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Regional adjustment to trade liberalization

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Abstract

In this paper, I examine the effect of trade reform on regional employment in Mexico. Three factors condition regional labor demand: (1) transport costs, which encourage firms to locate in regions with good access to foreign markets; (2) backward–forward linkages, which encourage firms to locate near buyers and suppliers, and (3) agglomeration economies, which reinforce the pre-trade pattern of industry location. The results suggest transport costs and backward–forward linkages influence regional employment. Post-trade employment growth is relatively high in regional industries that are close to the United States and near upstream and downstream industries. Trade reform appears to have contributed to the breakup of the Mexico City manufacturing belt and the formation of new industry centers in northern Mexico.

Keywords: Agglomeration economies; Industry location; Trade liberalization; Transport costs

JEL classification: F16; R12

1. Introduction

How do regions adjust to trade liberalization? In this paper, I study the effect of trade reform on regional industry employment in Mexico. I disentangle the effects of three opposing forces on regional labor demand: transport-cost considerations, which encourage firms to relocate their activities to regions with relatively

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low-cost access to foreign markets; backward–forward linkages, which give firms an incentive to locate near their buyers and suppliers; and agglomeration economies, which tend to reinforce the pre-trade pattern of industry location.

That international trade causes a sectoral reallocation of resources is a basic insight of trade theory. Whether the motivation for trade is relative factor abundance, increasing returns to scale, or imperfect competition, the transition from an open economy to a closed economy alters a nation's pattern of specialization. The effect of trade on the spatial allocation of resources has received less attention. Economists recently have begun to examine regional specialization within countries, but there has been little empirical work on how the transition to an open economy affects the location of economic activity.

One reason that industry location matters for trade is transport costs. Krugman (1991) shows that the interaction between plant-level scale economies and transport costs can explain the formation of cities. Krugman and Livas (1992) extend this framework to show that the size and location of cities is conditioned by the openness of an economy. Similarly, in Rauch (1993a) transport costs determine the volume of trade within and between countries.

A second reason that location matters for trade is the existence of backward and forward linkages between industries. Recent work by Venables (1996) and Krugman and Venables (1995) formalizes Hirschman's (Hirschman, 1958) concept of how vertical relationships between industries create a pattern of interdependent industry location. In this body of work, expansion in one industry contributes to the expansion of upstream and downstream industries.

A third reason that location matters for trade is the existence of externalities, which link the productivity of agents to the local agglomeration of resources. Dynamic externalities, due to knowledge spillovers or learning by doing, figure prominently in recent theories of economic growth (Romer, 1986, 1990; Lucas, 1988; Young, 1991). To the extent such externalities are localized, economic activity becomes geographically concentrated over time. Several recent studies have found evidence that is consistent with dynamic localized externalities (Glaeser et al., 1992; Jaffe et al., 1993; Henderson et al., 1995).

The importance of trade liberalization is that it changes the reference market for firms in a country. Given transport costs, we expect trade to shift resources to locations with relatively low-cost access to foreign markets, such as border regions and port cities. The existence of backward–forward linkages and agglomeration economies complicate the picture. They imply that the size or mix of industries in a region may also affect how it adjusts to trade. By this logic, as trade shifts employment across industries, we expect locations with large concentrations of firms, all else equal, to expand. To the extent closed-economy industry centers have relatively poor access to foreign markets, transport costs, backward–forward linkages, and agglomeration economies may have opposing effects on how regions adjust to the opening of the economy.

The regional effects of trade liberalization have important policy implications.

The current process of economic integration is likely to reorganize the location of economic activity in developed and developing regions alike. The formation of the European Union and the fall of communism in Eastern Europe imply a substantial increase in regional resource mobility on the European continent. The spread of trade reform in the developing world has reoriented producers in these countries towards a new set of markets. Wei (1993) finds that in China the fastest growing cities are those with large export sectors. For obvious reasons, many of these cities are located in coastal areas near Hong Kong. Regional movements in response to trade strain existing infrastructure and change relative regional economic fortunes.

Recent changes in Mexico's trade policy make the country an ideal case study. In 1985, after four decades of import-substitution industrialization, Mexico began to open its economy to trade. This involved both a reduction of import barriers and a relaxation of controls on exports. The government enacted reform swiftly, eliminating most trade barriers in the following three years. Mexico's location in North America makes trade liberalization equivalent to economic integration with the United States. For Mexican firms, proximity to foreign markets means proximity to the U.S. market. Yet, Mexico's closed-economy production centers are located far from the United States. Since the 1950s, manufacturing capacity has been concentrated in the country's interior, around Mexico City. While foreign markets lure firms to the Mexico–U.S. border, the existing pattern of industry location may work against this shift.

I estimate the change in regional industry labor demand in Mexico before and after trade reform as a function of transport costs to the United States, the local geographic concentration of industry, and a series of control variables. If transport costs matter, employment growth will be higher in regions close to the United States; if backward–forward linkages matter, employment growth will be higher in regions with large concentrations of vertically-linked industries; and if agglomeration economies matter, employment growth will be higher in large production centers. Following Glaeser et al. (1992), I study the effects of two types of agglomeration: within-industry agglomeration, the concentration of firms in the same industry; and industrial diversity, the concentration of firms in a broad range of industries.

To preview the results, I find evidence of both transport-cost effects and backward–forward linkages on post-trade employment growth. After trade liberalization, employment growth is higher in regional industries that are relatively close to the United States or that are proximate to related industries. These findings suggest that the closed-economy manufacturing belt around Mexico City is breaking apart, as new industrial centers form closer to the Mexico–U.S. border. The Mexican economy is changing from one based on one large industry center to one based on a number of broadly specialized industry centers. The North American Free Trade Agreement is likely to reinforce this trend. Consistent with Glaeser et al. (1992), I find no evidence employment growth is higher where within-industry agglomeration is higher; contrary to their results and to those of

Henderson et al. (1995), I find little evidence employment growth is higher where industrial diversity is higher.

2. Theory

2.1. International trade and industry location

In this section, I review briefly recent theoretical literature that addresses the relationship between international trade and industry location. Recent theories of trade have three common elements: increasing returns to scale, transport costs, and congestion costs. In Fujita (1988) and Krugman (1991) scale economies are internal to firms; in Henderson (1974) and Rauch (1989) scale economies are external to firms. The interaction of scale economies and transport costs creates a centripetal force, to use Krugman's language, that causes firms to agglomerate in industry centers. With internal economies, firms economize on both transport costs and production costs by locating near a large market; with external economies, firms benefit from spillovers by locating near other firms in their industry. Land rents, or another source of congestion costs, operate as a centrifugal force and work against agglomeration. To compensate workers for higher housing costs or congestion-related disamenities in agglomerated regions, firms must pay workers relatively high wages. If centripetal forces dominate centrifugal forces firms will agglomerate in one or more industry centers.[2]

In alternative formalizations, Rivera-Batiz (1988), Krugman and Venables (1995) and Venables (1996) allow production within each industry to contain several intermediate stages, each of which is characterized by increasing returns to scale. Given transport costs, firms prefer to locate near their upstream suppliers or downstream buyers. The complimentarity between the location decisions of upstream and downstream firms causes all firms in an industry to agglomerate in one or more regions. What distinguishes industry agglomerations in this case is that they contain firms that share backward and forward linkages.

