Immigration, Firm Relocation and Welfare of Domestic Workers.

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ABSTRACT

In this paper I argue that there is a general equilibrium link between immigration and relocation of production from the US regions. I show that this link crucially hinges on the specificity of immigrant labor. At one extreme, if immigrant employment is distributed across the industries similarly to the domestic workers, marginal productivity rises everywhere and there is no reason to relocate. If however immigrant employment concentrates in say agriculture, domestically mobile factors will leave other industries to take advantage of the increased productivity in agriculture. The disadvantaged industries that can relocate production will do so. The empirical exercise documents a positive relation between immigration and firm outflows across US states and presents evidence that this relation is likely to be driven by the specificity of immigrant labor. First, I find that states with the most specific immigrant labor experience the highest firm outflow rates. This relation is equally for either domestic or international relocation of production, but it does not hold for other reasons for firm's closures. Second, I find that industries where immigrants tend to work experience statistically significantly lower firm relocation rates.

JEL: F16, F22, F23, J61

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1. Introduction

Recent globalization efforts frequently encounter a lack of support because globalization does not affect everyone in the same way. Processes that might be good on average for everyone in the long run might at the same time disadvantage some in the short run. In this regard, no two facets of globalization receive more attention than immigration and relocation of production from the US, primarily because of their suspected effect on the domestic workers. Since both immigration and production relocation can be thought of as international movements of factors there is a possible general equilibrium link between the two. This paper studies this link. I present evidence alongside theory to answer two related questions: (1) what is the relation between immigration and outflow of firms, and (2) what does it imply about the link between the domestic and immigrant labor. The second question is important for understanding the effect of immigration on the welfare of domestic workers. Theoretically the link between immigration and-firm relocation out of a region crucially depends on the sector specificity of immigrant labor. It matters whether immigrant's cross-sectoral employment pattern is different from that one of American workers. At one extreme, if immigrants distribute across the industries similarly to the domestic workers, marginal productivity rises everywhere and there is no reason to relocate. If however immigrant employment concentrates in say agriculture, domestically mobile factors will leave other industries to take advantage of the increased productivity in agriculture. And those industries that can relocate out of the region will do so. The empirical exercise documents a positive relation between immigration and firm outflows across US states and presents evidence that this relation is likely to be driven by the specificity of immigrant labor. First, I find that states with the most specific immigrant labor experience the highest firm outflow rates. This relation holds for either domestic or international relocation of production, but it does not hold for other reasons for firm's closures. This evidence is especially convincing because theoretically there is no theoretical difference between relocation to another state or another country. Second, I find that industries where immigrants tend to work experience statistically significantly lower firm relocation rates.

A specific factors model is a natural way to approach the link between immigration and production relocation because factor specificity is a prominent observed feature of both. First, it has been noted that immigration labor is less mobile across industries that the domestic labor. Borjas (1994) points to the difference in skills and suggests that "at the time of arrival, immigrants earn less than natives because they lack the U.S.-specific skills that are rewarded in the American labor market (such as English proficiency)." Specificity of immigrant labor crucially affects the relation between inflows of immigrants and labor market outcomes. Jones (2004), among others, shows how the effects of immigrant inflows on domestic labor depend on industry specificity of immigrant labor. Second, the very fact of relocation of production can be thought of a transfer of some firm specific factor (like capital or know how) to a new location where it is combined with local inputs. Notably Caves (1996) argues that capital specificity is a crucial feature of foreign direct investments, which is one of the vehicles for production relocation.

Previous literature on welfare effects of immigration found mixed evidence of the connection between immigrant inflows and wages: see Borjas (1994) for a comprehensive review of this vast literature. The lack of a strong link to the wages does not mean, however, that immigration has no effects on the economy. Several papers investigated the economy's adjustment to the inflow of immigrants by focusing on the production patterns rather than wages. Hanson and Slaughter (1999) present evidence that regions adjust to the inflows of immigrants by changing industrial structure consistently with the Rybczynski hypothesis. Relevant to this literature, this paper points to one particular way immigration can change regional production mix. Bowen and Wu's (2004) study of immigration and trade focuses on the uneven distribution of immigrant labor across industries. They show that the effect of immigration crucially depends on where the immigrants work. The theoretical framework for this paper is similar to Bowen and Wu (2004) in that the difference between immigrant and local employment patterns is driven by the degree of specificity of immigrant labor.

This paper relates to several strands of literature. Relocation of production from a region can be viewed as an outflow of foreign direct investmentsin the sense that the firm decides to change location of production activities. In this sense the results presented here can be useful in discussion of the determinants of FDI flows, see Markusen (1998) for a detailed discussion of theory and evidence. Recent literature on FDI has seen amazing developments in modeling techniques and has produced a myriad of testable hypothesis that help understand behavior of multinationals. Two assumptions are at the basis of most models of FDI: firm level economies of scale and specificity of capital. Conveniently leaving aside the assumption of firm level economies, this paper employs a more traditional model of international factor mobility based only on sector specificity of some internationally mobile factor. A model of this kind has been put forth by Batra and Ramachandran (1980)[1], while Caves (1996) has argued for the central role of specificity of some inputs in explaining international investments. Evidence in favor of our theoretical model lends support to the use of these models for modeling immigration and relocation flows when we are interested primarily in aggregate factor flows. In addition to the literatures on immigration and FDI,

[1] A correction to this paper was published by Wahhab Khandker (1981)

this paper tangentially contributes to the literature on firm relocation. Pellenbarg et. al (2002) offer a detailed review of the literature on firm relocation. Our interest in firm relocation is not a direct match to this literature because most research on firm relocation uses disaggregated data sets and concentrates on firm's decision rather than general equilibrium effects on the number of firms in a region. Despite the title this paper is only tangentially related to the research on firm relocation which concentrates on the firm's decision to change location. Pallenbarg et. al (2002) present a detailed review of the literature. The relocation of the firms is viewed as an international movement of the industry specific factor and is considered only in the form of aggregate counts.

The next section develops a two country two sector specific-factors model with an internationally mobile factor and with varying specificity of immigrant labor. The empirical part of the paper documents the evidence.

2. Specific factors model with internationally mobile factor.

The theoretical model most closely resembles the model developed by Batra and Ramachandran (1980). Their model also has two industries and three factors in each industry. The industry that has both an internationally mobile and non-specific factor is located in home and foreign countries. The factor that is specific to this industry and internationally immobile "is measured not in terms of a physical unit but in terms of some intangible abstract unit whose transference … into the host country does not diminish its use in the source country." This allows the authors to concentrate on international capital flow. The model of this paper is different from the above mentioned paper in several respects.

First and foremost, the returns to the factor that is designated to the residual profit in the previous model play the central role in the welfare results of this model. Second, the model here offers a way to incorporate varying degrees of sector specificity of the immigrant labor inflow into a specific factor model. There is also a purely nominal difference in the way we assign countries and industries.

Before we go on to describing the model, a word on terminology is in order. The literature has used the word "mobile" to refer to both intersectoral and international mobility. In this paper we will use the words "specific" and "non-specific" to refer to sector specificity (not location specificity). At the same time words "mobile" and "immobile" will be used to refer to international mobility (not intersectoral mobility).

Assumptions of the model

A1: Small country assumption. Both countries are "small" in the sense that the world prices of the goods are not affected by the movements of factors.

This is a common way of abstracting from any terms of trade effects and concentrating on the interdependence between factor movements.

A2: Some factors are specific to an industry.

Assuming some factors are specific to a certain industry may be interpreted as a short run situation as suggested by Neary (1978). In light of this interpretation of factor specificity, assumption A2 means both the non-specific and the mobile factor can adjust *faster* than the specific immobile factor. This interpretation of the specificity assumption casts the paper in terms of short term adjustments rather than long run dynamics.

A3: Some factors are immobile across countries.

This assumption is at the heart of the HOV framework and it lies behind the interpretation of trade in goods as trade in embodied factors.

A4: Each domestic industry employs three factors:

a. Internationally immobile and specific factor, call it low-skilled labor, *L*.

b. Internationally immobile and sector non-specific factor, call it high-skilled labor, *H*.

c. Internationally mobile and sector specific factor, call it entrepreneurial capital, *E*.

A5: The size of the firm is proportionate to the amount of the entrepreneurial capital.

This assumption allows us to interpret the result of the analysis in terms of the number of firms, which matches the data set. The literature on the footloose entrepreneur and footloose capital models makes a similar assumption by choosing the units of the "entrepreneurial" factor so that one unit is required to run one firm, for an excellent layout of these models see Ottaviano, Rikslid, Thisse (2002).

A6: There are two countries, Home and Foreign. Furthermore, foreign country does not have a non-specific factor, H.

In addition to theoretical convenience this assumption will come useful when we make a link between the theory and empirics. It allows us to ignore general equilibrium effects in the foreign country, so that we can think of the foreign country as the next best destination (source) for the domestic (foreign) entreprenerial factor.

A7: The production is constant returns to scale with twice differentiable production functions and subject to decreasing marginal returns.

