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by

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Abstract: Despite the attention given to international trade in discussion of the economic struggles of many U.S. regions, it is unclear whether international trade shocks impact local economies more, or differently than shocks originating within the domestic economy. A challenge in making this discernment is separating trade shocks from common or domestic shocks. Therefore, using U.S. county-level data for 1990-2010, this study carefully constructs shocks to local economies, isolating those arising from international imports and exports to assess whether trade shocks have different effects from domestic shocks. In confirmatory analysis, we also employ a novel combination of IV and matching strategies. We examine a variety of indicators including employment growth, population growth, employment rates, wage rates and poverty rates. The results suggest that international trade shocks have some different effects than overall domestic shocks, though likely less than commonly perceived. We also find that domestic shocks dominate international trade shocks in explaining variation in regional labor market outcomes.

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Introduction

Increased trade with developing countries in recent decades has spurred concerns with potential adverse effects of trade on low-skilled labor in the U.S. Regions specialized in the production of goods intensive in the use of low-skilled labor may be especially adversely affected by increasing imports from developing countries (Autor and Dorn, 2013b). While increased U.S. exports to developing countries could provide offsetting aggregate gains, limited mobility of workers both geographically and across industries can cause idiosyncratic shocks to have large redistributive effects across regions and workers (Partridge et al., 2015). Yet, it is not clear whether international demand shocks differ in impacts from equal-sized domestic shocks and whether they are particularly responsible for regional labor market structural shifts. Shocks emanating from Bangalore or Shanghai may not matter more to U.S. workers than employment shifts emanating from within the country.

There are a number of reasons why trade could have differential effects across regions. Foremost, regions have different industry compositions with varying international import and export intensities. A key ingredient of Melitz international trade models is firm heterogeneity in productivity, in which trade-affected firms could be distributed unevenly across regions (Bernard et al., 2006; 2007). Exporting and import-competing firms may have supply chains that differ from the average. Expectations regarding future employment security in trade-related industries may differentially affect regional labor supply responses to trade-based employment shocks compared to domestic shocks. However, economists only recently have begun to focus on the geographical disparities in the effects of international trade on local labor markets.

Autor et al. (2013b) found increased trade with China to be associated with higher unemployment, lower labor force participation, and lower wages in affected U.S. regional labor markets. Significantly negative effects also have been found on wages of workers in industries and regions affected by increased U.S. imports from NAFTA (McLaren and Hakobyan, 2010). Dauth et al. (2014) report that increased trade exposure of Germany to China and Eastern European countries resulted in a net increase in manufacturing employment in Germany, attributable mostly to increased German exports to Eastern Europe and imports from China simply serving as substitutes for German imports of labor-intensive goods from other countries. Leichenko and Silva (2004) found some evidence of expected benefits for manufacturing export-intensive counties and losses in counties containing import-competing manufacturing industries arising from international trade exposure, though other results were counter to *a priori* expectations. Increased U.S. trade with developing countries has been found to relatively increase the demand and wage premium for high-skilled labor, particularly benefitting counties with a greater high-skill endowment (Kandilov, 2009). From the developing country perspective, Chiquiar (2008) found that regions in Mexico with greater exposure to international markets experienced a decrease in the skill premium with the passage of NAFTA, implying downward pressure on U.S. low-skilled manufacturing wages in competing industries.

Others contend that trade is not the major source of recent difficulties in low-skilled U.S. manufacturing, arguing that low-skilled goods produced in developing countries are not good substitutes for low-skilled manufacturing goods in the U.S. (Lawrence, 2008; Edwards and Lawrence, 2010). Consumer preferences and non-neutral technological progress may underlie the U.S. shift in employment from low-skilled manufacturing jobs to low-skilled service jobs (Autor and Dorn, 2013a). Similarly, increased interregional trade in the U.S. could be associated with national sectoral shifts, such as increased trucking services (Michaels, 2007). The sectoral reallocation nationally creates spatially-asymmetric employment shocks, directly affecting counties employment-intensive in the production of expanding and contracting sectors.

The relative contribution of shocks of domestic versus foreign origin on U.S. local area economies then remains an open question. Does the source of the shock matter in terms of the effects on local economies? Which shocks are the largest?

Therefore, in this paper we assess the regional effects of increased U.S. international trade from 1990 to 2010, including both the effects *relative to* equivalent-sized domestic shocks and their *total* effects after controlling for domestic shocks. In contrast to previous studies of the U.S., we examine trade between the U.S. and all other countries and consider both exports and imports. We construct regional measures of exposure to international trade shocks based on regional employment-intensiveness in sectors experiencing changes in national exports and imports. Also different from other similar studies (e.g., Leichenko and Silva, 2004; Autor et al., 2013b), we convert changes in national exports and imports into the associated changes in employment. The resulting regional trade measures represent the changes in regional employment that would occur if employment in each of the region's industries changed at the rate predicted nationally because of changes in exports and imports.

