that such an asymmetry was likely if students expect a year of job growth to be followed by further growth, but a year of job loss to be just as likely to reverse as to continue. Table 2 provides evidence for why expectations of this type would be rational. The table shows the transition matrix for negative, positive and zero values of net new jobs by industry. Negative employment shocks persist roughly 50 percent of the time, while positive shocks persist 70 to 80 percent of the time. If students have such expectations, years of job losses weakly encourage school drop out as the opportunity cost of schooling declines but the expected best job available in future is unchanged. Therefore, in the industries where new job arrivals encourage school acquisition, both job growth and job losses will increase schooling. This prediction is inconsistent with a neoclassical labor market setting, in which job gains and losses in a high skill industry will have opposite effects on education acquisition.[46]

In order to test the hypothesis that years of job losses encourage schooling in all industries, I interact the measure of net new jobs, l_{mci}, with indicator dummies so that β_i can differ between years of industry job creation and job destruction. $\boldsymbol{I}^+$ takes the value 1 if $l_{mci} > 0$, and $\boldsymbol{I}^-$ takes the value 1 if $l_{mci} < 0$:

$$S_{mc} = \sum_i \beta_{1i} l_{mci} \boldsymbol{I}^+ + \sum_i \beta_{2i} l_{mci} \boldsymbol{I}^- + \delta_m + \delta_{rc} + \varepsilon_{mc}. \tag{3}$$

If students expect new job arrivals to be serially uncorrelated in a year of job losses then I should find $\beta_{2i} \leq 0$ in all industries. As $l_{mci} < 0$ in a year of job losses, $\beta_{2i} < 0$ implies that cohort schooling increases with job losses.

Table 4 shows the results of regression 3. The positive net new jobs per worker coefficients are very similar to the coefficients on net new jobs per worker in table 3. Now, however, the positive coefficient on new job arrivals in non export manufacturing is significant. The hypothesis of asymmetric expectations is supported. While years of job growth have mixed effects on education across industries, years of job decline increase schooling in all industries. In the two industries where I find

These proportions seem reasonable: in the census sample, 9.6 percent of high-tech and 13.3 percent of the low-tech export manufacturing workers are age 18 or younger.

[46] Job losses will raise the relative demand for unskilled labor and vice versa.

significant positive schooling effects for positive net new jobs, the impacts of positive and negative job arrivals are significantly different at the 1 percent significance level ($\beta_{2i} < \beta_{1i}$). Therefore, this test provides evidence in support of a conceptual framework that incorporates stochastic vacancies. In subsequent sections of the paper, I will focus on the positive net new job effects that describe the educational impacts of a successful export-oriented industrialization policy.

4.2 Effects at Different Ages of Exposure

I now analyze the effects of new job arrivals at ages of exposure other than ages 15 and 16. Looking at other exposure ages also serves as a placebo test. If my results are driven, as I claim, by students altering education decisions when new job opportunities arrive in their municipality, then new job arrivals should not affect education levels if they arrive after all education decisions are complete. Figure 4 presents the IV coefficients on positive net new jobs per worker arriving at every age of exposure between 7-8 and 23-24.[47] The attenuation of the coefficients at older ages is reassuring, since at these ages there are fewer people left in school, and so a smaller fraction of the population is affected. The placebo test is satisfied, as there are no educational impacts from new manufacturing jobs by ages 22-23, the age at which students graduate college and education decisions are complete.[48] Therefore, the successful placebo test rules out explanations for my findings based on trends or third factors that do not factor directly into the educational decisions of students.

The effects at younger ages, shown in figure 4, may derive from several sources. New employment opportunities may directly affect parents or siblings rather than change the student's opportunity cost or perceived returns to schooling.[49] Youths may also drop out of school when a new factory opens even if they are too young to be employed there, as they expect to obtain a job there in future without additional education. Alternatively, new formal sector jobs may create informal jobs that encourage students to drop out of school—for example, informal piece-work contracts for a formal manufacturing firm.

[47] I cannot expect to pick out exact exposure ages. Since net new jobs are correlated over time, the impacts I identify may partially come from exposure at other ages. With such a short panel, and an age cohort spread over two school grades, I cannot meaningfully include multiple exposure ages in the same regression.

[48] The only impacts at ages 22-23 come from the two service industries. In table 7, I show that these effects are driven by the least educated groups. There is evidence of adult education in the 2000 census. Over 600,000 people older than 20 report currently attending school, yet have not completed grade 12. Therefore, the least skilled may continue to acquire skills in response to new service sector jobs at older ages.

[49] These new job opportunities will potentially increase family income and raise education, or require children to now look after younger siblings and reduce education. For evidence on schooling effects of trade liberalization through the income channel, see Edmonds and Pavcnik (2005) and Edmonds, Pavcnik, and Topalova (2008).

In conclusion, I find that new export manufacturing opportunities induce students to drop out of school, while new opportunities in other industries generally encourage skill acquisition. These differences are at first glance suprising. In particular, both high-tech export and non export manufacturing employ workforces with similar education levels, yet new job arrivals in the two sectors have opposite impacts on education. In the conceptual framework, I highlighted the additional industry characteristics beyond the skill level of the workforce that, in a world of stochastic vacancies, can drive such heterogenous responses. In section **6**, I show that the variation in these characteristics across the different industries can explain my findings. However, first, I explore the robustness of these results.

5 Robustness Checks

I perform a variety of robustness checks to ensure that my findings are not spurious. Tables 5 and 6 rerun the preferred IV specification, shown in column 1, with several modifications. Column 2 includes a municipality-level linear time trend. This trend controls for omitted variables that trend up or down relative to other municipalities in the state. With only 13 years of data, including trend terms risks over-fitting and causing attenuation due to the inclusion of an excessive number of controls in the regression. However, the coefficient on high-tech export manufacturing remains significantly negative, although smaller than in the basic specification.[50] In column 3, I cap education at 12 years and recalculate cohort schooling. By capping education at 12 years, most of the sample will have reached their final level of schooling by the year 2000, mitigating concerns that the amount of misreporting varies with the skill level of the municipality. In column 4, I further restrict attention only to individuals not at school at the time of the census. Results are very similar in both cases, therefore, I can be confident that my results are driven by students making school dropout decisions before the end of high school. Columns 5 and 6 split the sample into men and women.[51] I find similar results for both sexes. Column 7 shows that my results are robust to extending the cutoff threshold of my instrument from changes of 50 employees to changes of 100 employees in a single firm.

Further robustness tests are shown in table 6. Column 8 excludes the 781 small municipalities

[50]The other two manufacturing coefficients retain their signs and fall slightly but are no longer significant. The two coefficients on services actually reverse sign. The service sector is the most likely sector to suffer from reverse causation as fixed costs of expansion are smallest in this sector where less capital equipment is needed.

[51]The new jobs variables are net new (fe)male jobs per (fe)male worker and I instrument with net new (fe)male jobs per (fe)male worker for firms experiencing large expansions or contractions in total employment.

that saw no formal sector job growth over the period.[52] The coefficient on low-tech export manufacturing is no longer significant when these comparison municipalities are removed. Column 9 includes controls that account for the fact that rural municipalities may have seen differential trends over time and that the Progresa conditional cash transfer program was rolled out at the end of the period.[53] Column 10 excludes the two large cities in the sample, Monterrey and Guadalajara, which may have been driving my population weighted results. In both cases, results are unchanged.

I also explore how the results vary over different regions of Mexico. In columns 11 through 13, I divide the municipalities into three regions. In columns 14 and 15, I split the municipalities by average income in the year 2000. There is a positive effect on education from new high-tech export manufacturing jobs in the south, the poorest area of the country where very few such jobs were created. This result suggests that the initial skill distribution of the municipality matters, as high-tech export manufacturing jobs are relatively more skilled in this part of the country. Poorer municipalities experience relatively larger negative education effects from low-tech export manufacturing.[54] In summary, there is a robust negative impact of new job arrivals in export manufacturing on educational attainment.

Finally, I identify the broad skill level of the subpopulations who are most affected by new job arrivals in each industry. Table 7 shows the effect of new job arrivals at several ages on two relatively skilled subsets of the population; the "Schl>6" and "Schl>9" columns restrict the sample to individuals who, by the year 2000, have completed more than primary school and more than secondary school respectively. Although selection into these samples is endogenous to new job arrivals, these groupings allow me to crudely evaluate the impact of new job arrivals on subgroups who differ in their ρ, $\overline{y}_s$, and σ. The impact of new jobs in low-tech export manufacturing is concentrated only on the lowest skill types at ages 13-16.[55] For high-tech export manufacturing, the impacts decline

[52] For 67 percent of periods in my sample there was no change in formal sector employment. However, as these zeroes generally occur in small municipalities, they have little impact on my weighted regression results.

[53] To control for rural trends, I include a full set of state dummies interacted with a time trend multiplied by the percentage of the municipality population that is classified as rural. Progresa could potentially be a cause of omitted variable bias as the program encouraged children to stay in school at the tail end of my sample period by offering cash incentives. Therefore, I also include a Progresa dummy takes the value 1 in the 1998 and 1999 if more than 10 percent of the population reported receiving Progresa or Procampo payments in the 2000 Census (no specific Progresa indicator is available in the census)

[54] A possible explanation for this finding is that families in poorer municipalities are less able to financially support youths still at school (low $\overline{y}_t$), and so dropout is relatively more tempting when very low skill jobs arrive in these municipalities

[55] The coefficients become insignificant when I remove those with less than 7 years of school from the sample.

for higher skill types but remain significant at all ages.[56] Similar patterns are seen for professional services. Meanwhile, non export manufacturing jobs affect higher skill types in comparison to the two other manufacturing groups.

5.1 Migrants, Non-Migrants and Selective Migration

My results only pertain to the population of non-migrants. As the census does not record where migrants were living at ages 15 and 16, I cannot match these individuals to new local job opportunities at these ages and so I exclude them from my sample. Many export manufacturing workers migrate from poorer, often rural areas. McKenzie and Rapoport (2006) find that the option to migrate to the United States lowers educational attainment in Mexico.[57] Therefore, a plausible hypothesis is that my results understate the true educational decline as some potential migrants drop out of school in the belief that the benefits of migration have risen with the arrival of export manufacturing jobs in other municipalities. Unfortunately, I cannot examine this hypothesis using my empirical strategy.

However, migration effects could still bias my results if local labor market conditions differentially affect out-migration by skill group. For example, a new factory may stop a low skill worker from migrating, but have no impact on the migration decision of a high skill worker. The cohort average education, measured in the year 2000, could then fall, but the cause is the reduced out-migration of low skill workers. In appendix A, I address the concern that the negative schooling coefficients I find originate from such compositional effects. First, I show that new export manufacturing jobs do not affect the sample cohort size. Second, I use census data on the municipality of residence in 1995 to show that when new jobs arrive, it is the more skilled who are less likely to migrate. This finding only applies to internal migrants, but Chiquiar and Hanson (2005) find similar effects for emigrants to the United States.[58] Therefore, the negative impacts of export manufacturing that I find are likely even larger in magnitude, because compositional effects bias the coefficient upwards and attenuate my estimated coefficient.

In-migration also plays an important role by reducing the responsiveness of education to local

[56] The fact that new high-tech export jobs affect somewhat higher skill types compared to low-tech export jobs can explain the larger negative coefficients I find on high-tech export job arrivals. Education in Mexico is effectively bounded from below at primary school (6 years). Therefore, large negative educational changes are only possible for more skilled types who, prior to the arrival of the new factory, were intending to obtain several more years of schooling than primary school.

[57] Similarly, de Brauw and Giles (2008) show that, for rural China, reduced migration costs increase school dropout.

[58] However, in a recent paper, Moraga (2008) disputes this finding for international migrants.

employment shocks. I find that the presence of a large number of migrants working in a particular industry in a municipality significantly attenuates the educational impacts of new job arrivals. In the absence of the substantial in-migration present in Mexico, the negative schooling effects I document for the local population would be even larger.

6 Investigating the Role of Industry Characteristics

My empirical approach has focused on five broad industry groupings, for which I have found heterogenous educational impacts of new job arrivals. In an alternative approach, I regress cohort education on the total quantity of new formal sector job arrivals in the municipality, and also interact these job arrivals with various firm or industry characteristics. The conceptual framework suggests three industry characteristics that make school drop out more likely when new jobs arrive: a low serial correlation of labor demand shocks, a large employment share for unskilled workers and a relatively attractive wage profile for unskilled workers. This section reveals that such industry characteristics seem to describe the export manufacturing industries of Mexico, and, once these characteristics are controlled for, new jobs in export-intensive industries actually encourage students to stay in school relative to industries with similar characteristics.