We shall denote the two industries by X and Y. The variables for these two industries are denoted by the corresponding subscripts. The variables for the foreign country are denoted with an asterisk. Production of goods X and Y by two countries is given by:

$$X\left(E_X, H_X, L_X\right)$$
$$Y\left(E_Y, H_Y, L_Y\right)$$
$$X^*\left(E_X^*, L_X^*\right)$$
$$Y^*\left(E_Y^*, L_Y^*\right)$$

Formally assumption A7 implies:

$$S_F > 0$$
$$S_{FF} < 0$$
$$S_{FG} > 0$$
$$S_{FF}S_{GG} - S_{FG}^2 < 0$$

where $F \neq G \quad F = E, H, L \quad G = E, H, L \quad S = X, Y$

Denoting the world endowments of each factor with an upper bar, factor clearing implies the total consumption of the industry specific and internationally mobile factor E is given by

$$\overline{E}_X = E_X + E_X^*$$
$$\overline{E}_Y = E_Y + E_Y^*$$

Factor clearing in the domestic market for the non-specific internationally immobile factor H implies that

$$\overline{H} = H_X + H_Y$$

Industry specific and internationally immobile factor L is completely used in the corresponding country and industry

$$\overline{L}_X = L_X$$
$$\overline{L}_Y = L_Y$$
$$\overline{L}_X^* = L_X^*$$
$$\overline{L}_Y^* = L_Y^*$$

Profit maximization implies the value of marginal product of each factor will be equal to the factor prices.

$$p_X X_E = w_{E_X}$$
$$p_X X_E^* = w_{E_X}^*$$
$$p_Y Y_E = w_{E_Y}$$
$$p_Y Y_E^* = w_{E_Y}^*$$
$$p_X X_H = w_{H_X}$$
$$p_Y Y_H = w_{H_Y}$$

Non-specificity of H implies equality of returns across industries within home country

$$w_{H_Y} = w_{H_X} = w_H$$

International mobility of E implies it will relocate until the returns to the factor are equal in two countries

$$w_{E_X} = w_{E_X}^* = w_X$$
$$w_{E_Y} = w_{E_Y}^* = w_Y$$

Using conditions about the equalization of marginal products of the mobile and non-specific factor together with the wage equations and the factor clearing conditions the equilibrium can be described by the following three equations in three unknowns.

$$X_E\left(E_X, H_X, \bar{L}_X\right) = X_E^*\left(\bar{E}_X - E_X, \bar{L}_X^*\right)$$
$$Y_E\left(E_Y, \bar{H} - H_X, \bar{L}_Y\right) = Y_E^*\left(\bar{E}_Y - E_Y, \bar{L}_Y^*\right)$$
$$pX_H\left(E_X, H_X, \bar{L}_X\right) = Y_H\left(E_Y, \bar{L}_Y\right)$$

The endogenous variables are E_X, H_X, E_Y. Since in what follows we will concentrate our attention on one country the parameters of interest are only those related to the home country, that is $\bar{L}_X, \bar{L}_Y, \bar{H}$. Totally differentiating with respect to the endogenous variables and three parameters of interest we get.

$$\begin{bmatrix} X_{EE} + X_{EE}^* & 0 & X_{EH} \\ 0 & Y_{EE} + Y_{EE}^* & -Y_{EH} \\ pX_{HE} & -Y_{HE} & pX_{HH} + Y_{HH} \end{bmatrix} \begin{bmatrix} dE_X \\ dE_Y \\ dH_X \end{bmatrix} = \begin{bmatrix} -X_{EL} d\bar{L}_X \\ -Y_{EH} d\bar{H} - Y_{EL} d\bar{L}_Y \\ Y_{HH} d\bar{H} + Y_{HL} d\bar{L}_Y - pX_{HL} d\bar{L}_X \end{bmatrix}$$

Proposition 1. Under the assumptions A1-A7 the following three relations hold:

(1) $\frac{dE_S}{d\bar{L}_S} > 0, S = X, Y$

(2) $\frac{dE_S}{d\bar{L}_{-S}} < 0, S = X, Y$

(3) $\frac{dE_S}{d\bar{H}} > 0, S = X, Y$

Proof. This result is not new and is easily seen from the solution of the system of equations and signing terms using features of the production function.

Even though Proposition 1 might come as intuitive to someone familiar with the specific factors model, it is presented here because these comparative statics results are crucial to understanding the mechanism of the relation between immigrant inflows and firm relocation. There are three parts to this result. First, it says that the internationally mobile sector-specific factor will gravitate to the country with a shock to the specific immobile factor in the same sector. It is a rather intuitive result driven by the assumption on the production function. Second, the industry that did not receive a shock to its specific and immobile factor will become less attractive to the internationally mobile factor causing the latter to relocate to foreign country. This result is driven by our assumptions on the production function and the existence of the non-specific factor. The non-specific factor will shift into the sector with increased endowment and away from the other industry reducing the value of marginal product of the internationally mobile factor in that industry. Thus, the mobile factor will respond by relocating to foreign country. Third, the increase in the home country's endowment of the non-specific factor will attract the internationally mobile factor in both sectors. This is once again driven by the assumptions on the production function.

Figure 1 illustrates these relations in a framework familiar to the readers of Wong (1995). Consider an inflow of specific immobile labor to sector X. By increasing the value of marginal product of E and H domestic industry X will attract both E from the foreign country and H from sector Y. This change is reflected by dashed lines A and B. Pulling H from domestic sector Y will reduce marginal product of E in sector Y. Therefore E will flow from domestic sector Y to foreign sector Y. The combination of these two is reflected dashed lines C and D.

At this point we can claim that if the immigrant labor consists entirely of non-specific and immobile factor it will cause relocation to the foreign countries of the industry which does not employ the immigrant labor. However, immigrant inflows are likely to have more general composition. Therefore, we need to look for a stronger statement about the relation between relocation and immigration for a more general composition of immigrant labor force. In order to do this, assume the inflow of immigrant labor, *I*, consists of the non-specific factor and factors specific to each industry. Then, a change in immigrant inflow consists of the sum of changes of its additive components.

Definition D1: $dI = d\overline{L}_X + d\overline{L}_Y + d\overline{H}$

Denoting shares of each factor in the total inflows with α the equation above can be rewritten as

$$d\overline{L}_X = \alpha_X dI$$
$$d\overline{L}_Y = \alpha_Y dI$$
$$d\overline{H} = \alpha_H dI$$

Furthermore, in what follows we restrict our attention to the case of immigrant inflow and thus we also assume

$$d\overline{L}_X > 0, d\overline{L}_Y > 0, d\overline{H} > 0$$

Now we can state the result about the relation between relocation and inflows of immigrant labor.

Proposition 2. Under assumptions A1-A7 and using definition D1, $\exists \alpha_S \in (0,1)$ such that

$$\frac{dE_{-S}}{dI_S} < 0 \text{ for } S = X, Y$$

<u>Proof.</u> The proof is based on the result 1 and the intermediate value theorem.

This corollary result says there exists a value of share of a specific immobile factor in the immigrant flow such that the immigrant labor is "specific enough" to cause relocation. It also implies the more specific is the inflow of immigrant labor the stronger is the effect of immigration on firm relocation. This implication will be later compared to the patterns that emerge in the data and the resulting relation will seem consistent with the theoretical insight.

Distributive Welfare implications of immigration

Now we explore effects of the immigrant labor on the domestic workers. The effects of the inflow of factors on the returns to factors are given by

$$\begin{aligned}
dw_{\bar{L}_X} &= p_X \left[X_{LH} d\bar{H} - X_{LH} dH_Y + X_{LL} d\bar{L}_X \right] \\
dw_{\bar{L}_Y} &= p_Y \left[Y_{LE} dE_Y + Y_{LH} dH_Y + Y_{LL} d\bar{L}_Y \right] \\
dw_{\bar{H}} &= p_Y \left[Y_{HE} dE_Y + X_{HH} dH_X + X_{HL} d\bar{L}_X \right]
\end{aligned}$$

Proposition 3. In the economy described by the assumptions 1-7 and 8,

$$\frac{dE_S}{dI} < 0 \Rightarrow \frac{dw_{L_S}}{dI} < 0, S = X, Y$$

<u>Proof</u>. Consider the opposite is true. Immigrant inflows increase the stock of specific factor by assumption. If the stock of the non-specific domestic factor increases as well then the

marginal product of the internationally mobile factor increases and it would have relocated into the region not out of it, hence the contradiction.

Proposition 3 states that if immigrant inflows into a region lead to relocation of some industries from that region then this is an indicator that the low skilled workers in those industries are adversely affected by the immigration inflow. It hinges on two features of the model: (1) existence of a domestic factor that is not industry specific, assumption A4b; (2) varying degree of specificity of immigrant labor, definition D1. Proposition 3 justifies our interest in the relation between immigration and relocation because the relation is indicative of the distributive welfare effects on the domestic labor.

In summary, the model achieves three things. First, it suggests the link between relocation of production and immigrant labor inflows. Second, it points out the mechanism by which the inflow of immigrants can adversely affect the returns to specific domestic labor even if the immigrant labor is not specific to the same industry. Third, it produces a sufficient condition, in terms of observable variables, which indicates the immigrant labor inflow will lower the returns to industry specific internationally immobile domestic labor. This condition is described in terms of the response of relocation activities by firms to the inflows of immigrant labor.

3. Evidence

Theoretical model directs our attention to the relation between immigration and relocation as an indicator of distributional welfare effects on the domestic labor. We will proceed in three steps. After the description of the data and data related issues we will estimate the relation between immigration and relocation. Following the estimation we will explore two additional observable implications of the theoretical model.

3.1. Data description and issues[2]

The data on relocations come from two sources. The first source is the Mass Layoff Statistics (MLS) collected by the Bureau of Labor Statistics (BLS). It reports mass layoffs across the US states (layoffs of 50 workers or more) by reasons for the layoff events. Two of those reasons are "domestic relocation" and "relocation overseas." Strictly speaking there is nothing in the theoretical model that makes a difference between relocation into a neighboring state from a relocation to a foreign country. Therefore, lacking a good theoretical reason as to which one to use we will use the sum of the two as well as each of them separately. The data series on mass layoffs reports both events and number of separations. However, disclosure policies of the BLS generate a lot of missing cells in the panel making it impractical to use the number of separations. The situation is more encouraging when it comes to the relocation events. In this situation every missing cell approximately represents one event (see figure 2). This was determined from available aggregates also reported in the data set by dividing the total number of events by the number of missing cells.

The second source of relocation data comes from the NAFTA Trade Adjustment Assistance (NAFTA-TAA) program of the Employment and Training Administration of the Department of Labor. Employees, who lost their job because their firm relocated production to a Mexico or Canada, can petition for NAFTA Trade Adjustment Assistance. When a petition is filed the petitioners should point out the reason why they seek eligibility for

[2] A detailed description of the sources is presented in the Data Appendix.

assistance. Every petition is investigated and either certified or denied. These data report all certified petitions due to relocation of production abroad by SIC industrial categories and locations of the production facility from 1996 onward. The relation between the NAFTA-TAA and BLS-MLS statistics is described in figure 5. We would expect all of the NAFTA-TAA statistics lies above the 45 degree line because the threshold on the size of the layoff is lower in the former. Partly it can occur because some observations are assigned to a year with an error and partly because NAFTA-TAA data are self reported. Even though the incentive is to report the layoffs there is bound to be more noise in this measure than in the government mandated statistics. Summary statistics of relocation rates for both measures are presented in table 1. In this table the number of relocations is divided by the total employment of that state (in thousands). The relocation rates are only informative as relative measures. In order to transfer them into probabilities of experiencing a layoff event due to relocation of production we need the number of workers per firm. The count nature of the available data on relocations pre-determines the use of count data models to explore the relation between immigration and relocation.