In the next section, we follow Autor et al. (2013b) in using the theoretical trade model of Eaton and Kortum (2002) to derive an empirical local labor market model. The theoretical model follows in the tradition of comparative advantage driving trade flows, in which productivity shocks and trade agreements exert influence on trade flows. We translate international trade shocks and those arising from sector reallocation nationally to the local level.

Empirical implementation is discussed in Section 3, where we derive separate measures of international trade employment shocks and overall local labor demand employment shocks based on county-level industry composition. Including a measure that accounts for national sectoral employment reallocation also reduces estimation bias if it is correlated with international trade shocks (Autor et al., 2013b) such as through common productivity shocks. Other studies of trade for single countries (Autor et al. 2013b; Dauth et al., 2014) used trade between other countries as an instrument to reduce estimation bias, but this is not possible where U.S. trade with all countries is examined as in our case. The measures are used in cross-sectional growth equations for several labor market outcome measures for 1990-2000 and 2000-2010: employment growth, population growth, employment rate, wage rate, median income and poverty. Econometric estimation of the growth equations reveals the effects of the calculated trade and domestic shocks on local labor markets, which can be geographically uneven because of limited worker mobility across industries and regions (McLaren and Hakobyan, 2010; Autor et al., 2013b; Partridge et al., 2015). In sensitivity analysis, we employ a novel combination of using matching to derive instruments for IV analysis and we also use first difference approaches.

Section 4 contains the econometric results. Among our primary findings, both metro and nonmetro counties that are employment-intensive in sectors with increasing employment nationally (including that attributable to international trade) experience faster employment and population growth over the entire period. Only post-2000, do these areas experience increased employment rates, consistent with reduced population migration responses to the nationally-based employment shocks. Positive shocks likewise significantly increased wages post-2000 and reduced poverty over both decades.

Trade-based labor demand shocks generally had the same per unit effect on total county employment growth as did domestically-based shocks, with the exception of nonmetropolitan areas post-2000 where import shocks appeared to have no overall employment effect. Given that domestic shocks dominated trade-based shocks in terms of the variation in total nationally-based shocks, regional variation in job growth over both decades appeared to be driven primarily by domestically-based shocks. Even though local employment did not appear to be differentially affected by trade shocks versus domestic shocks, trade could have specific local effects if the public has different expectations about trade's future influence relative to domestic shocks. Indeed, exposure to export shocks did not differentially affect population responses during the 1990s, but it was associated with lower population growth responses post-2000. Population growth also was differentially negatively affected by greater exposure to import shocks post-2000, significantly so for metropolitan areas. This is suggestive of workers increasingly avoiding areas with greater exposure to international trade.

The more limited population responses to demand shocks in regions with greater exposure to export shocks generally cause them to have relatively larger positive employment rate effects. Greater exposure to import shocks also generally reduced employment rates more than the average national shock. Responses in area poverty to import shocks were greater during the

1990s, apparently driven by the differential employment rate effects of international trade. We then examine the robustness of the results. Section 5 summarizes and concludes the paper.

2. Theory

Our theoretical underpinnings for how international trade shocks affect local labor markets builds on the seminal work of Eaton and Kortum (EK) (2002) and the extension by Autor et al. (ADH) (2013b). ADH notably illustrate how the EK model can be used to specify an empirical local labor market model for examining the regional effects of international trade. Both the model of ADH and our model allow for international trade shocks to have uneven impacts across regions, depending on regional variation in intensities of industries with trade exposure and on interregional labor supply adjustments.

EK employ the Ricardian framework introduced by Dornbusch et al. (1977). Technological/productivity differences drive comparative advantage and trade flows. Region *i* produces various goods *j* along a [0, 1] continuum of intensity. In our case, the sum of all regions is the entire world, though like ADH, the regions we examine empirically are U.S. local labor markets. Region *i* is relatively efficient in producing *j*, using a constant returns to scale technology, $z_i(j)$. All regions in the U.S. have access to the same technology, though there are other reasons for different production efficiencies across regions (agglomeration, distance from markets, natural advantages such as access to natural resources, ports, etc.). Labor is assumed to be the only input, in which free mobility across industries in region *i* leads to the same unit production costs, w_i. Therefore, the price of one unit of *j* equals $w_i/z_i(j)$.

