Trade Shocks, Population Growth, and Migration

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Abstract

This paper examines the effect of trade-induced changes in Mexican labor demand on population growth and migration responses at the local level. It exploits cross-municipality variation in exposure to a change in trade policy between the U.S. and China that eliminated potential tariff increases on Chinese imports, negatively affecting Mexican manufacturing exports to the U.S.. Municipalities more exposed to the policy change, via their industry structure, experienced greater employment loss. In the five years following the change in trade policy, more exposed municipalities experience increased population growth, driven by declines in out-migration. Conversely, six to ten years after the change in trade policy, exposure to increased trade competition is associated with decreased population growth, driven by declines in in-migration and return migration rates, and increased out-migration. The sluggish regional adjustment is consistent with high moving costs and transitions across sectors in the short term.

Keywords: trade competition, job displacement, population growth, internal migration

JEL Classification: F16, J23, O12, R12, R23

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1 Introduction

Why, when, and where do individuals decide to migrate? Beyond its intrinsic relevance, the answer to this question has important implications for the estimates of several socioeconomic outcomes. Selective migration in response to an economic shock changes the composition of local labor markets. Consequently, estimated impacts on average socioeconomic outcomes might reflect both a direct treatment effect and a change in outcomes driven by changes in the labor market composition (Greenland et al., 2019; Arthi et al., 2022). Accounting for such compositional effects represents an empirical challenge, especially when individual panel data is not available.

This paper studies how trade-induced changes in Mexican labor demand affect population growth and migration flows at the local level. I exploit cross-municipality variation in exposure to a change in trade policy between the U.S. and China that negatively affected Mexican manufacturing exports to the U.S. market. I find that, in the five years following the change in trade policy, more exposed municipalities experience increased population growth, driven by declines in out-migration. These results are not driven by return migration from the U.S., which also relatively decreases in more exposed areas. Conversely, six to ten years after the plausibly exogenous change in trade policy, exposure to increased trade competition is associated with decreased population growth, driven by declines in in-migration and return migration rates, and increased out-migration. Furthermore, I find heterogeneity in the effects across population groups: the migratory response is driven primarily by less-educated and manufacturing sector workers.

My results indicate that exposure to trade competition affected population growth via a deterioration in labor market opportunities in the manufacturing sector, which led to income loss due to job loss and lower wages. The sluggish population response is consistent with the changes in internal migration that I document. However, the initial population growth is somewhat puzzling given the consistent negative dynamic effects on manufacturing employment and income that I find. I show that transitions across sectors are a plausible mechanism behind the reversal in population growth and out-migration. I find that there are job gains in the service sector that partially offset the job losses in manufacturing in the short term. In the long term, though, increased competition is associated with declines in employment and wages across all sectors. The slack response in service sector employment and wages, together with high moving costs, are possible channels behind the timing of the regional adjustment.

My primary empirical approach focuses on a change in trade policy between the U.S. and China that negatively affected Mexican manufacturing exports to the United States. In October 2000, the U.S. granted to China Permanent Normal Trade Relations (PNTR), which eliminated potential tariff increases on imports from China. In the U.S., Pierce and Schott (2016) link the decline manufacturing employment after 2000 to the surge in imports of Chinese goods in particular industries affected by PNTR. Given the technological similarity between China and Mexico at the time, the increase in Chinese exports to the U.S. also led to a decrease in demand for Mexican manufacturing products (Hanson and Robertson, 2008; Gallagher and Porzecanski, 2007) and hence a decline in manufacturing employment opportunities in Mexico (Chiquiar et al., 2017; Mendez, 2015; Utar and Torres Ruiz, 2013). Building on Pierce and Schott (2016, 2020), I construct a Mexican municipality-level measure of exposure to trade competition resulting from the U.S. granting PNTR to China, which differentially exposed regions to increased trade competition via their industry structure. Therefore, Mexican municipalities specializing in industries in which China had an initial comparative advantage were more exposed to this change in trade policy.[1]

The contribution of this paper is twofold. I identify first-order effects of increased international competition on Mexican trade and labor market associated with a change in trade policy between the U.S. and China, and I document the population response to this local labor demand shock. To the best of my knowledge, this is the first paper studying aggregate

[1] Chinese competition affected Mexico directly, through an increase in imports from China, and indirectly, through increased competition in the U.S. market. Fernández Guerrico (2021) shows the negative effect of both import and export competition on Mexican local labor market. Also, see Appendix A.

population changes as a response to trade competition in Mexico. There are, however, a vast number of studies examining the U.S.-Mexico migration (Caballero et al., 2019, 2018; Kaestner and Malamud, 2014; Mckenzie and Rapoport, 2010; Ibarraran and Lubotsky, 2007; Chiquiar and Hanson, 2005), and migration responses to income shocks (Quiñones, 2019; Angelucci, 2015; Kleemans, 2015; Belot and Hatton, 2012). The closest related paper is on the individual decision to migrate (Majlesi and Narciso, 2018), which finds that individuals living in areas with higher exposure to international competition were more likely to migrate within Mexico between 2002 and 2005.[2]

To provide evidence on the channels linking the population response to the trade shock, I examine the first-order effects of PNTR on Mexican manufacturing exports and local labor markets. I analyze trade competition between two south locations in a third, northern market, generated by a change in trade policy. Previous work finds a negative impact of Chinese competition in the U.S. market on employment and plant growth within Mexican Maquiladoras (Utar and Torres Ruiz, 2013). Here, using cross-municipality exposure to PNTR, I show the effect of increased export competition in the entire Mexican labor market.

Furthermore, using exposure to PNTR has advantages over methods that rely on supply-driven changes in China around the time of its accession to the WTO because it is based on a specific change in trade policy.[3] Following an approach similar to that used by Autor et al. (2013) in the U.S. context, related work studying the impact of Chinese competition in Mexico, use a measure regional variation in exposure to trade using changes in Mexican or U.S. imports per worker from China (Blyde et al., 2017; Mendez, 2015; Dell et al., 2019; Fernández Guerrico, 2021). Recent research argues that weighting the local industry shares by growth rates in Chinese exports is an imperfect way of isolating the variation in industries

[2] Majlesi and Narciso (2018) use data from the Mexican Family their sample covers 100 municipalities (oversampling rural areas) whereas my sample covers 2,382 municipalities and all working-age population covered in the Mexican Economics and Population Censuses.

[3] However, this approach also presents challenges because of possible trade spillovers to third countries. For example, Mau (2017) shows that a reduction in US tariff uncertainty arising from China's accession to WTO also positively affected China's exports to the European Union.

were China experienced rapid productivity gains (Goldsmith-Pinkham et al., 2020).[4] In using Pierce and Schott (2016) measure of industry-level exposure to China receiving PNTR the argument is not that the trade policy is random, but that the change in the trade policy is not correlated with pre-existing trends in outcomes at the local level. While this change in trade policy has been used to study changes in local labor markets in the U.S., I study the local labor market effects of PNTR in Mexico, given the importance of the U.S. as an export destination of manufacturing products for Mexico.

More broadly, my analysis relates to the literature on heterogeneous migratory responses to local labor market conditions based on workers' skills (Greenland et al., 2019; Notowidigdo, 2020; Utar, 2018; Cadena and Kovak, 2016; Bound and Holzer, 2000), the relative importance of regional mobility compared to sectoral mobility given adjustment costs (Dix-Carneiro and Kovak, 2017; Bartik, 2018; Autor et al., 2014), and the relative importance of out-migration compared to in-migration (Monras, 2018). Finally, this paper also relates to the extensive literature examining the effect of trade liberalization on labor market outcomes in the last two decades (Topalova, 2010; McCaig, 2011; Kovak, 2013; Autor et al., 2013, 2014; Dix-Carneiro, 2014; Acemoglu et al., 2016; Pierce and Schott, 2016), as well as an array of socio-economic outcomes such as education and child labor (Edmonds et al., 2009, 2010), marriage and fertility (Autor et al., 2015, 2019), health and mortality (Fernández Guerrico, 2021; Adda and Fawaz, 2020; Pierce and Schott, 2020) and crime (Dell et al., 2019; Khanna et al., 2019; Dix-Carneiro et al., 2018).[5] Here, using a similar identification strategy, I provide an insight into the direct effects of PNTR on Mexican exports to the U.S. and the impact on manufacturing employment as a possible mechanism that induced migratory responses.

The paper proceeds as follows. In the next section, I describe the data. Section 3 introduces my source of variation in labor demand and explains my empirical strategy. In

[4]A recent literature has advanced our understanding of the identification assumptions for shift-share designs discussing alternative approaches to recovering causal effects—assuming exposure "shares" are as good as random (Goldsmith-Pinkham et al., 2020), and assuming exposure "shocks" are as good as random (Borusyak et al., 2022; Adão et al., 2019).

[5]See Pavcnik (2017) for a literature review.

Sections 4 and 5, I present the results of increased trade exposure on aggregate population growth and migration responses, respectively. In Section 6, I examine the first-order effects of PNTR on Mexican labor market outcomes to provide evidence on the mechanisms linking the population response to the trade shock. Section 7 describes a series of robustness checks. Section 8 concludes.

2 Data

This section describes the data I use to investigate the relationship between international competition, labor demand, population growth, and migration responses.

Population growth and migration response across municipalities

Population data comes from the 2000 and 2010 Mexican Census of Population and Housing Units, and the 1995, 2005, and 2010 Intercensal Population and Housing Count collected by the Mexican National Institute of Statistics and Geography (INEGI). First, I use official tabulations of the full-count 2000 and 2010 Mexican Censuses, and the 1995 and 2005 Counts available at INEGI's website to calculate population growth (with gender and age breakdown) at municipality level.

Second, I also use official tabulations of the full-count based on questions included in the 2000, 2005, and 2010 Population Census and Count regarding individuals' location of residence 5 years prior to the survey. This data allows me to observe migration flows over 1995-2000, 2000-2005, and 2005-2010. Following Caballero et al. (2019), I define the return migration rate as the number of returning migrants to a municipality, divided by the municipality's population in the survey year. Additionally, I use data on migration intensity from the Mexican Population Council (CONAPO), which has information on the percentage of households whose member(s) have emigrated or returned to the US during 1995-2000 and 2005-2010.

Third, I measure internal migration flows. A municipality's out-migration rate between t-5 and t is the number of individuals leaving municipality i as a share of municipality i's population in t-5, while a municipality's in-migration rate is the number of in-migrants as a share of i's population in t-5. The main caveat of using INEGI's tabulations is that they only allow me to calculate in-migration and out-migration rates for each municipality based on individuals state of residence 5 years prior to the survey. Consequently, I do not observe migration rates between municipalities and within states when using INEGI tabulations of the full-counts.

Fourth, because movement across minor administrative divisions (i.e., municipalities or *municipios*) is only available for the long-form survey, I have information for an approximately ten percent sample of the Mexican population for years 2000 and 2010. This data comes from the Integrated Public Use Microdata Series (IPUMS) International, collected by the Minnesota Population Center. I also use IPUMS microdata to explore the heterogeneity in population response across different educational groups and sectors of employment.

Cross-municipality exposure to trade

To measure the initial industry employment shares, I use the 1999 Mexican Economic Census (with reference period 1998). I also use data from the 2004 and 2009 Mexican Economic Census (with reference periods 2003 and 2008, respectively) to examine changes in manufacturing employment and wages over the period. Data to compute the tariffs gaps (described in detail in Section 3.1) comes from Feenstra et al. (2002). Data on international trade flows is from UN Comtrade. This data is matched to 4-digit time-consistent manufacturing industries in the Mexican Economic Census using the concordance in (Pierce and Schott, 2009, 2016) between UN Comtrade 6-digit Harmonized System (HS) and 4-digit North American Industry Classification System (NAICS, or SCIAN in Spanish). I use the dataset provided by the authors to create 4-digit industry time-invariant family level dataset containing 83 constant manufacturing industries.

Finally, I use two additional sources of data to examine the main channels through which trade exposure affected manufacturing employment in export-oriented locations. First, the Maquila Export Industry Statistics (EIME) which concluded in 2006, and second, the Manufacturing Industry, Maquila and Export Services (IMMEX), which collects statistics on the export industry since 2007. These state-level statistics from the maquiladora industry are publicly available for 17 (of 32) states that are covered by plant-level surveys on maquiladoras conducted by INEGI.

3 Empirical Strategy

In this section, I discuss how I construct measures of Mexican municipalities' exposure to the changes in China-U.S. trade policy. I detail the specifications I use to estimate the causal effect of increased international competition on local employment, population growth, and migration.

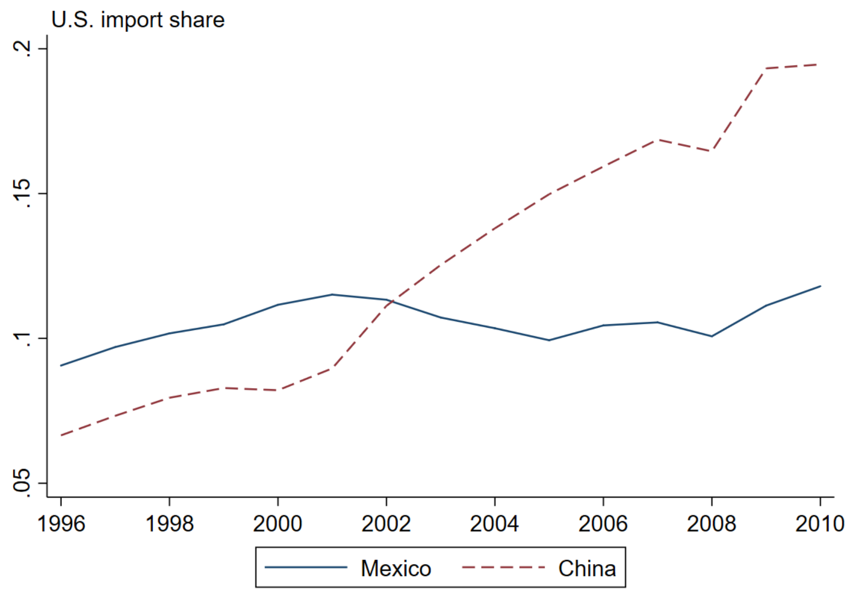
3.1 Labor Market Shock in Mexico - PNTR

My primary empirical approach exploits a change in trade policy between the U.S. and China that generated plausible exogenous variation in Mexican export demand from the United States.

The Mexican manufacturing sector experienced a rapid export-led expansion between the years 1986 and 2000, which started with the country's entry into the General Agreement on Tariffs and Trade (GATT) in 1986 and culminated with the signing of North American Free Trade Agreement (NAFTA) in 1994 and its implementation. The export to GDP ratio rose from 14 percent in 1986 to 25 percent in 2000, as Mexico became integrated into the world economy. Manufacturing exports represented 10 percent of merchandise exports over the 1980s, 43.5 percent in 1990, and 85 percent in 2000. Within NAFTA Mexico had developed a comparative advantage in the production of labor-intensive goods (Chiquiar et al., 2017; Feenstra and Kee, 2007; Gallagher et al., 2008; Hanson and Robertson, 2008).

In October 2000, the United States granted China Permanent Normal Trade Relations

Figure 1: Share of China and Mexico in United States' imports



Notes: This figure shows that China surpasses Mexico's share of U.S. imports shortly after the U.S. granted PNTR to China.

(PNTR), which reduced uncertainty regarding potential tariff rates on Chinese exports to the United States. Before China's accession to the WTO in 2001, the provision of tariffs rates was subject to annual renewal by the U.S. Congress. Hence, Chinese firms faced considerable uncertainty regarding future costs of exporting. Following China's accession to the WTO, the U.S. congress voted to grant NTR rates on a permanent basis. Pierce and Schott (2016) measure the impact of PNTR as the rise in U.S. tariffs on Chinese goods that would have occurred in the event of a failed annual renewal of China's NTR status (i.e., non-NTR tariffs). They define this difference between the observed NTR tariff rates and the potential non-NTR rates in industry j as the "NTR Gap":

$$NTRGap_j = NonNTRRate_j - NTRRate_j \tag{1}$$

I use Pierce and Schott (2016) approach to construct a measure of Mexican industries exposure to China receiving PNTR.[6] The intuition behind using this measure is that Mexican municipalities with industries that benefited from NAFTA, developing a comparative advantage and increasing exports to U.S., were more negatively affected by the trade liberalization between China and the United States. The change in trade policy between China and the U.S. was not correlated with Mexican pre-existing outcomes at the local level, while the industry-municipality shares predict changes in employment through the changes in the trade policy between third countries.