The panel data on immigration comes from the Yearbook of Immigration Statistics. The Yearbook reports number of legal immigrants by intended state of residence at the time of arrival. By using this data we effectively assume the immigrants will work at the intended location and the number of illegal immigrants is not significant. Time series of total immigration inflows is shown in figure 4. The number of immigrants does not exhibit a clear trend. Cross-state distribution of immigration flows (in logs) is presented in figure 3. This distribution remains relatively constant over time. The Yearbook does not have the data on the employment of immigrants across industries in all different states. Where ever this data is necessary we will turn to the Public Use Micro-Samples (PUMS) from 2000 Census (1% micro-samples). We also use chain weighted Gross State Product data to control for business cycle variation in the panel.

3.2. Relation between immigration and relocation.

The data exhibit evidence of over-dispersion and excess zeroes. Presence of over-dispersion is crucial for determining appropriate model because a regular Poisson model forces the mean and the variance to be equal. Therefore, tests for over-dispersion are in order. Upon initial evidence of over-dispersion we have decided to use a negative binomial specification, which was tested against a Poisson model with identical regressors using a likelihood ratio test. Over-dispersion and excess zeroes can be generated by unobserved heterogeneity. In order to accommodate heterogeneity in addition to more flexible negative binomial specification, the panel data set allows us to estimate a fixed effect specification to take out unobserved heterogeneity due to state specific individual effects.

The large proportion of zeroes can be driven either by the unobserved heterogeneity or the fact that zeroes are generated by a different process. In the first case, fixed-effects estimation and/or negative binomial specification should help account for the excess zeroes. In the second case, accounting for zeroes will require a correct specification of the process that generates zeroes. Two models that can account for this type of mixed data generating process are the zero-inflated Poisson and zero-inflated negative binomial models. It should be kept in mind these models are only as good as the model of the process that generates excess zeroes. Lacking a good theory and data to model excess zeroes we will have to rely on the negative binomial fixed effects specification to account for the unobserved heterogeneity, which might have also contributed to the excess zoeroes[3]. This caveat has to be kept in mind when interpreting the results of the regressions. One of the things did to remedy this problem was to omit observations for the states that have never had a single relocation event in the data set. The list of these states is given in table 5. The results did not change either qualitatively or quantitatively. In addition, many specifications with flexible dispersion parameters were rejected by the data in favor of the fixed-effects Poisson models indicating the over-dispersion in the data might have been successfully corrected by the fixed-effects estimation.

The negative binomial specification can be derived from Poisson by assuming that the arrival rate of a conditional Poisson process is determined by a set of regressors with a gamma-distributed specification error.

$$\Pr\left(Y_{it} = y \middle| \mu_{ij}\right) = Poisson\left(\mu_{ij}\right)$$

where $\mu_{it} = \exp\left(\beta_0 + \mathbf{x}'_{it}\beta_{it} + \varepsilon_i + \varepsilon_{it}\right) n_{ij}$

Assuming the relocation process follows a conditional Poisson process described above the distribution of the count variable is negative binomial. The specification of the relation between the expected relocation count and immigration is then given by:

$$REL_{it} = N_{it} \exp\left(\beta_0 + \ln IMM_{it}\beta_1 + \varepsilon_i + \varepsilon_{it}\right) \tag{3.1}$$

where REL_{it} – is a measure of relocation

IMM_{it} – is the number of immigrants (log-levels and lagged log-levels)

N_{it} – is the exposure to the data generating process. In our case it is proxied by the total employment of a state in a given year.

$CONT_{it}$ – controls, which include trend, year dummy, and/or Gross State Product

[3] Some obvious specifications of zero inflated models were attempted without success

The state specific error component is controlled for by the fixed effects.

Relocations can occur for a variety of reasons. Some of those reasons might be affected by the business cycle variation across state. This could be the case if relocation is just a manifestation of the general business activity level. In order to account for this variation in the relocation rates I have included Gross State Product (GSP) in the set or regressors.

The model given in equation 3.1 is estimated by an MLE procedure using two different negative binomial specifications, which differ only be the degree of flexibility of the dispersion parameter. Following Cameron and Taverdi (1998) I will refer to them as NB1 and NB2. Variance functions, ω, as a function of the mean, μ, for the two models is given by

$$\omega_{NB1} = (1+\alpha)\mu$$

$$\omega_{NB2} = (1+\delta\mu)\mu$$

In every case an alternative model is fitted using the Poisson MLE procedure and a likelihood ratio test of the null hypothesis that the likelihood of the Poisson is higher than the one of the respective negative binomial model. The results of the estimation are presented in tables 2 through 4.

The BLS MLS relocation counts are regressed on lagged inflow of immigrants to allow for some adjustment time during which the processes described in theoretical part might take place. The data on NAFTA-TAA certified petitions is regressed on the immigrant inflows from the same year because for almost half of the observations we do not know the exact date of the relocation, see data appendix for details. Therefore, the relocation counts will already include some information from the previous year as well as the next year.

The main conclusion coming from this table is that relocation from a state is significantly and positively correlated with inflows of immigrants into that state. This result holds even after controlling for trend or year dummies. The elasticity of relocation rates with respect to immigrant inflows varies from 0.60 to 1.44 saying that when immigrant inflows double the relocation rates from that state will increase anywhere from 60% to 144% depending on the particular measure.

Specification testing

In order to test whether the fixed effects model is appropriate we calculated Wald test statistics of joint significance of coefficients and equality of all coefficients. Both are rejected with high degree of confidence.

The random effects specification could produce more efficient estimates if the individual state effects were not correlated with the regressors. However, we have reasons to believe otherwise. Some geographical factors, which are outside the model, might affect the state specific intercepts but also be correlated with the number of immigrants coming into a state. Examples of those could be distance to the border, presence of a big metropolitan area, climate. Consistency of the fixed effects estimator lets us test it against the random effects estimator using a Hausman test. This test suggests that there is sufficient evidence to reject the null that the difference between the two models is not systematic. Thus, the random effects model is not appropriate.

Exposure is likely to be measured with an error. Ideally we would like to measure exposure by the number of firms in a state in a given year. By using total employment we have effectively assumed that the firm size does not differ across states and across years. With the firm size differing from year to year and from state to state there is likely to be a multiplicative measurement error. Estimation with exposure is identical to estimation with logarithm of the exposure variable and restriction of the coefficient to unity. In order to see if the estimates are affected by the multiplicative measurement error we will relax this assumption, include log of the exposure variable as an independent variable, and test whether the coefficient is significantly different from one. The absolute value of the coefficient is often different from one but the magnitude is not significantly different from one. Therefore, by the lack of a viable alternative, we choose to use total employment as the exposure variable.

3.3. Additional evidence in favor of the specific factors model

This section will present additional evidence suggesting that the specific factor view of the relation between relocation and immigration is a useful way of thinking about this issue. The specific factor model of immigration and relocation has two implications that are potentially observable in the available data set. First, the degree of specificity of regional immigrant labor inflow should positively relate to the relocation rate from the region. Second, if immigration is an important determinant of relocation then industries with the highest relocation rates should be the industries that receive the least immigrants. We will explore these two implications one at a time.

<u>Cross state variation in relocation rates and specificity of immigrant labor</u>

In order to construct a measure of sector specificity of immigrant labor we will compare industry shares of the total employment in a given state to the industry share in the employment of immigrants. We will use a measure based on the absolute differences:

$$S_s = \sum_i \frac{\left| s_{is}^{IMM} - s_{is}^{TOT} \right|}{N_{is}}$$

where

$$s_{is}^{IMM} = \frac{L_{is}^{IMM}}{\sum_i L_{is}^{IMM}}$$

$$s_{is}^{TOT} = \frac{L_{is}^{TOT}}{\sum_i L_{is}^{TOT}}$$

L_{is}^{IMM} - number of immigrants that work in industry *i* in state *s*

L_{is}^{TOT} - number of workers in industry *i* in state *s*

The index of sector specificity of immigrant labor is calculated based on the Census data for 2000. Unfortunately, the data do not have time variation that can match the data on firm relocations. Therefore, we have no way of knowing whether sector specificity of immigrant labor across the states is persistent over time. In order to cover all the bases we will look at the relation between 2000 values of S_s and all available measures of firm relocation rates for the years 1999-2001. The results for 2000 are presented in figures 7a through 7g. Each figure shows the scatter plot of the data, the fitted regression line, and z-value of the regression. In each case the regression is the negative binomial, NB2, with exposure equal to total employment of the state. High statistical significance and positive sign in all regressions lends support to the idea that the states with more specific immigrant labor inflows are also the states that have the highest firm relocation rates. The sign of this relation is positive for all measures of relocation also for 1999 and 2001 but statistical significance for some of the measures decreases.

As a simple check whether this relation is specific to relocations rather than other reasons for mass layoffs I suggest looking at the same relation for the layoffs rate for all reasons except relocations. This relation is represented in figure 7d. As we can see there is a negative relation between the measure of the sector specificity of immigrant labor inflows and the layoff rate. We cannot perform the same check on the NAFTA-TAA data because the laid off workers can qualify for assistance only if the layoffs can be connected to economic relations with the NAFTA countries.

<u>Cross industry variation in relocation rates and industry immigrant employment.</u>

Another observation that would be consistent with the theoretical model is that the industries that experience relocations should be the industries that receive relatively fewer immigrants. This of course assumes that immigrant labor exhibits similar specification patterns across states. The opposite would be true if the specificity of labor was somehow related to state characteristics rather than industry characteristics. The data on total employment by industry and employment of immigrants by industry will come from the Census data for 2000. Unfortunately, the MLS data do not allow for simultaneous tabulation by industry and reason. Therefore, this section will use only the TAA data on relocations.

In order to match the NAFTA-TAA data, which is reported by SIC industries, to the Census industrial classification 40 industry aggregates were created, which allowed for a perfect match to the Census industry classification but much less perfect match to the SIC codes. In some cases where a given SIC was in several industries I have equally allocated the value of the variable among industries. I have opted for this approach instead of dropping the data on partial matches between industries because of the limited availability of the relocation data. I have also omitted industries that do not have a positive observation on any of the measure of relocation for any of the years. In doing this I effectively interpret industries that do not have a single positive observation as immobile. This is a way to exclude industries that are not internationally mobile.

Scatter plots in figures 8a through 8c demonstrate the relation between industry relocation rates in different years and industry's employment of immigrants in that year. Once again the figures are presented for 2000 and the relation has been explored for years 1999-2001 because we do not have a strong theoretical prediction about persistence of the specificity of immigrant labor. Fitted values come from the negative binomial regression with total employment from the PUMS file as exposure. Note that in all cases there is a statistically significant and negative relation between industry's employment of immigrants and relocation rates in that industry. This result seems to fit with the rest of the evidence that the specific factors model is a useful way of looking at the relation between immigration and firm relocation.