Let τ_{nij} be the trade or distance costs of shipping good *j* from region *i* to destination *n*. τ includes shipping costs plus implicit costs related to trade agreements or other institutional barriers. Thus, the price of good *j* shipped from region *i* to destination *n* equals $p_{ni}(j)= (w_i/z_i(j))\tau_{nij}$. Consumers in *n* buy *j* from the region(s)/country(ies) with the lowest price.

ADH define the relative efficiency in production of good *j* for each region as T_{ij}, which combines the region's level of productivity relative to all other regions and the within-region relative efficiency in industry *j* from $z_i(j)$. A larger T_{ij} implies greater efficiency in production for

j in i. Define θ as the measure of dispersion of firm productivity in producing j within i, which is assumed to be common across all regions. A greater θ suggests *less* variability in productivity across goods j in i. A larger T_{ij} indicates a stronger technological absolute advantage, whereas a smaller θ suggests that comparative advantage across regions plays a more important trade role.

Let X_{nj} represent expenditures in the destination market n for good j, where X_n denotes total expenditures in n. ADH adapt EK to show that sales for industry j from region i in destination n's market (X_{nij}) is:

(1) $$X_{nij} = \frac{T_{ij}(w_i\tau_{nij})^{-\theta}}{\Phi_{nj}} X_{nj}$$

where Φ_{nj} is the "toughness of international competition" for good j, defined as:

(2) $$\Phi_{nj} \equiv \sum_i T_{ij}(w_i\tau_{nij})^{-\theta}.$$

Region i's sales to destination n are positively related to its technology T_{ij} and negatively related to its costs, as reflected by wages w_i and transportation costs τ_{nij}. Likewise, improved technology or reduced labor costs in a competitor nation reduces sales.

Following ADH (2013b), total labor demand in region i, industry j can be written as

(3) $L_{ij} = L^D(w_i, Q_{ij})$,

where Q_{ij} is the production of good j in region i, in which Q_{ij} is obtained by summing Equation 1 over all destination markets n:

(4) $$Q_{ij} = A_{ij}\sum_n \frac{X_{nj}\tau_{nij}^{-\theta}}{\Phi_{nj}},$$

where A_{ij} is cost-adjusted productivity $T_{ij}(w_i)^{-\theta}$. Total production in a region, Q_i, is the sum of output in Equation (4) across all j industries.

Using Equation (4), the following shows the first-order response of Q_{ij} to a demand shock in market n, the change in X_{nj}:

(5) $$\hat{Q}_{ij} = (X_{nij}/Q_{ij})\hat{X}_{nj},$$

where $\hat{X}$ is dln$X$. Equation (5) illustrates that the corresponding approximate percent change for Q_{ij} is directly proportional to the share of its production sold in market n.

Summing across markets, Equation 6 then shows the first-order direct change in Q_{ij} for shocks to all *n* destination markets*:*

(6) $$\hat{Q}_{ij} = \sum_{n} (X_{nij} / Q_{ij}) \hat{X}_{nj} \ .$$

Now consider that *n* represents all markets: international, national, and local; i.e., the forces affecting international trade above also apply to intra-national trade. This equation represents the effects of demand shocks (from all foreign and domestic sources) on a region. We are, however, also interested in the common (average) shock to each local U.S. region *i* in its *production* of *j*. The average common U.S. shock is composed of demand shocks that originate both in the U.S. and abroad, as well as all supply shocks in industry *j* that originate in the U.S. or abroad, which in turn affect labor demand. The net effect of these common demand and supply shocks are embodied in the U.S. production of industry *j*, $\hat{Q}_{usjj}$, or the common shock felt by all regions in their production of *j* is denoted by the average national change in the production in *j*. Therefore, assuming that the common (average) shock across all markets for U.S. produced goods and services can be shown as $\hat{Q}_{usj}$, the change in Q_{ij} due to the common (average) shock then equals

(7) $$\hat{Q}_{ij} = \hat{Q}_{usj} .$$

To derive the total change in production in region *i* in response to the common shocks, $\hat{Q}_i$, we first multiply both sides of equation (7) by Q_{ij}, and sum across all *j* industries. Then we divide both sides by Q_i to derive:

(8) $$\hat{Q}_i = \sum_{j} (Q_{ij} / Q_i) \hat{Q}_{usj} \ ,$$

which implies that the common/average shock is the region's industry mix growth rate term from shift-share analysis (Loveridge and Selting, 1998). Changes in international trade and domestic demand shifts are transmitted to regions based on their industry compositions (Markusen et al. 1991). Domestic demand shifts occur with evolving product cycles and shifts to services.