Table 1: PNTR and U.S. Import Shares - 1996-2010

	(1)	(2)	(3)	(4)
	$\frac{U.S.Imports_{jt}^{MEXICO}}{U.S.Imports_{jt}^{All}}$		$\frac{U.S.Imports_{jt}^{CHINA}}{U.S.Imports_{jt}^{All}}$	
$NTRGap_j * Post_t$	-0.117***	-0.0968***	0.425***	0.284***
	(0.0165)	(0.00777)	(0.0440)	(0.0123)
Rescaled 25th-75th pctile	-0.0405***	-0.0365***	0.1475***	0.1071***
	(0.0057)	(0.0029)	(0.0153)	(0.0046)
Observations	1,245	62,036	1,245	62,036
Industry j	4-digit	6-digit	4-digit	6-digit

Notes: This table presents estimates of Equation 2 of the relationship between China receiving PNTR and U.S. import shares from Mexico (Columns 1 and 2) and China (Columns 3 and 4). The dependent variable is the Chinese or Mexican import share in total U.S. manufacturing imports in industry j (4-digit level in Columns 1 and 3; 6-digit level in Columns 2 and 4) and year t (1996-2010). $NTRGap_j$, defined in Equation 1, is the difference between the observed NTR tariff rates and the potential non-NTR rates in industry j. The third to last row presents rescaled estimates to reflect the change in import shares for an industry j at the 75th compared to the 25th percentile of exposure to the tariff gap. Robust standard errors are in parenthesis (*** p<0.01, ** p<0.05, * p<0.1).

China's sharp increase in exports to the U.S. following PNTR is particularly relevant for Mexican manufacturing firms, given that nearly half of the manufacturing exports are produced by *maquiladoras*, or export assembly plants, with the U.S. as their export main destination (Utar and Torres Ruiz, 2013). To illustrate China's penetration in the U.S.

[6]Following Pierce and Schott (2016, 2020), NTR gaps are defined only for industries whose output is subject to import tariffs in the manufacturing sector. Industries whose output is not subject to tariffs, such as service industries, are assigned NTR gaps of zero.

market, Figure 1 shows that China surpasses Mexico's share of U.S. imports shortly after the passage of the bill that granted PNTR to China in October 2000. To provide direct evidence of the effect of PNTR as a source of increased Chinese trade competition for Mexican manufacturing exports in the U.S. market, I estimate Equation 2 separately for each U.S. trade partner: China and Mexico.

$$\frac{Imports_{jt}^{Origin}}{Imports_{jt}^{All}} = \beta_0 + \beta_1 NTRGap_j * Post_t + \nu_j + \eta_t + \epsilon_{jt} \tag{2}$$

where the outcome of interest is the Chinese or Mexican import share in total U.S. manufacturing imports in industry j and year t. $Post_t = 1[t > 2000]$ is a dummy that equals 1 after 2000; ν_j and η_t are industry and year fixed effects. Table 1 shows the results both for 4-digit industries and 6-digit industries. As expected, β_1 has a different sign for each country. The negative sign of the coefficients in Columns 1 and 2 imply that PNTR is associated with decreased Mexican import penetration in the U.S., while the positive sign in the coefficients in Columns 3 and 4 imply that PNTR leads to increased Chinese import penetration in the U.S..

Given that my outcomes of interest are at municipality level, I construct a geographically based measure of international competition. I create a municipality-level measure of the "NTR Gap" following Pierce and Schott (2020), who compute U.S. county-level exposure to PNTR. I construct a measure of Mexican municipalities (indirect) exposure to PNTR as the employment-share-weighted-average of NTR gaps across manufacturing industries that are subject to tariffs.

$$NTRGap_i = \sum_j \frac{L_{ji}}{L_i} NTRGap_j \tag{3}$$

where L_{ji} represents the employment in industry j in Mexican municipality i and L_i represents total employment in municipality i. Data to compute NTR gaps for each industry j using *ad valorem* equivalent tariff rates is provided by Feenstra et al. (2002). I follow Pierce and Schott (2016) and use NTR gaps in 1999, immediately preceding the policy change. Industry-level employment by municipality is from the 1999 Mexican Economic Census. There are 2,382 municipalities in my data, spanning the entire country. Figure 2 shows a map of Mexico's cross-municipality exposure to PNTR. Across municipalities, the unweighted NTR gap averages 7.8 percent and has a standard deviation of 6.5 percent, with an interquartile range from 2.8 to 10.6 percent. The average employment-share-weighted NTR gap is 0.2676 with a standard deviation of 0.099, and an interquartile range from 0.2082 to 0.3246.[7] Figure D.1 shows the employment-share-weighted-average NTR gaps across 4-digit NAICS industries in Mexico.

I exploit cross-municipality variation in exposure to PNTR based on their initial industry specialization, by comparing municipalities facing high and low Chinese competition in the U.S. before and after China was granted PNTR.

3.2 Estimation

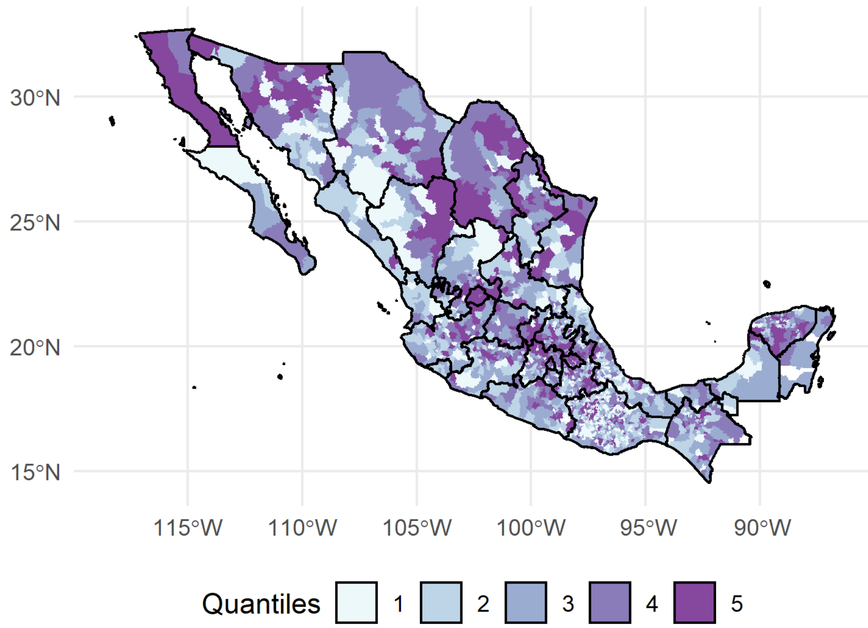
In this section, I explain the specifications I use to estimate the effect of exposure to international competition on municipality-level population adjustment, and I discuss the required specification assumptions.

Municipalities more or less exposed to international competition differ in level and trend before the change in trade policy, meaning that any direct comparison of exposed and non-exposed municipalities could be biased. To address pre-existing differences and to be able to explore the within-municipality variation in population growth, migration rates, and labor market outcomes, I start by assuming that:

$$Y_{i,t} = \alpha_i + \delta_t + \beta Z_i * Post_t + t.X_i'\gamma + u_{i,t} \tag{4}$$

[7] In other words, the average worker in municipalities at the 75th percentile of exposure worked in an industry with an NTR gap that was 11.64 percentage points higher than the average worker in municipalities at the 25th percentile. In the municipality-level analysis, I multiply the regression coefficients by 0.1164, the magnitude of an interquartile shift in a municipality exposure to PNTR.

Figure 2: Cross-municipality Exposure to the PNTR - Mexico



Note: This map of Mexico shows the cross-municipality exposure to Chinese competition in the U.S. market given by the employment-share-weighted-average of NTR Gaps across manufacturing industries that are subject to tariffs, as defined in Equation 3.

where $Y_{i,t}$ is the outcome for municipality i and year t related to population adjustment, Z_i is a measure of labor market changes at municipality level, and $Post_t$=1 [t>2000] is a dummy variable that equals 1 after 2000. α_i and δ_t are unobserved municipality and time effects, respectively, $t.X_i$ is a trend for municipality i, and $u_{i,t}$ is the error term.

I estimate quinquennial-specific models equivalent to fixed effects regressions because my data is available at five-year intervals (e.g., I estimate the effect of PNTR on population and migration over two periods: 2000-2005 and 2005-2010). Taking first differences of Equation 4, I obtain the regression model I will use throughout the analysis to estimate how exposure to Chinese competition based on municipalities' initial industrial specialization affected mobility in Mexico:

$$\Delta Y_{i,t} = \beta_0 + \beta_1 Z_i + X_i' \gamma + \Delta u_{i,t} \tag{5}$$

where $\Delta Y_{i,t}$ represents the change in the outcome variable in municipality i between years t-5 and t. Equation 5 will consistently estimate the casual effect of Z_i, under the assumption that municipalities more and less exposed to the change in China-U.S. trade policy would have had common changes in outcomes in the absence of the trade shock. Because the model is estimated in first differences, the quinquennial-specific models are equivalent to fixed effects regressions.[8] I use $NTRGap_i$, defined in Equation 3, as a plausible exogenous measure of labor market changes at municipality level, represented by Z_i in Equation 5. Mexican municipalities with a larger initial share of employment in industries where Chinese exports to the United States increased as a consequence of PNTR, have higher exposure to international competition.

In Appendix A, I show that my results are robust to using an alternative measure of exposure to international competition following the empirical approach proposed in Autor et al. (2013) instead of PNTR. In Appendix B, I show that my results are robust to using commuting zones (CZ) as geographic unit on analysis instead of municipalities. In Appendix C, I show that my results are robust to controlling for differential violence trends at municipality level.

4 The Effect of PNTR on Aggregate Population Growth

To explore aggregate changes in population growth, I use quinquennial (half-decadal) municipality level population data from the Mexican Population Census and Population Counts. I estimate Equation 5, where the outcome variable $\Delta Y_{i,t}$ represents the change in the municipalities i's log population between years t-5 and t. I use the NTR Gap, defined in Equation 3, as a plausible exogenous measure of labor market changes at municipality level, represented by Z_i in Equation 5. This specification differences out any time-invariant municipality treats, and controls for pre-trends in population growth. I include the lagged five-year change

[8]Estimating 5 as a fixed-effects regression assumes that the errors are serially uncorrelated (Autor et al., 2013). X_i allows for the possibility that the relationship between the outcome variable and municipality i's baseline characteristics changes in the post-PNTR period (Pierce and Schott, 2016).

in log population between 1995-2000—predating the change in trade policy—to control for the possibility that more and less exposed municipalities experienced differential population growth on average throughout this period (Greenland et al., 2019; Caballero et al., 2021; Bartik, 2018).

Table 2 presents estimation results of the average change in municipalities' log working-age population over 2000-2005 and 2005-2010. In addition to total population counts in Column 1, I present results by gender in Columns 2 and 3. Panel A shows the change in log working-age population between 2000 and 2005. An interquartile increase in the NTR gap increased population growth by 0.0123 log points or a 1.2 percent increase. However, Panel B shows that moving a municipality from the 25th to the 75th percentile of exposure is estimated to decrease population growth by -1.7 percent over 2005-2010. The estimates are statistically significant at 1 percent level.

The estimates presented in Table 2 imply an increase in log working-age population growth in the short term (i.e., 2000-2005), followed by a decrease in population growth in the middle term (i.e., 2005-2010) among municipalities with a higher average NTR gaps (i.e., those more exposed to Chinese competition in the U.S. market). These results are in line with those documented by Greenland et al. (2019), who find that the majority of the negative population response to PNTR in the U.S. occurs at a lag of seven years or more after the policy shift. The authors report that an interquartile increase in Chinese import competition exposure in the U.S. reduced local working-age population by -0.015 log points. This result is also consistent with previous work finding that full reallocation takes up to a decade or more (Dix-Carneiro, 2014; Artuç et al., 2010). However, in the short term the population adjustment in Mexico differs from that in the U.S.: While Greenland et al. (2019) find a negative but relatively muted response to PNTR in the short term, I document an initially increased population growth in more exposed municipalities. All in all, these results suggest that the timing of adjustment is important for estimation and that the mechanisms behind the population response to a trade-induced labor demand shock might differ in a

Table 2: International Competition and Five-year Changes in Log Working-age Population

	(1)	(2)	(3)
	All	**Men**	**Women**
PANEL A: $\Delta Log(Population)$ **2000-2005**			
$NTRGap_i$	0.106***	0.133***	0.0853**
	(0.0375)	(0.0411)	(0.0364)
Moving municipality from 25th to 75th pctile	0.0123***	0.0155***	0.0099**
	(0.0044)	(0.0048)	(0.0042)
PANEL B: $\Delta Log(Population)$ **2005-2010**			
$NTRGap_i$	-0.143***	-0.179***	-0.106***
	(0.0434)	(0.0497)	(0.0397)
Moving municipality from 25th to 75th pctile	-0.0166***	-0.0208***	-0.0123***
	(0.0051)	(0.0058)	(0.0046)
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on population growth over 2000-2005, in Panel A, and between 2005-2010, in Panel B. The dependent variable is the change in log municipality working-age population. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. Column 1 shows changes in log total population, while Columns 2 and 3 present the results for men and women, respectively. The second to last row in each panel presents rescaled estimates to reflect the change in log population for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

middle-income country like Mexico compared to the U.S..[9]

There are several factors potentially explaining the sluggish dynamic response to the labor demand shock that I find. First, the negative economic shock may cause declines in local income that reduce migration in the short term. Second, workers with different skill sets might be more or less mobile. Third, transitions across employers and sectors could be

[9]The five- to ten-year lag after PNTR with China corresponds with the spike in homicides that took place in Mexico over 2007-2010. In Appendix C, I show that my results are robust to controlling for differential violence trends at municipality level.

a mechanism by which workers adjust as opposed to regional mobility. Fourth, there could be increased return migration from the U.S., where the same industry-specific shock took place concurrently. In the next section, I empirically explore migration flows with the aim to provide some more insight into these channels, and I discuss how my results can be placed within the large structural literature that estimates models of location choice.[10]

5 The Effect of Exposure to PNTR on Migration

I observe migration between 1995-2000 and 2005-2010 based on responses to the 2000 and 2010 Mexican Population Census, and between 2000-2005 based on (a subset of) responses to the 2005 Population Count.[11] I estimate Equation 5, where the outcome variable $\Delta Y_{i,t}$ represents the in-migration, out-migration, or return migration rate in municipality i between 2000-2005 and 2005-2010. The variable $NTRGap_i$, defined in Equation 3, is the exogenous measure of labor market changes at municipality level, represented by Z_i in Equation 5. I include pre-shock migration rates from municipality i between 1995 and 2000 to account for the possibility that more and less exposed municipalities experienced differential migration on average throughout this period. This specification consistently estimates the effect of exposure to international competition if exposure to PNTR is independent of potential outcomes conditional on the lagged five-year migration rate.

[10] In canonical spatial equilibrium models (Rosen, 1979; Roback, 1982), workers will migrate across locations (and sectors) until real wages are equalized, and negative labor shocks will not cause heterogeneous effects on workers based on their original locations, sectors, or occupation. Topel (1986) and Moretti (2011) highlight that moving costs alter this prediction, leading to heterogeneous incidence of local labor demand shocks on directly exposed workers. Moreover, there is a large literature that estimates models of local or sector/occupation choice allowing for moving costs across locations (Kennan and Walker, 2011; Bishop, 2012; Diamond, 2016; Morten and Olivera, 2016; Shenoy, 2016), across sectors (Artuç et al., 2010; Dix-Carneiro, 2014), and occupations (Artuç and McLaren, 2015; Traiberman, 2019). See Bartik (2018) for a discussion.

[11] Migration data over the period 2000-2005 are not available to calculate all rates.

5.1 Return Migration from the U.S.

In Table 3, I present estimates of the effect of exposure to PNTR on return migration rates. Return migrants are defined as individuals living in Mexico during the year t, when the survey took place, but who lived in another country five years before. The return migration rate is the number of migrants divided by the source's population in the year t-5. Column 1 shows that moving from the 25th to 75th percentile of municipality exposure is estimated to decrease the return migration rate by -0.02 percentage points for the overall population between 2000-2005 and -0.3 percentage points between 2005-2010. Columns 2 and 3, which present the results for men and women, respectively, imply that the decreased in return migration is driven by men. The estimates in Column 3 of female return migration rates are imprecisely estimated in the short term, and they are relatively smaller in magnitude in the medium term.