IV. Conclusion

A specific-factors model with a country specific and an industry specific factor reconciles the positive relation between inflows of immigrants and firm relocations across the US states. Additional observable implications of the model are supported by the data. First, a comparison of industries reveals that the less favored by the immigrants industries experience lower relocation rates. Second, a comparison of immigrant labor specificity across states is also consistent with the specific-factors view. The states with the most specific (relative to total) immigrant labor experience the largest relocation rates.

Economic significance of the results remains an issue. With few relocation events in the Mass Layoff Statistics and in the NAFTA Trade Adjustment Assistance in 2000 the numbers are dwarfed by the turnover in the US labor market. The welfare implications are further limited because we considered only the outflows of firms from a given region without any regard for the net effect. The results however remain important as they point out a mechanism by which both immigration and firm relocation affect local labor. Findings may help explain how immigrants are absorbed by the domestic market and relocation can be one of the absorption mechanisms.

Policy alternatives can be affected by the implication. For example, restricting relocation will not prevent short term welfare loss to some domestic workers. They will still lose in the short run from sector specific immigration because the non-specific domestic factor will leave the industry. Also inflows of immigrants may adversely affect workers in the industries where the immigrants do no work by attracting domestically mobile factor away from other industries. The results of this paper have to be kept in prospective of distributive short term welfare effects on domestic labor.

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Table 1. Variation of State Relocation Rates per Thousand Employed

Year	Certified petitions due to shift in production (NAFTA-TAA)					
	to Mexico		to Canada		Total	
	mean	st.dev.	mean	st.dev.	mean	st.dev.
1996	0.0012	0.0014	0.0002	0.0005	0.0014	0.0015
1997	0.0009	0.0011	0.0002	0.0004	0.0012	0.0013
1998	0.0010	0.0010	0.0005	0.0006	0.0014	0.0012
1999	0.0012	0.0012	0.0003	0.0006	0.0015	0.0014
2000	0.0019	0.0021	0.0005	0.0008	0.0024	0.0023
2001	0.0012	0.0014	0.0005	0.0006	0.0017	0.0015
2002	0.0000	0.0001	0.0000	0.0000	0.0001	0.0001

Year	Mass layoffs due to relocation (BLS-MLS)					
	Domestic		Abroad		Total	
	mean	st.dev.	mean	st.dev.	mean	st.dev.
1996	0.0003	0.0006	0.0001	0.0002	0.0004	0.0007
1997	0.0003	0.0004	0.0002	0.0003	0.0005	0.0006
1998	0.0003	0.0006	0.0002	0.0004	0.0005	0.0008
1999	0.0003	0.0004	0.0002	0.0005	0.0005	0.0007
2000	0.0003	0.0006	0.0002	0.0004	0.0006	0.0009
2001	0.0005	0.0008	0.0004	0.0007	0.0009	0.0012
2002	0.0005	0.0009	0.0003	0.0006	0.0009	0.0011

Table 2. Independent variable: ln(*IMM*); controls: GSP

Dependent variable, REL_{it}	Poisson, FE	NB1, FE	NB2, FE
	Independent variable: $\ln(IMM_{i(t-1)})$		
Total relocations	1.16 (.226)	1.21 (.291)	1.07 (.312)
Domestic relocations	1.01 (.283)	1.08 (.336)	0.94 (.380)
Relocations overseas	1.44 (.379)	1.44 (.417)**	1.28 (.436)
All reasons except relocation	0.57 (.033)	0.53 (0.094)	0.53 (0.116)
	Independent variable: $\ln(IMM_{it})$		
Shift to NAFTA	0.63 (.150)	0.62 (.168)*	0.60 (.170)*
Shift to Mexico	0.75 (.166)	0.75 (.180)**	0.74 (.177)***
Shift to Canada	0.058 (.360)	0.058 (.360)***	0.009 (.381)***

Table 3. Independent variable: ln(*IMM*); controls: GSP, trend.

Dependent variable, REL_{it}	Poisson, FE	NB1, FE	NB2, FE
	Independent variable: $\ln(IMM_{i(t-1)})$ with trend		
Total relocations	1.14 (.225)	1.18 (.288)	1.01 (.314)
Domestic relocations	1.01 (.283)	1.08 (.336)	0.92 (.384)
Relocations overseas	1.22 (.370)	1.22 (.371)***	1.16 (.410)*
All reasons except relocation	0.54 (.033)	0.53 (.089)	0.48 (.113)
	Independent variable: $\ln(IMM_{it})$ with trend		
Shift to NAFTA	0.59 (.148)	0.59 (.156)***	0.59 (.152)***
Shift to Mexico	0.70 (.164)	0.70 (.170)***	0.71 (.165)***
Shift to Canada	0.07 (.355)	0.07 (.355)***	0.07 (.355)***

Table 4. Independent variable: ln*IMM*; Controls: GSP, year dummies			
Dependent variable, REL_{it}	Poisson, FE	NB1, FE	NB2, FE
	Independent variable: ln$IMM_{i(t-1)}$		
Total relocations	1.00 (.376) 0.008	1.08 (.458) 0.02	.86 (.534) 0.11
	p_{GOF} = 0.00		
Domestic relocations	.87 (.472) 0.07	.91 (.538) 0.09	.82 (.638) 0.20
	p_{GOF} = 0.03		
Relocations overseas	1.12 (.638) 0.08	1.11 (.644)*** .08	.87 (.472)** 0.07
	p_{GOF} = 0.99		
All reasons except relocation	.25 (.054) 0.00	.24 (.139) 0.08	.08 (.162) 0.61
	p_{GOF} = 0.00		
	Independent variable: lnIMM_{it}		
Shift to NAFTA	.35 (.263) 0.18	.35 (.274)*** 0.21	.34 (.269)*** 0.20
	p_{GOF} = 0.003		
Shift to Mexico	.40 (.293) 0.17	.41 (.300)*** 0.17	.40 (.294)*** 0.17
	p_{GOF} = 0.05		
Shift to Canada	.14 (.611) 0.82	.14 (.611)*** 0.82	.14 (.611)*** 0.82
	p_{GOF} = 0.50		

* Chi-squared rejects that this model is better than Poisson at 1%
** - Chi-squared test of this model against Poisson failed to reject the null that they are equal at 5%
*** - Chi-squared test of this model against Poisson failed to reject the null that they are equal at 10%
Note: standard errors are reported in brackets. Table 4 also reports p-values of the coefficients and p-values of the Poisson goodness of fit test

Table 5. States with no Relocations in Two Data Sets.

States with no relocations	
NAFTA-TAA	BLS-MLS
	Alaska
Delaware	Delaware
District of Columbia	District of Columbia
Hawaii	Hawaii
	Montana
	Nebraska
	North Dakota
Rhode Island	
	South Dakota
Wyoming	Wyoming

Figure 1. Factor Movements in Response to an Inflow of Specific and Internationally Immobile Labor.

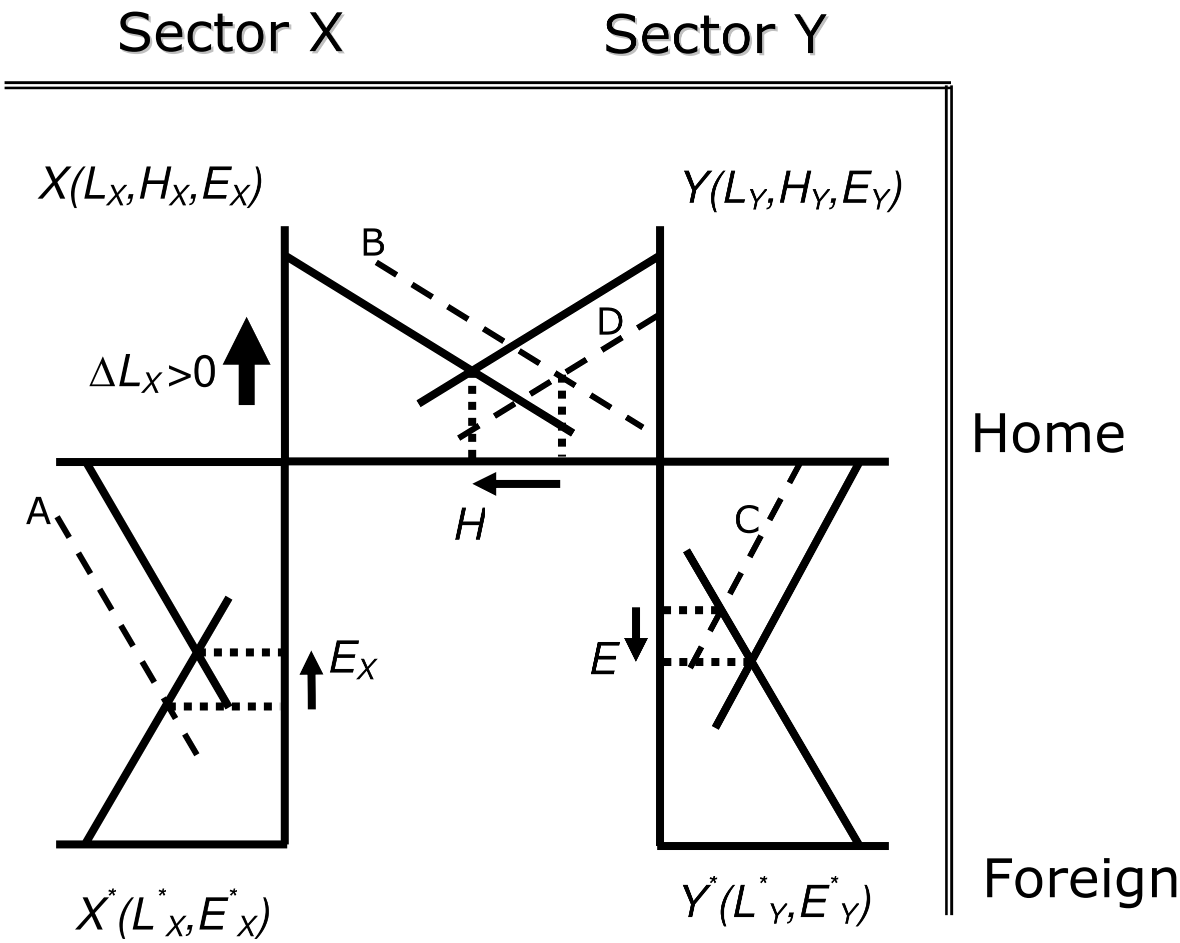


Figure 2. Layoff Events per Missing Observation.