If a region is production-intensive in internationally-import competing industries (high shares of Q_{ij}/Q_i in import-intensive industries), increased imports will disproportionately reduce expected growth in that region. If a region's industrial composition is concentrated in industries experiencing negative domestic shocks, expected regional growth would likewise be reduced, creating a negative bias in the import variable coefficient if local demand is excluded. This may be most prevalent in manufacturing, where most imports take place. U.S. productivity growth in manufacturing has led to declines in employment, which would be reflected in the industry mix common shock term. Controlling for the common shock would then eliminate the spurious negative link between U.S. manufacturing imports and U.S. manufacturing employment growth. Thus, in the empirical model, including the industry mix term from shift-share analysis controls for the net effect of *national* demand and supply shocks (domestic and/or international in origin), that, in turn, may be correlated with the trade shocks impacting the region.

We next illustrate the international component of the total common (average) shock. Treating the rest of the world outside of the domestic market as *R* (rest of the world), a trade shock could occur through changes in cost-adjusted productivity and trade costs (aside from shocks through exchange rates). ADH (2013b) show that the aggregate effect of these trade shocks on a U.S. (*u*) region *i*'s aggregate production equals:

$$(9)\ \hat{Q}_i = -\sum_j \frac{X_{uij}}{X_{uj}} \frac{X_{uRj}(\hat{A}_{Rj} - \theta \hat{\tau}_{Rj})}{Q_i}$$

The size of the trade shock's impact on region *i*'s production is then positively associated with the region's share of U.S. production of good *j* (X_{uij}/X_{uj}) and positively related to the magnitude of the change in trade imports $X_{uRj}(A_{Rj} - \theta \hat{\tau}_{Rj})$ due to the shock, relative to the region's total production Q_i.

In the empirical implementation of the model, the employment equivalents of the aggregated shocks in Equations (8) and (9) are used as explanatory variables for changes in local labor market outcomes. The shock in Equation (9) is used to assess whether international trade shocks have effects different from, or in addition to, the common/average (domestic and international) shocks of Equation (8), the question of primary interest to this investigation. This also allows us to assess the importance of trade-related shocks relative to domestic shocks for a range of regional outcomes. To the extent that interregional labor market adjustment is limited, the shocks will have uneven regional effects (ADH, 2013b; Partridge et al., 2015).

We follow ADH (2013b) in using employment shares to measure local industry intensities. One difference between our model and the base ADH model is that the latter focused on changes in national production due to trade, while ours converts the changes in trade into national sectoral employment changes. Using employment scales the results toward our desired metrics on outcomes. Productivity changes cause adjustments in output to have different-sized employment shocks in periods for industries experiencing different productivity growth.

There is an important consideration not directly addressed in the EK or ADH (2013b) models, and of key importance to our investigation: the role of expectations about the future. There is an extensive labor market literature in which expectations affect migration behavior (Neumann and Topel, 1991). Incorporating expectations reduces the impact of short-term demand shocks on human migration or local labor supply. Rather, short-term shocks primarily manifest themselves in terms of wage changes. In contrast, expectations of long-term shocks more likely stimulate migration and labor supply, rather than affecting the wage rate.

Expectations of strong productivity growth and its effects also may affect labor market adjustment. International competition may spur productivity improvements or offshore sourcing, such that export-intensive firms most actively pursue productivity growth (e.g., Bernard et al., 2007; Egger and Kreickemeier, 2009). Productivity growth increases employment only under certain conditions such as elastic demand for output (Combes et al., 2004). Expectations of local productivity growth (based on dependence on export-intensive sectors, for example) in the presence of a relatively inelastic demand response, may spur out-migration adjustments in anticipation of future employment reductions. Similarly, expectations about future import competition or foreign competition relative to domestic exports also may cause anticipatory migration adjustments in communities exposed to a high-intensity of import or export industries. Such responses would be consistent with McLaren and Hakobyan's (2010) finding that anticipation of future liberalization from NAFTA was sufficient to cause out-migration from localities with high-intensities of industries exposed to NAFTA. However, in a study of trade exposure in Germany, Dauth et al. (2014) find that increased import exposure reduces expected employment duration on the part of manufacturing employees, while higher export exposure increased expected employment duration, with the latter effect being the larger.

3. Empirical Implementation

Our sample consists of over 3,000 counties from the continental U.S. and District of Columbia.[1] We expect differential international trade impacts across rural versus urban counties because of agglomeration effects, differing workforce and industry compositions and differential labor supply responses (Partridge et al., 2012). Product cycle effects suggest that in the early stages of an innovative product, it will be produced in cities with better access to R&D and specialized workers. As production processes mature, production migrates to lower-cost rural settings; a key feature of the geography of U.S. manufacturing employment in the 1970, 1980s, and 1990s was the movement towards lower cost rural areas (Quigley, 2002). Thus, we divide the sample into counties in metropolitan (MSAs) and nonmetropolitan areas.[2] Experiments with dividing metropolitan counties into those that are part of larger MSAs (>250,000 population) and smaller MSAs produced similar results.