Before exploring the three industry characteristics, I investigate whether new jobs at exporting firms do indeed discourage education compared to non-exporting firms, consistent with my results using five broad industry categories. In the absence of firm level exporting data, I have two measures of export participation at a finer level than the broad industry group used previously. At the firm level, Maq_j is an approximate indicator of whether or not firm j is a Maquiladora, as described in data section 3.1. Therefore, I interact Maquiladora status with new job creation at the firm level and sum these interactions over all the firms in the municipality.[59] Similarly, at the 3-digit industry i' level, I have a measure of export intensity, namely the share of that industry's output that is exported over the sample period for the whole of Mexico, $Export_{i'\text{mex}}/Output_{i'\text{mex}}$.[60] I also interact $Export_{i'\text{mex}}/Output_{i'\text{mex}}$ with new job arrivals, but here by 3-digit industry, and sum

[59] As in section 4.1, I interact all these new variables with positive and negative indicator variables in order to separate years of job arrivals from years of job losses.

[60] There are 55 3-digit industry i' categories that can be matched between the 2000 census and the IMSS database. See section 3.1 for a description of these data.

these terms over all industries i':

$$S_{mc} = \beta_1 \boldsymbol{I}^+ \sum_{j \in m} l_{mcj} + \beta_2 \boldsymbol{I}^+ \sum_{j \in m} l_{mcj} Maq_j + \beta_3 \boldsymbol{I}^+ \sum_{i'} l_{mci'} \frac{Export_{i'}\text{mex}}{Output_{i'}\text{mex}} + ... + \delta_m + \delta_{rc} + \varepsilon_{mc}. \quad (4)$$

My previous findings suggest that new job arrivals at Maquiladora firms or in sectors with high export intensities will discourage education compared to other jobs; $\beta_2 < 0$, $\beta_3 < 0$.

Table 8 reports the results of this regression. Columns 1 and 2 include only one of the two exporter interactions and column 3 contains both terms. As expected, the coefficients β_2 and β_3 are negative. New job arrivals within Maquiladora or within industries with a high export intensity significantly reduce educational attainment, while new job arrivals alone encourage schooling.[61]

In the next three subsections, I interact new job arrivals with measures of the three industry characteristics described in the conceptual framework, and add these terms to equation 4. The results of this regression are shown in column 4 of table 8.

6.1 Serial Correlation of Job Creation

The conceptual framework predicts that if hiring is only weakly serially correlated within an industry, new jobs would be more likely to encourage drop out since such opportunities are less likely to also be available the next year. The transition matrix for positive, zero and negative net new jobs in table 2 shows that the two export manufacturing sectors have the lowest probability of a positive shock being followed by another positive shock.[62] Consequently, I interact new job arrivals with the transition probability that a year of municipality job growth in a 3-digit industry is followed by another year of job growth.[63] The predicted positive sign is found and the coefficient is significant. Therefore, there is supportive evidence that new export jobs induce dropout in part because the relative volatility of job growth in these industries encourages students to grab jobs when they become available.

[61]When both are included, the Maquiladora term remains negative but becomes insignificant. Maquiladoras are highly concentrated in export-intensive industries, and so the fact that one of these two exporting interaction terms becomes insignificant is not surprising.

[62]I also estimate an Arellano-Bond linear dynamic panel estimator and find a negative coefficient on past job growth only for high-tech export manufacturing. However, the panel is too short to differentiate the autoregressive processes across the different industries.

[63]These probabilities are calculated from the IMSS dataset. For the negative net new jobs terms, I interact the transition probability that a year of losses is followed by another year of losses. Ideally, I would estimate an ARMA model for each industry. However, the brevity of my panel precludes this.

6.2 Skill Level and Age of Employees

The conceptual framework suggests that new job arrivals in an industry where almost all jobs require high education levels will not induce dropout for students with low skills, since the opportunity cost of schooling does not change. Similarly, if an industry only employs more experienced older workers, immediate employment is not possible for a student and the opportunity cost of school will not rise with new job arrivals.

Figure 2 shows histograms of years of schooling and age for my five broad industry categories, as well as for the residual informal sector.[64] Low-tech export manufacturing demands the least skilled workers of the formal sector industries, with 40 percent the workforce having less than 9 years of schooling. Non export manufacturing and high-tech export manufacturing have almost identical skill distributions.[65] The service sectors are more skilled and the informal sector is, unsurprisingly, the least skilled.[66] In terms of the age distribution of employees, both export manufacturing sectors have significantly younger workforces. The younger age distribution may be a result of faster growing firms in these industries. I therefore control explicitly for firm growth in the regression specification. In summary, the export sectors have a comparatively young and unskilled workforce compared to other formal industries.

Guided by these descriptive statistics, I include three interaction terms calculated at the 3-digit industry from the 2000 census in equation 4. The results are shown in column 4 of table 8.[67] To measure the abundance of jobs available for unskilled workers, I interact new job arrivals with two terms: the national share of workers in industry i' with less than secondary school education, $S < 9$; and the national share of workers in industry i' with secondary schooling but no high school diploma, $9 \leq S < 12$. To measure the abundance of jobs available for young workers straight out of school, I interact new job arrivals with the national share of employees in industry i' who are

[64] I define private formal sector workers in the census as full-time workers with IMSS health insurance and non-zero income. Wives, children and unemployed husbands of IMSS workers are also eligible for IMSS insurance, and may impart some error. To match the sample of my main specification, the skill level sample comprises non-migrants aged 16 to 28. The age sample comprises non-migrants aged 15-50.

[65] Therefore, the skill level of the industry is not able to explain my finding that new jobs arrivals in these two industries had opposite effects on schooling. In a neoclassical labor market framework, this characteristic would determine whether or not new jobs in an industry encouraged school dropout.

[66] There are some excluded formal sector workers in this group: public sector employees insured by ISSSTE, employees of PEMEX and a relatively small number of agriculture, construction, mining and utilities workers insured by IMSS.

[67] Again, I must assume that these industry characteristics remained approximately constant over the period.

likely to have been in the workforce for 3 years or less.[68]In order to control for the fact that fast growing firms have younger employees on average, I also include an interaction between new job arrivals and the firm average growth rate. The higher the proportion of new jobs that are available to the young and unskilled, the more likely it is that new job arrivals will encourage school dropout. Therefore, the coefficients on these interaction terms should be negative. I find support for these conjectures, with significant negative coefficients on two of the interaction terms: the proportion of the workforce with only secondary schooling and the proportion of inexperienced workers.[69]

6.3 Wages Paid at Different Skill Levels

The conceptual framework suggests that the attractiveness of industry wages at different skill levels affects the dropout decision. New jobs in the industry are more likely to induce drop out if the wages for unskilled workers, relative to other industries, are high in comparison to the wages for skilled workers, again relative to other industries.[70]

The relative wages paid by different broad industry categories can be seen most clearly in figure 5. This figure shows smoothed plots of the wage differences between each industry and the local informal sector by skill level from the 2000 census for new workers in their first years of employment.[71] These premia should be treated with some caution as they do not take account of workers sorting on unobservables. However, they still provide useful evidence on wage differences by skill and industry. For workers with only 6 years of school, low-tech export manufacturing offers exceptional premia of over 20 percent. For intermediate years of schooling, high-tech export manufacturing offers the best premia of about 20 percent. However, with 12 years of schooling, non export manufacturing

[68]I assume workers graduated in the expected year based on their age, and calculate likely experience as age minus schooling minus 6. If a worker has less than 9 years of education, I count the number of years since they turned 16, the legal factory employment age.

[69]The two skill proportion terms are positively correlated. Accordingly, in the absence of the secondary schooling term, the primary schooling term becomes negative.

[70]If this ratio is high, a new job opportunity is more likely to affect the best job today than it is to affect the expected best future job.

[71]I focus on 6 to 12 years of schooling, the relevant education margin for most manufacturing workers in Mexico. These are wages for workers with five or less years of experience (age minus schooling minus six) post age 16. To estimate these wage premia, I run a Mincer-like wage regression of log income for individual j on a set of industry-school level dummies, $d_i d_s$. I also include a full set of municipality-school level fixed effects, γ_{ms}: $\ln Y_{jmis} = \sum_{i \neq \text{informal}} \sum_s \psi_{is} d_i d_s + \sum_m \sum_s \gamma_{ms} d_m d_s + X_j + \varepsilon_{jmis}$. By omitting the schooling dummies for the informal sector, the coefficients ψ_{is} on the other industry dummies measure the premium that each industry i pays over the informal sector wage at that skill level s. Controls, X_j, include sex, experience (interacted with industry) and a rural dummy. To obtain estimates of wage premia that are representative of the non-migrant population of Mexico excluding Mexico City, I weight wages in each municipality by the regression municipality weights.

offers the best premia of about 20 percent over the informal wage for that level of schooling.[72] The returns to education and the wage profiles in figure 6 show similar patterns.[73] These descriptive statistics are consistent with the very different schooling impacts of new jobs across the three manufacturing industries. The premia in the two export sectors are most generous at lower skill levels, while the premia in non export manufacturing are most generous for high school graduates.

These high premia in the export sectors support the ample evidence that exporters and foreign firms in Mexico pay higher wages for a given skill level (e.g. Bernard 1995). For the relatively low skilled workers they employ (75 percent of employees with 9 years of education or less), export manufacturing jobs are better remunerated than jobs in other sectors.

The insights that come from the census wage figures can be tested more rigorously by including two further interaction terms suggested by the conceptual framework : the ratio of the wage differences over the informal sector at 6 and 9 years of schooling, and the ratio of the same wage difference at 9 and 12 years of schooling in industry i' from the 2000 census. I should find negative coefficients on these interaction terms if new job arrivals are more likely to induce drop out when they offer relatively more attractive wages to low skill rather than high skill workers, compared to other local opportunities at those skill levels. The conjecture is supported by significant negative coefficients on the first ratio interaction term, and a negative but insignificant coefficient on the second ratio.[74]

6.4 Exporting, Industry Characteristics and Dropout

Finally, I include two additional firm-level controls to equation 4. First, I interact firm size (in terms of employees) with firm-level changes in employment. Firm size is a standard firm characteristic in the trade literature, but it is not significant in this context. Second, I interact firm average growth with firm-level changes in employment. The interaction terms suggested by the conceptual framework are likely to be correlated with firm growth rates (for example, the age of the workforce).

[72] The standard errors are generally large, as shown by the 95 percent confidence intervals at 6, 9 and 12 years of schooling. However, the difference in the wage premia for 9 years of schooling between high-tech export manufacturing and non export manufacturing is significantly different to the wage premia differential between the two industries with 12 years of schooling (F-stat of 7.24).

[73] For the returns to education, I run Mincer-like regressions again for new workers, but now including municipality-industry fixed effects instead of municipality-school level ones. I omit all the industry-school level dummies for workers with 9 years of education, and obtain the returns relative to 9 years of schooling in that industry for non-migrants in Mexico excluding Mexico City. For wage profiles, I plot locally weighted regressions of the wage relative to the local informal sector with 9 years of school to allow comparability across education levels and industries. I restrict the sample to men since many women in Mexico drop out of the labor market and return in later life, breaking the link between age and experience.

[74] These two ratios are highly correlated. The 9/12 becomes significantly negative when the 6/9 ratio is excluded.

I therefore include this term in order to avoid spurious correlation. New job arrivals at fast growing firms significantly encourage school dropout compared to slow growing firms.

Once the full set of interactions are included, there is no longer a negative effect from either being a Maquiladora or being in an export intensive industry. In fact, these coefficients become positive and significant. Therefore, new exporting jobs actually encourage students to stay in school relative to non-exporting industries with identical characteristics.

In the conceptual framework, I highlighted three industry characteristics that encourage school dropout in the context of a labor market with stochastic vacancies, namely a large number of jobs available to young unskilled workers, relatively high wages for very low skill workers and a low serial correlation of new job opportunities. I find support for the relevance of all three of these characteristics.