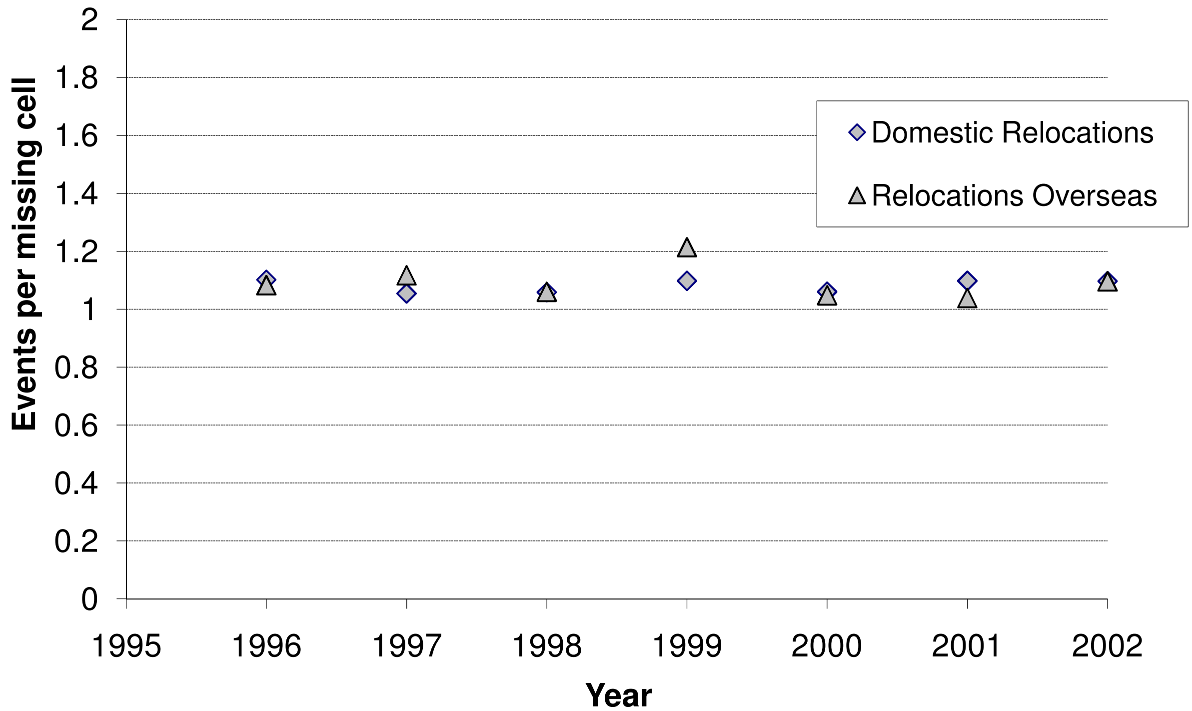


Figure 3. Summary Statistics and Data Display of the Number of Immigrants by State.

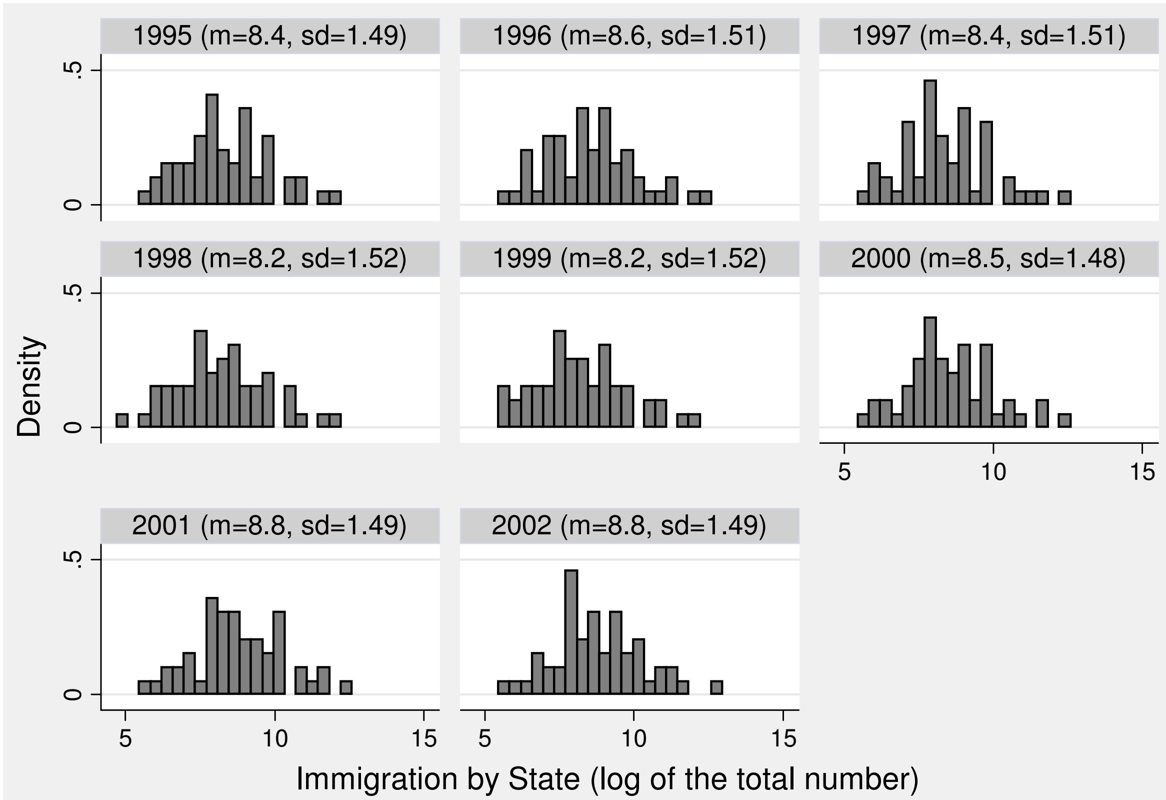


Figure 4. Total Number of Immigrants.

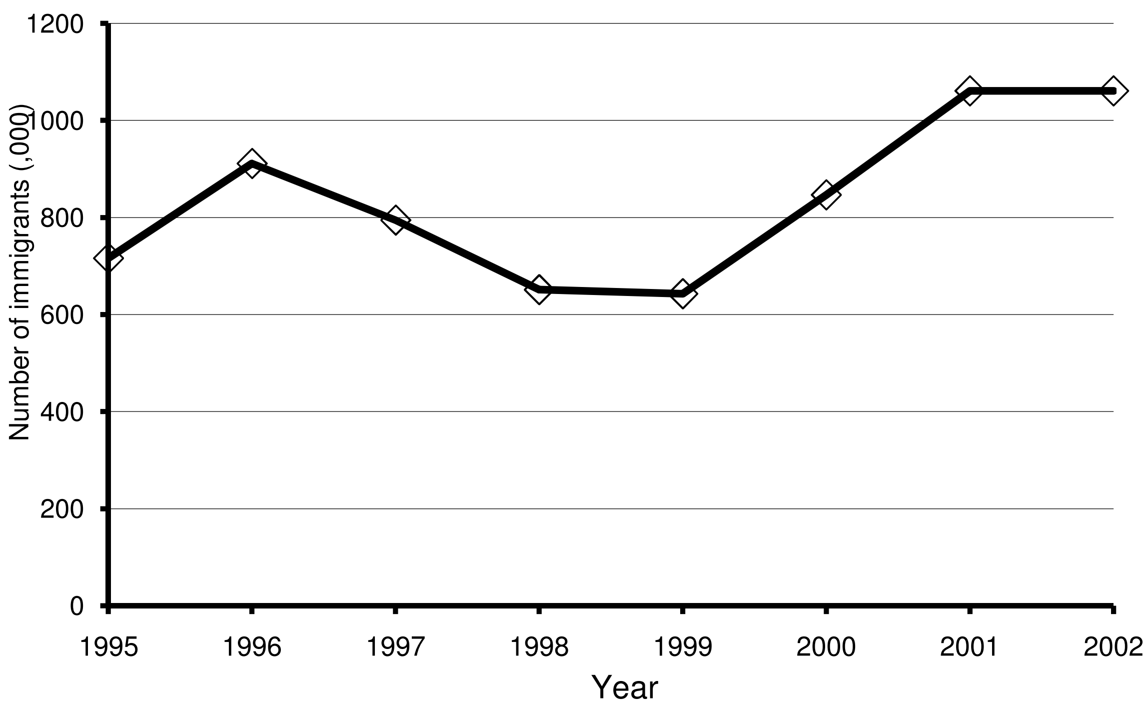


Figure 5. Relation between Relocation Counts from Two Sources.

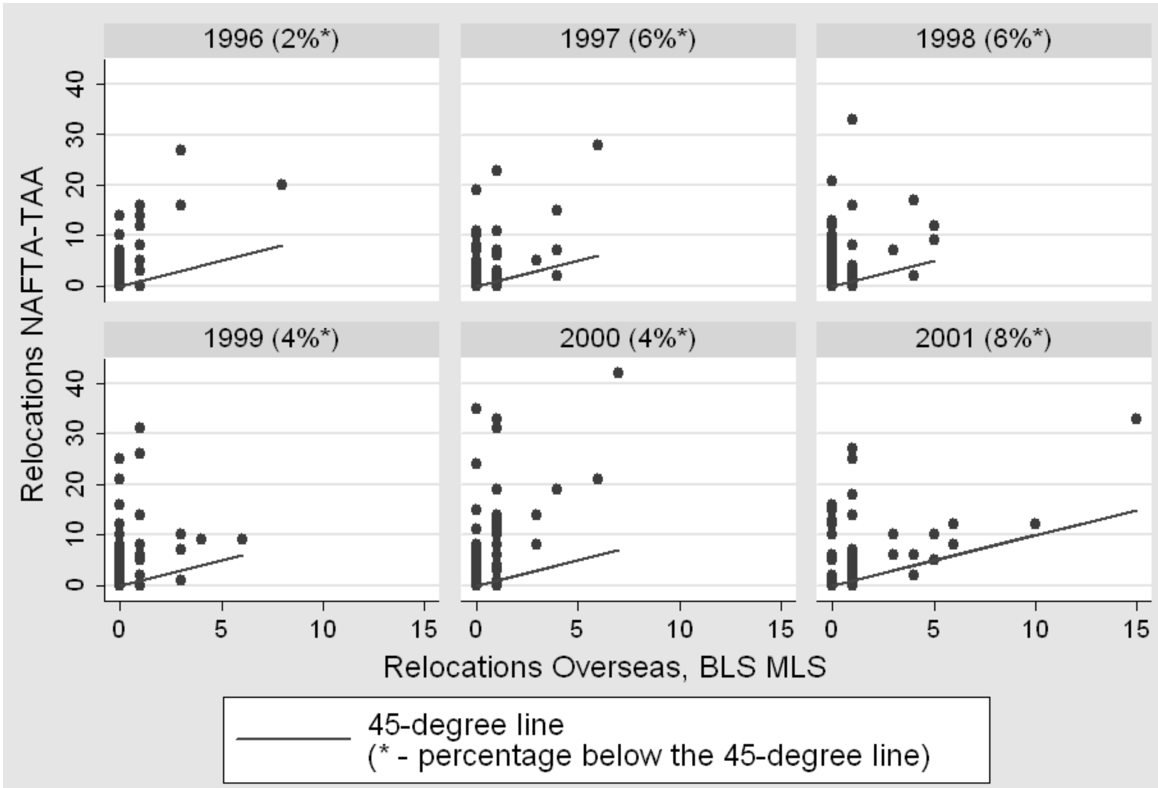


Figure 6a. Number of Mass Layoffs Due to Relocation from BLS MLS.