The use of counties has key advantages such as the aforementioned possibility of considering differences between urban and rural settings. The use of counties also has a long tradition in urban and regional economics and their labor market dynamics are well understood. As described below, a large share of the workforce lives and works in the same county and the county typically plays an important administrative function for policy. In contrast to MSAs or labor market areas, counties have consistent boundaries over time.

Because of our interest in comparing the pre-2000 period, before the dramatic rise of competition from low-wage countries (particularly China), to the post-2000 period, the two primary time periods we consider are 1990-2000 and 2000-2010. For sensitivity analysis, we

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[1]In our data, there are cases where independent cities (mostly in Virginia) are merged with the surrounding county to form a more functional region. We omit 43 mostly small rural counties due to missing data.

[2]A metropolitan area is a county or counties that contain a city of at least 50,000 in population, as well as additional counties with tight commuting linkages with the core urban area. We use the 2003 Census metropolitan area definitions. See the U.S. Census Bureau for details.

also estimate some models over the 2000-2007 and 2007-2010 periods to assess whether the Great Recession spawned different patterns.

We examine the impact of international trade by constructing two measures of import and export trade intensity of the local labor market, which proxy for the changes in county employment attributable to international exports and import competition. First, we estimate the average amount of employment nationally that is embodied in exports and imports for industry *j* in the beginning period *0* and ending period *t*:

(10) $enx_{jt}= nx_{jt}*(eus_{jt}/yus_{jt})$

(11) $enx_{j0}= nx_{j0}*(eus_{j0}/yus_{j0})$

where nx_{jt} is the value of U.S. imports (or exports) in period *t* for industry *j*, eus_{jt} is US employment in industry *j*, and yus_{jt} is U.S. production in industry *j*. The term in parentheses on the right-hand-side reflects the U.S. employment per dollar of output in industry *j* in year *t.* In multiplying by the value of imports (or exports) in year *t,* we derive the expected amount of employment embedded in imports (or exports) of industry *j* in year *t.* The underlying assumption is that, within each industry, the labor-intensity of goods that are exported, or domestically produced goods that are also imported, is similar to the national average. One possible problem that could plague our trade measures is that it may be expected that imports are more labor intensive than the national average for their respective industry and exports are less labor intensive. Of course, such a problem would also occur for other studies trying to assess trade's impact (e.g., Autor et al., 2013) because we do not know exactly which domestic firms are directly affected. Yet, as long as the differences in labor intensity that are affected by trade in a given industry are not systematically different across regions, all this would do is affect the scaling of the regression coefficients—e.g., if a higher than average numbers of workers are being displaced by imports, then the import regression coefficient in an employment model will be larger in magnitude.

We then apportion the export/import employment effects of a trade shock to each region based on its industry employment composition:

(12) $Trade_i = \sum_{j=1}^{n} (e_{ij0} / e_{i0})((enx_{jt} - enx_{j0}) / eus_{j0})$

where the first term in parentheses is industry *j's* share of employment in county *i* in the initial year; use of initial year employment shares reduces the potential for reverse causality with regional labor market outcomes. The second term is the predicted national growth rate in industry *j's* employment due to imports/exports over the *0* to *t* period. The summation across all industries creates the expected direct employment growth (or loss) in county *i* due to its shares of changes in national exports/imports. ADH's (2013b) base measure of trade is similar, but instead they use the expected amount of change of import (or exports) dollars per worker, which does not reflect the numbers of workers affected, especially if there are differential productivity shifts.[3,4]

The dependent variables potentially affected by international trade shocks consist of several measures reflecting county labor market outcomes. First, we examine the percentage change in total employment as reported by the U.S. Bureau of Economic Analysis (BEA). Total employment is the most comprehensive measure because it includes changes in employment that may arise from people who are forced into "necessity" self-employment from negative employment shocks. We also use wage and salary employment in sensitivity analysis, which does not include self-employment, but the results are similar.

We next examine the percentage change in population (from the U.S. Census Bureau) because it is a comprehensive measure that includes both foreign and domestic migration, and population estimates at the county-level data are relatively accurate. Domestic migration may be intertwined with natural increases and immigration, in which immigrants may be attracted to particular locations by the same factors as are domestic migrants, and where each may have

[3]Others consider similar industry-weighted changes in prices at the regional level (Leichenko and Silva, 2004; Topalava, 2010; McLaren and Hakobyan, 2010). As with ADH (2013b), such a measure does not directly measure employment, especially if there are differential productivity effects across industries.