This discussion suggests that there are three factors that determine where a given industry will locate: the costs of transporting goods to final markets, the location of industries that are a source of spillovers for the industry in question, and the location of industries that are a source of supply or demand. For a given equilibrium configuration, each of these factors are complementary, making it difficult to identify the independent effect that any one of them has on industry location. The empirical strategy of this paper is to examine how industries respond to the shock of trade liberalization. A reduction of trade barriers in effect lowers

[2]Other factors may contribute to agglomeration, such as site-specific natural resources (Courant and Deardorff, 1992) and consumer amenities (Roback, 1982). If resource and amenity supplies are fixed, they do not affect growth and can be ignored in the analysis that follows.

transport costs between the domestic market and the foreign market. In response to such a change in transport costs, firms may choose to relocate. I use the process of adjustment to trade liberalization to identify the factors that influence the pattern of industry location.

To implement trade models based on increasing returns empirically, there are several issues that need to be clarified. The first is where firms agglomerate. In a closed economy, the location of an industrial center may be indeterminant. That is, the interaction of transport costs, increasing returns, and congestion costs may imply that firms agglomerate in a single region, but any of several locations may be plausible candidates. The indeterminacy, however, exists only prior to firms having made their initial location decisions. Once a given pattern of industry agglomeration is established, the logic of increasing returns implies that it will persist. For the case of Mexico, Mexico City was the location where industrial firms first began to locate. It quickly became the country's major industrial center, a position the city maintained during Mexico's entire experiment with import-substitution industrialization.

A second issue is how international trade alters firms' location incentives. Consider the transition from a closed economy to an open economy. If foreign demand for domestically-produced goods is sufficiently large (i.e., if the country is small relative to the rest of the world), then firms, all else equal, will have an incentive to relocate to regions that have relatively low-cost access to the foreign market, such as border areas or port cities. If, however, the closed-economy industrial center is located far from such regions, firms may be reluctant to improve access to foreign markets, since that would require them to forego the benefits of being near their buyers and suppliers or industries from whom they derive externalities.[3] The case of Mexico exemplifies this tension: the size and proximity of the United States gives Mexican firms an incentive to locate in northern Mexico, but the closed-economy industrial center in Mexico City may give firms an incentive to remain in the center of the country.

A third issue is that trade, whether it is motivated by comparative advantage or increasing returns, generally causes an economy to become more specialized. Regions that are relatively specialized in import-competing industries are likely to contract and regions that are specialized in exporting industries are likely to expand. To determine the effects of transport costs, backward–forward linkages, and agglomeration economies on industry location, it is necessary to control for the effect of trade on industrial specialization at the national level.

[3]In the long run, if firms have a joint incentive to move, entire industry centers may relocate. Fixed moving costs operate as an initial barrier to relocation, but there are a variety of mechanisms through which firms coordinate their actions. Rauch (1993b), for instance, models a case where developers use industrial parks to coordinate the relocation of industries. In the empirical analysis, I focus on medium-run adjustment to trade liberalization, in which such wholesale movements of industries have low probability.

2.2. An empirical model

To the extent that transport costs to foreign markets affect firms' location decisions, we expect trade liberalization to cause a relocation of activities towards regions with relatively good access to foreign markets. To the extent backward–forward linkages or agglomeration economies matter, we expect large concentrations of firms to grow relative to small ones.

I study how trade liberalization affects regional industry employment using a profit-function approach. Industries may be located in any number of regions. For simplicity assume each regional industry ships its goods to a single destination (e.g., all goods pass through a central processing zone). Assume also there are positive transport costs that take Samuelson's iceberg form: of each unit of output shipped from region i to the central market a fraction t_i arrives. Trade liberalization, in addition to changing relative prices, changes the destination market. By Hotelling's Lema, the demand for labor in region i by industry j is given by

$$L_{ij} = -\frac{\partial \Pi_j(R_{ij}, t_{ij} p_j, \xi_{ij})}{\partial w_{ij}} \tag{1}$$

where $\Pi()$ is the profit function; L_{ij} is employment in region i, industry j; R_{ij} is a vector of factor prices for ij, some of which vary across regions and others of which do not; p_j is the national price of industry j's output; ξ_{ij} is a vector of external effects, such as agglomeration economies or backward–forward linkages; and w_{ij} is the wage.

A standard problem in empirically identifying external effects is that at any moment of time their effects are indistinguishable from those of unobserved site-specific resources. To avoid the identification problem created by fixed factors, I study the growth of regional labor demand; if external effects are dynamic in nature, they have implications for growth that fixed factors do not. Taking logs, I assume I can reexpress Eq. (1) as

$$\Delta \ln(L_{ijt}) = \alpha + \theta \, \Delta \ln(w_{ijt}) + \sum_{h=1}^{H} \rho_h \, \Delta \ln(r^h_{ijt}) + \gamma \, \Delta \ln(t_{ijt} p_{jt}) + \phi \, \Delta \ln(\xi_{ijt}) \tag{2}$$

where Δ is the difference operator and the r^h_{ij}'s are non-labor factor prices. For given factor and output prices, growth in external effects increases regional industry labor demand. The backward–forward linkages hypothesis is that employment growth will be higher in regions where the concentration of firms in upstream and downstream industries is higher. The dynamic agglomeration-economies hypothesis is that growth in external effects are a function of the initial concentration of resources in a given location. Following this logic, I assume that growth in external effects can be expressed as a function of initial levels of industry concentration:

$$\Delta \ln(\xi_{ijt}) = a + \sum_{l=1}^{L} b_l \ln(x^l_{ijt-1}) + \epsilon_{ijt} \tag{3}$$

where the x^l_{ijt-1}'s are resource concentrations that generate external effects and ϵ_{ijt} is an error term.

The first type of external effects I study are backward–forward linkages. The idea that firms benefit from proximity to firms in upstream and downstream industries has not yet been considered in the empirical literature on dynamic externalities. I also consider two types of agglomeration economies: within-industry effects, where firms benefit from being near other firms in their industry; and diversity effects, where firms benefit from proximity to firms in a wide array of industrial activities. Within-industry effects, also known as Marshall-Arrow-Romer externalities, have been widely studied in the empirical literature (e.g., Carlton, 1983, Henderson et al., 1995 and Glaeser et al., 1992). The hypothesis that industrial diversity enhances growth relates to Jacobs' (1969) concept of the cross-fertilization of ideas between firms in different industries. In the growth of U.S. city industries, Glaeser et al. (1992) find evidence of externalities related to industrial diversity but not of within-industry externalities; Henderson et al. (1995) find evidence of both within-industry and diversity effects, where within-industry effects tend to die out over short time horizons.