To further explore the migration response to and from the U.S., I use additional data on U.S.-Mexico migration from the Mexican National Population Council (CONAPO). This dataset has information on the percentage of households with migrants to the U.S. and the percentage of households with return migrants between 1995-2000 and 2005-2010. Table 4 shows that moving a municipality from the 25th to the 75th percentile of exposure to trade competition increased the percentage of households with migrants to the U.S. by 0.31 percentage points over 2005-2010, whereas it decreased the percentage of households with return migrants by -0.35 percentage points.[12]

All in all, these estimates suggest that return migration is not the driver of the increased population growth observed in the first five years after the U.S. granted PNTR to China. Thus, if Mexican workers returned to Mexico as a consequence of the negative effect of PNTR in U.S. local labor markets (where the same industry-specific shock took place concurrently), they were less likely to choose more exposed municipalities in Mexico. Turning to the effects

[12] Given that there is no data on migration over 2000-2005, the results presented in Table 4 are comparable to those in Panel B of Table 3.

Table 3: International Competition and Five-year Changes in Return Migration Rates

	(1)	(2)	(3)
	All	**Men**	**Women**
PANEL A: Return migration rate from U.S. 2000-2005			
$NTRGap_i$	-0.00188***	-0.00324***	-0.000639
	(0.000676)	(0.00101)	(0.000434)
Moving municipality from 25th to 75th pctile	-0.0002***	-0.0004***	-0.0001
	(0.0001)	(0.0001)	(0.0001)
PANEL B: Return migration rate from U.S. 2005-2010			
$NTRGap_i$	-0.0222***	-0.0337***	-0.0116***
	(0.00323)	(0.00517)	(0.00168)
Moving municipality from 25th to 75th pctile	-0.0026***	-0.0039***	-0.0014***
	(0.0004)	(0.0006)	(0.0002)
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and return migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the return migration rate from the U.S.. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the return migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

over the medium term, if Mexican workers returned to Mexico, in response for example to the Great Recession, they were less likely to choose Mexican municipalities exposed to PNTR.[13] The decline in return migration six to ten years after the negative labor demand shock may have contributed to the decreased population growth in the medium term, though in the

[13] Caballero et al. (2021) find that the decline in U.S. employment brought about by the Great Recession is associated with increase return migration and decreased emigration in Mexican locations with strong initial ties to the hardest hit US migrant destinations. These municipalities experienced 2.1 percentage point faster population growth over 2005-2010. Caballero et al. (2018) show that the average Mexican state's return migration rate nearly quadrupled over this time period (rates were 0.3 percent on average in 2005 and 1.13 percent on average in 2010.

Table 4: International Competition and Change in % of Households with Migrants 2005-2010

	(1) % Households with migrants to U.S.	(2) % Households with returned migrants
$NTRGap_i$	2.672** (1.317)	-3.020*** (0.713)
Moving a municipality from 25th to 75th pctile	0.3111** (0.1533)	-0.3515*** (0.0830)
Observations	2,382	2,382

Notes: This table shows the effect of Mexican municipalities' exposure to international competition in the U.S. market on Mexico-U.S. migration between 2005-2010 with respect to the pre-shock period 1995-2000. The dependent variable is the percentage of households with migrants to the U.S. in Column 1 and the percentage of households with returned migrants from the U.S. in Column 2. Data is from the Mexican Population Council (CONAPO). $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in returned migration for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

next section I show that internal migration played a larger role.

5.2 Internal Migration in Mexico

Workers whose initial municipalities faced greater competition may choose to migrate out to less affected regions. Similarly, more exposed municipalities might be less likely to attract migrants after a negative labor demand shock. Previous work finds mixed migration responses to trade shocks at the local level. In the U.S., Autor et al. (2013) find that rising imports per worker due to China's emergence were not clearly associated with population growth at the local level. Greenland et al. (2019) confront these results by documenting that an intequartile increase in Chinese import competition exposure in U.S. reduced local working age population by 0.015 log points, with the majority of the population response taking place in the medium term (i.e., seven years or more). While results in Greenland et al. (2019) suggest that young people tended to move away (i.e., out-migrate) from trade-shocked locations, Monras (2018) documents that most of the response of internal migration in the U.S. during the Great Recession is accounted for variation in in-migration.

The previous evidence is also mixed in less-developed economies. For example, Majlesi and Narciso (2018) find that a one standard deviation increase in exposure to competition from China is associated with a one percentage point higher probability of out-migration from 150 municipalities covered in the Mexican Family Life Survey (Majlesi and Narciso, 2018).[14] However, Dix-Carneiro and Kovak (2017) and Dix-Carneiro and Kovak (2019) find no evidence for systematic migration responses to liberalization-induced labor demand shocks in Brazil during the 1990s.

In Table 5 and Table 6, I present estimation results of the effect Mexican municipalities exposure to increase Chinese competition in the U.S. market on in-migration and out-migration, respectively. Table 5 estimates Equation 5 using the in-migration rates over the 2000-2005 period and over the 2005-2010 period as dependent variables in Panels A and B, respectively. I include the in-migration rate during the 1995-2000 period to control for pre-shock migration rates (Greenland et al., 2019; Caballero et al., 2019; Bartik, 2018). Column 1 shows that moving from the 25th to the 75th percentile of municipality exposure is estimated to decrease the overall in-migration rates by -0.05 percentage points over 2000-2005, although this change is imprecisely estimated, and -0.2 percentage points over 2005-2010. The latter estimate implies a -7 percent reduction with respect to the baseline in-migration rate.

Similarly, Table 6 presents out-migration rates over the same periods. Column 1 in Panel A shows that moving from the 25th to the 75th percentile of municipality exposure to trade is estimated to decrease overall out-migration rates by -0.7 percentage points over 2000-2005, which represents a -6 percent reduction with respect to the baseline out-migration

[14] Alternatively, a change from zero to full exposure to competition from China raises the probability of migration to another municipality by 20 percentage points; their estimates imply that exposure to trade with China can explain around 10 percent of migration within Mexico between 2002 and 2005. (Majlesi and Narciso, 2018).

Table 5: International Competition and Five-year Changes in In-migration Rates

	(1)	(2)	(3)
	All	Men	Women
PANEL A: In-migration rate from other states 2000-2005			
$NTRGap_i$	-0.00419	-0.00753	-0.000823
	(0.00706)	(0.00733)	(0.00693)
Moving a municipality from 25th to 75th pctile	-0.0005	-0.0009	-0.0001
	(0.0008)	(0.0009)	(0.0008)
PANEL B: In-migration rate from other states 2005-2010			
$NTRGap_i$	-0.0246***	-0.0298***	-0.0195**
	(0.00928)	(0.00949)	(0.00922)
Moving a municipality from 25th to 75th pctile	-0.0029***	-0.0035***	-0.0023**
	(0.0011)	(0.0011)	(0.0011)
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and in-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the in-migration rate to municipality i from municipalities in a different state. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the in-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

rate. Conversely, Column 1 in Panel B shows an increase in the overall out-migration rate of 1.1 percentage points over 2005-2010, which represents a 9 percent increase with respect to baseline. Columns 2 and 3 in Tables 5 and 6 present the estimates for men and women, respectively. Results by gender are similar in magnitude over the period 2005-2010 (Panel B). However, changes in migration rates are larger in magnitude for men over the period 2000-2005 (Panel A).

The results presented thus far provide some insights into how migration responses explain

Table 6: International Competition and Five-year Changes in Out-migration Rates

	(1)	(2)	(3)
	All	Men	Women
PANEL A: Out-migration rate to other states 2000-2005			
$NTRGap_i$	-0.0626**	-0.0809***	-0.0450*
	(0.0253)	(0.0254)	(0.0257)
Moving a municipality from 25th to 75th pctile	-0.0073**	-0.0094***	-0.0052*
	(0.0030)	(0.0030)	(0.0030)
PANEL B: Out-migration rate to other states 2005-2010			
$NTRGap_i$	0.0979***	0.102***	0.0943***
	(0.0256)	(0.0266)	(0.0249)
Moving a municipality from 25th to 75th pctile	0.0114***	0.0118***	0.0110***
	(0.0030)	(0.0031)	(0.0029)
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and out-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the out-migration from municipality i to municipalities in a different state. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the out-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

the population growth in municipalities more exposed to PNTR. In the five years following the change in trade policy, more exposed municipalities increased population growth, driven by declines in out-migration. If find evidence against these results being driven by return migration from the U.S., which also relatively declines in more exposed areas. In-migration is negative, although imprecisely estimated in the short term. Conversely, six to ten years after the plausibly exogenous change in trade policy, exposure to increased trade competition is associated with decreased population growth, driven by declines in in-migration and return migration rates, and increased out-migration.

My results are consistent with lagged population adjustments that are driven by significant changes in internal migration, documented in the related literature.[15] For example, Bartik (2018) finds that exposure to PNTR is associated with slightly higher out-migration rates and lower in-migration rates over 2000-2010 in the U.S.. Moving from the 25th to 75th percentile of CZ exposure is estimated to increase out-migration rates by 0.1-0.4 percentage points, although this change is imprecisely estimated, and decrease in-migration by -0.8 percentage points.[16] The paper highlights workers' imperfect mobility to move locations in response to either positive (hydraulic fracturing) and negative (PNTR with China) changes in labor demand, which suggests that migration responses are not necessarily driven by losses of industry-specific human capital or other particular features of negative shocks in particular. However, liquidity-constrained individuals those who migrate to cope with a negative shock might be less likely to invest in migration compare to those who accumulate positive shocks and save up for migration over time as an investment to benefit from higher wages in a further-away city (Kleemans, 2015). If moving costs prevent workers from relocating in response to a negative labor demand shock, the migration response may be heterogeneous across sub-populations. In the next section, I examine whether less-educated workers and manufacturing workers drive the migration response documented thus far.

Heterogeneous effects of exposure to PNTR

Structural models of location choice examine two different types of explanations for the incidence of local labor demand shocks—one base on mobility costs and one based on com-

[15] A large literature investigates the effects of local labor demand shocks and worker migration responses. In the US, this literature has documented significant population responses to changes in local wages (Topel, 1986; Bartik, 2018; Blanchard and Katz, 1992; Moretti, 2011).

[16] In addition to studying the negative effect of PNTR exposure, Bartik (2018) studies the effect of a positive local income shock due to the fracking boom in the U.S. over the same period. The author finds that fracking reduces out-migration by -1.5 percentage points for non-college individuals. This represents roughly a -7 percent decline relative to the baseline out-migration rate of 19 percent. The estimate for in-migration is positive and of moderate magnitude, although imprecisely estimated. Despite the large rise in local income, fracking has not caused large long-term increases in in-migration, although the estimated decline in out-migration is moderately in magnitude. This muted in-migration result is consistent with the finding that fracking has large effects on earnings of the original residents of exposed locations.

pensating factors. If out-migration of workers is low primarily because of mobility costs, then the incidence of local labor demand shocks will be primarily borne by low-skill workers, who are comparatively immobile. Alternatively, low-skilled workers might be less likely to out-migrate if the incidence local labor demand shocks are borne by housing and social insurance programs (Notowidigdo, 2020).[17]

To explore whether the migration response to PNTR is driven by certain sub-populations, I use a 10% subsample of the Mexican population who answered the long-form Census surveys (i.e., IPUMS microdata sample). In years 2000 and 2010 these surveys also asked individuals whether they lived in a different municipality within the same state five years before. Table 7 presents the estimates of Equation 5 for the period 2005-2010 using the IPUMS sample. As before, the regression controls for the pre-shock in-migration rate, (i.e., 1995-2000).[18] Panel A shows an interquartile shift in exposure to international competition reduced overall in-migration by 0.2 percentage points over 2005-2010, although imprecisely estimated. The magnitudes of the in-migration estimates from other states (Table 5, Panel B) and from other municipalities (Table 7, Panel A) are very similar.[19]

The IPUMS sample microdata also enables me to explore whether the migration response is driven by particular subpopulations beyond gender. In Columns 4 and 5 of Table 7, I explore variation across educational groups. The dependent variable is the change in the in-migration rate of those without a high-school diploma (Column 4) and those who have

[17] Notowidigdo (2020) documents that adverse shocks reduce the costs of housing. GMM estimates of the model reveal that the comparative immobility of low-skill workers is not due to higher mobility costs per se, but rather a lower incidence of adverse labor demand shocks. While mobility costs constrain out-migration, they do not similarly constrain in-migration because there are a large number of potential in-migrants with negligible mobility costs. Consequently, positive local labor demand shocks increase population more than negative shocks reduce population.

[18] As I explained in Section 2, the Mexican Population Census and Count only have information on aggregate internal migration flows at municipality level to/from other states. Using this data, I am able to calculate in-migration and out-migration rates for each municipality based on individuals state of residence 5 years prior to the survey. Consequently, estimation results could be a lower bound if migration rates between municipalities and within states are relevant. Information on in-migration from other municipalities is not available in the 2005 Mexican Population Count. The results on Table 7 should be compared to Panel B (i.e., period 2005-2010) in Table 5.

[19] However, the estimates of in-migration from other states using the IPUMS sample, presented in Panel B show an increase of 0.5 percentage points, slightly higher than the aggregate results using the full sample.

Table 7: International Competition and Five-year In-migration Rates (IPUMS Sample)

	(1) All	(2) Men	(3) Women	(4) Less than High-school	(5) Completed High-school	(6) Manufacturing Sector	(7) Other Sectors
PANEL A: In-migration rate from other municipalities 2005-2010							
$NTRGap_i$	-0.0207	-0.0268	-0.0153	-0.0368*	0.0421	-0.102***	-0.0104
	(0.0226)	(0.0234)	(0.0224)	(0.0212)	(0.0283)	(0.0365)	(0.0205)
Moving a municipality from 25th to 75th pctile	-0.0024	-0.0031	-0.0018	-0.0043*	0.0050	-0.0119***	-0.0012
	(0.0026)	(0.0027)	(0.0026)	(0.0025)	(0.0033)	(0.0043)	(0.0024)
PANEL B: In-migration rate from other states 2005-2010							
$NTRGap_i$	-0.0433**	-0.0433**	-0.0436**	-0.0547***	-0.0105	-0.103***	-0.0352**
	(0.0183)	(0.0187)	(0.0181)	(0.0186)	(0.0184)	(0.0320)	(0.0157)
Moving a municipality from 25th to 75th pctile	-0.0051**	-0.0051**	-0.0051**	-0.0064***	-0.0012	-0.0120***	-0.0041**
	(0.0021)	(0.0022)	(0.0021)	(0.0022)	(0.0022)	(0.0037)	(0.0018)
Observations	2,382	2,382	2,382	2,382	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and in-migration rates between 2005-2010. In Panel A, the dependent variable is the in-migration rate to municipality i from any other municipality in Mexico. In Panel B, the dependent variable is the in-migration rate to municipality i from municipalities in a different state. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the in-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Source: IPUMS International. Data for Panel A is not available for 2000-2005; thus, these results should be compared to those in Panel B of Table 5. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

completed high-school (Column 5). The decline in in-migration is driven by individuals with incomplete high-school. Estimates presented in Column 4 imply that an interquartile increase in the NTR gap would have reduced in-migration for those without a high-school diploma between -0.4 and -0.6 percentage points. This estimate is statistically significant at 10% for in Panel A and 1% in Panel B. Finally, Columns 6 and 7 show the heterogeneous response across sectors of employment. Estimates in Column 6 imply significant reductions in in-migration from manufacturing sector workers, of about -1.2 percentage points. The estimates are more than three times larger for manufacturing workers than other sectors.[20]

The heterogeneous response documented in Columns 4 to 7 is consistent with the fact that PNTR affected the manufacturing sector. Given that repeated cross-section data does not allow me to observe the population response among individuals displaced from their jobs due to the exposure to the trade shock, it is reassuring to observe that the response is driven by populations directly affected by it.

My results are in line with those of Greenland et al. (2019), who explore heterogeneity across educational groups using U.S. IPUMS microdata and find that the working-age interquartile effect of PNTR in the Census data (i.e., -0.015 log points decline in working-age population) is bounded by estimated effects among those with less than high-school diploma (-0.025 log points) and those with a high-school diploma or some college (-0.013 log points). My results are also consistent with Aldeco et al. (2019) who, using a different type of local shock, find a -0.27 percent decrease in inflows of less-educated Mexican workers into harder-hit areas and no effect on outflows, pointing to the importance of moving costs. Relatedly, Dix-Carneiro and Kovak (2017) find that the detrimental effect of the 1990s Brazilian trade liberalization on wages grew over time, a feature that is consistent with imperfect labor mobility across regions. Among more general labor demand shocks, this literature largely finds evidence that workers leave or avoid declining areas and move toward areas with more job opportunities (Bartik, 1991; Blanchard and Katz, 1992; Carrington, 1996; Black et al., 2005; Foote et al., 2019).[21]

[20] Appendix Table D.1 shows that 79% of the Mexican working-age population (i.e., 20-64 years old) had not completed high-school in year 2000. The table also shows that 10% of the Mexican working-age population is employed in the manufacturing sector in year 2000. The male-to-female ratio in the manufacturing sector was 2 in year 2000 (see Appendix Table D.2). According to the 1998 Mexican Economic census 30% of the labor force was employed in manufacturing.