These three industry characteristics are typical of export manufacturing firms in Mexico. The fact that exporting sectors possess the industry characteristics that induce dropout is not a coincidence. Mexico, like many other developing countries with large export manufacturing sectors, has an abundance of low skill labor. Therefore, the Heckscher-Ohlin theorem would predict that Mexico has a comparative advantage in industries intensive in that factor. Firms hoping to manufacture in Mexico for export therefore use technologies and produce products that are intensive in unskilled labor. For a variety of reasons listed previously, exporting firms also pay wages that are relatively high for the age and skill level of workers they employ. Similarly, the volatility of employment in the export manufacturing sector is not coincidental. Bergin, Feenstra, and Hanson (2007) provide evidence that the Maquiladora sector is exceptionally volatile because shocks to US demand are amplified in the employment decisions of firms that outsource to Mexico. The net result is that the new export manufacturing opportunities generated by Mexico's trade liberalization discouraged skill acquisition between 1986 and 2000.

7 Income Effects

I now turn to analyzing the income effects that arise from the arrival of new jobs. The 2000 census records the earned monthly income for everyone employed in the last month. I run the same reduced form as my main specification for schooling, except that I replace schooling with the cohort mean of log earned income, $\ln Y_{mc}$:[75]

$$\ln Y_{mc} = \sum_i \beta_{1i} l_{mci} \boldsymbol{I}^+ + \sum_i \beta_{2i} l_{mci} \boldsymbol{I}^- + \delta_m + \delta_{rc} + \varepsilon_{mc}. \quad (5)$$

The identification argument and the IV strategy are identical to those detailed for the schooling regression in section 3.3. However, reverse causality is less of an issue than in the schooling case as it is unlikely that cohort income deviations in the year 2000 influenced labor demand in previous years.

The income effects of net new job arrivals generally mirror the educational impacts and are shown in table 9. Those industries where new jobs encourage more schooling see positive income gains, as would be expected. However, for high-tech export manufacturing, where new jobs discourage education acquisition, I find the opposite effects. Despite the high wages on offer in the industry, by the year 2000 the average log income of cohorts heavily exposed to the arrival of high-tech export manufacturing jobs in earlier years actually declines compared to less exposed cohorts.[76] The arrival of low-tech export manufacturing jobs brings no such income losses in later years.[77]

The magnitude of the income loss from high-tech export manufacturing conforms with the estimates of the returns to schooling in Mexico. For my preferred IV specification, I find a negative coefficient of -0.580 on log income. This corresponds to a "return to schooling" of 7.9 percent per year.[78] This return to an additional year of schooling is in the range of between 7.5 percent and 16.1 percent suggested by Patrinos (1995) and Psacharopoulos, Velez, Panagides, and Yang (1996) for Mexico. An estimate of the returns to schooling in the lower end of this range is not surprising, given that these are hypothetical returns to schooling. I am comparing the income of a student for whom new export manufacturing plants open at her key school leaving age to the income of an otherwise identical student in the alternative scenario, where no factory opened. Because these new export jobs pay high wages, the estimated returns to schooling will be lower than the genuine

[75] This measure excludes everyone who reports no earned income, and so I am evaluating the wage margin not the labor market participation margin. I use log income as is standard in the labor literature, both to reduce problems related to outliers and because income is typically log normal. I drop all workers who report working for less than 20 hours per week, and winsorize the log wage at the 1 percent tails. Results are essentially unchanged without this cleaning procedure.

[76] There is no evidence that new jobs in export manufacturing alter the variance of earned income, perhaps compensating for the lower income. A similar specification to equation 5, but with log income replaced by the variance of log income, produces insignificant coefficients.

[77] One possible explanation for the lack of a negative income effect, despite lower schooling, is that new jobs at these firms induce the very lowest skill groups to drop out. For this group, the returns to education are particularly flat, and these firms pay a very high premium over the informal sector (shown in figures 6 and 5).

[78] The returns to schooling is the exponential of the income coefficient divided by the coefficient on schooling.

returns to schooling for the student in the alternative scenario, who did not have a new high-paying export manufacturing job on offer.

I can also calculate a back of the envelope discount rate using my conceptual framework and the coefficients on new high-tech export jobs. With a constant wage throughout the workers lifetime and at-school income at half of work income, the value of the implied discount rate is 11 percent with log utility (where coefficient of risk aversion, σ, equals 1).[79]

It is valuable to note that these coefficients are not representative of the population as a whole. My estimates derive from comparing the subset of the population whose educational choices and incomes were altered by the arrival of new factories in their municipality to similar subgroups who were not exposed to the arrival of new factories at key school leaving ages. This subgroup likely contains youths who have unusually high returns from, or a particular disposition for, factory work. The impact of new factory jobs on the subgroup of non-migrants whose decisions are altered by large firm expansions or contractions is particularly relevant. For an industrial policymaker considering how the education of the local population is affected by the placement of a new factory, this is a subgroup that is of primary interest.

7.1 Individual Welfare Implications

The large positive externalities associated with education make government intervention justifiable. However, before addressing such policy considerations in the conclusion, I will focus on the welfare implications of my findings for the individuals making the education decisions.

In light of my findings, it is important to note that incomes losses do not imply welfare losses. Some impatient or credit-constrained students will quite rationally forgo schooling for immediate income gains, knowing that in a few years their salaries will be lower than if they had stayed at school. Policymakers may still have paternalistic concerns for their citizens if they believe that adolescents are particularly predisposed to discount the future heavily when faced with delayed and uncertain gains. There is a growing body of evidence in cognitive neuroscience, discussed by Oreopoulos (2007), that adolescents are particularly predisposed to such behavior as the frontal lobes associated with planning and decision making only fully develop in adulthood.[80] Similarly,

[79]For σ=0.5 the discount rate rises to 13.3 percent, and falls to 7.3 percent for σ=2. If at-school income is a quarter of work income, the discount rates are 2.4 percent, 5.5 percent and 7.6 percent in order of descending risk aversion.

[80]For example see Sowell, Thompson, Holmes, Jernigan, and Toga (1999) or Galvan, Hare, Parra, Penn, Voss, Glover, and Casey (2006).

peer effects at this stage of life are particularly strong, and may cause excessive dropout rates. In support of such hypotheses, 74 percent of American school dropouts surveyed by Bridgeland, DiIulio, and Morison (2006) would want to stay in school if they could relive that decision.

Credit constraints can also result in youths dropping out of school when new jobs arrive if there are high-return investment opportunities, such as starting a small business, that become feasible with the income from an export manufacturing job. Atkin (2008) provides evidence for a related story, as women induced to work in a factory at young ages make larger health investments in their children. In order for credit constraints to explain my findings, the returns on the investment must not show up in earned income by the year 2000. Additionally, these credit constraints will also bind when non-export jobs arrive for example, and so new jobs arriving in this sector would have to be impacting educational choices of a different subpopulation that was not credit constrained. As an empirical check on the validity of the credit constraints hypothesis, I rerun the income regression for the richer and poorer municipalities separately. The negative schooling coefficients should be larger for poorer municipalities where credit constraints are more binding.[81] Columns 4 and 5 of table 9 shows this regression and reveal that the exact opposite is true.[82] Therefore, the credit constraints story is an unlikely explanation for the negative income effects of new jobs in high-tech export manufacturing.

There are several situations where the income losses I find would imply clear welfare losses. Students may drop out early in anticipation of obtaining a high-tech export manufacturing job in the future, but they are unable to obtain a job at that firm when they apply.[83] Alternatively, students may actually be misestimating the industry wage profile and did not expect their incomes to be lower by the year 2000. In an earlier version of this paper, Atkin (2009) provides empirical evidence that students may not have fully anticipated the decline in the returns to experience that new assembly line technologies brought to this industry. If students incorrectly forecast future incomes, as in these two situations, a specific policy remedy may be appropriate.[84] Jensen (2010) and Nguyen (2007) carry out successful information interventions that provide students with more accurate estimates

[81] If there are also higher returns to investment in richer municipalities, larger negative income effects in richer municipalities are possible.

[82] High-tech export manufacturing increases incomes in poorer municipalities, although students still drop out of school early (table 6). In these areas, the high wages on offer may compensate for the lower level of education, given the paucity of well-paying local alternatives.

[83] This outcome may be particularly likely in the export sector, which had the lowest serial correlation of new job creation.

[84] Of course, in these cases students may have correctly forecast future incomes, but Mexico experienced a bad realization of a stochastic process.

of the returns to education. In a similar vein, emerging low-cost export manufacturing locations could inform the local population of the volatile nature of these jobs and their likely wage profiles.

8 Conclusions

There is enormous concern over the impact of globalization on the poorer segments of society. One of the most robust stylized facts to come from analyzing firm-level data in developing countries is that exporting and multinational firms pay higher wages than similar firms. However, comparing such firm-level wages for a given skill level presents a misleading picture if skill acquisition is endogenous to the arrival of these firms.

This paper finds that for Mexico during the period 1986 to 2000, the changing industry composition brought about by trade liberalization altered the skill distribution. In particular, new export manufacturing jobs induced students to drop out of school at younger ages. The magnitudes I find suggest that for every ten new jobs created in high-tech export manufacturing, one student dropped out at grade 9 rather than continuing on through grade 12. Despite high-tech export manufacturing paying high wages for a given skill level, new jobs in this industry eventually reduced incomes for those cohorts in school at the time these jobs arrived, since these workers acquired less education than they would have otherwise. The specific characteristics of export manufacturing in Mexico can explain these negative schooling impacts. Export manufacturing firms offer an abundance of jobs to unskilled workers, these jobs are particularly volatile, and the formal-sector wages that these firms pay are particularly remunerative at lower skill levels.

My findings are relevant for designing industrial policies that will allow developing countries to gain fully from the increasing globalization of production. In the previous section, I discussed the individual welfare consequences of these schooling decisions. However, individual educational decisions have positive externalities, which justify governments all over the world subsidizing school attendance.[85] Accordingly, many developing countries, including Mexico, have prioritized raising the skill level of the workforce. These policies are often based on the explicit assumption that a more educated workforce will attract firms that produce high value-added exports, rather than simple Maquiladora-type assembly operations. It is crucial for the success of such policies to know

[85] The most prominent of these spillovers comes from educated workers making those around them more productive. Lucas (1988) suggests that such human capital externalities may be large enough to explain income differences across the world, and recently Moretti (2004) provides evidence using plant-level data.

that under certain conditions export manufacturing jobs pull students out of school, while other formal sector employment opportunities may actually encourage skill acquisition. Feedback loops can magnify these impacts. For example, if export manufacturing lowers skill levels in a municipality, the resulting low-skill population will put downward pressure on unskilled wages and attract even more export-assembly operations. These forces can quickly polarize a country's geographic distribution of schooling attainment, with skilled and unskilled regions forming. Policymakers should also be wary that when footloose export-assembly jobs move to lower-wage countries, as has already started happening to Mexico, the prospects for the areas that encouraged export manufacturing could be bleak, left without jobs or skills.

Fortunately, there are several potential policy remedies. A system of payments conditional upon school attendance would neutralize the negative educational impact of export manufacturing jobs. The much-studied Progresa program in Mexico does just that, providing cash transfers to parents who keep their children in school up to grade 9 (Schultz 2004).[86] Alternatively, the age of earliest employment in export manufacturing could be raised above 16 to ensure that most Mexican workers will have already chosen their final education levels before being allowed to work in an export manufacturing plant. Engineering a steadier flow of new firm arrivals could reduce dropout by putting less pressure on students to grab formal sector jobs as soon as they appear.[87] Reducing the psychic cost of returning to school in later life would allow adults to obtain the foregone education should the export manufacturing jobs dry up or if the adult comes to regret their decision to drop out of school. Finally, policymakers may wish to go further and promote the type of exporting firms with the characteristics that I find encourage, rather than discourage, skill acquisition.

[86]The roll out was too late to have an impact on my sample.

[87]I find some support for this hypothesis as municipalities which experienced more variable job growth had lower average educational attainment, conditional upon the mean job growth in the municipality. Results available on request.

Appendix A Migration Composition Effects

The negative educational effects of new export manufacturing jobs that I find may be spurious if new jobs prevent low skilled individuals from migrating, and thereby lower the average education of my sample without changing schooling decisions. I carry out two empirical tests to explore the relevance of such out-migration composition effects.