To identify location-specific factors that affect regional industry employment growth, I need to control for the sectoral effects of trade reform. I do so by reexpressing Eq. (2) in terms of deviations from national industry weighted averages. If labor is the only factor whose price varies across states, taking deviations from national-industry changes eliminates the output price and all non-labor factor prices from the expression.[4] Eq. (2) becomes

$$\Delta \ln\left(\frac{L_{ijt}}{L_{jt}}\right) = \theta\, \Delta \ln\left(\frac{w_{ijt}}{\bar{w}_{jt}}\right) + \gamma\, \Delta \ln\left(\frac{t_{ijt}}{\bar{t}_{jt}}\right) + \sum_{l=1}^{L} \beta_l \ln\left(\frac{x^l_{ijt-1}}{\bar{x}^l_{jt-1}}\right) + \epsilon_{ijt} - \bar{\epsilon}_{jt} \tag{4}$$

where

$$y_{jt} = \sum_{i \in I} y_{ijt},\ \bar{z}_{jt} = \sum_{i \in I} \omega_{ijt} z_{ijt},\ \omega_{ijt} = L_{ijt} \Big/ \sum_{i \in I} L_{ijt}$$

I use the expression in Eq. (4) for estimation.

[4]This will also be the case if the prices of capital, energy, and materials only vary across locations in terms of transport costs to the central processing zone.

3. The data

Data are from the Mexico *Industrial Census*, which is a comprehensive survey of manufacturing establishments by state and four-digit (ISIC) industry. Mexico has 54 industries and 32 states. I have data from the four most recent censuses, 1980, 1985, 1988, and 1993. Mexico initiated its liberalization of trade in 1985. I use two sets of observations on changes in regional-industry labor demand: 1980–1985, the period preceding trade liberalization, and 1985–1993, the period following the initiation of trade reform.[5]

3.1. The liberalization of trade

Mexico's economy was largely closed to trade from the 1950s until the mid 1980s. The government initiated a conscious policy of trade protection in the late 1940s when it raised tariffs and instituted a system of import licenses (King, 1970). Successive administrations expanded trade barriers by increasing the range of goods covered by import licenses and enacting export controls.[6] Trade barriers biased firms towards production for the domestic market. Periodic overvaluation of the exchange rate was an additional incentive against exporting.

The Mexican government began to reduce trade restrictions in 1985. The reform was both swift and unanticipated. At the time of liberalization, the popular press was skeptical of the government's reformist resolve, due in part to failed reform attempts in the late 1970s and early 1980s. The government moved quickly, however, drastically lowering most trade barriers within three years. Table 1 shows annual average tariffs and import-license coverage by two-digit (ISIC) industry for the period 1984–1990. In 1985, the national average tariff was 23.5%, and import-license requirements covered 92.2% of national production. By 1987, import-license coverage had been reduced to 25.4% of national production and the average tariff had been reduced to 11.8%, with a maximum rate of 20%. The government also abolished export controls and devalued the nominal exchange rate. Although Mexico's trade reform was unilateral, the fact that it reduced import barriers and disincentives for exporting gave it the effect of opening the economy to trade.

[5]Since I have data for two different years after the implementation of trade reform, 1988 and 1993, it is possible to examine both short-run and medium-run adjustment to trade liberalization. In unreported results, I find that employment responses during the 1985–1988 period are qualitatively similar to employment responses during the 1985–1993 period. Hence, I limit the reported results to the longer time period. A difference between the results for 1985–1988 and those for 1985–1993 is that the effects of transport costs on average annual regional industry employment growth are larger in the former period. One explanation for this is that the regional adjustment to trade reform happened soon after trade barriers began to fall.

[6]In 1980, Mexico had export controls on 85.0% of non-oil exports.

Table 1
Average tariffs and import-license requirements by two-digit industry, 1984–1990

Industry (ISIC)		1984	1985	1986	1987	1988	1989	1990
Food products	*t*	42.9	45.4	32.1	22.9	14.8	15.8	16.2
	q	100.0	80.1	62.2	33.3	20.8	20.6	16.8
Textiles,	*t*	38.6	43.2	40.4	26.6	16.8	16.6	16.7
Apparel	*q*	92.9	66.8	38.0	31.1	2.8	1.1	1.0
Wood products	*t*	47.3	48.5	44.9	29.9	17.7	17.6	17.8
	q	100.0	75.6	25.7	0.0	0.0	0.0	0.0
Paper, printing	*t*	33.7	36.5	34.8	23.7	7.7	10.1	9.9
	q	96.7	54.1	11.2	9.5	3.4	4.1	0.0
Chemicals	*t*	29.1	29.9	27.0	20.5	13.4	14.3	14.4
	q	85.7	54.0	21.1	4.8	0.0	0.0	0.0
Basic metals	*t*	37.1	38.5	33.8	22.4	13.8	14.3	14.3
	q	99.0	53.1	5.2	0.0	0.0	0.0	0.0
Non-metallic	*t*	13.6	16.7	18.4	13.8	7.9	11.0	11.0
Minerals	*q*	93.3	47.4	0.0	0.0	0.0	0.0	0.0
Metal products	*t*	43.1	46.3	30.0	20.8	14.1	15.9	16.1
	q	90.7	74.8	54.7	51.4	42.7	44.1	44.1
Other industries	*t*	40.9	42.9	40.5	27.5	17.1	18.1	18.4
	q	100.0	50.0	0.0	0.0	0.0	0.0	0.0

Note: All values percentages. t = average tariff rate. q = average share of production subject to import-license requirements.
Source: Unpublished data, Mexican Ministry of Trade and Industrial Promotion.

3.2. Regional employment in Mexico

Trade reform has coincided with sectoral and spatial employment shifts in Mexico. While the sectoral effects of trade are interesting in their own right, I focus on the regional aspect of adjustment. To identify geographic patterns of employment growth, it is useful to summarize employment changes at the regional level. I group states into five regions running north to south: the Border contains states that border the United States; the North contains the next tier of northern states; the Center contains states surrounding Mexico City; Mexico City contains the two states the capital occupies; and the South contains all states south of the capital.

Table 2 shows regional shares of national employment by two-digit industry for 1980 and 1993. There are three striking features about regional employment in Mexico. The first is the overall geographic concentration of manufacturing. Under the closed economy, the central states, and Mexico City in particular, were Mexico's manufacturing belt. In 1980, the Mexico City region contained 44.4% of national manufacturing employment, and the Center contained 25.5%. Hanson (1997) finds this pattern of industry location had existed since 1960.