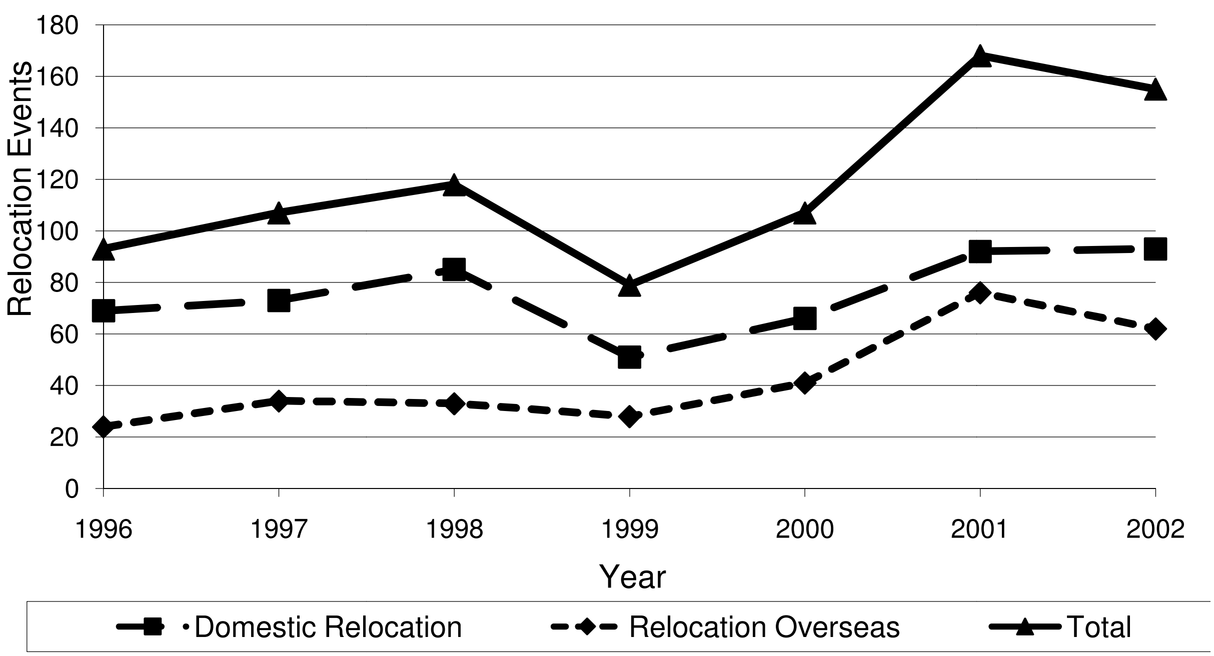


Figure 6b. Number of Certified NAFTA-TAA Petitions

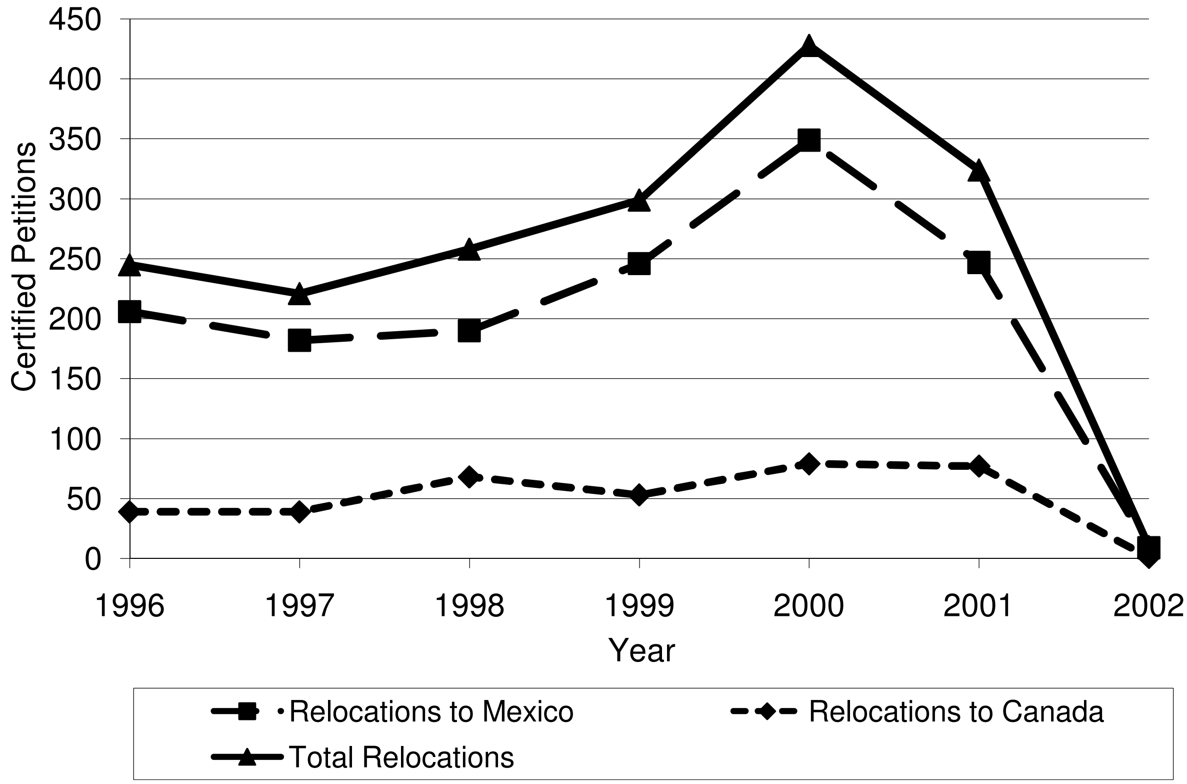
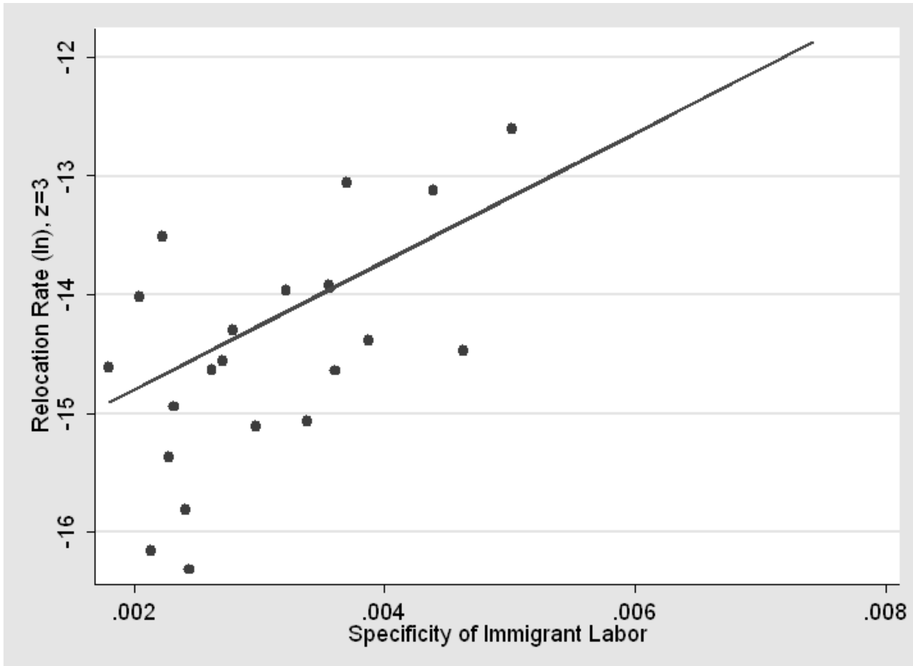
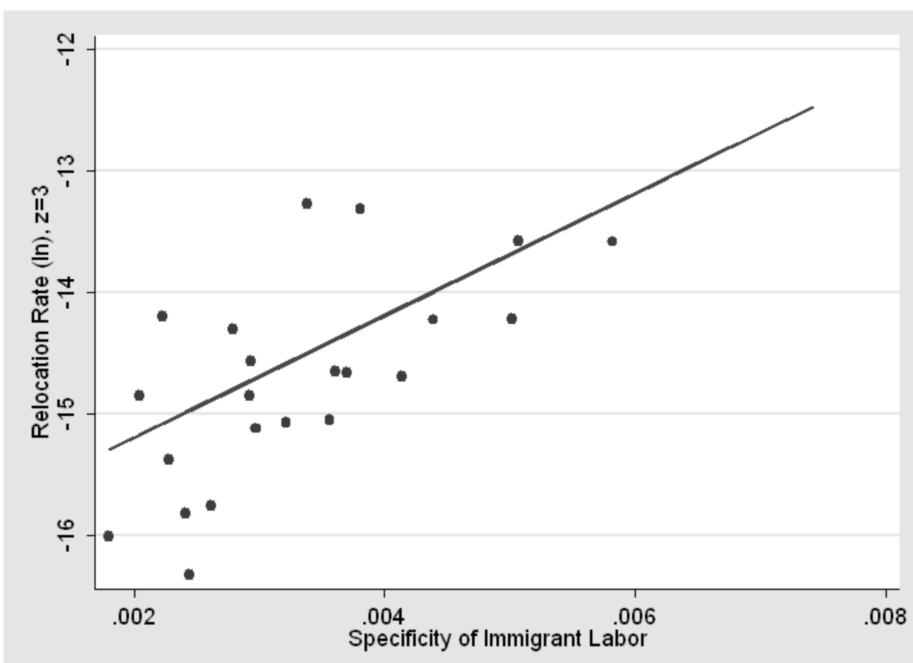