[21] See Greenland et al. (2019) for a review. My results are also related to the literature studying how local wages, rents, and employment respond to local labor demand shocks (Topel, 1986; Bartik, 1991; Blanchard and Katz, 1992; Saks and Wozniak, 2011; Notowidigdo, 2020), which allowed local labor demand shocks to influence worker migration through wage and rents changes, and more recently to Diamond (2016), whose results suggest that endogenous local amenity changes are an important mechanism driving workers' migration responses to local labor demand shocks. There is also a large economic geography literature that explores the role of migration for the propagation of economic shocks. See Howard (2020); Caliendo et al.

Although the initial decision to explore the effects of trade exposure on aggregate changes in population growth using quinquennial municipality level population counts is driven by data availability (to be able to match aggregate population changes to migration responses), it sheds light on the dynamics of the adjustment process. The fact that the population response to trade shocks may be sluggish and heterogeneous across sub-populations is relevant when analyzing the effects of these shocks on other socioeconomic outcomes. In the next section, I examine the relationship between exposure to PNTR and local labor market outcomes to provide an insight into the channels through which increase exposure to trade affect worker mobility, such as employment opportunities and wages. I also show that the negative effect of PNTR exposure was larger in more export-oriented locations.

6 The Effect of exposure to PNTR on Local Labor Markets

The primary mechanism through which trade competition might lead to aggregate population changes and internal migration is via deterioration in employment opportunities in the manufacturing sector. In this section, I quantify the first-order effects of the trade shock on employment and wages. First, I show the direct effect of exposure to PNTR on overall manufacturing employment and wages using data from the Mexican Economic Census. Second, I examine whether there is an heterogeneous response to PNTR in locations with a higher concentration of export-oriented industries using data from the Mexican maquila export industry statistics from INEGI. Third, I explore whether transitions across sectors of employment are a plausible mechanism explaining the sluggish population response that I document above.

The effects of exposure to PNTR on manufacturing employment

(2019); Kline and Moretti (2014); Allen and Arkolakis (2014); Diamond (2016); Redding and Rossi-Hansberg (2016).

I start by documenting a deterioration in employment opportunities in the manufacturing sector in more exposed municipalities that might have lead to aggregate population changes and internal migration that I find in the previous sections. The municipality-industry level data on manufacturing employment is available in the Mexican Economic Census, while the population counts and migration data is available in the Mexican Population Census. Given that the two data sources do not perfectly overlap, I look at the relationship between exposure to PNTR and changes in manufacturing employment over 1998–2003 and 2003-2008, but the population and migration analysis is over 2000-2005 and 2005-2010.[22]

Table 8: International Competition and Manufacturing Employment

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: $\Delta Log(manufacturing)$ **1998-2003**			
$NTRGap_i$	-1.018***	-0.345*	-1.755***
	(0.191)	(0.185)	(0.234)
Moving municipality from 25th to 75th pctile	-0.1184***	-0.0402*	-0.2042***
	(0.0222)	(0.0215)	(0.0272)
PANEL B: $\Delta Log(manufacturing)$ **2003-2008**			
$NTRGap_i$	-0.968***	-0.861***	-1.319***
	(0.202)	(0.207)	(0.220)
Moving municipality from 25th to 75th pctile	-0.1127***	-0.1002***	-0.1535***
	(0.0235)	(0.0241)	(0.0256)
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on manufacturing employment over 1998-2003, in Panel A, and between 2003-2008, in Panel B. The dependent variable is the change in log manufacturing employment. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. Column 1 shows changes in log total manufacturing workers, while Columns 2 and 3 present the results for men and women, respectively. The second to last row in each panel presents rescaled estimates to reflect the change in log manufacturing employment for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

[22] While I acknowledge this limitation in the analysis, the two data sources are the best available in terms of representativeness and geographic coverage, to the best of my knowledge.

Table 8 shows that manufacturing employment has a negative and statistically significant relationship with municipality exposure to Chinese competition in the U.S. market. Column 1 estimates imply that overall manufacturing employment in a municipality at the 75th percentile of trade exposure declined by -0.12 log points more than in a municipality at the 25th percentile over 1998-2003, and by -0.11 log points more over 2003-2008. Columns 2 and 3 show the trade-induced decline in manufacturing employment for men (-0.04 to -0.10 log points) and women (-0.15 to -0.20 log points), respectively. The economic relevance of my estimates is in line with previous work investigating the effect of Chinese competition in the US market on Mexican labor market outcomes. Fernández Guerrico (2021) finds that manufacturing employment in a municipality at the 75th percentile of trade exposure declined by -0.08 log points more than in a municipality at the 25th percentile over 1998-2003, and by -0.15 log points more over 1998-2013. Dell et al. (2019) also document a negative relationship between increased Chinese competition in the US and Mexican manufacturing employment opportunities.[23] Chiquiar et al. (2017) find regionally heterogeneous effects of exposure to Chinese competition on unemployment in 53 Mexican metropolitan areas; increase Chinese import penetration in the U.S. is associated with a 1.32 percentage point increase in the unemployment rate in border areas and a 0.41 percentage point increase in non-border areas. Utar and Torres Ruiz (2013) results indicate that about half of the -1.2 percent decline in maquiladoras employment between 2001 and 2006 can be attributed to Chinese competition.[24]

If the competition with China in the US market is felt significantly among maquiladoras, then one expects to see the impact on maquila employment and wages. In the next section,

[23] Dell et al. (2019) first stage estimates imply that a ten thousand USD increase in predicted international competition per worker results in a 0.08 (1998-2013) to 0.97 (1998-2003) standard deviation decline in employment, noting that a one standard deviation in manufacturing employment is nearly twice as large for 1998-2013 (0.23) as for 1998-2003 (0.13).

[24] The magnitude of my estimates is also comparable to the seminal papers on the China shock effect on U.S. local labor markets. Autor et al. (2013) find that Chinese import penetration explains 25 to 66 percent of the overall decline in US manufacturing employment from 2000 to 2007, or -5 to -11 percentage points of the overall -20 percent decline. Pierce and Schott (2016) find a relative decline in American manufacturing employment of -0.15 log points as a consequence of exposure to PNTR.

I quantify these first-order effects to examine whether they are a mechanism explaining the population response to the change in trade policy documented in the previous sections.

The effect of exposure to PNTR on export-oriented industries

Next, I examine whether the relationship between exposure to PNTR and manufacturing employment is heterogeneous depending on how export-oriented an industry is in a particular location. My data does not allow me to distinguish between export-oriented and domestic-market-oriented plants within a municipality; I try to overcome this data limitation by documenting changes in manufacturing employment in locations where the Mexican maquiladora industry has a higher concentration. Maquiladoras are labor-intensive export processing plants in Mexico that are tied to the US manufacturing sector. The number of workers employed in the Mexican maquiladora manufacturing industry dropped from 1.29 million workers in 2000 to 1.16 million in 2005 (INEGI, 2007). In terms of sales, maquiladoras' exports to the US represented 99.7% of the total maquiladoras' exports in 1993 and 94% in 2006.[25] Previous work has documented that Mexican maquiladoras and Chinese plants had very similar export baskets (Gallagher and Porzecanski, 2007; Gallagher et al., 2008), and find that both employment and plant growth at Mexican maquiladoras were negatively affected by Chinese competition in the U.S. (Utar and Torres Ruiz, 2013).

For this part of the analysis, I use state-level statistics from the maquiladora industry that are publicly available at INEGI. First, the Maquila Export Industry Statistics (EIME) which concluded in 2006, and second, the Manufacturing Industry, Maquila and Export Services (IMMEX), which collects statistics on the export industry since 2007.[26]

[25]See Utar and Torres Ruiz (2013) for a detailed description of the Maquiladora Industry in Mexico in this period.

[26]Although initially restricted to the border states and the Baja California free trade zone, maquiladoras can be established anywhere in Mexico since 1989. The state-level information from EIME and IMMEX is available for 17 (of 32) states that are covered by these plant-level surveys conducted by INEGI: Aguascalientes, Baja California, Coahuila de Zaragoza, Chihuahua, Ciudad de Mexico, Durango, Guanajuato, Jalisco, Mexico, Nuevo Leon, Puebla, San Luis Potosi, Sonora, Tamaulipas, Yucatan. EIME and IMMEX are not compatible in the type of variables and aggregation they used. Consequently, to approximate the periods examined as close as possible to the rest of the analysis, I show results for 2000-2005 using EIME data, and 2007-2010 and 2007-2012 using IMMEX. Also, EIME has data on the states of Zapatecas and Sinaloa but IMMEX does not; in turn, IMMEX has data on the states of Queretaro and Veracruz de Ignacio

Table 9 Column 1 estimates imply that an interquartile shift in state exposure to PNTR is associated with a -0.27 log points decrease in manufacturing employment in the maquila industry between years 2000 and 2005.[27] This effect size is in line the results in Utar and Torres Ruiz (2013), who document a 23 percentage point loss in manufacturing employment in maquiladora plants as a consequence of increased Chinese competition in the U.S. market over the same period. Columns 2 and 3 show results for the 2007-2010 and 2007-2012 period using IMMEX data. Estimates imply that moving a state from the 25th to the 75th percentile of exposure to PNTR is associated with a decrease of -0.03 and -0.05 log points, respectively.

Table 9: Trade Competition and Manufacturing Employment in Maquiladoras

	(1) **2000-2005**	(2) **2007-2010**	(3) **2007-2012**
Dependent variable: $\Delta Log(MaquiladoraManufacturing)$			
$NTRGap_s$	-14.22***	-1.778***	-2.502**
	(4.653)	(0.378)	(0.955)
Moving state from 25th to 75th pctile	-0.2730***	-0.0341***	-0.0480**
	(0.0893)	(0.0073)	(0.0183)
Source	EIME	IMMEX	IMMEX
Observations (states)	17	17	17

Notes: This table presents state-level estimates of Equation 5 and shows the effect of Mexican states' exposure to international competition on maquiladora manufacturing employment over 2000-2005, 2007-2010, and 2007-2012. The dependent variable in the change in log manufacturing employment in export processing plants surveyed by the EIME and IMMEX with high-concentration of export-oriented industries (maquiladoras). $NTRGap_s$ is a measure of Mexican states exposure to the change in trade policy between the U.S. and China. Column 1 shows changes in log maquiladora workers between 2000-2005 using data from the EIME, while Columns 2 and 3 present the results for the periods 2007-2010 and 2007-2012 using data from IMMEX. The second to lasr row presents rescaled estimates to reflect the change in log manufacturing maquiladora employment for a Mexican state at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted states.

The effect of exposure to PNTR on manufacturing wages

Llave but EIME does not.

[27]Estimates imply losses in employment across genders between 2000 and 2005: -0.28 log points for men and -0.27 log points for women. I do not have data by gender at state level from IMMEX.

Finally, I examine the effect on wages. I use information from the Mexican Economic Census on the annual wage bill at municipality level.[28] I do not observe individual wages, which means that I cannot distinguish between changes in the average wage due to changes in wages for individual workers or to changes in the composition of workers. This data limitation may introduce a bias in the estimation. For example, if workers with lower wages are more likely to lose employment, then the observed changes in the average wage will understate the changes in wages relative to the case in which the composition of workers is constant (Blyde et al., 2020; Autor et al., 2013).

I estimate the effect of exposure to PNTR on two outcome variables available in the Economic Census data. First, the change in log wages, which only includes regular wages paid to all employees without social security contributions.[29] Second, the change in the log of payroll, which includes regular wages paid to workers and social security contributions paid by the employer. I use the consumer price index (INPC) from INEGI to deflate both outcomes and express wages and payroll in year 2010 constant prices.

Table 10 shows estimates of the effect of exposure to PNTR on the change in log regular wages and log total payments (including regular wages and social security contributions) made by employers at municipality level. Columns 1 and 3 in Panel A show that moving a municipality from the 25th to the 75th percentile of exposure to PNTR is associated with a statistically significant decrease in municipality-level average wages of -0.16 log points over 1998-2003 and -0.12 log points over 2003-2008. The change in log payroll is similar in magnitude, -0.15 log points over 1998-2003 and -0.14 log points over 2003-2008. In Panel B, I replicate the analysis from Panel A for the subset of export-oriented locations, that is, municipalities located in states with high concentration of maquiladora employment that I

[28] Unfortunately, the annual wage bill is not disaggregated by gender.

[29] A Mexican employer that fully complies with the components of the labor regulations included in the census would pay 18% of wages as social security contributions. Employers are required to pay social security contributions for its wage employees, in practice though, compliance with this obligation is not uniform. Workers are considered informal when their employers do not make social security contributions for them (Blyde et al., 2020). Related work finds that firms replace some formally hired wage employees with informally hired wage employees as a response to the China shock (Blyde et al., 2020; Fernández Guerrico, 2021).

Table 10: Trade Competition and Wages

Dependent variable:	(1) $\Delta Log(Wages)$	(2) $\Delta Log(Payroll)$	(3) $\Delta Log(Wages)$	(4) $\Delta Log(Payroll)$
	1998-2003		**2003-2008**	
PANEL A: All municipalities				
$NTRGap_i$	-1.423***	-1.287***	-1.021***	-1.181***
	(0.273)	(0.283)	(0.261)	(0.270)
Moving a municipality from 25th to 75th pctile	-0.1656***	-0.1498***	-0.1189***	-0.1374***
	(0.0318)	(0.0330)	(0.0304)	(0.0314)
Observations	2,382	2,382	2,382	2,382
PANEL B: Municipalities in export-intensive regions				
$NTRGap_i$	-1.830***	-1.755***	-0.862**	-0.947**
	(0.382)	(0.394)	(0.366)	(0.380)
Moving a municipality from 25th to 75th pctile	-0.2359***	-0.2262***	-0.1111**	-0.1221**
	(0.0493)	(0.0508)	(0.0472)	(0.0489)
Observations	1,076	1,076	1,076	1,076

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on the municipality level wage bill over 1998-2003, in Columns 1 and 2, and between 2003-2008, in Columns 3 and 4. The dependent variable is the change in log regular wages and payroll (including social security contributions made by employers). $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. Panel A shows changes in log wages and payroll in all municipalities, while Panel B presents the results for municipalities located in export-intensive states as with a large concentration of maquiladora employment as defined in Table 9. The second to last row in each panel presents rescaled estimates to reflect the change in log manufacturing employment for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

examined above using data from th EIME and IMMEX. The effect of exposure to PNTR are larger in this subset of municipalities; an interquartile shift in exposure to PNTR in export-oriented municipalities is associated with a reduction in wages and payroll of about -0.23 log points over 1998-2003 and -0.11 long points over 2003-2008. The results presented in this section imply that the labor market adjusted both along the employment margin and through wage reductions in the manufacturing sector.

The effect of PNTR on non-manufacturing employment and wages

The evidence presented thus far points to several factors explaining the dynamic population response to the negative labor demand shock that I find. My results indicate that exposure to PNTR affected population growth via a deterioration of labor market opportunities in the manufacturing sector, which led to income loss due to job loss and lower wages. The sluggish population adjustment is consistent with the changes in internal migration that I document in the previous sections. However, the initial positive population growth remains somewhat puzzling given the consistent negative effects on manufacturing employment opportunities and income that I document during the whole period.