The second striking feature of the data is the variation in geographic concentration across industries. In 1980, employment in food products and non-

Table 2
Regional shares of national employment by two-digit industry, 1980 and 1993

Industry	Regional share of national employment, 1980					Regional share of national employment, 1993				
	Border	North	Center	Mex.	South	Border	North	Center	Mex.	South
All manufacturing	20.95	5.25	25.48	44.44	3.89	29.84	7.47	28.22	28.72	5.75
Food products	17.70	10.59	33.92	28.70	9.10	19.01	11.90	35.42	22.27	11.41
Textiles, apparel	11.29	4.98	35.12	43.92	4.69	18.64	8.00	40.03	27.25	6.09
Wood products	19.18	14.65	20.30	36.90	8.97	27.38	13.89	27.91	19.47	11.35
Paper, printing	13.89	3.61	13.47	65.14	3.91	20.08	6.70	20.14	48.26	4.83
Chemicals	14.59	1.78	26.31	55.73	1.60	20.72	1.79	28.47	45.73	3.28
Non-met. minerals	32.08	5.29	23.85	34.55	4.24	30.15	7.15	35.74	19.60	7.37
Basic metals	49.22	2.52	18.40	29.82	0.05	37.51	9.29	20.22	32.17	0.81
Metal products	26.90	2.76	18.90	50.71	0.73	49.71	5.34	17.40	26.14	1.41
Other industries	15.61	0.85	13.06	69.19	1.28	28.65	2.94	17.50	41.29	9.62

Note: All figures in percentages.
Source: Author's calculations based on data from Censo Industrial, various years.

Table 3
Average annual relative employment growth by region and two-digit industry, 1980–1993

Industry	Annual average employment growth in region relative to nation as a whole (%), 1980–1985					Annual average employment growth in region relative to nation as a whole (%), 1985–1993				
	Border	North	Center	Mex.	South	Border	North	Center	Mex.	South
All manufacturing	1.62	3.91	3.91	−4.17	−0.13	3.41	1.97	−1.16	−2.85	4.96
Food products	0.76	2.61	0.50	−2.03	−0.55	0.41	−0.16	0.23	−1.91	3.18
Textiles, apparel	2.74	3.66	3.23	−3.61	−8.03	4.56	3.64	−0.38	−3.71	8.28
Wood products	3.79	4.58	0.86	−4.89	−1.52	2.08	−3.52	3.44	−4.94	3.89
Paper, printing	3.18	6.29	6.37	−2.60	−4.86	2.63	3.82	1.05	−2.13	5.67
Chemicals	−2.32	−4.31	10.01	−6.97	11.49	5.84	2.79	−5.27	1.88	1.85
Non-met. minerals	−2.11	1.86	5.91	−4.16	4.18	0.54	2.62	1.37	−4.49	4.31
Basic metals	−3.84	15.79	5.41	−0.29	39.32	−1.00	6.45	−2.20	1.13	11.27
Metal products	4.83	7.66	1.57	−4.62	6.48	4.66	3.47	−2.01	−5.40	4.21
Other industries	7.41	22.74	−8.88	−1.52	11.07	2.96	1.28	9.21	−5.50	18.28

Source: Author's calculations based on data from Censo Industrial, various years.

metallic minerals was spread relatively evenly across regions. These industries include goods, such as tortillas and cement, that are not traded over long distances, hence their location reflects the regional distribution of urban and rural populations. Other industries are highly concentrated geographically. Over 75% of employment in textiles and apparel, paper and printing, chemicals, metal products, and other industries is concentrated in just two regions. These industries are relatively footloose, in that production is relatively intensive in the use of mobile factors. High levels of agglomeration in footloose industries are consistent with some sort of scale economies.

The third salient feature of the data is that over the 1980s there was a dramatic shift in relative employment from the center to the north. Between 1980 and 1993, the Mexico City region's share of manufacturing employment fell from 44.4% to 28.7%, while the Border region's share increased from 21.0% to 29.8%. The regional employment shift was not uniform across industries. Table 3 shows relative employment growth by region and two-digit industry for the periods 1980–1985 and 1985–1993. From 1985 to 1993, the Border had manufacturing employment growth relative to the nation as a whole of 3.4%, but relative employment growth varied widely across individual industries, ranging from 4.6% in textiles and apparel, 5.8% in chemicals, and 4.7% in metal products, to 0.4% in food products and -1.0% in basic metals. After 1985, relative manufacturing employment growth in Mexico City was negative for all industries but two.[7]

The northward shift in employment after 1985 is consistent with the transport-costs hypothesis that, in response to trade liberalization, firms shift their operations to locations with relatively good access to foreign markets. Location, however, does not tell the whole story. The geographic concentration of industry prior to trade reform may be consistent with backward–forward linkages or agglomeration economies. The heterogeneity in regional-industry responses to trade suggests that location-specific factors other than proximity to the United States play an important role in explaining how regional industries adjust to trade.

4. Empirical results

If location-specific factors such as agglomeration and access to foreign markets condition adjustment to trade reform, then the most direct way to identify these effects is to study industries in different locations and verify in which locations industry employment grows faster. I study changes in state-industry employment during 1980–1985 and 1985–1993. There are 1728 (32 states$\times$54 industries) potential observations per time period, but not all industries are present in all

[7]Surprisingly, the South has positive relative employment growth after 1985. This may be due to the expansion of oil production in the region and to the fact that one state in the south, Yucatán, is relatively close to Florida and has developed a large export processing industry. The region's share of manufacturing employment is small, totalling only 5.8% in 1993.

locations. I have 1107 observations for 1980–1985 and 1160 observations for 1985–1993.

4.1. Variable definition

Table 4 gives variable definitions and Table 5 gives variable means and standard errors for each time period. The dependent variable is average annual relative employment growth-employment growth in the state industry relative to employment growth in the national industry. Following Eq. (4), I specify relative employment growth as a function of initial conditions in the state industry relative to the national industry,

Table 4
Variable definitions

(1) Relative employment growth	$\ln(L_{ijS}) - \ln(L_{ijt}) - [\ln(L_{jS}) - \ln(L_{jt})]$
(2) Relative wage	$\ln\left(\frac{\text{REM}_{ijt}/L_{ijt}}{\text{REM}_{jt}/L_{jt}}\right)$
(3) Relative establishment size	$\ln\left(\frac{L_{ijt}/\text{EST}_{ijt}}{L_{jt}/\text{EST}_{jt}}\right)$
(4) Relative female share of labor force	$\ln\left(\frac{\text{FEL}_{ijt}/L_{ijt}}{\text{FEL}_{jt}/L_{jt}}\right)$
(5) Backward–forward linkages	$\ln\left(\frac{L_{ikt}/L_{ijt}}{L_{kt}/L_{jt}}\right)$
(6) Within-industry agglomeration	$\ln\left(\frac{L_{ijt}/L_{it}}{L_{jt}/L_{t}}\right)$
(7) Relative industrial diversity	$\ln\left(\frac{\Sigma_{l\neq j}(L_{ilt}/L_{it})^2}{\Sigma_{l\neq j}(L_{lt}/L_{t})^2}\right)$
(8) Relative transport costs	$\ln\left(\frac{T_i}{\Sigma_i \omega_{ijt} T_i}\right)$

t = initial period
S = final period
i = state
j = four-digit industry
k = two-digit industry (to which j belongs)
L = employment
REM = total remunerations
T_i = distance in kilometers from capital of state i to U.S. border
$\omega_{ijt} = L_{ijt}/L_{jt}$
FEL = female employment
EST = number of establishments