Figure 7a. Relation between Domestic Relocation (BLS-MLS) and Specificity of Immigrant Labor across States in 2000



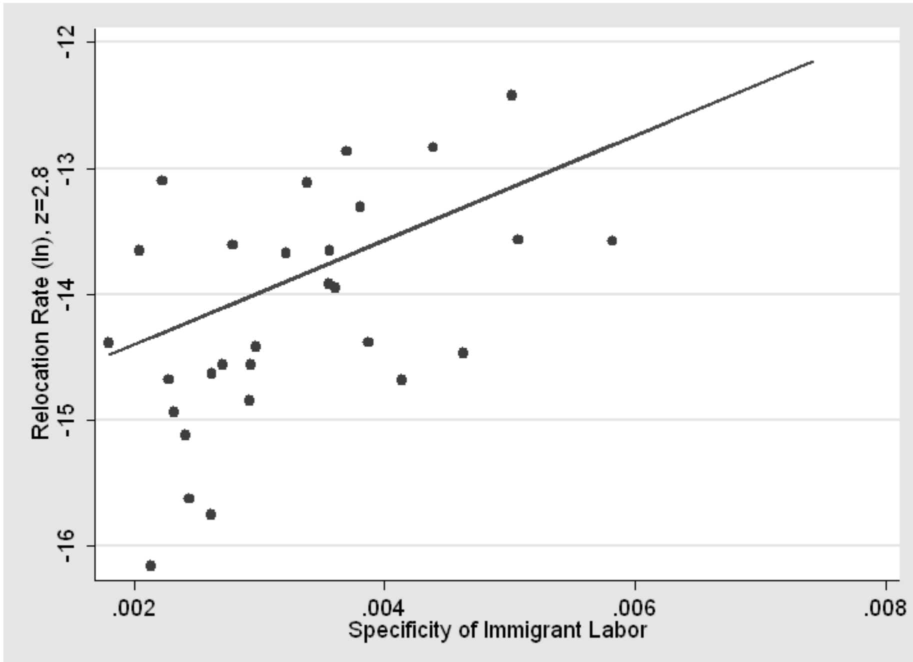
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 7b. Relation between Relocation Abroad (BLS-MLS) and Specificity of Immigrant Labor across States in 2000



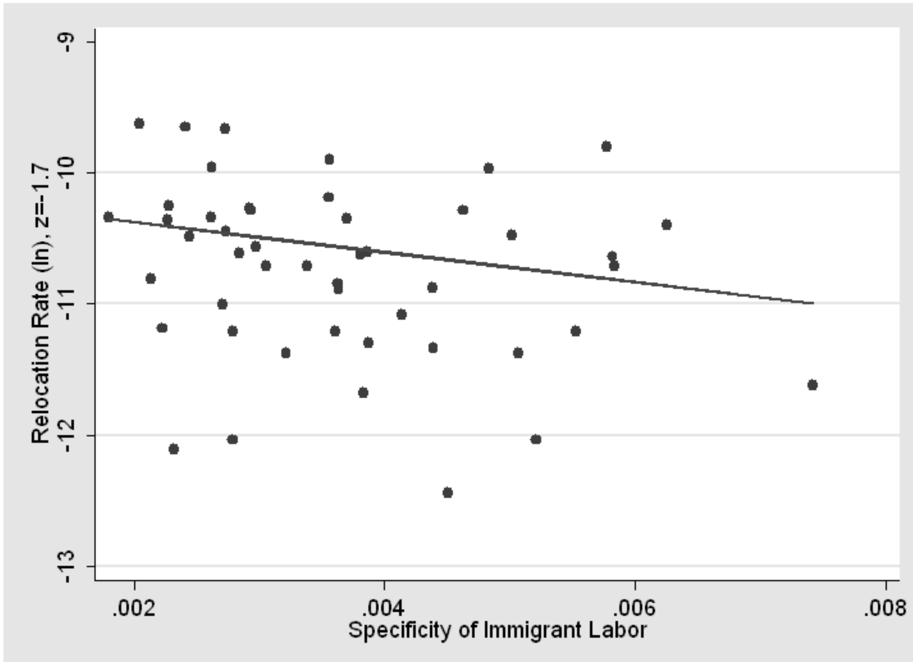
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 7c. Relation between Total Relocation (BLS-MLS) and Specificity of Immigrant Labor across States in 2000



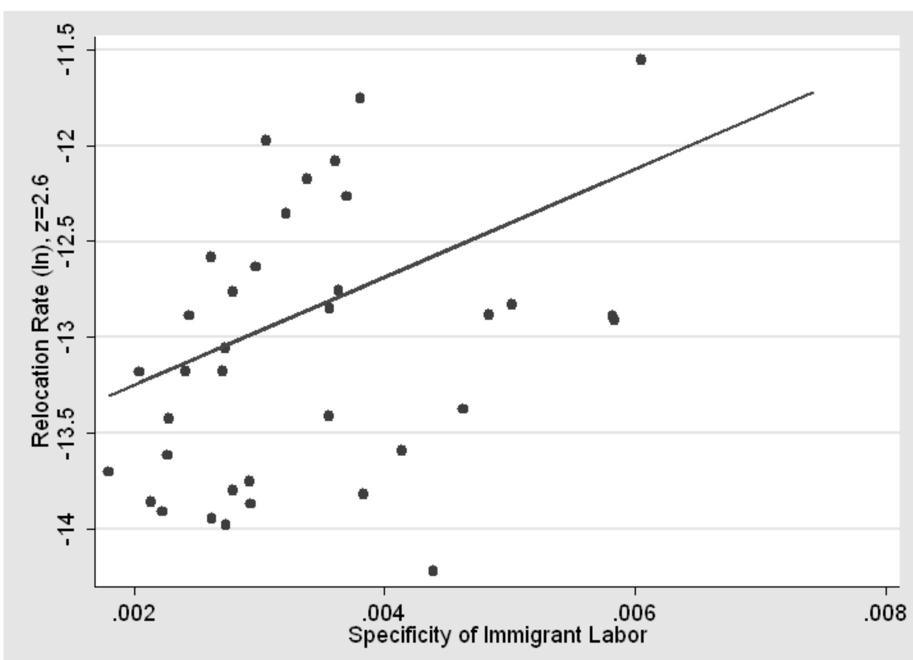
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 7d. Relation between Layoffs due to All Reasons Except Relocations (BLS-MLS) and Specificity of Immigrant Labor across States in 2000



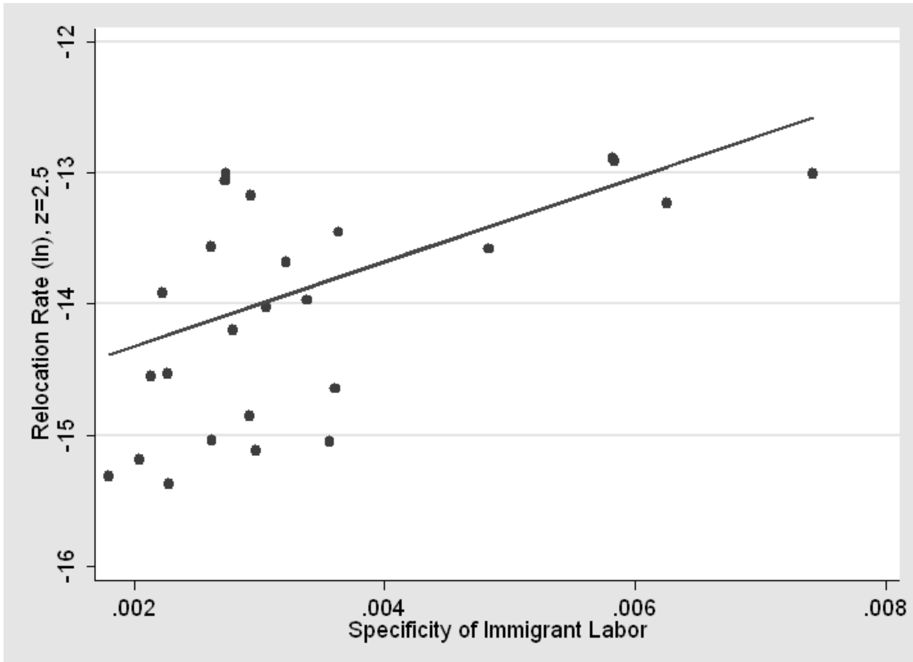
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 7g. Relation between Relocation to Mexico (NAFTA-TAA) and Specificity of Immigrant Labor across States in 2000



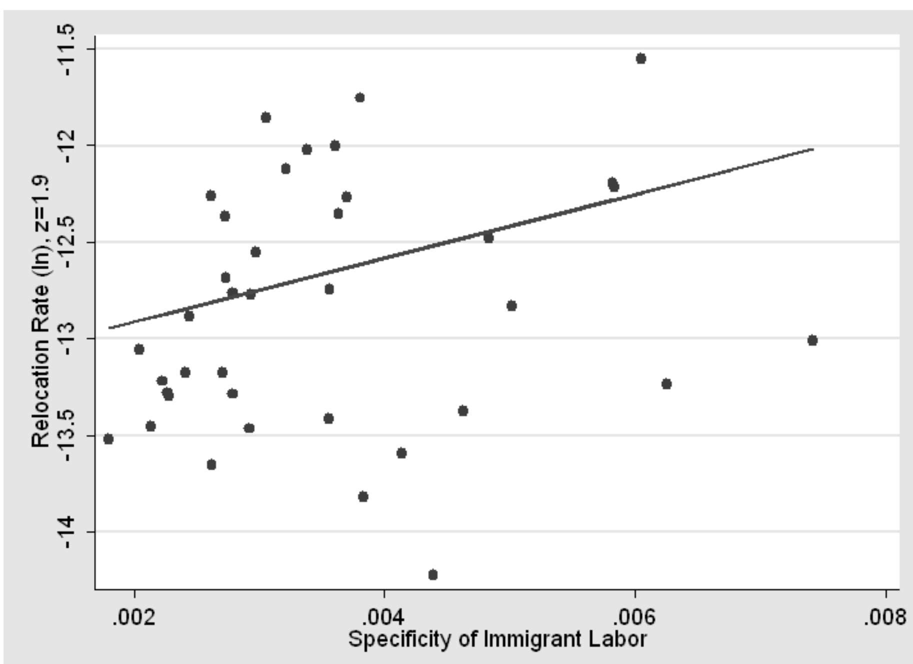
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 7f. Relation between Relocation to Canada (NAFTA-TAA) and Specificity of Immigrant Labor across States in 2000