The first test looks at the size of different cohorts of non-migrants. If these composition effects are important, and if the less skilled are deciding not to migrate, the size of the sample cohort should rise with new jobs in export manufacturing. To test this hypothesis, I replace cohort years of schooling with log cohort size $\ln N_{mc}$ in equation 2, the main specification:[88]

$$\ln N_{mc} = \sum_i \beta_{1i} l_{mci} \boldsymbol{I}^+ + \sum_i \beta_{2i} l_{mci} \boldsymbol{I}^- + \delta_m + \delta_{rc} + \varepsilon_{mc}.$$

Table 10 shows the results from this regression. The cohort size responds positively to new service jobs, but there seems to be no impact from new jobs arrivals in the three manufacturing sectors.

The second test examines whether skill differences between migrants and non-migrants can explain the negative coefficients on new export manufacturing jobs. If so, I should find that the education of out-migrants rises relative to the education of non-migrants in a municipality when new export manufacturing jobs arrive. As the census only records where people lived in 1995, I cannot exploit the panel dimension of my data. Instead, I take the average education of people who lived in the municipality in 1995 but not in 2000, $S_{leave,mt}$, divided by the education of people who lived in the municipality in both 1995 and 2000, $S_{stay,mt}$, as my dependent variable.[89] The ratio is then regressed on the sum of the changes in employment over these years by industry, interacted with positive and negative indicator dummies. I also include a full set of state dummy variables:

$$\frac{1}{5} \sum_{t=95}^{99} \frac{S_{leave,mt}}{S_{stay,mt}} = \sum_i \beta_{1i} [\sum_{t=95}^{99} l_{mit}] \boldsymbol{I}^+ + \sum_i \beta_{2i} [\sum_{t=95}^{99} l_{mit}] \boldsymbol{I}^- + \delta_r + \varepsilon_m.$$

If my finding of negative schooling impacts from new export jobs is driven by the less educated remaining in the municipality when new jobs arrive, the ratio of leavers to stayers education will

[88] I use log cohort size as municipality populations vary greatly. By using logs I am looking at proportional changes. Net new jobs are already scaled, as they are divided by the number of workers in the municipality.

[89] Accordingly, I restrict my sample to cohorts who turned 15 or 16 between 1995 and 1999.

increase with positive changes in employment between 1995 and 2000 (β_{1i}>0).

The results are reported in table 10. For all sectors the β_{1i} coefficients are negative. New formal jobs keep the more educated youth in the municipality.[90] This is strong evidence, at least for the later years in the sample, that when new jobs arrive, out-migration effects would tend to increase cohort education averages through composition effects. Therefore, the magnitude of my finding that new export manufacturing jobs reduce schooling is likely attenuated by out-migration. The fact that new jobs in other sectors increased education, however, may purely or partly be coming from composition effects.

Migration may have other effects on my estmates. For example, if a particular industry only employs migrants, then new jobs in that industry should have no impact on the education decisions of local youth. I test this hypothesis using the in-migrants I identify in the 2000 Census. I calculate ϑ_{mi}, the proportion of migrants in each industry in each municipality and then interact ϑ_{mi} with positive and negative net new jobs per worker:

$$S_{mc} = \sum_i \beta_{1i} l_{mci} \boldsymbol{I}^+ + \sum_i \beta_{3i} l_{mci} \vartheta_{mi} \boldsymbol{I}^+ + ... + \delta_m + \delta_{rc} + \varepsilon_{mc}.$$

If the presence of migrants reduces the impact of new job arrivals on the local population, I expect β_{3i} to be significant and of the opposite sign to β_{1i}. These results are detailed in table 11. For high-tech export manufacturing, commerce and non export manufacturing, I find the expected pattern.[91] The magnitudes of β_{3i} and β_{1i} are similar, implying that there is essentially no effect on non-migrant education when new jobs arrive in an industry that employs only migrants. The implication of this finding is that, in the absence of internal migration in Mexico, local education choices will be even more affected by the arrival of new employment opportunities than my results suggest.

[90]For job losses, the effects are also negative or highly insignificant, implying that the more educated leave the municipality when there are no formal sector jobs.

[91]Although in the latter case, the β_{3i} term is not significant.

References

Abowd, J., and T. Lemieux (1993): "The Effects of Product Market Competition on Collective Bargaining Agreements: The Case of Foreign Competition in Canada," *The Quarterly Journal of Economics*, 108(4), 983–1014.

Airola, C., and J. Juhn (2005): "Wage Inequality in Post-Reform Mexico," Working Papers 2005-01, Department of Economics, University of Houston.

Aitken, B., A. Harrison, and R. Lipsey (1996): "Wages and Foreign Ownership A Comparative Study of Mexico, Venezuela, and the United States," *Journal of International Economics*, 40(3-4), 345–371.

Akerlof, G., and J. Yellen (1990): "The Fair Wage-Effort Hypothesis and Unemployment," *The Quarterly Journal of Economics*, 105(2), 255–283.

Angrist, J., and V. Lavy (1999): "Using Maimonides' Rule to Estimate The Effect of Class Size on Scholastic Achievement*," *Quarterly journal of economics*, 114(2), 533–575.

Atkin, D. (2008): "Working for the Future: Female Factory Work and Child Health in Mexico," Discussion paper, Yale University.

——— (2009): "Endogenous Skill Acquisition and Export Manufacturing in Mexico," Discussion Paper 224, BREAD Working Paper Series.

Baker, G., M. Gibbs, and B. Holmstrom (1994): "The Internal Economics of the Firm: Evidence from Personnel Data," *Quarterly Journal of Economics*, 109(4), 881–919.

Baltagi, B., and C. Kao (2000): "Nonstationary Panels, Cointegration in Panels and Dynamic Panels: A Survey," *Advances in Econometrics*, 15, 7–52.

Bartik, T. (1991): *Who Benefits from Dtate and Local Economic Development Policies?* WE Upjohn Institute for Employment Research Kalamazoo, MI.

Bartik, T. J. (2006): "How Do the Effects of Local Growth on Employment Rates Vary with Initial Labor Market Conditions?," Staff Working Papers 09-148, W.E. Upjohn Institute for Employment Research.

Beaudry, P., and J. DiNardo (1991): "The Effect of Implicit Contracts on the Movement of Wages Over the Business Cycle: Evidence from Micro Data," *The Journal of Political Economy*, 99(4), 665–688.

Becker, G. (1962): "Investment in Human Capital: A Theoretical Analysis," *The Journal of Political Economy*, 70(S5), 9.

Behrman, J. R., P. Sengupta, and P. Todd (2005): "Progressing through PROGRESA: An Impact Assessment of a School Subsidy Experiment in Rural Mexico," *Economic Development and Cultural Change*, 54(1), 237–275.

Bergin, P. R., R. C. Feenstra, and G. H. Hanson (2007): "Outsourcing and Volatility," NBER

Working Papers 13144, National Bureau of Economic Research.

Bernard, A. (1995): "Exporters and Trade Liberalization in Mexico: Production Structure and Performance," Discussion paper, MIT.

Bernard, A., and J. Jensen (1995): "Exporters, Jobs, and Wages in US Manufacturing: 1976-1987," *Brookings Papers on Economic Activity: Microeconomics*, 1995, 67–112.

Bernard, A. B., R. Robertson, and P. K. Schott (2004): "Is Mexico A Lumpy Country?," NBER Working Papers 10898, National Bureau of Economic Research.

Bertrand, M., E. Duflo, and S. Mullainathan (2004): "How Much Should We Trust Differences-in-Differences Estimates?," *Quarterly Journal of Economics*, 119(1), 249–275.

Bridgeland, J., J. DiIulio, and K. Morison (2006): "The Silent Epidemic: Perspectives of High School Dropouts," *Report by Civic Enterprises*.

Burdett, K., and D. Mortensen (1998): "Wage Differentials, Employer Size, and Unemployment," *International Economic Review*, 39(2), 257–273.

Bureau of Economic and Business Affairs (2001): "Economic Policy and Trade Practices," Mexico country report, U.S. Department of State.

Card, D., and T. Lemieux (2000): "Dropout and Enrollment Trends in the Post-War Period: What Went Wrong in the 1970s?," NBER Working Papers 7658, National Bureau of Economic Research.

Chesnokova, T., and K. Krishna (2009): "Skill Acquisition, Credit Constraints, and Trade," *International Review of Economics and Finance*, 18(2), 227–238.

Chiquiar, D., and G. Hanson (2005): "International Migration, Self-Selection, and the Distribution of Wages: Evidence from Mexico and the United States," *Journal of Political Economy*, 113(2), 239–281.

Clark, D. (2009): "Do Recessions Keep Students in School? The Impact of Youth Unemployment on Enrolment in Postcompulsory Education in England," *Economica*, 9999(9999).

Cragg, M., and M. Epelbaum (1996): "Why has Wage Dispersion Grown in Mexico? Is it the Incidence of Reforms or the Growing Demand for Skills?," *Journal of Development Economics*, 51, 99–116.

Davis, D., and J. Harrigan (2007): "Good Jobs, Bad Jobs, and Trade Liberalization," NBER Working Papers 13139, National Bureau of Economic Research.

de Brauw, A., and J. Giles (2008): "Migrant Opportunity and the Educational Attainment of Youth in Rural China," Policy Research Working Paper Series 4526, The World Bank.

Duval Hernandez, R. (2006): "Informality, Segmentation and Earnings in Urban Mexico," Discussion paper, Center for U.S.-Mexican Studies.

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

Edmonds, E., N. Pavcnik, and P. Topalova (2008): "Trade Adjustment and Human Capital Investments: Evidence from Indian Tariff Reform," Discussion paper, CEPR Discussion Papers.

Federman, M., and D. Levine (2005): "The Effects of Industrialization on Education and Youth Labor in Indonesia," *The BE Journal of Macroeconomics*, 5(1), 1.

Feenstra, R., and G. Hanson (1997): "Foreign direct investment and relative wages: Evidence from Mexico's maquiladoras," *Journal of International Economics*, 42(3-4), 371–393.

Findlay, R., and H. Kierzkowski (1983): "International Trade and Human Capital: A Simple General Equilibrium Model," *The Journal of Political Economy*, 91(6), 957–978.

Frias, J. A., D. Kaplan, and E. Verhoogen (2009): "Exports and Wage Premia: Evidence from Mexican Employer-Employee Data," Discussion paper, Columbia University.

Galvan, A., T. Hare, C. Parra, J. Penn, H. Voss, G. Glover, and B. Casey (2006): "Earlier Development of the Accumbens Relative to Orbitofrontal Cortex Might Underlie Risk-Taking Behavior in Adolescents," *Journal of Neuroscience*, 26(25), 6885.

Goldin, C., and L. Katz (1997): "Why the United States Led in Education: Lessons from Secondary School Expansion, 1910 to 1940," NBER Working Papers 6144, National Bureau of Economic Research.

Hanson, G., and A. Harrison (1999): "Trade Liberalization and Wage Inequality in Mexico," *Industrial and Labor Relations Review*, pp. 271–288.

Harrison, A., and J. Scorse (forthcoming): "Multinationals and Anti Sweatshop Activism," *American Economic Review.*

Helper, S., D. Levine, and C. Woodruff (2006): "How Does Economic Liberalization affect Investment in Education?: Evidence from Mexico," Discussion paper, UCSD.

Helpman, E., O. Itskhoki, and S. Redding (2008): "Inequality and Unemployment in a Global Economy," NBER Working Papers 14478, National Bureau of Economic Research.

Ibarraran, P. (2004): "Essays on Labor Markets and Economic Integration in Mexico," Ph.D. thesis, University of California, Berkeley.

Jensen, R. (2010): "The (Perceived) Returns to Education and the Demand for Schooling," *Quarterly Journal of Economics, Forthcoming.*

Kahn, L. (2007): "The Long-Term Labor Market Consequences of Graduating from College in a Bad Economy," Discussion paper, Harvard University.

Kaplan, D. S., G. M. Gonzalez, and R. Robertson (2007): "Mexican Employment Dynamics: Evidence from Matched Firm-Worker Data," Discussion paper, ITAM.

Le Brun, A., S. Helper, and D. Levine (2009): "The Effect of Industrialization on Children's Education–The Experience of Mexico," *UC Berkeley: Institute for Research on Labor and Employment.*

Lucas, R. (1988): "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 22(1), 3–42.