Table 5
Variable means and standard errors

Variable (all variables are logs)	1980–1985 (observations = 1107)		1985–1993 (observations = 1160)	
	Mean	Std. err.	Mean	Std. err.
Relative employment growth	0.022	0.178	0.013	0.115
Relative wage	−0.518	0.693	−0.432	0.637
Relative establishment size	−0.464	1.096	−0.423	1.071
Relative female labor force	−0.208	0.728	−0.219	0.801
Backward–forward linkages	0.229	1.086	0.190	1.033
Within-industry agglomeration	−0.364	1.244	−0.344	1.228
Relative industrial diversity	0.958	0.439	0.959	0.430
Relative distance to U.S.	−0.386	1.340	−0.346	1.352

$$\Delta \ln\left(\frac{L_{ijt}}{L_{jt}}\right) = \phi_0 + \phi_1 \ln\left(\frac{\mathrm{REM}_{ijt-1}/L_{ijt-1}}{\mathrm{REM}_{jt-1}/L_{jt-1}}\right) + \phi_2 \ln\left(\frac{T_{ij}}{\sum_i \omega_{ijt} T_{ij}}\right) + \phi_3 \ln\left(\frac{L_{ikt-1}/L_{ijt-1}}{L_{kt-1}/L_{jt-1}}\right) + \phi_4 \ln\left(\frac{L_{ijt-1}/L_{it-1}}{L_{jt-1}/L_{t-1}}\right) + \phi_5 \ln\left(\frac{\sum_{h\neq j}(L_{iht-1}/L_{it-1})^2}{\sum_{h\neq j}(L_{ht-1}/L_{t-1})^2}\right) + \phi_6 \ln\left(\frac{L_{ijt-1}/\mathrm{EST}_{ijt-1}}{L_{jt-1}/\mathrm{EST}_{jt-1}}\right) + \phi_7 \ln\left(\frac{\mathrm{FEL}_{ijt-1}/L_{ijt-1}}{\mathrm{FEL}_{jt-1}/L_{jt-1}}\right) + \epsilon_{ijt} - \bar{\epsilon}_{jt} \quad (5)$$

where i indexes the state, j indexes the four-digit industry, and k indexes the two-digit industry to which j belongs. The first term in Eq. (5) is the state-industry wage relative to the national-industry wage. I measure the wage as annual remuneration per worker. I use the relative wage in the initial period, rather than the change in the relative wage, to avoid introducing simultaneity into the regression. To the extent wages reflect market conditions, I expect relative employment growth to be decreasing in the initial relative wage.

The second term in Eq. (5) is the change in transport costs. Prior to trade liberalization, transport costs may change relatively little over time.[8] In the transition to an open economy, the change in transport costs reflects the inclusion of foreign consumers as a source of demand. A reasonable proxy for transport costs to foreign markets is distance to the United States, which I measure as road

[8]Over long periods, transport costs may change, as roads and transportation improve. It is unlikely such developments significantly alter transport costs over short time horizons.

distance from a state capital to the nearest major U.S. border crossing.[9] The distance variable in Eq. (5) is state distance to the United States relative to industry weighted-average distance to the United States. The transport-costs hypothesis is that distance to the United States will be uncorrelated with employment growth prior to trade reform (1980–1985) and negatively correlated with employment growth after trade reform (1985–1993).

The third through fifth terms in Eq. (5) are growth in external effects, which by hypothesis are a function of initial levels of industry concentration. The first source of external effects is backward–forward linkages. The idea is that firms benefit from proximity to upstream and downstream industries. I define upstream and downstream industries as those that share a given industry's two-digit classification. The two-digit classification combines industries that share direct buyer–supplier relationships. In apparel, for instance, my measure of upstream and downstream industries includes textiles, knitwear, and leather. These industries supply apparel firms with most of their inputs and are also likely to use similar production and distribution technologies. I measure backward–forward linkages as two-digit state employment relative to four-digit state employment, adjusted by two-digit national employment relative to four-digit national employment. If backward–forward linkages matter, I expect relative employment growth to be higher where the concentration of upstream and downstream industries is higher.

The second source of external effects is within-industry agglomeration, which I measure as the share of state employment in the industry relative to the share of national employment in the industry. Glaeser et al. (1992) describe this as a measure of regional specialization as it controls for situations where the regional industry is large purely because the region is large. If within-industry externalities are positive, I expect relative employment growth to be higher where within-industry agglomeration is higher.

The third source of external effects is industrial diversity. I measure diversity for a regional industry as the sum of squared state employment shares for all other industries in the state relative to the sum of squared national employment shares for all other industries in the nation. The more even is the distribution of state (national) employment across industries, the smaller is the sum of squared state (national) employment shares. The smaller is the ratio of squared state employment shares to squared national employment shares, the more diverse is the state relative to the nation as a whole. If industrial diversity generates positive externalities, relative employment growth will be higher where the relative diversity measure is lower.

The sixth and seventh terms in Eq. (5) represent other factors that may affect

[9]Using distance to measure transport costs is equivalent to assuming that land transport is the only available means of ferrying goods. During the 1980s, over 80.0% of goods transported between Mexico and the United States were shipped by truck (Castillo, 1993).

employment growth. To control for differences in technology, competition, and union activity across regions, I include the log of the average establishment size in the state-industry relative to the weighted-average establishment size in the industry as a whole, where establishment size is workers per establishment. Prior to trade reform, Mexico allowed off-shore in-bond assembly plants, known as *maquiladoras*, to operate along the Mexico–U.S. border. Maquiladoras hire a large share of women relative to other manufacturing establishments. The presence of maquiladoras along the border may have created regional differences in labor-force composition. To control for this possibility, I include the share of employment that is female in the state industry relative to share of employment that is female in the national industry.

4.2. Estimation issues

I control for the possibility there are idiosyncratic components to regional industry employment growth by allowing the error term ϵ_{ijt} in Eq. (5) to have the following structure:

$$\epsilon_{ijt} = \kappa_i + \mu_j + \nu_t + \eta_{ijt} \tag{6}$$

where κ_i is a fixed state effect, μ_j is a fixed industry effect, ν_t is a fixed year effect, and η_{ijt} is an i.i.d. random variable with mean zero and variance σ^2. Random-effects estimation, the standard alternative approach, requires I assume the elements of ϵ_{ijt} are uncorrelated across states, industries, and years. Recall that not all industries are present in all states. That a given industry has zero employment in a state reflects the combined characteristics of the state and the industry, implying there is little basis to assume that state effects and industry effects are uncorrelated. In this case, fixed-effects estimation is the more appropriate approach.