[4]ADH consider an employment measure in sensitivity analysis, but it attributes all indirect employment effects to the affected local area through using the national input-output table. One concern is that a significant share of inputs would be imported from surrounding U.S. regions and thus their measure is an over-estimate of local employment effects in which the measurement error would vary by location and by the industry composition of the local area (which affects the share of local inputs). By contrast, when including only the direct industry effects, any local indirect multiplier effects would be part of the regression coefficient.

causal effects on the other (Partridge et al., 2008b; 2009a). Population change and net migration are the result of people "voting with their feet" on current and expected future economic conditions such as international competition.

Then we assess the change in the employment-population ratio over the respective sample periods to confirm the BEA population and employment findings regarding possible changes in regional labor market dynamics. In this case, county employment is from *place-of-residence* data from the U.S. Bureau of Labor Statistics and population is those 18 and over from the U.S. Census Bureau.

We also assess whether international trade affects the distribution of income by examining the following outcomes: county poverty rates, median household income, and average county wages. These are derived from the 1990 and 2000 Censuses, the U.S. Census Bureau SAIPE estimates, the 2011 American Community Survey (for poverty rates and median household income); and the U.S. BEA for average county wages. The relative distributional consequences of trade are *a priori* ambiguous at the local level. An increase in import competition may particularly adversely affect less-skilled workers, while positively affecting some higher-skilled workers as trade-impacted firms increase their skill requirements. As such, it is possible that both average wages and poverty rates increase, with ambiguous impacts on median household income. As described below, these predictions are relative to a common employment shock that is of either domestic or international origin.

Using the economic outcome measures described above, for the metropolitan and nonmetropolitan sub-samples, our base specification for a given county *i* located in state *s* is:

$$(13)\ \%\mathbf{OUTCOME}_{is(t\text{-}0)} = \alpha + \boldsymbol{\beta}\mathbf{TRADE}_{is0} + \boldsymbol{\lambda}\mathbf{ECON}_{is0} + \boldsymbol{\varphi}\,\mathbf{GEOG}_{is0} + \boldsymbol{\gamma}\mathbf{AMENITY}_{is0} + \boldsymbol{\delta}\mathbf{DEMOG}_{is0} + \sigma_s + \varepsilon_{is(t\text{-}0)},$$

where the dependent variables are measured between periods 0 and *t* (i.e., 1990-2000, 2000-2007, 2007-2010, and 2000-2010). **TRADE** reflects our measures of the county's exposure to imports and exports (Equation 12), which may have effects that differ from average common shocks; **ECON** includes other measures of economic activity; **GEOG** includes measures of the location's proximity to larger urban areas; **AMENITY** contains measures of natural amenities; and **DEMOG** contains demographic/human capital attributes that would be related to labor force quality and labor supply shifts that could affect outcomes. The regression coefficients are α, $\boldsymbol{\beta}$, $\boldsymbol{\lambda}$, $\boldsymbol{\varphi}$, $\boldsymbol{\gamma}$, and $\boldsymbol{\delta}$; σ_s are state fixed effects that account for common factors within a state; and ε is the residual, which is allowed to be clustered.[5]

ADH (2013b) note that changes in import competition in an industry *j* could be correlated with industry demand shocks that affect local economic conditions and could cause estimation bias. There could be a correlation between domestic-based shocks facing a local area and the amount of import competition faced by the industries concentrated in that region – e.g., places manufacturing a product facing strong competition from imports. ADH (2013b) address this by instrumenting for Chinese import intensity using Chinese trade patterns with other advanced economies, which was necessary because they did not account for other local demand conditions. We instead more fully control for all national/international shocks in the **ECON** and **GEOG** vectors to remove the influence of other employment shocks from the residual.[6] One reason for our approach is we examine trade with all countries, which includes trade with other advanced economies, precluding their use in constructing instruments.

The primary variable in **ECON** is the industry mix employment growth for the period (e.g., 1990-2000; 2000-2010) shown in Equation 8, except in employment terms. The industry mix

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[5] Using the STATA cluster command to account for clustering of the residual, the residual is assumed to be spatially correlated with neighboring counties within its BEA functional economic region but independent of county residuals in other regions. There are 177 BEA Economic Areas that surround an "economic node," reflecting a region that has connections in labor and product markets, as well as information exchanges (Johnson and Kort, 2004). Accounting for spatial autocorrelation only affects the estimated standard errors.