McKenzie, D., and H. Rapoport (2006): "Can Migration Reduce Educational Attainment? Evidence from Mexico," Policy Research Working Paper Series 3952, The World Bank.

Minnesota Population Center (2007): "Integrated Public Use Microdata Series-International: Version 3.0," Available online at http://international. ipums. org/international.

Moraga, J. F.-H. (2008): "New Evidence on Emigrant Selection," UFAE and IAE Working Papers 742.08, Unitat de Fonaments de l'Anàlisi Econòmica (UAB) and Institut d'Anàlisi Econòmica (CSIC).

Moretti, E. (2004): "Workers' Education, Spillovers, and Productivity: Evidence from Plant-Level Production Functions," *American Economic Review*, 94(3), 656–690.

Munshi, K., and M. Rosenzweig (2006): "Traditional Institutions Meet the Modern World: Caste, Gender, and Schooling Choice in a Globalizing Economy," *American Economic Review*, 96(4), 1225–1252.

Nguyen, T. (2007): "Information, Role Models and Perceived Returns to Education: Experimental Evidence from Madagascar," Discussion paper, Massachusetts Institute of Technology.

Nicita, A., and M. Olarreaga (2007): "Trade, Production, and Protection Database, 1976-2004," *The World Bank Economic Review*, 21(1), 165.

Oreopoulos, P. (2007): "Do Dropouts Drop Out Too Soon? Wealth, Health and Happiness from Compulsory Schooling," *Journal of Public Economics*, 91(11-12), 2213–2229.

Oreopoulos, P., T. Von Wachter, and A. Heisz (2006): "The Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates," NBER Working Papers 12159, National Bureau of Economic Research.

Oster, E. (2010): "Do Call Centers Promote School Enrollment? Evidence from India," Discussion paper, University of Chicago Booth School of Business.

Patrinos, H. (1995): "Education and Earnings Differentials," Discussion paper, World Bank.

Psacharopoulos, G., E. Velez, A. Panagides, and H. Yang (1996): "Returns to Education During Economic Boom and Recession: Mexico 1984, 1989 and 1992," *Education Economics*, 4(3), 219–230.

Robertson, R. (2004): "Relative Prices and Wage Inequality: Evidence from Mexico," *Journal of International Economics*, 64(2), 387–409.

Schank, T., C. Schnabel, and J. Wagner (2007): "Do Exporters Really Pay Higher Wages? First Evidence from German Linked Employer–Employee Data," *Journal of International Economics*, 72(1), 52–74.

Schultz, T. P. (2004): "School Subsidies for the Poor: Evaluating the Mexican Progresa Poverty Program," *Journal of Development Economics*, 74(1), 199–250.

Shapiro, C., and J. Stiglitz (1984): "Equilibrium Unemployment as a Worker Discipline Device," *The*

American Economic Review, 74(3), 433–444.

Shastry, G. K. (2008): "Human Capital Response to Globalization: Education and Information Technology in India," Discussion paper, University of Virginia.

Sowell, E., P. Thompson, C. Holmes, T. Jernigan, and A. Toga (1999): "In Vivo Evidence for Postadolescent Brain Maturation in Frontal and Striatal Regions," *Nature Neuroscience*, 2, 859–860.

Spear, L. (2000): "The Adolescent Brain and Age-Related Behavioral Manifestations," *Neuroscience and biobehavioral reviews*, 24(4), 417–463.

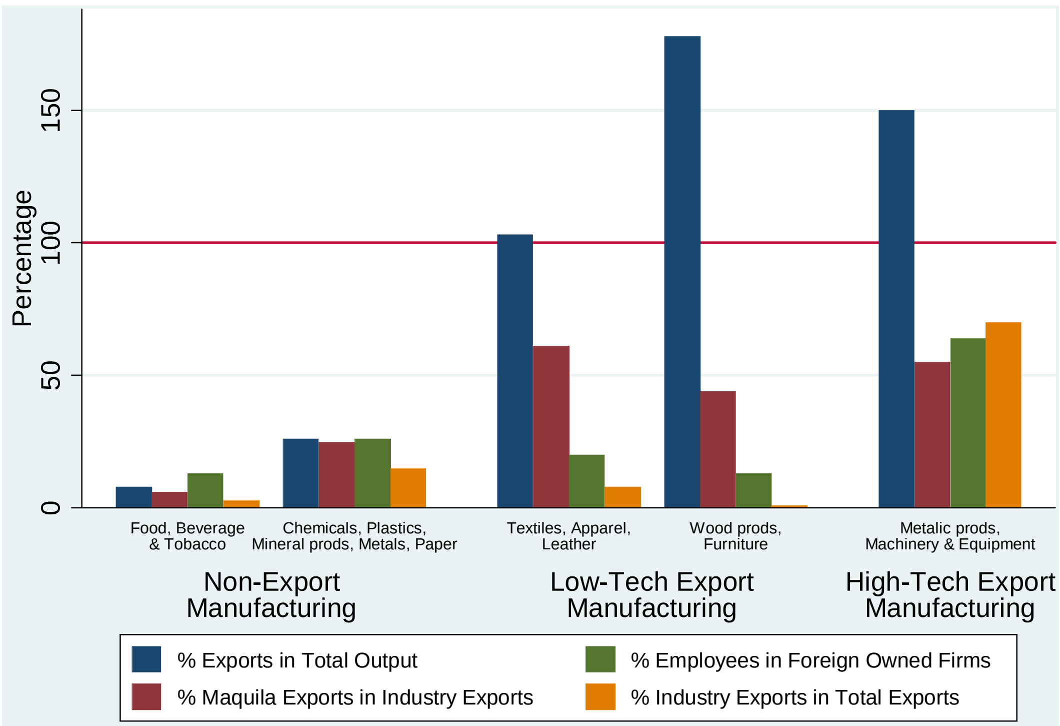
Stokey, N. L. (1991): "Human Capital, Product Quality, and Growth," *The Quarterly Journal of Economics*, 106(2), 587–616.

UNCTAD (2002): *World Investment Report 2002: Transnational Corporations and Export Competitiveness.* United Nations Conference on Trade and Development, Geneva.

Verhoogen, E. (2008): "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector," *Quarterly Journal of Economics*, 123(2).

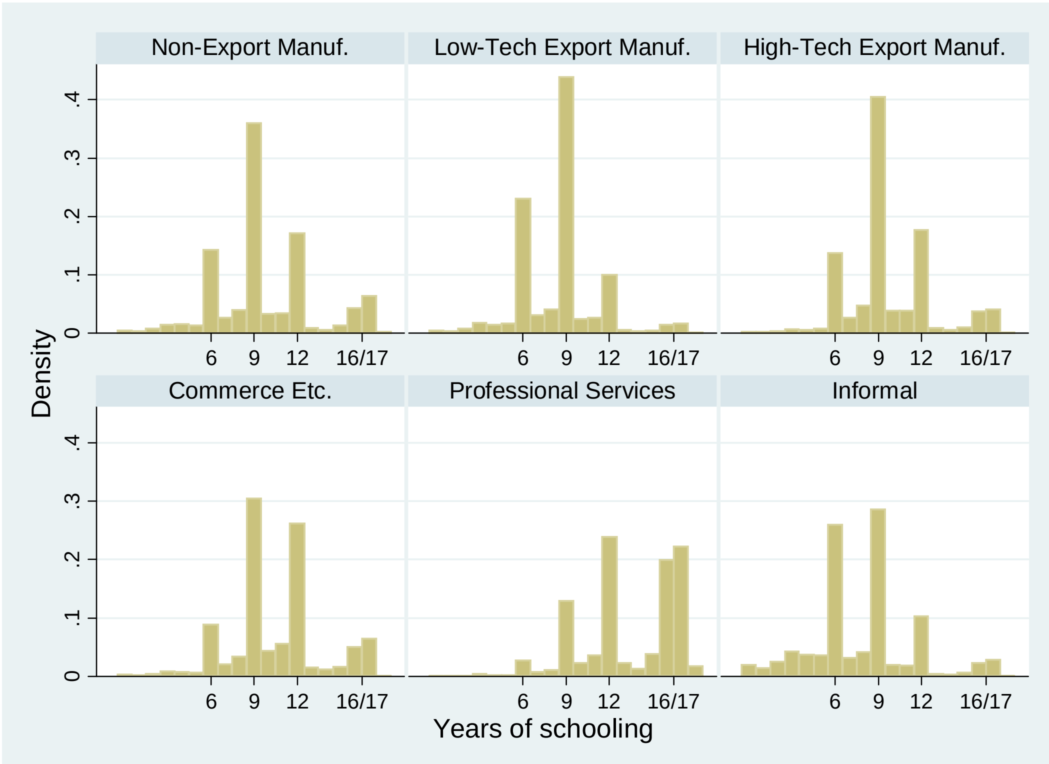
Zhou, L. (2003): "Why do Exporting Firms Pay Higher Wages?," Discussion paper, Emory University, Atlanta.

Figure 1: Manufacturing Industry Features



Sources: Export and Output Data from Nicita and Olarreaga (2007), Maquila Exports and Industry Exports data from Banco de Mexico and Employees in Foreign Owned Firms from Ibarraran (2004).

Figure 2: Histogram of Education by Industry (2000, Insured by IMSS)



Histogram of Employee Age by Industry (2000, Insured by IMSS)

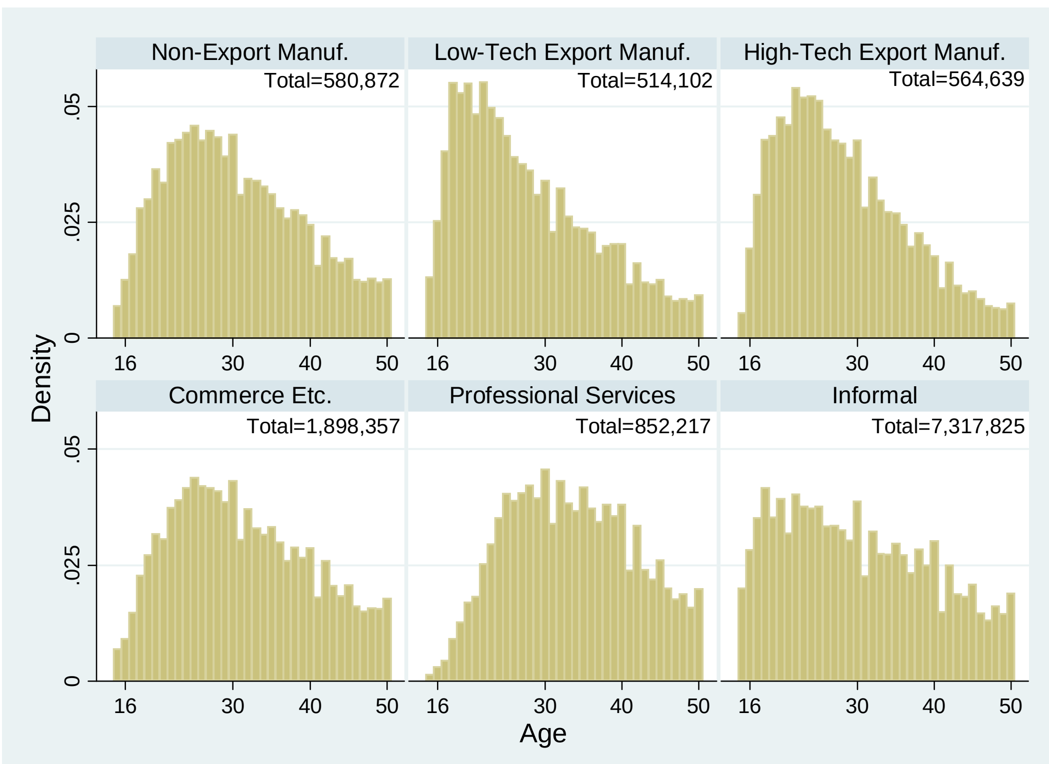


Figure 3: Visual Identification for 20 Municipalities with Biggest High-Tech Export Manufacturing Inflows

Figure 4: Effect of Positive Net New Jobs per Worker at Different Exposure Ages (Instrumented)