The regression equation I estimate is expressed in terms of deviations from national-industry weighted averages, which creates an error term with the following structure:

$$\epsilon_{ijt} - \bar{\epsilon}_{ijt} = \kappa_i - \sum_g \omega_{gjt}\kappa_g + \mu_j - \sum_g \omega_{gjt}\mu_j + \nu_t - \sum_g \omega_{gjt}\nu_t + \eta_{ijt} - \sum_g \omega_{gjt}\eta_{gjt} \tag{7}$$

$$= \kappa_i - \sum_g \omega_{gjt}\kappa_g + \eta_{ijt} - \sum_g \omega_{gjt}\eta_{kjt} \tag{8}$$

where ω_{ijt} is state-industry ij's share of national-industry j's employment. Taking deviations eliminates industry and year effects, but leaves state effects and a random error term, $\eta_{ijt} - \Sigma_g\ \omega_{gjt}\eta_{gjt}$, which has mean zero and nonspherical

variance $\sigma^2(1-\Sigma_g\ \omega_{gjt}{}^2)$. The second right-hand-side term in Eq. (7) varies across industries, introducing a new industry effect into the regression.

One way to eliminate all fixed effects is to take deviations from state and industry means. The problem with this is that two of my regressors, transport costs and industrial diversity, vary little across industries within a state. Instead, I estimate the model in the form of Eq. (5), and I run each regression twice, first without controlling for fixed effects and then including state and industry dummy variables. Given the sample size, using dummy variables to control for fixed effects does not substantially reduce the degrees of freedom of the regression. I use White's (White, 1980) correction to obtain heteroskedasticity-consistent standard errors.

4.3. Estimation results

4.3.1. The pre-reform period (1980–1985)

Table 6 gives estimation results on relative employment growth for 1107 observations during the period 1980–1985. The regressions reported in the (a) columns do not include state and industry dummies; those in the (b) columns do. Among the control variables, the relative wage and the relative size of the female

Table 6
Regression results on regional industry relative employment growth, 1980–1985

Variables	(1.a)	(1.b)	(2.a)	(2.b)
Relative wage	0.0066	0.0006	0.0011	−0.0040
	(0.0105)	(0.0129)	(0.0104)	(0.0124)
Relative establishment size	−0.0486**	−0.0550**	−0.0110	−0.0102
	(0.0079)	(0.0088)	(0.0096)	(0.0114)
Relative female labor force	0.0088	0.0079	0.0017	0.0025
	(0.0084)	(0.0088)	(0.0081)	(0.0086)
Backward–forward linkages			0.0395**	0.0407**
			(0.0080)	(0.0087)
Within-industry agglomeration			−0.0131	−0.0211*
			(0.0077)	(0.0102)
Relative industrial diversity			0.0220	−0.0937**
			(0.0123)	(0.0294)
Relative distance to U.S.	−0.0034	0.0124	0.0016	0.0235*
	(0.0046)	(0.0109)	(0.0045)	(0.0105)
Fixed effects	No	Yes	No	Yes
Adjusted R^2	0.080	0.225	0.140	0.275
Observations	1107	1107	1107	1107

*, indicates statistical significance at the 0.05 level.
**, indicates statistical significance at the 0.01 level.
Heteroskedasticity-consistent standard errors are in parentheses. Fixed effects estimation indicates the inclusion of dummy variables for the industry and the state.

labor force are unrelated with relative employment growth, but relative employment growth is lower where relative establishment size is higher.

The most interesting results are those for the distance variable, the backward–forward linkage variable, and the agglomeration variables. As expected for the pre-reform period, relative distance to the United States is unrelated with relative employment growth. The coefficient on the variable is statistically insignificant at the 0.05 level in three of four regressions; where it is significant, it is positive rather than negative. This suggests distance to foreign markets does not reduce regional labor demand in a regime where firms produce mostly for domestic markets.

The results show that backward–forward linkages are positively correlated with employment growth. The backward–forward linkages variable is positive and statistically significant at the 0.01 level in both regressions that it appears. The quantitative effect of these linkages appears to be moderate. From the results in column (2.b), which control for fixed effects, a one standard deviation increase in backward–forward linkages (1.086) increases average annual relative employment growth by 4.45%, or 0.4 standard deviations.

There is no evidence that agglomeration economies are associated with higher employment growth. Relative employment growth is lower where within-industry agglomeration is higher; the variable is negative in both regressions and statistically significant at the 0.05 level in one regression. There is weak evidence that industrial diversity is related with relative employment growth; the variable is negative (which is consistent with higher employment growth in locations with more industrial diversity) and statistically significant at the 0.05 level in one regression, but it is positive and statistically insignificant in another regression.

The results for relative employment growth during the pre-trade reform period of 1980–1985 suggest that Mexico was undergoing a spatial reallocation of employment even before the economy opened to trade. Employment growth was relatively low in densely concentrated regions, as evidenced by the negative coefficients on the agglomeration economy variable, and relatively high in regions that contained clusters of vertically-linked firms, as evidenced by the positive coefficient on the backward–forward linkages variable. One explanation for these findings is that firms anticipated trade reform and began to relocate their activities prior to its actual initiation. This is inconsistent, however, with the fact that regional industries close to the United States did not grow more rapidly than other regions. An alternative explanation is that Mexico's manufacturing belt was beginning to sag under its own weight. Mexico City grew to enormous size between 1950 and 1980; in the latter period it accounted for over 44% of national manufacturing employment. Congestion costs and union militancy may have encouraged firms to move their activities out of the capital. This is consistent with the fact that relative establishment size is negatively related with growth, as large established firms are more likely to have a union presence than are small firms.

The results on backward–forward linkages suggest that while Mexico's manufacturing heartland was shrinking, broadly specialized regional industrial complexes were developing elsewhere in the country.

4.3.2. The post-reform period (1985–1993)

Table 7 gives estimation results for 1160 observations during the period 1985–1993. The most striking change from the results for 1980–1985 is that relative employment growth is lower in regional industries that are relatively distant from the United States; the distance variable is negative and statistically significant at the 0.05 level in all regressions. This is consistent with the hypothesis that with the opening of the Mexican economy firms have begun to shift their activities towards the Mexico–U.S. border region. The quantitative effect of distance is not large, however. From column (2.b), in which controls for fixed effects are included, a one standard deviation increase in relative distance (1.352) reduces average annual relative employment growth by 1.5%, which is 0.13 standard deviations.