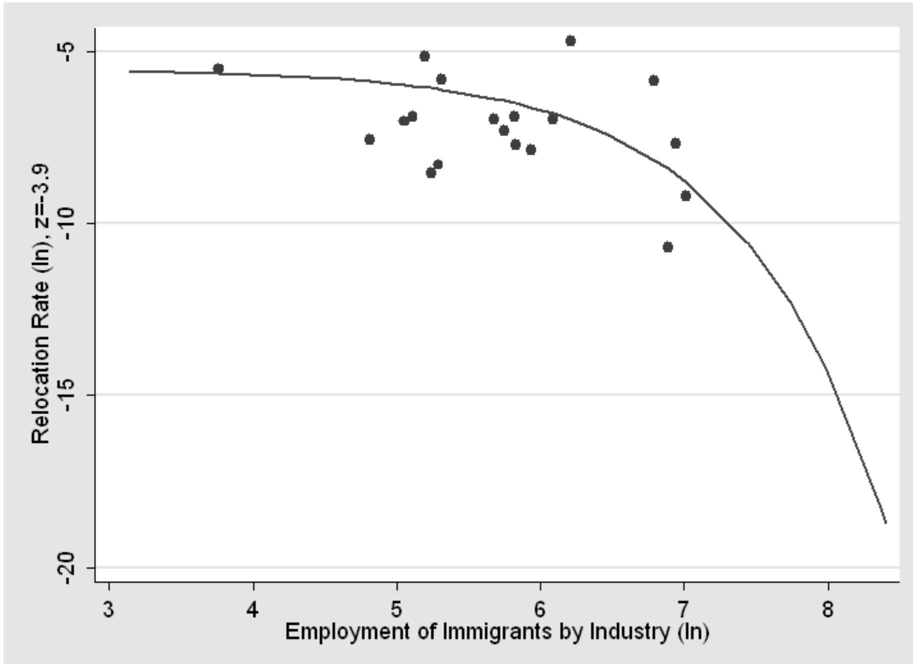
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 7g. Relation between Total Relocation (NAFTA-TAA) and Specificity of Immigrant Labor across States in 2000



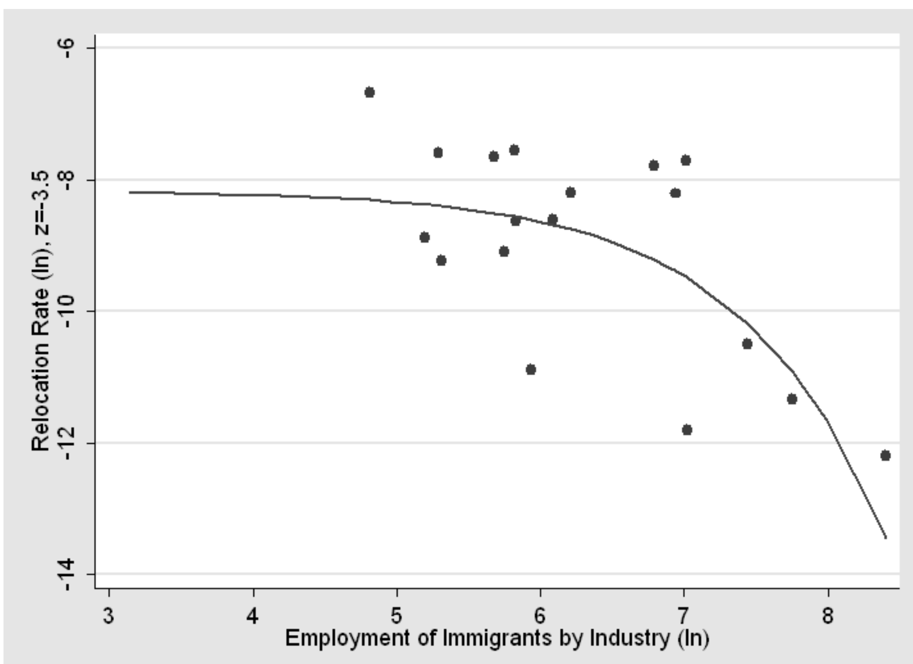
Note: Reported z-value is from an NB2 regression with total employment as exposure

Figure 8a. Relation between Relocation Rate to Mexico and Employment of Immigrants across Industries for 2000.



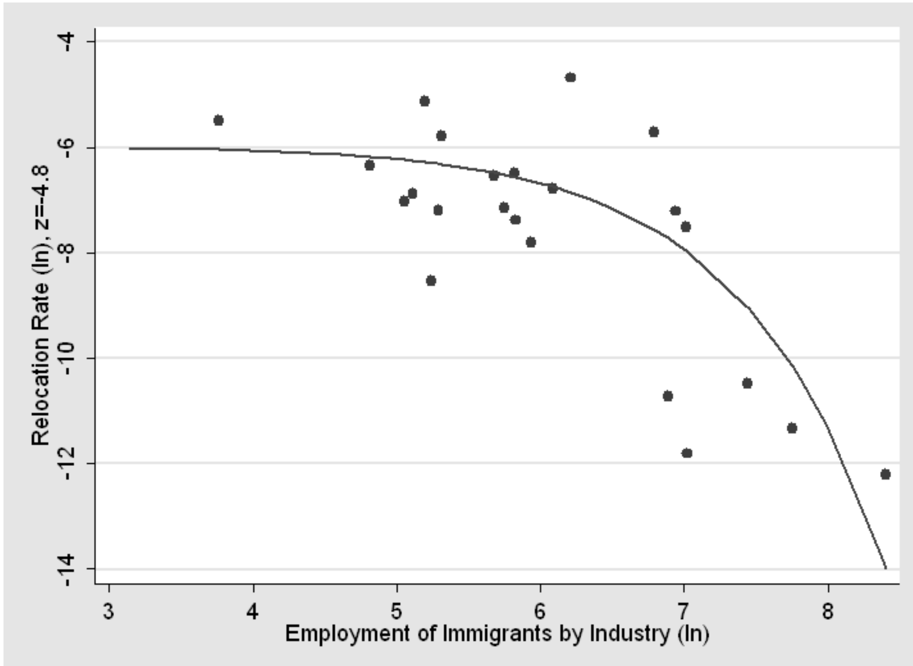
Note: Reported z-value is from an NB2 regression with total industry employment as exposure

Figure 8b. Relation between Relocation Rate to Canada and Employment of Immigrants across Industries for 2000.



Note: Reported z-value is from an NB2 regression with total industry employment as exposure

Figure 8c. Relation between Total Relocation Rate and Employment of Immigrants across Industries for 2000.



Note: Reported z-value is from an NB2 regression with total industry employment as exposure

Data Appendix

This appendix describes data sources and specific manipulations that were performed to make these data useable.

Immigration and Visas

The data on the number of immigrants by intended state of residence was obtained from the 2002 Yearbook of Immigration Statistics and 1995-2001 Statistical Yearbook of the Immigration and Naturalization Service. The recent data can be accessed at http://uscis.gov/graphics/shared/aboutus/statistics/Immigs.htm. Data on the number of workers and NAFTA workers by intended state of residence were obtained from the same source. One data inconsistency that I was not able to track down is that the 1997 Yearbook reports visa numbers for 1996. Since the 1996 data could not be found in any other source I decided to replace it with the average of 1995 and 1997 value.

Mass layoffs events due to relocation

This data comes from two sources: (1) Bureau of Labor statistics and (2) Employment and Training Administration of the US Department of Labor. First, the number of layoffs due to relocation was taken from Mass Layoffs Statistics collected and reported by the Bureau of Labor Statistics (URL: http://www.bls.gov/mls/). The data is available starting from the second quarter of 1995 and until 2004. According to the Bureau of Labor Statistics "Establishments which have at least 50 initial claims for unemployment insurance (UI) filed against them during a consecutive 5-week period are contacted by State agencies to determine whether those separations are of at least 31 days duration, and, if so, information is obtained on the total number of persons separated, the reasons for these separations, and recall expectations." The data has many cells that are suppressed due to BLS disclosure standards. From a personal communication with the BLS I was able to make sure that those variables are greater than zero but the exact number is not disclosed. The data base also reports total number of events for each year. I used this information along with the available cells to calculate the average number of events per missing cell. The numbers were sufficiently close to one (see table ___) so that I have deemed it appropriate to replace the undisclosed cells with ones. The number of work separations by industry is also reported in the BLS's Extended Mass Layoffs Associated with Domestic and Overseas Relocations, First Quarter 2004. This report can be accessed at the following URL: http://www.bls.gov/news.release/reloc.toc.htm .

Second, the layoff events when a company shifts production leave another trail with the Department of Labor when the workers who are laid off can petition for North American Free Trade Agreement-Transitional Adjustment Assistance. Following an investigation the Employment and Training Administration makes a determination of whether the workers are eligible to apply for the assistance. An example of a successful petition is shown in Appendix __. (URL: http://www.doleta.gov/tradeact/determinations.cfm). This data differs significantly from the BLS layoffs statistics: the data is self reported, the threshold for application is only 3 workers. The date of the actual event are not always reported. For those events that are reported the average time between the event and the determination is on the order of one year. Therefore, I have used the following procedure to obtain the data on dates. I used the actual date from which the assistance can start (Impact Date field in the data set) and where this field was missing I constructed the date by subtracting one year from the date of the determination.

Gross State Product

The data on Gross State Product is collected and reported by the Bureau of Economic Analysis as a part of Regional Economic Accounts I have used the chain-weighted figures for 1996-2001 (URL: http://www.bea.gov/bea/regional/gsp.htm).

Total Employment

The data on total employment by state comes from the Regional Economic Information System (REIS) 1996-2002 (URL: http://www.bea.gov/bea/regional/docs/cd.asp).