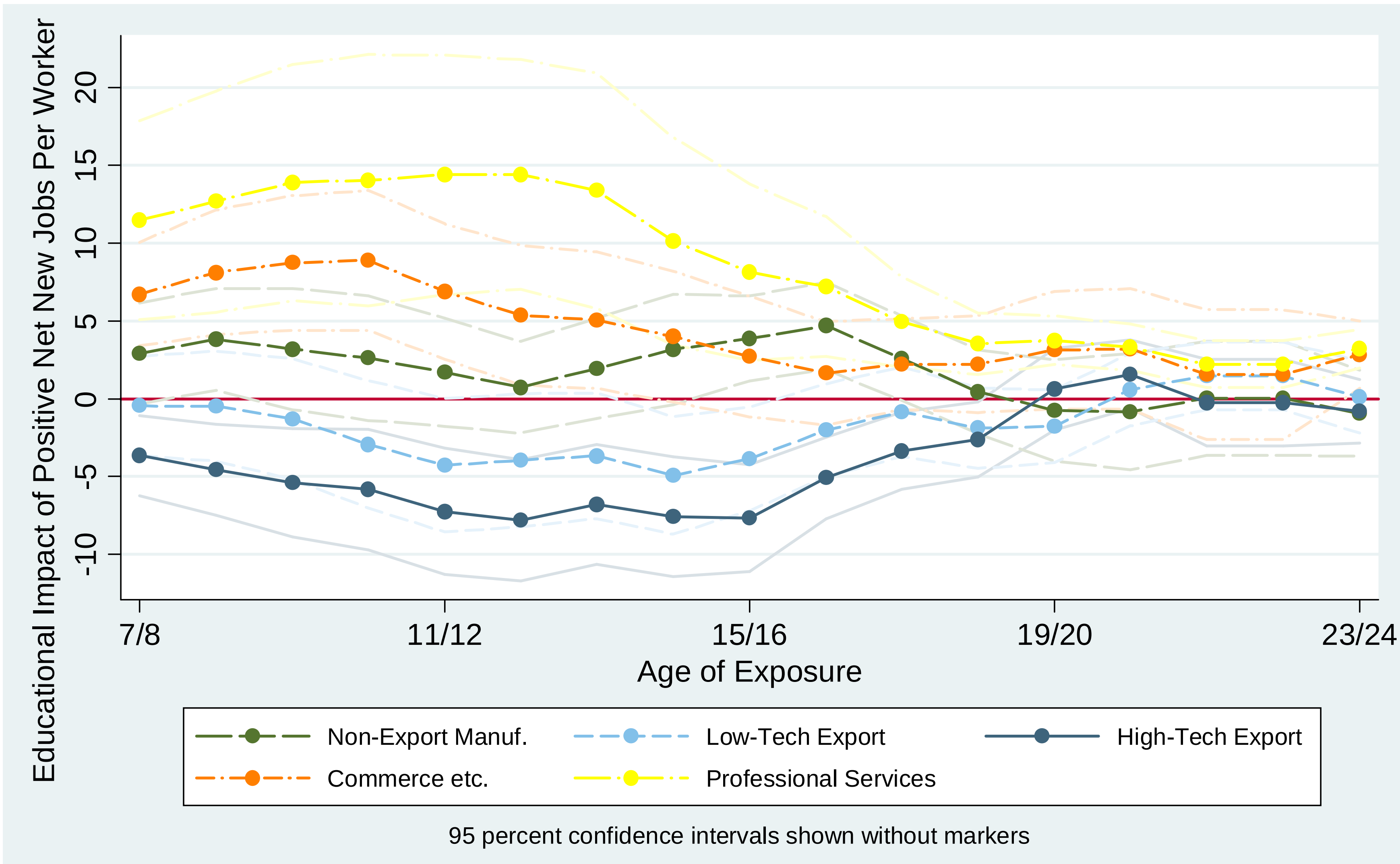


Figure 5: Formal Sector Wage Premia for New Workers (2000, Insured by IMSS)

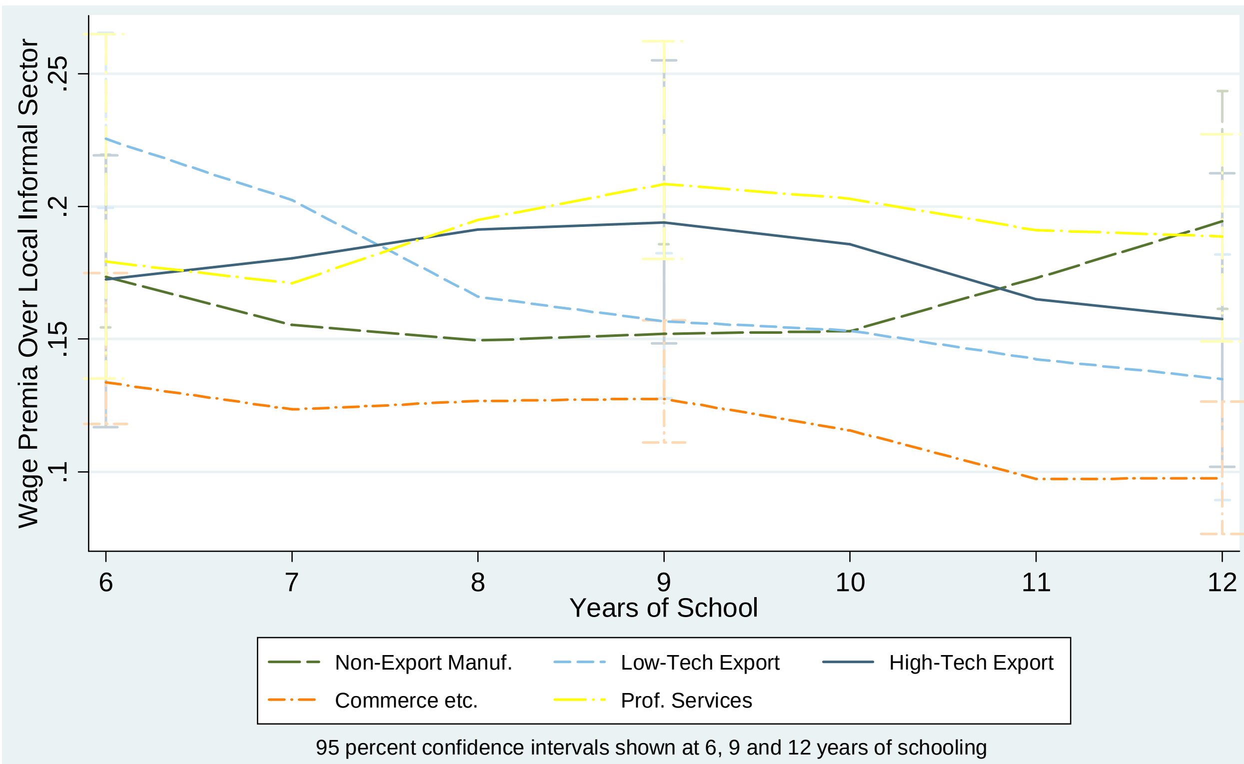
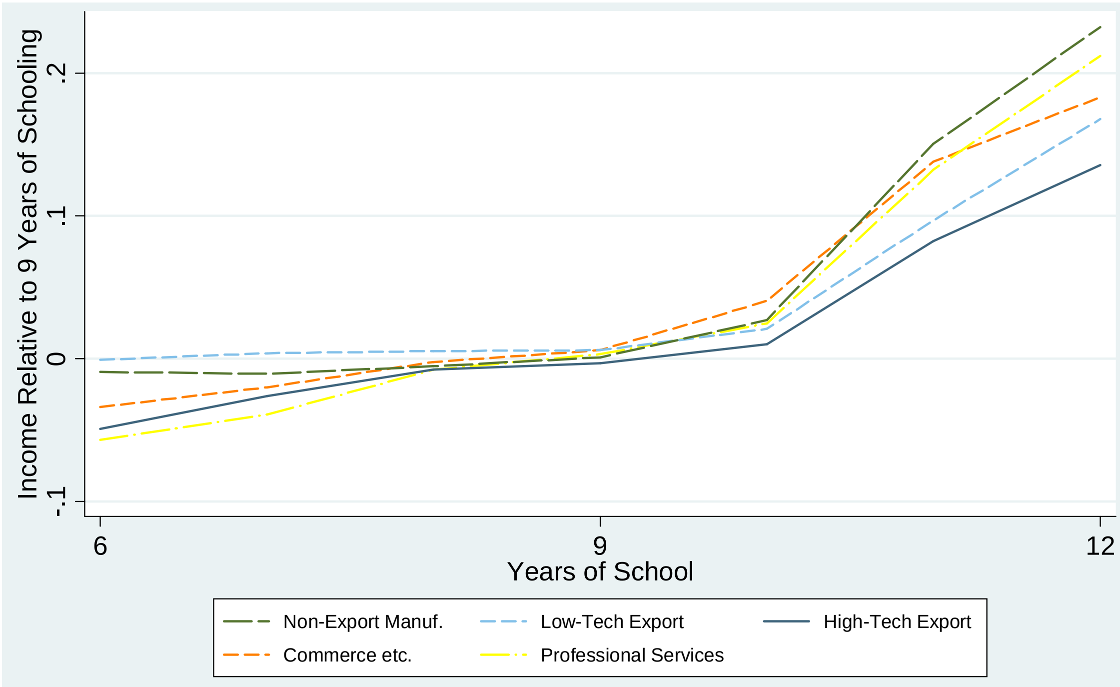


Figure 6: Returns to Schooling for New Workers (2000, Insured by IMSS)



Wage Profiles for Different Levels of Schooling (2000, Insured by IMSS)

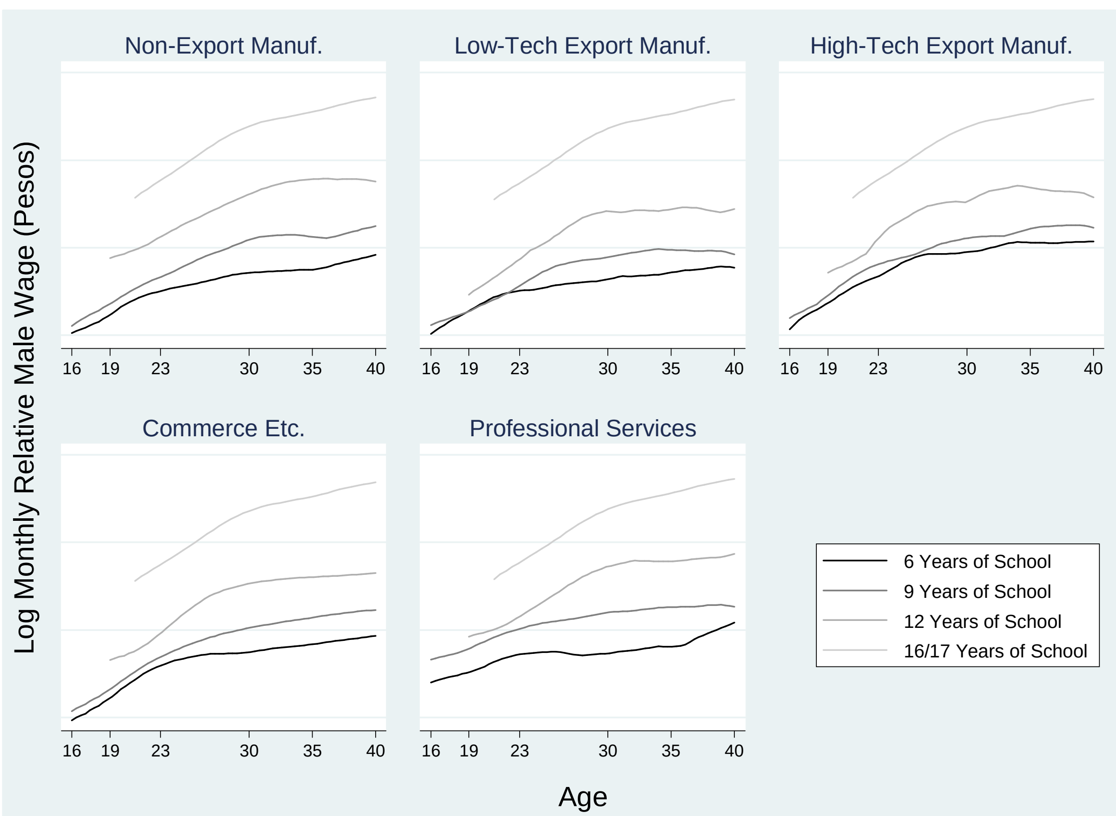


Table 1: Sample Means

Census Schooling Sample (2000, Age 16-28, Non Migrants, Excludes Mexico City)			
	mean	standard deviation	observations
Age	21.54	0.0038	1,706,582
Years of School	8.51	0.0038	1,636,520
Attending School (1=yes, 0=no)	0.21	0.0004	1,696,172
Employed (1=yes, 0=no)	0.52	0.0005	1,706,582
Insured by IMSS (1=yes, 0=no)	0.42	0.0011	1,706,582
Monthly Log Earned Income (Pesos)	7.47	0.0011	667,103
Sex (1=male, 0=female)	0.48	0.0005	1,706,582
Municipality Size	8540.26	816.7	1808
IMSS Annual Firm Sample (1985-2000)			
	mean	standard deviation	observations
Firm Size (Employees)	12.08	0.044	11,365,321
Firm Size (Firms Changing Employment)	16.03	0.065	7,675,094
Firm Size (Firms Hiring/Firing$\geq$ 50 in single year)	416.41	4.140	109,263
Proportion Male Workers	0.68		11,365,321
Unique Firms			2,194,681
Employees (1985)			4,472,491
Firms (1985)			372,520
Employees (2000)			12,509,298
Firms (2000)			912,284