The results on backward–forward linkages are consistent with those from the

Table 7
Regression results on regional industry relative employment growth, 1985–1993

Variables	(1.a)	(1.b)	(2.a)	(2.b)
Relative wage	−0.0051	−0.0043	−0.0067	−0.0067
	(0.0069)	(0.0100)	(0.0073)	(0.0101)
Relative establishment size	−0.0369**	−0.0405**	−0.0278**	−0.0278**
	(0.0045)	(0.0057)	(0.0056)	(0.0078)
Relative female labor force	0.0287**	0.0261**	0.0256**	0.0237**
	(0.0057)	(0.0062)	(0.0058)	(0.0061)
Backward–forward linkages			0.0192**	0.0220**
			(0.0050)	(0.0053)
Within-industry agglomeration			0.0030	0.0018
			(0.0047)	(0.0064)
Relative industrial diversity			0.0086	−0.0073
			(0.0075)	(0.0323)
Relative distance to U.S.	−0.0149**	−0.0125*	−0.0143**	−0.0110*
	(0.0025)	(0.0055)	(0.0025)	(0.0056)
Fixed effects	No	Yes	No	Yes
Adjusted R^2	0.179	0.313	0.197	0.331
Observations	1160	1160	1160	1160

*, indicates statistical significance at the 0.05 level.
**, indicates statistical significance at the 0.01 level.
Heteroskedasticity-consistent standard errors are in parentheses. Fixed effects estimation indicates the inclusion of dummy variables for the industry and the state.

pre-reform period. The presence of vertically-related industries is positively correlated with employment growth. This suggests that employment growth in Mexico is resulting in the creation of broadly specialized regional industrial centers; the results on the distance variable suggest that the most successful industrial centers are those located in northern Mexico, relatively close to the U.S. market. The regression results again fail to show evidence that agglomeration enhances growth. The coefficient on within-industry agglomeration is positive but statistically insignificant in both regressions that it appears; the coefficient on relative industrial diversity is positive in one regression, negative in another, and statistically insignificant in both cases.

Another change from the previous results is that relative employment growth is higher where the relative size of the female labor force is higher; the variable is positive and statistically significant at the 0.01 level in all regressions. This is consistent with the idea that since trade reform Mexican firms are converting to assembly-type activities, which are relatively intensive in the use of female labor. As before, the initial relative wage is unrelated with growth. The results on relative establishment size are more consistent than in the previous sample; the coefficient is negative and statistically significant at the 0.01 level in all regressions.

Comparing Tables 6 and 7, it appears that after the initiation of trade liberalization there was a structural break in the pattern of regional labor demand, which is consistent with the theories presented in section two. To test this hypothesis, I combine observations from the two time periods and re-estimate the regression. If trade liberalization has caused a structural break, the regression coefficients will differ for the two time periods. Table 8 shows results for pooled regressions. In all regressions, I reject the hypothesis that regression coefficients are the same in both periods at the 0.01 level. The results on individual coefficients summarize the findings described in the preceding tables: in the post-reform period (1985–1993), the negative effect of distance to the U.S. and the positive effect of the female share of the labor force are larger in absolute value. It also appears the effect of backward–forward linkages on employment growth was smaller after trade reform (though the previous results show the effect is positive and statistically significant in both time periods).

4.3.3. Sensitivity analysis

To check the robustness of my findings, I re-estimate the regression equation, imposing a number of restrictions on the sample. One possibility is that the results are being driven by the decomposition of the Mexico City manufacturing belt, and that in outlying regions the agglomeration and distance effects evident in Tables 6–8 do not exist. To verify this is not the case, I drop regional industries in the Mexico City region from the sample. The first two columns of Table 9 show the results. Coefficient magnitudes and patterns of significance are virtually identical to those in the corresponding columns of Table 8.

Table 8
Regression results on pooled sample

Variable	(1.a)	(1.b)
Relative wage	0.0012	−0.0003
	(0.0104)	(0.0109)
Relative establishment size	−0.0112	−0.0127
	(0.0095)	(0.0102)
Relative female labor force	0.0017	0.0007
	(0.0081)	(0.0081)
Backward–forward linkages	0.0394**	0.0428**
	(0.0080)	(0.0081)
Within-industry agglomeration	−0.0131	−0.0150
	(0.0077)	(0.0085)
Relative industrial diversity	0.0201*	−0.0063
	(0.0094)	(0.0151)
Relative distance to U.S.	0.0017	−0.0293
	(0.0044)	(0.0731)
Relative wage*year85	−0.0082	−0.0025
	(0.0128)	(0.0132)
Relative establishment	−0.0165	−0.0193
size*year85	(0.0110)	(0.0111)
Relative female	0.0239*	0.0253*
labor force*year85	(0.0100)	(0.0096)
Backward–forward	−0.0202*	−0.0203*
linkages*year85	(0.0095)	(0.0091)
Within-industry	0.0161	0.0132
agglomeration*year85	(0.0090)	(0.0088)
Relative industrial	−0.0097	−0.0253
diversity*year85	(0.0081)	(0.0157)
Relative distance to	−0.0162**	−0.0144**
U.S.*year85	(0.0050)	(0.0052)
F-statistic on		
year85 coefficients	4.85**	4.94**
Fixed effects	No	Yes
Adjusted R^2	0.158	0.221
Observations	2267	2267

*, indicates significance at the 0.05 level.
**, indicates significance at the 0.01 level.
Heteroskedasticity-consistent standard errors in parentheses. Year85 is a dummy variable that takes a value of one if the year is 1985.

A second possibility is that the results are being driven by regional variation in adjustment to Mexico's stabilization policies in the late 1980s. Mexico experienced a severe recession over the period 1986–1987. Due to the presence of the maquiladora industry, states along the Mexico–U.S. border were oriented towards export production before trade liberalization. Producers in interior states