To shed light on why there is a reversal in the population response to PNTR, I explore whether transitions across sectors are a mechanism by which workers adjust as opposed to regional mobility in the short term. I find evidence indicating that Chinese competition reallocated Mexican employment from manufacturing to services in the short run, in line with Bloom et al. (2019) and Faber et al. (2022) findings in the U.S.. Column 1 in Table D.3 shows that an interquartile shift in exposure to PNTR is associated with a 0.03 log points increase in overall non-manufacturing employment in more exposed municipalities in 1998-2003, followed by a decline of the same magnitude in 2003-2008. Columns 2-4 show the contribution by service sub-sectors, which experience short-term increases in employment of 0.12-0.13 log points, followed by long-term declines of -0.14 log point. The service sub-sectors that explain the overall response represent 19.6 percent (wholesale, professional services, and management) and 11.9 percent (transportation, warehousing, information, finance, insurance, and real estate) of non-manufacturing jobs at baseline.[30]

Lastly, Table D.4 shows the effect of PNTR on the non-manufacturing-sector wage bill. In

[30] The initial share of non-manufacturing employment is 70 percent. Following the same criteria as Bloom et al. (2019), I aggregate all NAICS non-manufacturing sectors into three broad categories: Column 1 shows the total contribution of non-manufacturing sectors; Column 2 shows the contribution by Non-Manufacturing sub-sectors 43 (wholesale), 54-56 (professional services and management); Column 3 shows the contribution by sub-sectors 48-49 (transportation & warehousing), 51 (information) and 52-53 (FIRE); Column 4 shows the contribution by other Non-manufacturing sub-sectors: 11-23 (mining, utilities, construction), 46 (retail), 61-81 (education, health, entertainment, accommodation and food).

the short term, coefficient estimates for the effect on overall wages in the non-manufacturing sector are negative but imprecisely estimated. In the long term, moving a municipality from the 25th to the 75th percentile of exposure to PNTR is associated with a statistically significant decline of -0.10 log points in the overall non-manufacturing wage bill.[31]

All in all, there are short-term job gains in the non-manufacturing sector that partially offset the job losses in manufacturing. The fact that manufacturing employment and wages fall immediately while service-sector employment and wages are more sluggish to respond is a possible mechanism behind the reversal out-migration and in population growth.

7 Robustness Checks

My primary empirical approach follows that of Pierce and Schott (2016) who analyze the effect of the U.S. granting PNTR to China in October 2000 and the surge in U.S. imports of Chinese goods that accompanied the policy change. To the best of my knowledge, this paper is the first to exploit such change in trade policy in Mexican labor markets. However, vast previous work exploits Chinese entry to the WTO as plausible source of exogenous variation in international competition in Mexico following an empirical approach inspired by Autor et al. (2013) seminal paper. In Appendix A, I show that my results using exposure to PNTR are similar to those following the empirical approach I use in Fernández Guerrico (2021) to analyze the effect of increased trade competition on leading causes of mortality in Mexico, following Autor et al. (2013).

Second, one might be concerned that municipalities in the same Mexican commuting zone might be part of an integrated labor market in equilibrium (Caballero et al., 2021). In Appendix B, I show that results are very similar when aggregating the unit of analysis to the Mexican commuting zone level, showing that the choice of Mexican market aggregation does not substantially affect my findings.

Third, population growth and migration may also be influenced by factors other than

[31] The data used and the limitations described for Table 10 results on manufacturing wages apply here.

exposure to trade, such as violence and crime, which could confound the results in the latter period of analysis.[32] In Appendix C, I control for local homicides to capture the effects of drug-related violence in Mexico during my period of analysis. Because municipality-level violence and criminal activity might have been affected by the trade-induced manufacturing employment shock (Dell et al., 2019; Dix-Carneiro et al., 2018), I control differential violence trends at municipality level. I also show that my migration and population results are not driven by increased regional violence by dropping the municipalities in the most violent states over the 2005-2010 period that overlaps with the spike in homicides (i.e., 2007-2010). Finally, I show that my results are robust to dropping municipalities in border states in Appendix Table D.5.

In the sensitivity checks described in this section, the economic relevance and sign of my estimates remains unchanged. In a few cases, described in detail in each Appendix, the estimation is somewhat less precise (i.e., coefficients are sometimes statistically significant at 5 or 10 percent instead of 1 percent as in the main analysis). All in all, I conclude that my results are robust to a series of sensitivity tests described above and in the Appendix.

8 Conclusion

This paper studies how trade-induced changes in Mexican labor demand affect population growth and migration flows at the local level. I exploit cross-municipality variation in exposure to a change in trade policy between the U.S. and China that eliminated potential tariffs increases on Chinese imports. I show that trade competition resulting from the U.S. granting China Permanent Normal Trade Relations (PNTR) increased the U.S. manufacturing import share from China and decreased the U.S. import share from Mexico. After documenting first-order negative effects of PNTR on Mexican manufacturing exports to the U.S. market

[32] Some regions in Mexico experience an spike in the homicide rate between 2007-2010, which could also affect population adjustment costs (Aldeco et al., 2019; Ajzenman et al., 2015). However, a strand of the literature finds muted effects of violence on migration in Mexico over the same period (Basu and Pearlman, 2017; Utar, 2021). See appendix for a more detailed discussion of the related literature.

at industry level, I construct a Mexican municipality measure of exposure to trade competition based on their industry structure. I show that Mexican municipalities specializing in industries in which China had an initial comparative advantage were more exposed to the change in trade policy. Next, I document the deterioration in manufacturing employment opportunities, which plausibly lead to income loss (due to job loss or lower wages), as the main mechanism leading to aggregate population changes and internal migration.

The results presented in this paper imply dynamic population effects in response to increased municipality-level exposure to Chinese competition in the U.S. market. In the five years following the change in trade policy, more exposed municipalities have increased population growth, driven by declines in out-migration. I find evidence against these results being driven by return migration from the U.S., which also relatively declines in more exposed areas. The effect on in-migration is negative, although imprecisely estimated in this quinquennial. Conversely, six to ten years after the plausibly exogenous change in trade policy, exposure to increased trade competition is associated with decreased population growth, driven by declines in in-migration and return migration rates, and increased out-migration.

My results are consistent with lagged population adjustments that are driven by significant changes in internal migration. I show that transitions across sectors of employment, as opposed to short-term regional adjustments, are a plausible mechanism behind the reversal in population growth and out-migration. I find that job gains in the non-manufacturing sector partially offset the manufacturing job losses in the short term. In the long term, though, exposure to PNTR is associated with declines in employment and wages across all sectors. The slack response in service sector employment and wages, together high moving costs, are possible channels behind the timing of the regional adjustment.

Finally, using exposure to PNTR has advantages over methods that rely on supply-driven changes in China around the time of its accession to the WTO because it is based on a specific change in trade policy. However, this approach could also present challenges because of possible trade spillovers to third countries. For example, the change in US-China policy could also have affected Chinese import penetration non-US destinations, such as Mexico, due to shared distribution channels and fixed costs of exporting. My results are robust to using supply-driven methods used in the related literature. Nevertheless, possible trade policy spillovers to third countries are a relevant consideration for future research.

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Appendix: Trade Shocks, Population Growth, and Migration

Sofía Fernández Guerrico

Contents

A Comparison with the Existing Literature

In this section, I compare my results to those obtained following the approach of Fernández Guerrico (2021).[33] I examine changes in exposure to international trade for Mexican municipalities associated with the growth in Mexican imports from China, and the growth in U.S. imports from China. In Section A.1, I discuss how I construct the measures of municipality exposure to international competition to account for the potential endogeneity of Mexican trade exposure stemming from both direct and indirect Chinese competition. Section A.2 discusses the 2SLS estimation.

A.1 Exposure to International Competition

Following Autor et al. (2013), I construct the following measure of municipality exposure to trade:

$$\Delta ICW_{it}^{D} = \sum_{j} \frac{L_{ij,0}}{L_{j,0}} \frac{\Delta CE_{jt}^{D}}{L_{i,0}} \tag{A.1}$$

where ΔICW_{it}^{D} is the changed in international competition per worker faced by Mexican municipality i between the initial year and year t. $L_{ij,0}$ is the manufacturing employment of industry j in municipality i in the initial year, $L_{j,0}$ is the total manufacturing employment for industry j, $L_{i,0}$ is the initial size of the labor force in municipality i. ΔCE_{jt}^{D} is the observed change in Chinese manufacturing exports in industry j to destination D between the initial year and year t. Different Chinese export destinations, D, allow me to construct two measures that capture exposure to direct and indirect international competition.

Chinese competition in the U.S. market - an alternative measure of exposure to PNTR

First, I examine the changes in exposure to international trade for Mexico associated with the growth in U.S. imports from China. My measure of local labor market shock is the

[33] Fernández Guerrico (2021) studies the effect of a trade-induced negative shock to Mexican labor demand on health and mortality in Mexico. This section summarizes the empirical approach used in that paper (see Section 4 "Empirical Strategy").

average change in Chinese import penetration in the U.S. weighted by each industry's share in initial municipality level employment. Mexican municipalities with a larger initial share of employment in industries where Chinese exports to the U.S. increased after China joined the WTO, have higher exposure to trade competition. Setting the U.S. as Chinese export destination D in Equation A.1 above I obtain $\Delta ICW_{it}^{U.S.}$, where $\Delta CE_{jt}^{U.S.}$ is the change in Chinese manufacturing exports to the U.S. in industry j between the initial year and year t.

To identify the supply-driven component of U.S. imports from China, I instrument the growth of Chinese exports to U.S. using the growth of Chinese exports to a group of high-income countries. Specifically, I instrument the measured U.S. import exposure ΔICW_{it}^{US} with a non-U.S. exposure variable ΔICW_{it}^{HIGH} constructed using trade data on industry-level growth of Chinese export to other high-income markets. The idea is that because of similarities in the economic structure and income, these group of countries and the U.S. are similarly exposed to increased import penetration from China.[34] Using ΔICW_{it}^{HIGH} to instrument for changes in trade exposure allows me to identify the causal effect of rising Chinese competition in the U.S. market on Mexican population adjustment and labor market outcomes.

I estimate the first stage using Chinese exports to high-income countries to instrument for my measure of Mexican export competition in the U.S. market:

$$\Delta ICW_{i,t}^{US} = \beta_0 + \beta_1 \Delta ICW_{i,t}^{HIGH} + X_i'\gamma + \epsilon_{i,t} \tag{A.2}$$

Import competition - Additional Evidence

Second, I examine the changes in exposure to international trade for Mexico associated with the growth in Mexican imports from China. My measure of local labor market shock is the average change in Chinese import penetration in a municipality's industries weighted by each industry's share in initial municipality level employment. Setting Mexico as Chinese

[34] The eight high-income countries are those used by Autor et al. (2013): Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland.

export destination D in Equation A.1 above I obtain ΔICW_{it}^{MEX}, where ΔCE_{jt}^{MEX} is the change in Chinese manufacturing exports to Mexico in industry j between the initial year and year t.

To identify the supply-driven component of Mexican imports from China, I instrument the growth of Chinese exports to Mexico using the growth of Chinese exports to a group of middle-income countries. Specifically, I instrument the measured import exposure ΔICW_{it}^{MEX} with a non-Mexico exposure variable ΔICW_{it}^{MIDDLE} constructed using trade data on industry-level growth of Chinese exports to other middle-income markets. The idea is that because of similarities in the economic structure and income, this group of countries and Mexico are similarly exposed to increased import penetration from China.[35] Using ΔICW_{it}^{MIDDLE} to instrument for changes in import exposure allows me to identify the causal effect of rising Chinese import exposure on Mexican population adjustment and labor market outcomes.

I estimate the first stage using Chinese exports to middle-income countries similar to Mexico to instrument Mexican exposure to import competition:

$$\Delta ICW_{i,t}^{MEX} = \beta_0 + \beta_1 \Delta ICW_{i,t}^{MIDDLE} + X_i'\gamma + \epsilon_{i,t} \tag{A.3}$$

where $\Delta ICW_{i,t}^{D}$ is divided by 1,000 to be in units of 1,000 USD. The sample includes 2,383 Mexican municipalities. The regressions are weighted by the initial working-age population size. In my baseline results, X_i' only include state fixed effects.

A.2 2SLS Estimation

Using a 2SLS specification, I examine whether municipalities with higher exposure to international competition per worker experience differential changes in population growth and migration as a consequence of the negative shock to manufacturing employment.

[35] The eight middle-income countries are those used by Mendez (2015): Argentina, Brazil, Chile, Colombia, Costa Rica, Greece, Panama, and Portugal.

$$\Delta Y_{i,t} = \beta_0 + \beta_1 \Delta Z_{i,t} + X_i'\gamma + \Delta u_{i,t} \tag{A.4}$$

where $\Delta Y_{i,t}$ is the aggregate population growth and migration rates between the initial year and year t in municipality i. $\Delta Z_{i,t}$ is the change in municipality i's labor market conditions between the initial year and year t. My measure of the local labor market shock is the average change in Chinese international competition per worker (ICW); estimates of β then represent the effect of exposure to Chinese trade competition for municipalities. X_i' includes baseline municipality-level controls and state fixed effects.

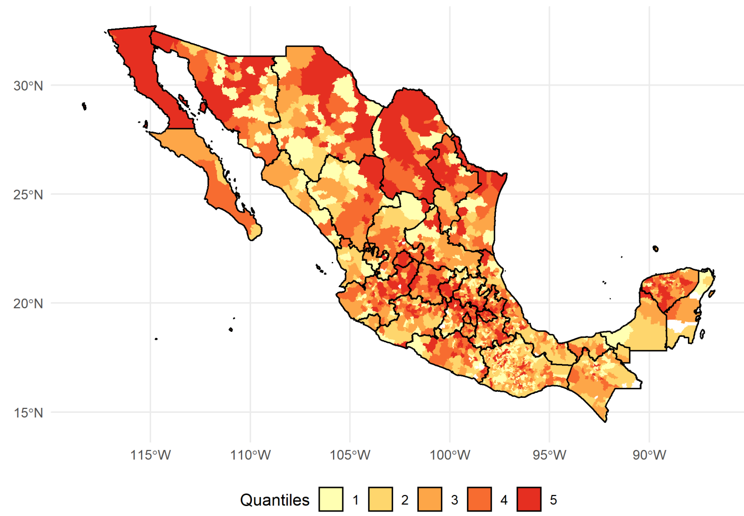
Following Autor et al. (2013), I exploit cross-industry and cross-local-labor-market (i.e., municipality) variation in trade competition stemming from China's entry to the WTO in 2001 to identify the effect of labor-demand shocks that are concentrated in manufacturing. Chinese exports to middle-income countries (i.e., source of plausibly exogenous variation for Mexican import competition) and to high-income countries (i.e., source of plausibly exogenous variation for Mexican export competition in the U.S.) are reasonably independent of unobserved shocks to Mexican municipality-level health outcomes.

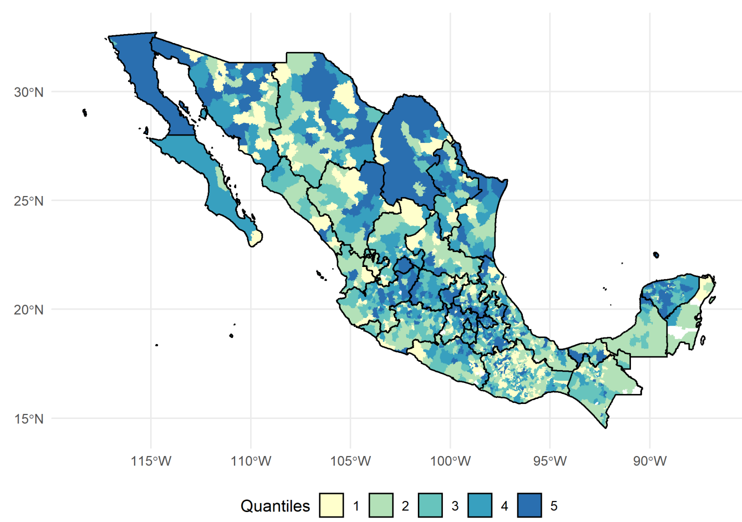
Figure A.1 shows two maps of Mexico's cross-municipality exposure to Chinese export competition in the U.S. market (top) and to Chinese import competition in the domestic market (bottom). The tables in Section A.3 replicate the main results of Section 4 and Section 5 using this alternative identification strategy. Some of the coefficients for population growth and internal are significant at 5 or 10 percent, while estimates in the main analysis are significant at 1 percent level. Overall, the magnitude of the estimates is similar to those presented in the main analysis and direction of the effect remains unchanged.[36] All in all, my results are robust to using Autor et al. (2013) empirical approach using either direct import competition and indirect export competition in the U.S. market.

[36] The two exceptions are that the change in the overall and male return migration rates in the short term are imprecisely while it is significant for women in Panel A of Table A.2. Also, the in-migration rate from other municipalities for less-educated workers is imprecisely estimated in Panel A of Table A.6.

A.3 Tables and Figures

Figure A.1: Cross-municipality Exposure to International Competition per Worker - Mexico





Notes: These maps of Mexico show the cross-municipality exposure to international competition per worker (ICW) between 1998-2013. The map on top shows exposure to Chinese export competition in the U.S. market and the bottom map shows Chinese import competition in the domestic market (Fernández Guerrico, 2021).