[6]The correlation of locally-based shocks with trade shocks should be relatively small. Suppose there is an international trade shock that indirectly affects local demand for good *j,* perhaps by changing local income through hiring or layoffs. Equation 5 shows that this impact on local production of *j* equals:

$$\hat{Q}_{ij} = \sum_n (X_{nij} / Q_{ij}) \hat{X}_{nj}$$

The locally sold production share (X_{iij}/Q_{ij}) for traded goods is small by definition. For example, Jeeps trucks are assembled in Toledo, Ohio. The share of those Jeeps locally sold in Toledo is very small, which means that import shocks on Jeep sales would have very little feedback effects through affecting local demand for Jeeps. Likewise, the share of corn that is locally consumed in a typical U.S. corn belt county is very small as well, meaning that trade shocks to corn markets would have few spillovers on local corn sales. Hence, local shocks on a traded good sector have very little impact on the local production of that good (as a share of total output of the good).

variable represents labor demand shocks that is calculated by summing the products of the initial 1990/2000 industry shares at the four-digit level and the corresponding national U.S. growth rates. Industry mix employment growth represents the overall growth rate that occurs in a county if all of its industries grow at their respective national growth rates. Variation in industry mix employment growth across counties originates from their differing industry compositions at the beginning of the respective period. If an industry experiences a national or international shock, the county's industry mix employment growth rate is affected to the extent that this industry is present in the county. The industry mix growth rate captures the overall labor demand shock from all sources and the associated coefficient represents the average or common effect of any/all shocks.

The industry mix variable comes from the long-standing shift-share model (Loveridge and Selting, 1998) that has been around since at least 1960. It has been used extensively as an exogenous shift measure for local employment shocks in empirical studies of local labor markets (e.g., Bartik, 1991; Blanchard and Katz, 1992; Bound and Holzer, 2000; Moretti, 2010). The expression is devoid of local supply influences to the extent industries are not too regionally-concentrated (Blanchard and Katz, 1992), which is likely true given our use of counties and aggregated national industries. In some sense, there are some similarities with how we use this variable and Moretti's (2010) use of this instrument, in that while the latter was not estimating the effects of trade, Moretti was estimating how (traded) durable and nondurable manufacturing shocks affect local employment. Our interest in the specific impact of international trade shocks is captured in our **TRADE** variables, which allows us to assess whether international trade shocks (part of the total common shock) have effects that differ from the average or common shock. Controlling for all shocks with the industry mix term should eliminate the concern that local exposure to trade is correlated with unaccounted for domestic shocks in the residual.

GEOG includes measures of access to the urban hierarchy that affect local economic conditions. First, are proximity measures to the nearest urban areas differentiated by their importance in the urban hierarchy starting with distance to the nearest metropolitan area with additional variables capturing relative proximity to metropolitan areas of 250,000 to 500,000 people; 500,000 to 1.5 million people; and greater than 1.5 million population. Partridge et al. (2008a, 2009b) provide details of their calculation. **GEOG** also contains county population, population of the nearest/actual urban center to account for competing urbanization economies and congestion effects, and the county land area in square miles.

The vector **AMENITIES** represents the natural amenity attractiveness of the area, which can affect population and employment growth. Amenity attractiveness is measured by a 1-7 scale developed by the U.S. Department of Agriculture based on measures of climate, proximity to water and topography, etc. (McGranahan, 1999). We also include three indicator variables for close proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes to capture other natural amenity and productivity effects. We include state fixed effects to account for state-specific factors such as tax and regulatory policy differences or historic settlement. Not including state fixed effects would likely cause omitted variable bias. With the inclusion of state fixed effects, the other regression coefficients are interpreted as the average response for *within*-state changes in the explanatory variables.

The **DEMOG** vector denotes mostly labor supply factors associated with human capital and mobility, all measured in the initial period. There also are five measures of race or ethnicity; four variables measuring the education levels of the county's residents; female percent of the population; percent of the population that is married, and the percent reporting a work disability (see Partridge et al. (2012) for details).

4. Empirical Results

4.1 Geography of Trade

Figures 1 and 2 illustrate the magnitudes of import and export employment shocks from Equation (12) for the 1990-2000 and 2000-2010 periods for U.S. MSA and nonmetropolitan counties. For imports, larger positive numbers are associated with larger import shocks and greater predicted job *losses,* while larger positive numbers for export shocks are associated with greater predicted job *gains*.

Panels A and B of Figure 1 reveal a common pattern for metropolitan import job shocks in both decades; southeastern and northeastern urban areas were hardest hit by increased U.S. imports. Rustbelt MSAs experienced larger negative shocks in the 1990s and interior California MSAs experienced greater import job shocks after 2000. The nonmetropolitan import job shock patterns in Figure 2 are similar except that the Great Plains region shifted from small to large import shocks post 2000—likely due to increased agricultural imports. Another difference is that negative import shocks in nonmetro southeastern counties were more pervasive in the 1990s than in their metro counterparts.