Table 2: Transition Matrix for Net New Jobs Per Worker

	Next Periods Value			Next Periods Value			Next Periods Value		
Initial Value	Negative	Zero	Positive	Negative	Zero	Positive	Negative	Zero	Positive
	Non Export Manuf.			Low-Tech Export Manuf.			High-Tech Export Manuf.		
Negative	53.03	3.10	43.87	53.76	2.87	43.38	51.08	4.13	44.79
Zero	4.94	91.84	3.23	3.94	94.7	1.36	3.79	94.4	1.81
Positive	18.51	6.12	75.37	18.04	8.44	73.52	18.83	10.29	70.88
	Commerce etc.			Professional Services					
Negative	51.65	1.79	46.55	48.85	2.67	48.47			
Zero	5.22	90.72	4.06	2.51	93.98	3.51			
Positive	15.23	3.30	81.47	11.09	6.78	82.13			

Table 3: The Effect of Net New Jobs on Educational Attainment

	(1)	(2)	(3)	(4)
	OLS	IV (Large Δs)	RF (Large Δs)	IV2 (Bartik)
Net New Jobs/Worker at Age 15-16	Cohort Average Completed Years of Schooling			
Non Export Manufacturing	2.349**	1.454	1.509	-5.190
	(1.03)	(1.02)	(1.03)	(4.04)
Low-Tech Export Manufacturing	-3.677***	-4.019***	-4.311***	-10.38***
	(1.17)	(1.39)	(1.48)	(2.94)
High-Tech Export Manufacturing	-6.910***	-6.548***	-6.657***	-10.93**
	(1.51)	(1.41)	(1.46)	(4.36)
Commerce, Personal Services	6.101***	1.422	1.759	10.97***
	(1.31)	(1.32)	(1.60)	(3.45)
Professional Services	5.119***	4.942***	4.969***	19.75***
	(1.49)	(1.51)	(1.54)	(6.27)
Observations	23484	23484	23484	23466
R^2	0.26	0.26	0.25	0.20
Municipalities	1808	1808	1808	1808
Kleibergen-Paap rk Wald F-stat (1^{st} Stage)		558.03		10.08

Notes: Dependent variable is the cohort average years of schooling in the year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at ages 15 and 16. The IV (LargeΔs) column instruments net new jobs per worker by the net new jobs per worker attributable to firms that expand or contract their employment by 50 or more employees in a single year. The RF (LargeΔs) column is the reduced form regression, and regresses schooling on net new jobs per worker attributable to firms that expand or contract employment by 50 or more employees in a single year. The IV (Bartik) column instruments net new jobs per worker with the predicted net new jobs per worker if existing employment in industry i municipality m grew at the state-industry growth rate that year. State-time and municipality dummies not shown. Regression weighted by cell population, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

Table 4: The Assymetric Effect of Net New Jobs on Educational Attainment

LHS: Cohort Average Years of School	(1) OLS	(2) IV (Large Δs)	(3) RF (Large Δs)
Positive Net New Jobs Per Worker at Ages 15-16			
Non Export Manufacturing	5.119***	3.870***	4.175***
	(1.53)	(1.39)	(1.41)
Low-Tech Export Manufacturing	-3.601**	-3.862**	-4.095**
	(1.46)	(1.70)	(1.82)
High-Tech Export Manufacturing	-8.056***	-7.674***	-7.741***
	(1.86)	(1.75)	(1.80)
Commerce, Personal Services	8.405***	2.708	3.775
	(1.82)	(1.97)	(2.50)
Professional Services	9.150***	8.123***	8.378***
	(3.17)	(2.90)	(3.04)
Negative Net New Jobs Per Worker at Ages 15-16			
Non Export Manufacturing	-2.394	-2.510	-2.406
	(1.58)	(1.70)	(1.67)
Low-Tech Export Manufacturing	-4.398*	-4.917	-5.195*
	(2.51)	(3.01)	(2.89)
High-Tech Export Manufacturing	-5.808*	-4.169	-4.259
	(3.13)	(3.15)	(3.21)
Commerce, Personal Services	-4.004**	-2.521	-1.832
	(1.72)	(2.56)	(2.15)
Professional Services	-13.11***	-9.315***	-8.052***
	(2.79)	(2.47)	(2.13)
Observations	23484	23484	23484
R^2	0.27	0.27	0.26
Municipalities	1808	1808	1808
Kleibergen-Paap rk Wald F-stat (1^{st} Stage)		86.50	

Notes: Dependent variable is the cohort average years of schooling in the year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at ages 15 and 16 interacted with a dummy variable that takes the value 1 if net new jobs per worker is positive, and another dummy variable that takes the value 1 if net new jobs per worker is negative. The IV (LargeΔs) column instruments (interacted) net new jobs per worker by the (interacted) net new jobs per worker attributable to firms that expand or contract their employment by 50 or more employees in a single year. The RF (LargeΔs) column is the reduced form regression, and regresses schooling on (interacted) net new jobs per worker attributable to firms that expand or contract employment by 50 or more employees in a single year. State-time and municipality dummies not shown. Regression weighted by cell population, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

Table 5: Robustness Checks 1: Other Specifications

LHS: Cohort Average Years of School	(1) Basic IV Spec.	(2) Muni. Trend	(3) Capped at 12	(4) Not at School	(5) Men Only	(6) Women Only	(7) $\lvert\Delta l_{mci}\rvert \geq 100$
Positive Net New Jobs Per Worker at Ages 15-16							
Non Export	3.870***	1.409	1.913**	1.778	2.539**	5.747**	4.723***
Manufacturing	(1.388)	(1.254)	(0.950)	(1.201)	(1.10)	(2.54)	(1.49)
Low-Tech Export	-3.862**	-1.039	-3.408***	-3.934**	-3.975**	-3.440**	-3.866**
Manufacturing	(1.699)	(0.960)	(1.204)	(1.596)	(1.78)	(1.74)	(1.97)
High-Tech Export	-7.674***	-3.417***	-4.904***	-5.426***	-5.880***	-6.211***	-7.745***
Manufacturing	(1.752)	(1.149)	(1.162)	(1.320)	(1.92)	(2.11)	(1.78)
Commerce,	2.708	-2.388**	1.568	2.257	0.582	6.533	2.515
Personal Services	(1.975)	(1.178)	(1.425)	(1.606)	(1.32)	(4.08)	(2.12)
Professional	8.123***	-3.874***	4.453**	4.694**	6.376***	8.479**	7.915***
Services	(2.897)	(1.105)	(1.779)	(1.907)	(2.14)	(3.42)	(2.86)
Negative Net New Jobs Per Worker at Ages 15-16							
Non Export	-2.510	-1.525	-1.655	-2.125*	-0.773	-10.04***	-3.246*
Manufacturing	(1.696)	(1.469)	(1.162)	(1.191)	(1.34)	(3.72)	(1.79)
Low-Tech Export	-4.917	-0.0679	-1.413	-3.651	-3.195	0.886	-6.187*
Manufacturing	(3.010)	(2.647)	(2.347)	(2.802)	(3.34)	(3.89)	(3.43)
High-Tech Export	-4.169	-2.475	-3.348	-1.494	-5.959***	1.016	-3.945
Manufacturing	(3.146)	(2.298)	(2.376)	(2.319)	(1.87)	(2.01)	(3.28)
Commerce,	-2.521	-0.501	-1.469	-0.533	-0.280	-11.18	-2.178
Personal Services	(2.555)	(1.864)	(1.712)	(2.105)	(1.47)	(17.3)	(2.74)
Professional	-9.315***	-3.624**	-6.195***	-5.381***	-6.592**	-7.571***	-7.494***
Services	(2.468)	(1.694)	(1.727)	(1.857)	(2.79)	(2.40)	(2.28)
Observations	23484	23484	23484	23477	23328	23375	23484
R^2	0.27	0.56	0.29	0.42	0.20	0.21	0.27
Municipalities	1808	1808	1808	1808	1808	1808	1808

Notes: Dependent variable is the cohort average years of schooling in the year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at ages 15 and 16. These variables are instrumented by the net new jobs per worker attributable to firms that expand or contract their employment by more than 50 employees in a single year. Specifications described in section 5. State-time and municipality dummies not shown. Regression weighted by cell population, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** 5 percent and *** 1 percent.

Table 6: Robustness Checks 2: Regional Effects

LHS: Cohort Average Years of School	(8) Formal Muni.	(9) Rural Trends	(10) No Big Cities	(11) Northern	(12) Central	(13) Southern	(14) Richer	(15) Poorer
	Positive Net New Jobs Per Worker at Ages 15-16							
Non Export Manufacturing	3.592***	2.806**	3.334**	7.286***	1.118	5.068**	3.398*	3.321**
	(1.39)	(1.319)	(1.321)	(2.395)	(2.612)	(2.088)	(1.825)	(1.656)
Low-Tech Export Manufacturing	-1.685	-2.451*	-5.033***	-3.368	-3.973*	-9.004	-3.770**	-10.46***
	(1.88)	(1.410)	(1.717)	(2.434)	(2.395)	(8.483)	(1.687)	(3.035)
High-Tech Export Manufacturing	-7.572***	-5.708***	-4.961***	-5.477***	-27.06***	9.632	-6.037***	-8.220***
	(1.65)	(1.343)	(1.574)	(1.604)	(7.978)	(24.78)	(1.597)	(2.647)
Commerce, Personal Services	3.353*	2.096	3.449*	5.788***	-5.220	7.853**	-1.317	4.823**
	(1.96)	(1.499)	(1.823)	(2.213)	(3.741)	(3.605)	(2.017)	(2.406)
Professional Services	7.573***	4.012***	6.274**	15.97***	8.262***	-1.953	6.372***	6.507
	(2.64)	(1.405)	(2.502)	(3.719)	(2.824)	(16.20)	(2.391)	(4.180)
Negative Net New Jobs Per Worker at Ages 15-16								
Non Export Manufacturing	-1.849	-1.572	-1.715	-4.725	-6.170**	2.496	-2.650	-2.697
	(1.73)	(1.707)	(1.625)	(3.749)	(2.705)	(2.007)	(1.950)	(3.742)
Low-Tech Export Manufacturing	-5.869**	-2.601	-3.735	-7.249	-1.940	-22.81	-4.855	2.048
	(2.93)	(2.680)	(3.001)	(5.822)	(3.179)	(15.05)	(4.504)	(4.213)
High-Tech Export Manufacturing	-4.063	-3.069	-5.504*	-1.549	4.253	-23.65	-4.175	4.297
	(3.16)	(3.085)	(3.213)	(4.570)	(5.574)	(14.98)	(3.543)	(4.669)
Commerce, Personal Services	-3.225	-3.075	-3.399	-7.829**	6.296	0.0768	-0.756	2.793
	(2.53)	(2.222)	(2.371)	(3.414)	(5.349)	(6.185)	(4.231)	(2.532)
Professional Services	-9.530***	-9.659***	-6.255***	-13.01***	-11.81**	2.132	-8.620***	-9.325
	(2.41)	(1.991)	(2.135)	(2.799)	(4.828)	(25.70)	(2.456)	(8.155)
Observations	13350	23484	23458	4302	9789	9393	11748	11736
R^2	0.31	0.41	0.23	0.49	0.19	0.18	0.36	0.32
Municipalities	1027	1808	1806	331	753	724	904	904

Notes: Dependent variable is the cohort average years of schooling in the year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at ages 15 and 16. These variables are instrumented by the net new jobs per worker attributable to firms that expand or contract their employment by 50 or more employees in a single year. Specifications described in section 5. State-time and municipality dummies not shown. Cell population weights, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** 5 percent and *** 1 percent.