Table A.1: International Competition and Five-year Changes in Log Working-age Population - Alternative identification strategy

	(1) **All**	2 **Men**	3 **Women**
PANEL A: $\Delta Log(Population)$ **2000-2005**			
$\Delta ICW_{i,t}^{MEX}$	0.0376*	0.0430*	0.0384*
	(0.0229)	(0.0247)	(0.0215)
Moving a municipality from 25th to 75th pctile	0.0090*	0.0102*	0.0091*
	(0.0055)	(0.0059)	(0.0051)
$\Delta ICW_{i,t}^{US}$	0.00196*	0.00235*	0.00196*
	(0.00117)	(0.00125)	(0.00111)
Moving a municipality from 25th to 75th pctile	0.0100*	0.0120*	0.0099*
	(0.0059)	(0.0063)	(0.0056)
PANEL B: $\Delta Log(Population)$ **2005-2010**			
$\Delta ICW_{i,t}^{MEX}$	-0.0343**	-0.0395**	-0.0249*
	(0.0144)	(0.0156)	(0.0136)
Moving a municipality from 25th to 75th pctile	-0.0196**	-0.0227**	-0.0141*
	(0.0082)	(0.0090)	(0.0077)
$\Delta ICW_{i,t}^{US}$	-0.00295**	-0.00332**	-0.00218*
	(0.00142)	(0.00154)	(0.00132)
Moving a municipality from 25th to 75th pctile	-0.0173**	-0.0195**	-0.0128*
	(0.0084)	(0.0090)	(0.0078)
Observations	2,382	2,382	2,382

Notes: This table presents second stage estimates estimates of Equation A.4 and shows the effect of Mexican municipalities' exposure to international competition on population growth over 2000-2005, in Panel A, and between 2005-2010, in Panel B. The dependent variable is the change in log municipality working-age population. $ICW_{i,t}^{D}$, defined in Equation A.1 is the change in international competition reported in units of 1,000 USD per worker. $ICW_{i,t}^{US}$ is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, defined in Equation A.2. $ICW_{i,t}^{MEX}$ is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed, instrumented with the observed growth of Chinese exports to a group of middle-income countries, defined in Equation A.3. In each sub-panel, the first two rows present point estimates, which should be interpreted as the change in the log population associated with an increase of 1,000 USD in $ICW_{i,t}^{D}$, while in the second two rows present rescaled estimates to reflect the change in log population for a Mexican municipality at the 75th compared to the 25th percentile of exposure. Column 1 shows changes in log total population, while Columns 2 and 3 present the results for men and women, respectively. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table A.2: International Competition and Five-year Changes in Return Migration Rates - Alternative identification strategy

	(1) **All**	2 **Men**	3 **Women**
PANEL A: Return migration rate from U.S. 2000-2005			
$\Delta ICW_{i,t}^{MEX}$	-0.000114 (0.000269)	-0.000616 (0.000388)	0.000284 (0.000174)
Moving a municipality from 25th to 75th pctile	-0.0000 (0.0001)	-0.0001 (0.0001)	0.0001 (0.0000)
$\Delta ICW_{i,t}^{US}$	6.48e-06 (1.57e-05)	-2.09e-05 (2.26e-05)	2.73e-05*** (9.93e-06)
Moving a municipality from 25th to 75th pctile	0.0000 (0.0001)	-0.0001 (0.0001)	0.0001*** (0.0001)
PANEL B: Return migration rate from U.S. 2005-2010			
$\Delta ICW_{i,t}^{MEX}$	-0.00352*** (0.000620)	-0.00616*** (0.000973)	-0.00119*** (0.000359)
Moving a municipality from 25th to 75th pctile	-0.0020*** (0.0004)	-0.0035*** (0.0006)	-0.0007*** (0.0002)
$\Delta ICW_{i,t}^{US}$	-0.000248*** (6.59e-05)	-0.000460*** (9.69e-05)	-6.39e-05 (4.16e-05)
Moving a municipality from 25th to 75th pctile	-0.0015*** (0.0004)	-0.0027*** (0.0006)	-0.0004 (0.0002)
Observations	2,382	2,382	2,382

Notes: This table presents second stage estimates estimates of Equation A.4 and shows the effect of Mexican municipalities' exposure to international competition on return migration over 2000-2005, in Panel A, and between 2005-2010, in Panel B. The dependent variable is the return migration rate from the U.S.. $ICW_{i,t}^{D}$, defined in Equation A.1 is the change in international competition reported in units of 1,000 USD per worker. $ICW_{i,t}^{US}$ is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, defined in Equation A.2. $ICW_{i,t}^{MEX}$ is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed, instrumented with the observed growth of Chinese exports to a group of middle-income countries, defined in Equation A.3. In each sub-panel, the first two rows present point estimates, which should be interpreted as the change in the return migration rate associated with an increase of 1,000 USD in $ICW_{i,t}^{D}$, while in the second two rows present rescaled estimates to reflect the change in return migration for a Mexican municipality at the 75th compared to the 25th percentile of exposure. Column 1 shows the overall change in the migration rate, while Columns 2 and 3 present the results for men and women, respectively. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table A.3: International Competition and Change in % of Households with Migrants 2005-2010 - Alternative identification strategy

	(1) % Households with migrants to U.S.	(2) % Households with returned migrants
$\Delta ICW_{i,t}^{MEX}$	0.809*** (0.216)	-0.634*** (0.133)
Moving a municipality from 25th to 75th pctile	0.4559*** (0.1218)	-0.3576*** (0.0748)
$\Delta ICW_{i,t}^{US}$	0.0660*** (0.0170)	-0.0377*** (0.0101)
Moving a municipality from 25th to 75th pctile	0.3917*** (0.1006)	-0.2237*** (0.0601)
Observations	2,382	2,382

Notes: This table shows second stage estimates the effect of Mexican municipalities' exposure to international competition in the U.S. market on Mexico-U.S. migration between 2005-2010 with respect to the pre-shock period 1995-2000. The dependent variable is the percentage of households with migrants to the U.S. in Column 1 and the percentage of households with returned migrants from the U.S. in Column 2. Data is from the Mexican Population Council (CONAPO). $ICW_{i,t}^{D}$, defined in Equation A.1 is the change in international competition reported in units of 1,000 USD per worker. $ICW_{i,t}^{US}$ is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, defined in Equation A.2. $ICW_{i,t}^{MEX}$ is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed, instrumented with the observed growth of Chinese exports to a group of middle-income countries, defined in Equation A.3. In each sub-panel, the first two rows present point estimates, which should be interpreted as the change in the percentage of household with migrants associated with an increase of 1,000 USD in $ICW_{i,t}^{D}$, while in the second two rows present rescaled estimates to reflect the change in the percentage of household with migrants for a Mexican municipality at the 75th compared to the 25th percentile of exposure. Column 1 shows changes in log total population, while Columns 2 and 3 present the results for men and women, respectively. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table A.4: International Competition and Five-year Changes in In-migration Rates - Alternative identification strategy

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: In-migration rate from other states 2000-2005			
$\Delta ICW_{i,t}^{MEX}$	-0.00303	-0.00262	-0.00338
	(0.00361)	(0.00365)	(0.00360)
Moving a municipality from 25th to 75th pctile	-0.0007	-0.0006	-0.0008
	(0.0009)	(0.0009)	(0.0009)
$\Delta ICW_{i,t}^{US}$	-9.75e-05	-4.82e-05	-0.000144
	(0.000200)	(0.000201)	(0.000202)
Moving a municipality from 25th to 75th pctile	-0.0005	-0.0002	-0.0007
	(0.0010)	(0.0010)	(0.0010)
PANEL B: In-migration rate from other states 2005-2010			
$\Delta ICW_{i,t}^{MEX}$	-0.00355	-0.00339	-0.00370
	(0.00263)	(0.00268)	(0.00261)
Moving a municipality from 25th to 75th pctile	-0.0020	-0.0019	-0.0021
	(0.0015)	(0.0015)	(0.0015)
$\Delta ICW_{i,t}^{US}$	-0.000524**	-0.000524**	-0.000524**
	(0.000264)	(0.000267)	(0.000263)
Moving a municipality from 25th to 75th pctile	-0.0031**	-0.0031**	-0.0031**
	(0.0016)	(0.0016)	(0.0016)
Observations	2,382	2,382	2,382

Notes: This table presents second stage estimates estimates of Equation A.4 of the relationship between increased Mexican municipalities' exposure to Chinese competition, and in-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the in-migration rate to municipality i from municipalities in a different state. $ICW_{i,t}^{D}$, defined in Equation A.1 is the change in international competition reported in units of 1,000 USD per worker. $ICW_{i,t}^{US}$ is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, defined in Equation A.2. $ICW_{i,t}^{MEX}$ is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed, instrumented with the observed growth of Chinese exports to a group of middle-income countries, defined in Equation A.3. In each sub-panel, the first two rows present point estimates, which should be interpreted as the change in the in-migration rate associated with an increase of 1,000 USD in $ICW_{i,t}^{D}$, while in the second two rows present rescaled estimates to reflect the change in the in-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure. Column 1 shows change in the overall in-migration rate, while Columns 2 and 3 present the results for men and women, respectively. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table A.5: International Competition and Five-year Changes in Out-migration Rates - Alternative identification strategy

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: Out-migration rate from other states 2000-2005			
$\Delta ICW_{i,t}^{MEX}$	-0.0260**	-0.0312***	-0.0216*
	(0.0114)	(0.0116)	(0.0112)
Moving a municipality from 25th to 75th pctile	-0.0063**	-0.0075***	-0.0052*
	(0.0027)	(0.0028)	(0.0027)
$\Delta ICW_{i,t}^{US}$	-0.00109*	-0.00140**	-0.000815
	(0.000556)	(0.000569)	(0.000545)
Moving a municipality from 25th to 75th pctile	-0.0055*	-0.0071**	-0.0041
	(0.0028)	(0.0029)	(0.0028)
PANEL B: Out-migration rate from other states 2005-2010			
$\Delta ICW_{i,t}^{MEX}$	0.0132**	0.0119*	0.0142**
	(0.00661)	(0.00681)	(0.00643)
Moving a municipality from 25th to 75th pctile	0.0075**	0.0068*	0.0081**
	(0.0038)	(0.0039)	(0.0037)
$\Delta ICW_{i,t}^{US}$	0.00132**	0.00123*	0.00138**
	(0.000670)	(0.000682)	(0.000660)
Moving a municipality from 25th to 75th pctile	0.0077**	0.0072*	0.0081**
	(0.0039)	(0.0040)	(0.0039)
Observations	2,382	2,382	2,382

Notes: This table presents second stage estimates estimates of Equation A.4 of the relationship between increased Mexican municipalities' exposure to Chinese competition, and out-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the out-migration rate to municipality i from municipalities in a different state. $ICW_{i,t}^{D}$, defined in Equation A.1 is the change in international competition reported in units of 1,000 USD per worker. $ICW_{i,t}^{US}$ is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, defined in Equation A.2. $ICW_{i,t}^{MEX}$ is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed, instrumented with the observed growth of Chinese exports to a group of middle-income countries, defined in Equation A.3. In each sub-panel, the first two rows present point estimates, which should be interpreted as the change in the out-migration rate associated with an increase of 1,000 USD in $ICW_{i,t}^{D}$, while in the second two rows present rescaled estimates to reflect the change in the out-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure. Column 1 shows change in the overall out-migration rate, while Columns 2 and 3 present the results for men and women, respectively. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table A.6: International Competition and Five-year In-migration Rates (IPUMS Sample) - Alternative identification strategy

	(1) All	(2) Men	(3) Women	(4) Less than High-school	(5) Completed High-school	(6) Manufacturing Sector	(7) Other Sectors
PANEL A: In-migration rate from other municipalities 2005-2010							
$\Delta ICW_{i,t}^{MEX}$	-0.00484	-0.00729	-0.00256	-0.00597	0.00454	-0.0187**	-0.00297
	(0.00616)	(0.00644)	(0.00599)	(0.00563)	(0.00740)	(0.00852)	(0.00570)
Moving a municipality from 25th to 75th pctile	-0.0030	-0.0045	-0.0016	-0.0036	0.0028	-0.0114**	-0.0018
	(0.0038)	(0.0039)	(0.0037)	(0.0034)	(0.0045)	(0.0052)	(0.0035)
$\Delta ICW_{i,t}^{US}$	-0.000469	-0.000700	-0.000268	-0.000633	0.000454	-0.00214**	-0.000198
	(0.000639)	(0.000676)	(0.000606)	(0.000608)	(0.000690)	(0.000935)	(0.000564)
Moving a municipality from 25th to 75th pctile	-0.0030	-0.0045	-0.0017	-0.0041	0.0029	-0.0138**	-0.0013
	(0.0041)	(0.0044)	(0.0039)	(0.0039)	(0.0045)	(0.0060)	(0.0036)
PANEL B: In-migration rate from other states 2005-2010							
$\Delta ICW_{i,t}^{MEX}$	-0.00866*	-0.00871*	-0.00853**	-0.00939**	-0.00226	-0.0171**	-0.00672*
	(0.00442)	(0.00466)	(0.00429)	(0.00449)	(0.00461)	(0.00731)	(0.00392)
Moving a municipality from 25th to 75th pctile	-0.0053*	-0.0053*	-0.0052**	-0.0057**	-0.0014	-0.0104**	-0.0041*
	(0.0027)	(0.0028)	(0.0026)	(0.0027)	(0.0028)	(0.0045)	(0.0024)
$\Delta ICW_{i,t}^{US}$	-0.000935*	-0.000981*	-0.000893*	-0.00105**	-0.000243	-0.00171*	-0.000696*
	(0.000497)	(0.000501)	(0.000497)	(0.000514)	(0.000453)	(0.000872)	(0.000421)
Moving a municipality from 25th to 75th pctile	-0.0060*	-0.0063*	-0.0058*	-0.0068**	-0.0016	-0.0110*	-0.0045*
	(0.0032)	(0.0032)	(0.0032)	(0.0033)	(0.0029)	(0.0056)	(0.0027)
Observations	2,382	2,382	2,382	2,382	2,382	2,382	2,382

Notes: This table presents second stage estimates estimates of Equation A.4 of the relationship between increased Mexican municipalities' exposure to Chinese competition, and in-migration rates between 2005-2010. In Panel A, the dependent variable is the in-migration rate to municipality i from any other municipality in Mexico. In Panel B, the dependent variable is the in-migration rate to municipality i from municipalities in a different state. $ICW_{i,t}^{D}$, defined in Equation A.1 is the change in international competition reported in units of 1,000 USD per worker. $ICW_{i,t}^{US}$ is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, defined in Equation A.2. $ICW_{i,t}^{MEX}$ is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed, instrumented with the observed growth of Chinese exports to a group of middle-income countries, defined in Equation A.3. In each sub-panel, the first two rows present point estimates, which should be interpreted as the change in the in-migration rate associated with an increase of 1,000 USD in $ICW_{i,t}^{D}$, while in the second two rows present rescaled estimates to reflect the change in the in-migration rate for a Mexican region at the 75th compared to the 25th percentile of exposure. Data for Panel A is not available for 2000-2005; thus, these results should be compared to those in Panel B of Table A.4. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table A.7: Exposure to International Competition - First Stage Estimates

	(1) **2000-2005**	(2) **2005-2010**
Panel A: Import competition		
	ΔICW^{MEX}	
ΔICW^{MIDDLE}	0.287***	0.157***
	(0.0116)	(0.00879)
Rescaled 25th-75th pctile	0.1810***	0.3884***
	(0.0073)	(0.0218)
First Stage F-stat	233.14	46.28
Panel B: Export competition		
	ΔICW^{US}	
ΔICW^{HIGH}	1.287***	0.949***
	(0.0284)	(0.0235)
Rescaled 25th-75th pctile	5.2888***	5.9383***
	(0.1168)	(0.1471)
First Stage F-stat	2019.78	315.34
Observations	2,382	2,382

Notes: This table shows first stage estimates of Equation A.3 in Panel A and Equation A.2 in Panel B. Observations are municipalities weighted by the start-of-period working-age population. $\Delta ICW_{i,t}^{D}$ is the change in international competition reported in units of 1,000 USD per worker, defined in Eq. A.1. ΔICW^{MEX} is a measure of the change in Chinese import penetration in Mexico, instrumented with the observed growth of Chinese exports to a group of middle-income countries, ΔICW^{MIDDLE}. ΔICW^{US} is the municipality level exposure to Chinese export competition in the U.S., instrumented using the change in Chinese exports to other high-income countries, ΔICW^{HIGH}. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

B Commuting-Zone-level Analysis

The tables presented in this section show that the estimation results are robust to using commuting zones (CZ) as geographic unit of analysis.[37] For the CZ-level analysis, I assign municipalities to Mexican commuting zones using the crosswalk kindly provided by Blyde et al. (2017).[38] I estimate of a CZ-level version of Equation 5 as follows:

$$\Delta Y_{cz,t} = \beta_0 + \beta_1 Z_{cz} + X'_{cz}\gamma + \Delta u_{cz,t} \tag{B.1}$$

Equation B.1 will estimate the casual effect of Z_{cz}, under the assumption that commuting zones more and less exposed to the change in China-U.S. trade policy would have had common changes in outcomes in the absence of the trade shock. Because the model is estimated in first differences, the quinquennial-specific models are equivalent to fixed effects regressions.[39] I will use the $NTRGap_{cz}$, defined in Equation B.2, as a plausible exogenous measure of labor market changes at commuting-zone level, represented by Z_{cz} in Equation B.1.