Table 9
Regression results using restricted samples

Variable	(1.a)	(1.b)	(2.a)	(2.b)	(3.a)	(3.b)
Relative wage	0.0021	−0.0034	−0.0064	−0.0031	−0.0112	−0.0203
	(0.0107)	(0.0111)	(0.0112)	(0.0115)	(0.0181)	(0.0190)
Relative establishment	−0.0098	−0.0114	−0.0062	−0.0084	−0.0065	−0.0144
size	(0.0101)	(0.0108)	(0.0105)	(0.0112)	(0.0145)	(0.0153)
Relative female	0.0021	0.0010	−0.0042	−0.0070	0.0013	0.0005
labor force	(0.0083)	(0.0083)	(0.0092)	(0.0091)	(0.0108)	(0.0107)
Backward–forward	0.0403**	0.0446**	0.0310**	0.0361**	0.0388**	0.0374**
linkages	(0.0081)	(0.0084)	(0.0081)	(0.0084)	(0.0111)	(0.0109)
Within-industry	−0.0140	−0.0144	−0.0135	−0.0188*	−0.0192	−0.0205
agglomeration	(0.0079)	(0.0091)	(0.0079)	(0.0088)	(0.0119)	(0.0125)
Relative industrial	0.0129	−0.0021	0.0146	−0.0121	0.0049	−0.0107
diversity	(0.0103)	(0.0159)	(0.0104)	(0.0159)	(0.0157)	(0.0238)
Relative distance	0.0030	−0.0431	0.0068	0.0623	−0.0033	0.0650
to U.S.	(0.0046)	(0.0781)	(0.0176)	(0.0804)	(0.0066)	(0.0841)
Relative wage*year85	−0.0070	−0.0009	−0.0013	0.0027	0.0017	0.0146
	(0.0131)	(0.0137)	(0.0136)	(0.0138)	(0.0210)	(0.0212)
Relative establish	−0.0180	−0.0188	−0.0196	−0.0223	−0.0237	−0.0320*
size*year85	(0.0117)	(0.0118)	(0.0123)	(0.0122)	(0.0162)	(0.0160)
Relative female	0.0234*	0.0251*	0.0343**	0.0348**	0.0198	0.0202
labor force*year85	(0.0102)	(0.0100)	(0.0111)	(0.0108)	(0.0126)	(0.0125)
Backward–forward	−0.0213*	−0.0211*	−0.0123	−0.0118	−0.0234	−0.0237
linkages*year85	(0.0096)	(0.0093)	(0.0098)	(0.0095)	(0.0128)	(0.0123)
Within-industry	0.0165	0.0115	0.0191*	0.0176	0.0232	0.0224
agglomeration*year85	(0.0093)	(0.0091)	(0.0094)	(0.0091)	(0.0136)	(0.0132)
Relative industrial	−0.0100	−0.0340	0.0001	−0.0084	−0.0035	−0.0189
diversity*year85	(0.0084)	(0.0188)	(0.0093)	(0.0159)	(0.0136)	(0.0249)
Relative distance	−0.0162**	−0.0136*	−0.0227	−0.0269	−0.0167*	−0.0148*
to U.S.*year85	(0.0051)	(0.0055)	(0.0204)	(0.0199)	(0.0073)	(0.0077)
F-statistic on						
year85 coefficients	4.81**	5.14**	3.34**	3.37**	3.64**	3.78**
Fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.154	0.218	0.135	0.227	0.161	0.240
Observations	2070	2070	1748	1748	1347	1347

*, indicates significance at the 0.05 level.
**, indicates significance at the 0.01 level.
Notes: Heteroskedasticity-consistent standard errors in parentheses.
Columns (1.a) and (1.b) exclude the Mexico City region; columns (2.a) and (2.b) exclude the Border region; columns (3.a) and (3.b) exclude the food product, wood product, non-metallic minerals, and primary metal industries.

may have suffered a large fall in demand for their goods relative to border producers during the period 1985–1993 due to the fact that they were primarily oriented towards production for the domestic market. What appears to be a northern shift in regional labor demand after trade reform may only have been the

uneven effects of Mexico's stabilization policies. To verify that the presence of the maquiladora industry is not responsible for the results, I drop industries in the Border region from the sample. The second two columns of Table 9 show the results. Again, the results are very similar to those in the corresponding columns of Table 8. Two minor differences in the results are that the effect of distance from the United States is less precisely estimated and there is no longer a statistically significant reduction in the effect of backward–forward linkages after trade reform (again, the effect of backward–forward linkages is positive and statistically significant in both time periods).

So far, I have pooled all industries together, which imposes the assumption that transport costs, backward–forward linkages, and agglomeration economies matter equally for all industries. This approach is somewhat restrictive. Some industries produce goods that are not widely traded across regions or that are intensive in the use of relatively immobile inputs. The industries I exclude are food products, paper and printing, non-metallic minerals, and basic metals. The remaining industries – textiles and apparel, wood products, chemicals, metal products, and other industries – are relatively intensive in the use of mobile resources. The last two columns of Table 9 show the results. Again, the results are quite similar to those in Table 8.

4.4. Discussion

The empirical results describe the general features of the post-trade reform pattern of industry location that is emerging in Mexico. Since reform, there has been a northward shift in the location of manufacturing activities. Mexico's closed-economy manufacturing belt in Mexico City is diminishing in importance, as firms relocate their activities to regions in northern Mexico where they have better access to foreign markets. The implementation of the North American Free Trade Agreement, by eliminating tariffs and non-tariff barriers on trade in the region, will further improve Mexico's access to the U.S. market, which should only reinforce the motivation of firms to be located near the United States.[10]

Accompanying industry relocation is a change in the composition of Mexico's industry centers. Broadly specialized regional industrial centers in northern Mexico are replacing the dense concentrations of industries around Mexico City

[10]Not all aspects of North American economic integration favor northern Mexico. The liberalization of foreign investment restrictions in Mexico, which began in the 1980s and was accelerated by NAFTA, will presumably increase U.S. direct investment in Mexico. If foreign investment flows into non-traded activities, such as banking, retail trade, and consumer services, economic activity in existing population centers, such as Mexico City, may expand.

that dominated the Mexican economic landscape under import-substitution industrialization. The shift involves both a spatial decentralization of employment, as industry moves from Mexico City to a number of locations in northern Mexico, and a lessening of regional specialization, as manufacturing activities expand in the new industrial sites. One puzzle in the data is that it appears that the breakup of the Mexico City manufacturing belt was underway before 1985, and hence cannot be entirely attributed to trade liberalization. Changes in tax policy and environmental regulations that favor outlying regions, expanded union-organizing activities, and the overall increase in congestion costs are all candidate explanations for the decline of Mexico City as an industry center.

5. Concluding remarks

This paper studies the regional effects of trade liberalization. I focus on the roles of transport costs, which encourage firms to relocate to regions with relatively good access to foreign markets; backward–forward linkages, which encourage firms to locate near buyers and suppliers; and agglomeration economies, which encourage the growth of pre-existing industry centers. The particular case I consider is regional industry employment growth in Mexico before and after trade reform. Consistent with the transport-costs hypothesis, employment growth after trade reform is higher in regions that are relatively close to the United States. Consistent with the backward–forward linkage hypothesis, employment growth is higher in regional industries that are located near their upstream and downstream industries. I find no evidence that agglomeration economies are positively correlated with employment growth. Together, the results describe the decomposition of the Mexico City manufacturing belt and the creation of smaller, broadly specialized industry centers in northern Mexico.

In the last fifteen years, there have been dozens of episodes of trade liberalization in the developing world and the formerly communist countries. The regional effects of reform have received scant attention. My results suggest that regions differ greatly in the manner in which they adjust to trade. Industry relocation creates additional adjustment costs that policy makers often ignore in planning how to open an economy to foreign competition. More generally, my results support the idea that with economic integration national identities are descendent and regional identities are ascendent. As NAFTA further integrates Mexico into the North American economy, it seems natural to expect that the ties between northern Mexico and the southwestern United States will strengthen and that those between northern and southern Mexico will weaken. In such a world, it increasingly makes sense to take regions, rather than nations, the unit of analysis in international trade.

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