Table 7: Effects at Different Ages and Schooling Decisions

LHS: Cohort Avg. Schooling	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RHS: Positive Net	Exposure Ages 13-14			Exposure Ages 15-16			Exposure Ages 18-19			Exposure Ages 22-23		
New Jobs/Worker	Full	Schl >6	Schl >9	Full	Schl >6	Schl >9	Full	Schl >6	Schl >9	Full	Schl >6	Schl >9
Non Export	1.95	1.95	3.29**	3.87***	3.88***	4.88***	0.45	0.46	1.61	1.216	-1.67	-1.61
Manufacturing	(1.64)	(1.30)	(1.67)	(1.39)	(0.98)	(1.48)	(1.37)	(1.41)	(1.30)	(1.49)	(1.36)	(1.35)
Low-Tech Export	-3.67*	-0.60	0.11	-3.86**	0.12	0.787	-1.89	-1.678	-0.269	-1.06	-1.33	-0.60
Manufacturing	(2.05)	(1.37)	(1.44)	(1.70)	(1.32)	(1.246)	(1.32)	(1.23)	(1.35)	(1.31)	(1.04)	(1.27)
High-Tech Export	-6.79***	-3.43***	-3.17***	-7.67***	-4.57***	-3.05***	-2.63**	-2.81***	-2.78***	-1.31	-0.60	-0.71
Manufacturing	(1.95)	(1.20)	(0.96)	(1.75)	(1.25)	(1.08)	(1.23)	(0.96)	(1.04)	(1.11)	(0.90)	(1.09)
Commerce,	5.05**	0.89	3.04**	2.708	0.81	0.129	2.22	1.17	0.957	2.98*	1.90	0.20
Personal Services	(2.24)	(1.44)	(1.37)	(1.98)	(1.27)	(1.19)	(1.58)	(1.26)	(1.39)	(1.66)	(2.04)	(1.86)
Professional	13.36***	7.96***	4.98***	8.12***	5.37***	4.67***	3.53***	2.76***	2.13***	3.05***	-1.43**	-0.28
Services	(3.86)	(1.96)	(1.48)	(2.90)	(1.70)	(1.14)	(1.01)	(0.68)	(0.61)	(0.69)	(0.71)	(0.53)
Observations	23486	22906	17970	23484	22669	19352	23475	22232	18468	23466	21643	17489
R^2	0.63	0.92	0.93	0.27	0.79	0.91	0.23	0.27	0.65	0.35	0.16	0.12
Municipalities	1808	1808	1740	1808	1807	1748	1808	1804	1731	1808	1801	1672

Notes: Dependent variable is the cohort average years of schooling in the year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at the listed exposure ages. These variables are instrumented by the net new jobs per worker attributable to firms that expand or contract their employment by 50 or more employees in a single year. Schl>x restricts sample to those with more than x years of schooling in 2000. Negative net new jobs per worker not shown. State-time and municipality dummies omitted. Regression weighted by cell population, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** 5 percent, *** 1 percent.

Table 8: The Effect of Net New Jobs on Educational Attainment by Industry Characteristics

	(1)	(2)	(3)	(4)
IV Specification	LHS: Cohort Average Years of School			
Positive Net New Jobs Per Worker	3.285***	4.177***	4.269***	26.02
(All Industries, All Firms)	(1.01)	(1.17)	(1.18)	(21.2)
$\boldsymbol{I}^{+}\sum_{j\in m}$(New Jobs Per Worker$_j$	-7.017***		-1.284	3.799*
$\times$Maquiladora Indicator$_j$)	(1.70)		(1.81)	(2.22)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$		-0.0205***	-0.0187***	0.0594***
$\times\frac{\text{Export}_{i'\text{mex}}}{\text{Output}_{i'\text{mex}}}$)		(0.0048)	(0.0055)	(0.019)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$				71.97**
$\times p_{\text{mex}}$(New Jobs$_{i't+1}> 0$|New Jobs$_{i't}> 0$))				(34.3)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$				25.30
$\times$Employee Share with $S < 9_{i'\text{mex}}$)				(16.1)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$				-68.72***
$\times$Employee Share with $9 \leq S < 12_{i'\text{mex}}$)				(22.2)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$				-247.2***
$\times$Employee Share$\leq$3 years out of school$_{i'\text{mex}}$)				(46.7)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$				-4.838***
$\times\frac{\text{Wage Premium }(S=6)_{i'\text{mex}}}{\text{Wage Premium }(S=9)_{i'\text{mex}}}$)				(1.28)
$\boldsymbol{I}^{+}\sum_{i'}$(New Jobs Per Worker$_{i'}$				-0.00383
$\times\frac{\text{Wage Premium }(S=9)_{i'\text{mex}}}{\text{Wage Premium }(S=12)_{i'\text{mex}}}$)				(0.0051)
$\boldsymbol{I}^{+}\sum_{j\in m}$(New Jobs Per Worker$_j$				-0.0000760
$\times$Firm Employees$_j$)				(0.00013)
$\boldsymbol{I}^{+}\sum_{j\in m}$(New Jobs Per Worker$_j$				-0.0119***
$\times$Firm Mean Growth Rate$_j$)				(0.00079)
Observations	23484	23484	23484	23484
R^2	0.25	0.26	0.26	0.27
Municipalities	1808	1808	1808	1808

Notes: Dependent variable is cohort average years of schooling in year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at ages 15 and 16 interacted with positive and negative indicator variables. Negative new new jobs coefficients not shown. Interacted net new jobs per worker terms instrumented with interactions of net new jobs per worker attributable to firms that expand or contract their employment by 50 or more employees in a single year. Additional new jobs terms are interactions between firm/3-digit industry job arrivals and firm/3-digit industry characteristics (firm Maquiladora status, proportion of national industry output exported 1986-1999, national industry transition probabilities of two consecutive years of positive new job arrivals 1986-1999, proportion of national industry employees with less than 9 years of schooling in the year 2000, proportion of national industry employees with between 9 and 11 years of schooling in 2000, proportion of national industry employees out of school for 3 years or less in 2000, national industry "wage premia" for employees with primary school divided by premia for those with secondary school in 2000, national industry "wage premia" for employees with secondary school divided by premia for those with high school in 2000, number of firm employees and mean firm job growth). State-time and municipality dummies not shown. Regression weighted by cell population, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

Table 9: The Effect of Net New Jobs on Log Earned Monthly Income

LHS: Cohort Monthly Log Income, Year 2000 (Pesos)	(1) OLS	(2) IV (Large Δs)	(3) RF (Large Δs)	(4) Richer Mun.	(5) Poorer Mun.
Positive Net New Jobs Per Worker at Ages 15-16					
Non Export Manufacturing	1.051***	0.908***	0.978***	0.822*	0.750
	(0.33)	(0.34)	(0.35)	(0.48)	(0.49)
Low-Tech Export Manufacturing	-0.0125	0.0768	0.0936	0.408	-1.277***
	(0.26)	(0.29)	(0.31)	(0.35)	(0.47)
High-Tech Export Manufacturing	-0.685**	-0.580**	-0.555**	-0.473	0.151
	(0.27)	(0.27)	(0.28)	(0.30)	(0.53)
Commerce, Personal Services	1.553***	0.484	0.696*	-0.0341	0.568
	(0.33)	(0.30)	(0.39)	(0.34)	(0.59)
Professional Services	1.068***	0.917***	0.947***	0.667***	0.0172
	(0.25)	(0.24)	(0.25)	(0.21)	(0.87)
Negative Net New Jobs Per Worker at Ages 15-16					
Non Export Manufacturing	-0.794	-0.852	-0.803	-1.435	0.556
	(0.72)	(0.76)	(0.74)	(0.88)	(1.14)
Low-Tech Export Manufacturing	0.510	-0.123	-0.0723	-0.960	0.778
	(0.51)	(0.53)	(0.50)	(0.81)	(0.83)
High-Tech Export Manufacturing	0.600	0.608	0.623	0.169	2.201*
	(0.70)	(0.73)	(0.73)	(0.85)	(1.13)
Commerce, Personal Services	-1.104**	-0.941	-0.687	-0.381	-0.917
	(0.48)	(0.66)	(0.57)	(0.88)	(0.73)
Professional Services	-0.242	0.184	0.277	0.00402	1.761
	(0.31)	(0.32)	(0.29)	(0.29)	(1.40)
Observations	22069	22069	22069	11132	10937
R^2	0.75	0.75	0.75	0.81	0.62
Municipalities	1802	1802	1802	903	899

Notes: Dependent variable is the cohort average monthly log earned income in the year 2000. Independent variables are net new jobs per worker arriving in cohort's municipality at ages 15 and 16 interacted with positive and negative value dummies. In columns 2, 4 and 5, these variables are instrumented by the net new jobs per worker attributable to firms that expand or contract their employment by 50 or more employees in a single year. In column 3, the reduced form, I replace net new jobs per worker by net new jobs per worker from large expansions or contractions. In columns 4 and 5, I divide the municipalities into the richer and poorer half by year 2000 municipality average income. State-time and municipality dummies omitted. Cell population weights, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

Table 10: The Effect of Net New Jobs on Cohort Size and Selective Migration

	(1) Log Cohort Size	(2) Ratio of Leavers Schooling to Stayers (1995-1999)
Positive Net New Jobs Per Worker at Ages 15-16		
Non Export Manufacturing	0.353	-0.434
	(0.51)	(0.59)
Low-Tech Export Manufacturing	-0.512	-0.787*
	(0.40)	(0.47)
High-Tech Export Manufacturing	-0.283	-1.061***
	(0.43)	(0.39)
Commerce, Personal Services	1.299***	-0.485
	(0.39)	(0.55)
Professional Services	1.784***	-2.684***
	(0.62)	(0.77)
Negative Net New Jobs Per Worker at Ages 15-16		
Non Export Manufacturing	0.470	0.840
	(0.48)	(2.45)
Low-Tech Export Manufacturing	-1.071	-0.284**
	(0.82)	(0.12)
High-Tech Export Manufacturing	-0.462	0.0986
	(0.57)	(1.16)
Commerce, Personal Services	-0.754	-1.349
	(0.69)	(1.07)
Professional Services	-2.594***	-1.983
	(0.74)	(1.52)
Observations	23484	1663
R^2	1.00	0.07
Municipalities	1808	1663

Notes: In column 1, State-time and municipality dummies not shown. Regression weighted by total municipality population, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. In column 2, State dummies not shown. Regression weighted by total cohort populations, excludes Mexico City. Robust standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

Table 11: The Interaction of Industry Migrant Proportions and Net New Jobs

	Cohort Average Years of School
Positive Net New Jobs Per Worker at Ages 15-16	
Non Export Manufacturing	6.275***
	(2.33)
Low-Tech Export Manufacturing	-0.0497
	(3.18)
High-Tech Export Manufacturing	-16.06***
	(4.07)
Commerce, Personal Services	13.53***
	(2.64)
Professional Services	0.126
	(5.46)
Positive Net New Jobs Per Worker at Ages 15-16×Proportion Migrants Workers$_{im}$	
Non Export Manufacturing	-8.125
	(9.98)
Low-Tech Export Manufacturing	-16.83
	(11.0)
High-Tech Export Manufacturing	21.84***
	(7.71)
Commerce, Personal Services	-15.74**
	(6.40)
Professional Services	45.75**
	(18.9)
Observations	22127
R^2	0.91
Municipalities	1703

Notes: ϑ_{im} is the proportion of formal workers in the 2000 census in industry i and municipality m that are neither born in that state nor lived in that municipality 5 years ago. Negative net new jobs per worker not shown. State-time and municipality dummies omitted. Cell population weights, excludes Mexico City and migrants. Municipality clustered standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.