Given that my outcomes of interest are at CZ level, I construct a geographically based measure of international competition. I create a CZ-level measure of the "NTR Gap" following Pierce and Schott (2020), who compute U.S. county-level exposure to PNTR. I construct a measure of Mexican CZ (indirect) exposure to PNTR as the employment-share-weighted-average of NTR Gaps across manufacturing industries that are subject to tariffs.

$$NTRGap_{cz} = \sum_j \frac{L_{j,cz}}{L_{cz}} NTRGap_j \tag{B.2}$$

where $L_{j,cz}$ represents the employment in industry j in Mexican commuting zone cz and

[37] To the best of my knowledge, Mexico has no official definition of CZs covering the whole country like the United States. INEGI has defined 59 metropolitan zones that cover around 300 municipalities out of the 2,382 municipalities used in this paper.

[38] See Blyde et al. (2017) Appendix A for a description of the algorithm used by the authors to group Mexican municipalities in commuting zones.

[39] Estimating Equation B.1 as a fixed-effects regression assumes that the errors are serially uncorrelated (Autor et al., 2013).

L_{cz} represents total employment in commuting zone cz. Data to compute "NTR Gaps" for each industry j using *ad valorem* equivalent tariff rates is provided by Feenstra et al. (2002). I follow (Pierce and Schott, 2016) and use NTR gaps in 1999, immediately preceding the policy change. Industry-level employment by CZ is from the 1999 Mexican Economic Census. There are 774 commuting zones in my data, spanning the entire country.

The tables in Section B.1 replicate the main results of Section 4, Section 5, and Section 6 estimating Equation B.1 to obtain CZ-level estimates of the effect of PNTR on population growth, migration, and employment. Although compared to the main tables some of these estimates are statistically significant at 5 or 10 percent level as apposed to 1 percent, the magnitude of the estimates is very similar to those presented in the main analysis and direction of the effect remains unchanged.[40] All in all, my results are robust to using commuting zones as geographic unit of analysis.

[40]With the exception of the coefficients for population growth over 2005-2010 (Table B.1, Panel B) and return migration over 2000-2005 (Table B.2, Panel A) which are somewhat imprecisely estimated compared to the main results, while the magnitudes and signs very similar.

B.1 Tables

Table B.1: International Competition and Five-year Changes in Log Working-age Population - Commuting Zones

	(1)	(2)	(3)
	All	**Men**	**Women**
PANEL A: $\Delta Log(Population)$ **2000-2005**			
$NTRGap_{cz}$	0.145***	0.167***	0.131***
	(0.0474)	(0.0527)	(0.0442)
Moving CZ from 25th to 75th pctile	0.0175***	0.0201***	0.0158***
	(0.0057)	(0.0064)	(0.0053)
PANEL B: $\Delta Log(Population)$ **2005-2010**			
$NTRGap_{cz}$	-0.117*	-0.153*	-0.0738
	(0.0679)	(0.0922)	(0.0473)
Moving CZ from 25th to 75th pctile	-0.0141*	-0.0184*	-0.0089
	(0.0082)	(0.0111)	(0.0057)
Observations (CZ)	774	774	774

Notes: This table presents estimates of Equation B.1 and shows the effect of Mexican commuting zones (CZ) exposure to international competition on population growth over 2000-2005, in Panel A, and between 2005-2010, in Panel B. The dependent variable is the change in log CZ working-age population. $NTRGap_{cz}$, defined in Equation B.2 is a measure of Mexican CZ exposure to the change in trade policy between the U.S. and China. Column 1 shows changes in log total population, while Columns 2 and 3 present the results for men and women, respectively. The second to last row in each panel presents rescaled estimates to reflect the change in log population for a Mexican CZ at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted CZs.

Table B.2: International Competition and Five-year Changes in Return Migration Rates - Commuting Zones (CZ)

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: Return migration rate from U.S. 2000-2005			
$NTRGap_{cz}$	-0.00192	-0.00312	-0.000855
	(0.00173)	(0.00263)	(0.000966)
Moving CZ from 25th to 75th pctile	-0.0002	-0.0004	-0.0001
	(0.0002)	(0.0003)	(0.0001)
PANEL B: Return migration rate from U.S. 2005-2010			
$NTRGap_{cz}$	-0.0224**	-0.0325**	-0.0129***
	(0.00895)	(0.0142)	(0.00434)
Moving CZ from 25th to 75th pctile	-0.0027**	-0.0039**	-0.0016***
	(0.0011)	(0.0017)	(0.0005)
Observations	774	774	774

Notes: This table presents estimates of Equation B.1 of the relationship between China receiving PNTR, which increased Mexican CZs' exposure to Chinese competition in the U.S. market, and return migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the return migration rate from the U.S.. $NTRGap_{cz}$, defined in Equation B.2 is a measure of Mexican CZs (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the return migration rate for a Mexican CZ at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted CZs.

Table B.3: International Competition and Five-year Changes in In-migration Rates - Commuting Zones (CZ)

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: In-migration rate from other states 2000-2005			
$NTRGap_{cz}$	-0.00938	-0.0153	-0.00349
	(0.00963)	(0.0110)	(0.00859)
Moving CZ from 25th to 75th pctile	-0.0011	-0.0018	-0.0004
	(0.0012)	(0.0013)	(0.0010)
PANEL B: In-migration rate from other states 2005-2010			
$NTRGap_{cz}$	-0.0292**	-0.0358***	-0.0228*
	(0.0120)	(0.0121)	(0.0122)
Moving CZ from 25th to 75th pctile	-0.0035**	-0.0043***	-0.0028*
	(0.0014)	(0.0015)	(0.0015)
Observations	774	774	774

Notes: This table presents estimates of Equation B.1 of the relationship between China receiving PNTR, which increased Mexican CZs' exposure to Chinese competition in the U.S. market, and in-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the in-migration rate to commuting zone cz from a different state. $NTRGap_{cz}$, defined in Equation B.2 is a measure of Mexican CZs (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the in-migration rate for a Mexican CZ at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted CZs.

Table B.4: International Competition and Five-year Changes in Out-migration Rates - Commuting Zones (CZ)

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: Out-migration rate to other states 2000-2005			
$NTRGap_{cz}$	-0.0798**	-0.0993***	-0.0604
	(0.0369)	(0.0367)	(0.0386)
Moving CZ from 25th to 75th pctile	-0.0096**	-0.0120***	-0.0073
	(0.0044)	(0.0044)	(0.0047)
PANEL B: Out-migration rate to other states 2005-2010			
$NTRGap_{cz}$	0.0999**	0.107**	0.0935*
	(0.0498)	(0.0510)	(0.0489)
Moving CZ from 25th to 75th pctile	0.0121**	0.0129**	0.0113*
	(0.0060)	(0.0062)	(0.0059)
Observations	774	774	774

Notes: This table presents estimates of Equation B.1 of the relationship between China receiving PNTR, which increased Mexican CZs' exposure to Chinese competition in the U.S. market, and out-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the out-migration rate to commuting zone cz from a different state. $NTRGap_{cz}$, defined in Equation B.2 is a measure of Mexican CZs (indirect) exposure to the change in trade policy between the U.S. and China. The second to last row presents rescaled estimates to reflect the change in the out-migration rate for a Mexican CZ at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted CZs.

Table B.5: International Competition and Manufacturing Employment - Commuting Zones

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: $\Delta Log(manufacturing)$ **1998-2003**			
$NTRGap_{cz}$	-1.108***	-0.604**	-2.201***
	(0.241)	(0.265)	(0.259)
Moving CZ from 25th to 75th pctile	-0.0779***	-0.0425**	-0.1547***
	(0.0169)	(0.0186)	(0.0182)
PANEL B: $\Delta Log(manufacturing)$ **2003-2008**			
$NTRGap_{cz}$	-1.276***	-0.939***	-2.040***
	(0.325)	(0.326)	(0.384)
Moving CZ from 25th to 75th pctile	-0.0897***	-0.0660***	-0.1434***
	(0.0229)	(0.0229)	(0.0270)
Observations (CZ)	774	774	774

Notes: This table presents estimates of Equation B.1 and shows the effect of Mexican commuting zones (CZ) exposure to international competition on manufacturing employment over 1998-2003, in Panel A, and between 2003-2008, in Panel B. The dependent variable is the change in log manufacturing employment. $NTRGap_{cz}$ is a measure of Mexican CZ exposure to the change in trade policy between the U.S. and China, defined in Equation B.2. Column 1 shows changes in log total manufacturing workers, while Columns 2 and 3 present the results for men and women, respectively. The second to last row in each panel presents rescaled estimates to reflect the change in log population for a Mexican CZ at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted CZs.

C Sensitivity Analysis - Homicides Spike 2007-2010

In this section, I show that my results are not sensitive to controlling for local homicides trends to capture the effects of drug-related violence in Mexico during my period of analysis.

Recent work studying population mobility in Mexico finds mixed effects of crime and violence. On one side, Aldeco et al. (2019) find that net domestic migration into violent municipalities decreases, driven by lower inflows while outflows are mostly unaffected. The effect is driven by lower-skilled individuals facing higher migration costs. Ajzenman et al. (2015) document a negative effect of violence in the price of low-income housing over 2008-2011, showing that although both poor and non-poor households tend to move more in the municipalities where the increase in crime is the greatest, this effect larger for poor households. On the other side, Caballero et al. (2021) show that controlling for municipality-level homicide rate trends does not change their results on the effect of U.S. local labor demand shocks during the Great Recession on U.S.-Mexico international migration. Utar (2021) finds a modest migration response to violence; people living in violent states are more likely to emigrate to another countries relative to non-violent states. However, there is a strong overall declining trend in the number of international emigrants (namely emigrants to the US) over the sample period, which is likely due to stricter policies in the US (Bazzi et al., 2021). Using data from the Mexican Census and labor force surveys, Basu and Pearlman (2017) find a muted migration response to drug violence at municipal and state levels that is incompatible with a story of wide-scale displacement from violence.

I calculate the number of homicides by municipality using administrative registers from INEGI. This data provides information from all deaths certificates filed in Mexico. First, because municipality-level violence and criminal activity might have been affected by the trade-induced manufacturing employment shock (Dell et al., 2019; Dix-Carneiro et al., 2018), I control differential violence trends at municipality level. In Equation 4, the term $t.X_i$ represents the baseline homicide rate interacted with time dummies to control for differential violence trends in municipality i over time. This term allows for the possibility that the relationship between the outcome variables and municipality i's baseline violence and crime changes in the post-PNTR period (Pierce and Schott, 2016). In Equation 5, after taking first differences, I include the baseline homicide rate in the term X_i. I avoid including the post-treatment homicides rate as a covariate as it can potentially be affected by the treatment (Wooldridge, 2005; Callaway and Sant'Anna, 2021). These results are presented in Tables C.1-C.7. Second, in Table C.8, I show that my migration and population results are not driven by increased regional violence by dropping the municipalities in the most violent states when analyzing the changes in population growth, migration, and manufacturing employment between 2005 and 2010. These states are: Baja California, Chihuahua, Durango, Guerrero, Michoacán, Nayarit, Sinaloa, Sonora (Utar, 2021; Aburto et al., 2016; Dell, 2015).

The tables in Section C.1 replicate the main results of Section 4, Section 5, and Section 6 estimating Equation 5 to obtain estimates of the effect of PNTR on population growth, migration, and employment, controlling for local violence trends. Overall, the magnitude and sign of the estimates is very similar to those presented in the main analysis and statistical significance of the estimated effect remains unchanged.[41] All in all, my results are robust to differential violence trends at the local level.

[41] The two exceptions are that the change in the female out-migration rate in the short term is imprecisely estimated in Panel A of Table C.5. Also, the in-migration rate from other municipalities for less-educated workers is imprecisely estimated in Panel A of Table C.6, while it was significant at 10 percent in the main results.

C.1 Tables

Table C.1: International Competition and Five-year Changes in Log Working-age Population - Controlling for local violence trends

	(1)	(2)	(3)
	All	**Men**	**Women**
PANEL A: $\Delta Log(Population)$ **2000-2005**			
$NTRGap_i$	0.0916**	0.118***	0.0729**
	(0.0380)	(0.0415)	(0.0369)
Moving a municipality from 25th to 75th pctile	0.0107**	0.0138***	0.0085**
	(0.0044)	(0.0048)	(0.0043)
PANEL B: $\Delta Log(Population)$ **2005-2010**			
$NTRGap_i$	-0.142***	-0.179***	-0.104**
	(0.0445)	(0.0508)	(0.0410)
Moving a municipality from 25th to 75th pctile	-0.0165***	-0.0208***	-0.0121**
	(0.0052)	(0.0059)	(0.0048)
Municipality-level homicide trends	YES	YES	YES
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on population growth over 2000-2005, in Panel A, and between 2005-2010, in Panel B. The dependent variable is the change in log municipality working-age population. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. Column 1 shows changes in log total population, while Columns 2 and 3 present the results for men and women, respectively. The second to last row in each panel presents rescaled estimates to reflect the change in log population for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.2: International Competition and Five-year Changes in Return Migration Rates - Controlling for local violence trends

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: Return migration rate from U.S. 2000-2005			
$NTRGap_i$	-0.00206***	-0.00357***	-0.000694
	(0.000690)	(0.00102)	(0.000448)
Moving a municipality from 25th to 75th pctile	-0.0002***	-0.0004***	-0.0001
	(0.0001)	(0.0001)	(0.0001)
PANEL B: Return migration rate from U.S. 2005-2010			
$NTRGap_i$	-0.0228***	-0.0350***	-0.0116***
	(0.00329)	(0.00525)	(0.00173)
Moving a municipality from 25th to 75th pctile	-0.0027***	-0.0041***	-0.0014***
	(0.0004)	(0.0006)	(0.0002)
Municipality-level homicide trends	YES	YES	YES
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and return migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the return migration rate from the U.S.. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. The second to last row presents rescaled estimates to reflect the change in the return migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.3: International Competition and Change in % of Households with Migrants 2005-2010 - Controlling for local violence trends

	(1) % Households with migrants to U.S.	(2) % Households with returned migrants
$NTRGap_i$	3.010**	-2.949***
	(1.323)	(0.721)
Moving a municipality from 25th to 75th pctile	0.3504**	-0.3432***
	(0.1540)	(0.0839)
Municipality-level homicide trends	YES	YES
Observations	2,382	2,382

Notes: This table shows the effect of Mexican municipalities' exposure to international competition in the U.S. market on Mexico-U.S. migration between 2005-2010 with respect to the pre-shock period 1995-2000. The dependent variable is the percentage of households with migrants to the U.S. in Column 1 and the percentage of households with returned migrants from the U.S. in Column 2. Data is from the Mexican Population Council (CONAPO). $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. The second to last row presents rescaled estimates to reflect the change in returned migration for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.4: International Competition and Five-year Changes in In-migration Rates - Controlling for local violence trends

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: In-migration rate from other states 2000-2005			
$NTRGap_i$	-0.00688	-0.0103	-0.00343
	(0.00711)	(0.00741)	(0.00695)
Moving a municipality from 25th to 75th pctile	-0.0008	-0.0012	-0.0004
	(0.0008)	(0.0009)	(0.0008)
PANEL B: In-migration rate from other states 2005-2010			
$NTRGap_i$	-0.0280***	-0.0335***	-0.0227**
	(0.00965)	(0.00986)	(0.00959)
Moving a municipality from 25th to 75th pctile	-0.0033***	-0.0039***	-0.0026**
	(0.0011)	(0.0011)	(0.0011)
Municipality-level homicide trends	YES	YES	YES
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and in-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the in-migration rate to municipality i from municipalities in a different state. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. The second to last row presents rescaled estimates to reflect the change in the in-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.5: International Competition and Five-year Changes in Out-migration Rates - Controlling for local violence trends

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: Out-migration rate to other states 2000-2005			
$NTRGap_i$	-0.0478**	-0.0660***	-0.0302
	(0.0242)	(0.0243)	(0.0246)
Moving a municipality from 25th to 75th pctile	-0.0056**	-0.0077***	-0.0035
	(0.0028)	(0.0028)	(0.0029)
PANEL B: Out-migration rate to other states 2005-2010			
$NTRGap_i$	0.103***	0.107***	0.0992***
	(0.0261)	(0.0271)	(0.0254)
Moving a municipality from 25th to 75th pctile	0.0120***	0.0125***	0.0115***
	(0.0030)	(0.0032)	(0.0030)
Municipality-level homicide trends	YES	YES	YES
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and out-migration rates between 2000-2005 (Panel A) and 2005-2010 (Panel B). The dependent variable is the out-migration from municipality i to municipalities in a different state. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. The second to last row presents rescaled estimates to reflect the change in the out-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.6: International Competition and Five-year In-migration Rates (IPUMS Sample) - Controlling for local violence trends

	(1) All	(2) Men	(3) Women	(4) Less than High-school	(5) Completed High-school	(6) Manufacturing Sector	(7) Other Sectors
PANEL A: In-migration rate from other municipalities 2005-2010							
$NTRGap_i$	-0.0196	-0.0258	-0.0141	-0.0364	0.0467	-0.110***	-0.00802
	(0.0243)	(0.0253)	(0.0239)	(0.0230)	(0.0290)	(0.0394)	(0.0217)
Moving a municipality from 25th to 75th pctile	-0.0023	-0.0030	-0.0016	-0.0043	0.0055	-0.0128***	-0.0009
	(0.0028)	(0.0030)	(0.0028)	(0.0027)	(0.0034)	(0.0046)	(0.0025)
PANEL B: In-migration rate from other states 2005-2010							
$NTRGap_i$	-0.0461**	-0.0460**	-0.0464**	-0.0577***	-0.0107	-0.110***	-0.0372**
	(0.0201)	(0.0205)	(0.0198)	(0.0205)	(0.0195)	(0.0347)	(0.0171)
Moving a municipality from 25th to 75th pctile	-0.0054**	-0.0054**	-0.0054**	-0.0068***	-0.0013	-0.0129***	-0.0044**
	(0.0023)	(0.0024)	(0.0023)	(0.0024)	(0.0023)	(0.0041)	(0.0020)
Municipality-level homicide trends	YES	YES	YES	YES	YES	YES	YES
Observations	2,382	2,382	2,382	2,382	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 of the relationship between China receiving PNTR, which increased Mexican municipalities' exposure to Chinese competition in the U.S. market, and in-migration rates between 2005-2010. In Panel A, the dependent variable is the in-migration rate to municipality i from any other municipality in Mexico. In Panel B, the dependent variable is the in-migration rate to municipality i from municipalities in a different state. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities (indirect) exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. The second to last row presents rescaled estimates to reflect the change in the in-migration rate for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition, which is the tariff gap for the average worker of 0.11 percentage points. Source: IPUMS International. Data for Panel A is not available for 2000-2005; thus, these results should be compared to those in Panel B of Table C.4. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.7: International Competition and Manufacturing Employment - Controlling for local violence trends

	(1) **All**	(2) **Men**	(3) **Women**
PANEL A: $\Delta Log(manufacturing)$ **1998-2003**			
$NTRGap_i$	-1.032***	-0.369**	-1.766***
	(0.191)	(0.185)	(0.236)
Moving municipality from 25th to 75th pctile	-0.0879***	-0.0315**	-0.1505***
	(0.0163)	(0.0157)	(0.0201)
PANEL B: $\Delta Log(manufacturing)$ **2003-2008**			
$NTRGap_i$	-0.992***	-0.878***	-1.322***
	(0.200)	(0.205)	(0.221)
Moving municipality from 25th to 75th pctile	-0.0845***	-0.0748***	-0.1127***
	(0.0170)	(0.0175)	(0.0188)
Municipality-level homicide trends	YES	YES	YES
Observations	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on manufacturing employment over 1998-2003, in Panel A, and between 2003-2008, in Panel B. The dependent variable is the change in log manufacturing employment. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. It controls for municipality-level homicide trends. Column 1 shows changes in log total manufacturing workers, while Columns 2 and 3 present the results for men and women, respectively. The second to last row in each panel presents rescaled estimates to reflect the change in log manufacturing employment for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table C.8: International Competition and Five-year Changes in Population Growth, Migration Rates, and Manufacturing Employment - Dropping Violent States

	(1) **All**	(2) **Men**	(3) **Women**
		2005-2010	
PANEL A: Population Growth (Table 2)			
$NTRGap_i$	-0.151***	-0.189***	-0.113***
	(0.0447)	(0.0515)	(0.0401)
Moving a municipality from 25th to 75th pctile	-0.0175***	-0.0220***	-0.0131***
	(0.0052)	(0.0060)	(0.0046)
PANEL B: Return Migration Rate (Table 3)			
$NTRGap_i$	-0.195***	-0.0308***	-0.00908***
	(0.00337)	(0.00550)	(0.00157)
Moving a municipality from 25th to 75th pctile	-0.0023***	-0.0036***	-0.0011***
	(0.0004)	(0.0006)	(0.0002)
PANEL C: In-migration rate from other states (Table 5)			
$NTRGap_i$	-0.0242***	-0.0286***	-0.0200**
	(0.00868)	(0.00884)	(0.00864)
Moving a municipality from 25th to 75th pctile	-0.0028***	-0.0033***	-0.0023**
	(0.0010)	(0.0010)	(0.0010)
PANEL D: Out-migration rate to other states (Table 6)			
$NTRGap_i$	0.101***	0.102***	0.100***
	(0.0279)	(0.0290)	(0.0271)
Moving a municipality from 25th to 75th pctile	0.0117***	0.0118***	0.0116***
	(0.0032)	(0.0034)	(0.0031)
		2003-2008	
PANEL E: Manufacturing Employment (Table 8)			
$NTRGap_i$	-1.024***	-0.930***	-1.380***
	(0.221)	(0.228)	(0.240)
Moving a municipality from 25th to 75th pctile	-0.0783***	-0.0711***	-0.1054***
	(0.0169)	(0.0174)	(0.0183)
Observations	1,982	1,982	1,982

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' (located in "non-violent" states) exposure to international competition on population growth (Panel A), return migration (Panel B), in-migration (Panel C), and out-migration (Panel D) over 2005-2010, and manufacturing employment (Panel E) over 2003-2008. Each Panel indicates the table that presents the main results using the full sample of municipalities. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. The second to last row in each panel presents rescaled estimates to reflect the change in log population for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

D Additional Tables and Figures

Table D.1: Summary Statistics - Mexican Population Census 2000 (IPUMS Sample)

	Mean	Std. Dev.
Demographics		
Age	36.51	11.99
Men	0.48	0.50
Married	0.73	0.44
Employment-to-Population by main sectors		
Manufacturing	0.10	0.30
Agriculture & mining	0.13	0.34
Services	0.10	0.30
Construction	0.05	0.22
Sales	0.09	0.28
Education		
Less than High School	0.79	0.41
High School Graduate	0.15	0.35
College Graduate	0.06	0.26
Place of residence in 1995		
Different state	0.04	0.20
Different Municipality	0.07	0.25
Different Country	0.01	0.08

Source: IPUMS International and INEGI, 2000 Mexican Population Census. Sample includes working-age individuals (20-64 years old).

Table D.2: Male-to-female ratio by Sector of Employment, 2000

Sector	**Male-to-female ratio**
Agriculture, fishing, forestry	9.3
Mining	7.2
Manufacturing	**2.0**
Electricity, gas and water	6.2
Construction	36.2
Wholesale and retail trade	1.3
Hotels and restaurants	0.9
Transportation, storage and communications	7.8
Financial services and insurance	1.3
Public administration and defense	2.0
Real estate and business services	2.1
Education	0.7
Health and social work	0.6
Other services	5.2
Private household services	0.1

Source: IPUMS international, Mexican Population Census, 2000. Number of observations: 2,750,218. Sample includes working-age individuals (20-64 years old) who are employed.

Table D.3: Trade Competition and Non-Manufacturing Employment

Dependent variable: Δ Log(Non-Manufacturing Employment)

	(1) Total non-mfg	(2) NAICS 43, 54-56	(3) NAICS 48-53	(4) Other non-mfg
PANEL A: 1998-2003				
$NTRGap_i$	0.271***	0.993***	1.125***	0.195*
	(0.0998)	(0.248)	(0.308)	(0.112)
Moving a municipality from 25th to 75th pctile	0.0315***	0.1155***	0.1310***	0.0227*
	(0.0116)	(0.0289)	(0.0358)	(0.0131)
PANEL B: 2003-2008				
$NTRGap_i$	-0.218*	-1.203***	-0.0435	-0.121
	(0.130)	(0.269)	(0.307)	(0.123)
Moving a municipality from 25th to 75th pctile	-0.0254*	-0.1400***	-0.0051	-0.0141
	(0.0152)	(0.0313)	(0.0358)	(0.0144)
Initial share of total mfg & non-mfg Emp.	70%	14%	8%	48%
Initial share of total non-mfg Emp.	100%	19.6%	11.9%	68.5%
Observations	2,382	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on the municipality level wage bill over 1998-2003, in Panel A, and between 2003-2008, in Panel B. The dependent variable is the change in log non-manufacturing employment non-manufacturing sectors as classified by INEGI. Column 1 shows the total contribution of non-manufacturing sectors; Column 2 shows the contribution by Non-Manufacturing subsectors 43 (wholesale), 54-56 (professional services and management); Column 3 shows the contribution by subsectors 48-49 (transportation & warehousing), 51 (information) and 52-53 (FIRE); Column 4 shows the contribution by other Non-manufacturing subsectors: 11-23 (mining, utilities, construction), 46 (retail), 61-81 (education, health, entertainment, accommodation and food). $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. The second to last row in each panel presents rescaled estimates to reflect the change in log manufacturing employment for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Table D.4: Trade Competition and Non-Manufacturing Wages

Dependent variable:	$\Delta Log(Wages)$				$\Delta Log(Payroll)$			
	(1) Total non-mfg	(2) NAICS 43, 54-56	(3) NAICS 48-53	(4) Other non-mfg	(5) Total non-mfg	(6) NAICS 43, 54-56	(7) NAICS 48-53	(8) Other non-mfg
PANEL A: 1998-2003								
$NTRGap_i$	-0.0830	0.165	-0.508	0.0402	-0.130	0.125	-0.518	-0.0117
	(0.215)	(0.296)	(0.435)	(0.218)	(0.216)	(0.302)	(0.436)	(0.222)
From 25th to 75th pctile	-0.0097	0.0192	-0.0591	0.0047	-0.0151	0.0145	-0.0603	-0.0014
	(0.0250)	(0.0345)	(0.0506)	(0.0254)	(0.0251)	(0.0352)	(0.0507)	(0.0258)
PANEL B: 2003-2008								
$NTRGap_i$	-0.922***	-1.446***	-0.745	-1.065***	-0.915***	-1.445***	-0.904*	-1.036***
	(0.213)	(0.326)	(0.473)	(0.192)	(0.220)	(0.335)	(0.495)	(0.197)
From 25th to 75th pctile	-0.1073***	-0.1683***	-0.0867	-0.1240***	-0.1065***	-0.1682***	-0.1052*	-0.1206***
	(0.0247)	(0.0379)	(0.0551)	(0.0224)	(0.0256)	(0.0390)	(0.0576)	(0.0229)
Observations	2,382	2,382	2,382	2,382	2,382	2,382	2,382	2,382

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' exposure to international competition on the municipality level wage bill over 1998-2003, in Panel A, and between 2003-2008, in Panel B. The dependent variable in columns 1-4 and 5-8 is the change in log regular wages and payroll (including social security contributions made by employers), respectively, for non-manufacturing sectors as classified by INEGI. Columns 1 and 5 show the non-manufacturing total; Columns 2 and 6 show the contribution by Non-Manufacturing subsectors 43 (wholesale), 54-56 (professional services and management); Columns 3 and 7 show the contribution by subsectors 48-49 (transportation & warehousing), 51 (information) and 52-53 (FIRE); Columns 4 and 8 show the contribution by other Non-manufacturing subsectors: 11-23 (mining, utilities, construction), 46 (retail), 61-81 (education, health, entertainment, accommodation and food). $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. The second to last row in each panel presents rescaled estimates to reflect the change in log manufacturing employment for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). Observations are population-weighted municipalities.

Table D.5: International Competition and Five-year Changes in Population Growth, Migration Rates, and Manufacturing Employment - Dropping Border States

	(1) **All**	(2) **Men**	(3) **Women**	(4) **All**	(5) **Men**	(6) **Women**
Period		**2000-2005**			**2005-2010**	
PANEL A: Population Growth (Table 2)						
$NTRGap_i$	0.0954**	0.120***	0.0716*	-0.159***	-0.197***	-0.126***
	(0.0408)	(0.0449)	(0.0393)	(0.0473)	(0.0560)	(0.0413)
Moving municipality from 25th to 75th pctile	0.0104**	0.0131***	0.0078*	-0.0173***	-0.0215***	-0.0137***
	(0.0044)	(0.0049)	(0.0043)	(0.0051)	(0.0061)	(0.0045)
PANEL B: Return Migration Rate (Table 3)						
$NTRGap_i$	-0.00235***	-0.00340***	-0.00131***	-0.0205***	-0.0290***	-0.0123***
	(0.000753)	(0.00118)	(0.000430)	(0.00363)	(0.00591)	(0.00170)
Moving municipality from 25th to 75th pctile	-0.0003***	-0.0004***	-0.0001***	-0.0022***	-0.0032***	-0.0013***
	(0.0001)	(0.0001)	(0.0000)	(0.0004)	(0.0006)	(0.0002)
PANEL C: In-migration rate from other states (Table 5)						
$NTRGap_i$	-0.00528	-0.00952	-0.00100	-0.0224**	-0.0277***	-0.0172*
	(0.00807)	(0.00827)	(0.00801)	(0.0101)	(0.0103)	(0.0101)
Moving municipality from 25th to 75th pctile	-0.0006	-0.0010	-0.0001	-0.0024**	-0.0030***	-0.0019*
	(0.0009)	(0.0009)	(0.0009)	(0.0011)	(0.0011)	(0.0011)
PANEL D: Out-migration rate to other states (Table 6)						
$NTRGap_i$	-0.0558**	-0.0716**	-0.0403	0.0984***	0.105***	0.0931***
	(0.0284)	(0.0281)	(0.0292)	(0.0273)	(0.0284)	(0.0265)
Moving municipality from 25th to 75th pctile	-0.0061**	-0.0078**	-0.0044	0.0107***	0.0114***	0.0101***
	(0.0031)	(0.0031)	(0.0032)	(0.0030)	(0.0031)	(0.0029)
Period		**1998-2003**			**2003-2008**	
PANEL E: Manufacturing Employment (Table 8)						
$NTRGap_i$	-0.925***	-0.347*	-1.663***	-1.119***	-0.967***	-1.439***
	(0.200)	(0.189)	(0.241)	(0.213)	(0.216)	(0.230)
Moving municipality from 25th to 75th pctile	-0.0825***	-0.0309*	-0.1484***	-0.0998***	-0.0863***	-0.1283***
	(0.0178)	(0.0168)	(0.0215)	(0.0190)	(0.0193)	(0.0205)
Observations	2,108	2,108	2,108	2,108	2,108	2,108

Notes: This table presents estimates of Equation 5 and shows the effect of Mexican municipalities' (located in non-border states) exposure to international competition on population growth (Panel A), return migration (Panel B), in-migration (Panel C), and out-migration (Panel D) over 2000-2005 (Columns 1-3) and 2005-2010 (Columns 4-6), and manufacturing employment (Panel E) over 1998-2003 (Columns 1-3) and 2003-2008 (Columns 1-3). Each Panel indicates the table that presents the main results using the full sample of municipalities. $NTRGap_i$, defined in Equation 3 is a measure of Mexican municipalities exposure to the change in trade policy between the U.S. and China. The second to last row in each panel presents rescaled estimates to reflect the change in log population for a Mexican municipality at the 75th compared to the 25th percentile of exposure to international competition. Robust standard errors in parenthesis (*** p<0.01, ** p<0.05, * p<0.1). Observations are population-weighted municipalities.

Figure D.1: Histogram - Pierce and Schott (2016) measure of exposure