Panels C and D of Figure 1 show that positive MSA export employment shocks were largest in the Eastern Great Lakes and Northeast in the 1990-2000 period, suggesting that import-based losses in the regions were partially offset by export-based gains. A distinct westward shift in the largest (positive) export shocks occurred after 2000. Also notable is the lack of positive *export* employment shocks in the Rustbelt region post-2000, leaving them without offsetting gains for their predicted import losses. The Southeast generally did not experience large export employment shocks in either decade. The nonmetro export shocks follow a similar pattern, except that the Great Plains region fared well in both decades.

4.2 Correlation of Key Variables

Appendix Table 1 reports the metropolitan and nonmetropolitan county correlations for the 1990-2000 and 2000-2010 samples for the industry mix, export, and import employment shock (trade) variables. We also include what we refer to as the domestic industry mix employment shock, which nets out the import and export effects by adding the negative import employment shock and subtracting out the positive export shock to produce the domestic industry mix employment growth effect (see below in Equation (14)).

Across all samples, the domestic industry mix and the overall industry mix terms are highly correlated, with coefficients ranging between 0.96 and 0.99. The stronger correlation for domestic industry mix suggests that variation in non-international trade shocks is the dominant feature in the variation in overall shocks. There also is a relatively high correlation between exports and imports of 0.53 in the 1990s metropolitan sample, where, in general, the correlation is positive. This crosstrade positive correlation is consistent with exports and imports occurring in the same product groups. Also notable are the negative correlation coefficients for *both* exports and imports with domestic shocks and industry mix employment shocks, with the exception of the industry mix and export shocks in the 2000-10 nonmetro sample. This likely partly occurs because internationally traded goods are concentrated in manufacturing, where employment growth lagged the national average growth across all sectors. The correlation is most notable in the 1990s for import shocks, in which the correlations with both industry mix growth variables ranges between -0.40 and -0.58. One implication is that omitting domestic shocks primarily would affect the import estimates for the 1990s, in which the negative correlation suggests that the omission of domestic shocks would negatively bias the import coefficients for the 1990s. Yet, the correlation between exports and the common/domestic shock terms in both the 1990s and 2000-2010 is quite low, as is the correlation of imports with the common shock terms for 2000-2010 is also low, suggesting that omitting the common/domestic shock terms would have a much smaller bias (if any) for those cases.

4.3 Regression Results

Table 2 shows the base results for the key independent variables: (1) industry mix employment growth, (2) change in import employment growth, and (3) change in export employment growth, the latter two being our **TRADE** variables (Equation 12). Column 1 shows the MSA county results for 1990-2000 and column 2 shows those for 2000-2010. Columns 3 and 4 show the corresponding results for nonmetro counties.

Employment Growth. Panel A of Table 2 shows the results for U.S. BEA total (place of work) employment growth, where for Model 1 only the (domestic and international) common industry mix shock measure is included in the model, while the variables representing export and import shocks are omitted. Both Models 1 and 2 include the other control variables described in the empirical implementation.

Because international demand shocks already are captured in the (total) industry mix variable, the trade variable effects are interpreted as *relative* to the industry mix coefficient, which reflects the effects of the common or average employment shock. Greater local exposure to nationally growing export employment contributes to greater industry mix employment growth, while greater exposure to nationally growing imports reduces industry mix employment growth. Thus, a negative 'export shock' coefficient signals a reduction in the positive effect on employment growth of a positive shock. A negative 'import impact' coefficient indicates an enhanced negative effect of a negative shock. The coefficients of the trade variables indicate whether there are trade-shock impacts in addition to those already included in the common industry mix growth rate.

The industry mix employment shock term is consistently positive and highly statistically significant in the employment growth regressions. The 1990-2000 results for Models 1 and 2 reveal an industry mix growth rate coefficient of over 2 in MSA counties, suggesting that for every exogenous new job, there are in total two jobs created—one direct from the shock and another one indirectly created by spillovers such as through supply chain links. For nonmetro counties, the corresponding industry mix coefficient is about 1.4, suggesting smaller spillovers. In both MSA and nonmetro samples, the import and export job shock terms are statistically insignificant, suggesting that import and export shocks had similar job growth effects as a common shock.

For 2000-2010, industry mix employment growth remains statistically significantly related to job growth, although the magnitude of the coefficient decreased. With one exception, the trade employment shock variables are statistically insignificant, suggesting total trade employment effects similar to those following a common employment shock. The exception is the positive coefficient for the import shock variable in the nonmetro specification. This suggests that import shocks had smaller than average negative employment effects post-2000; industries in rural areas competing against imports may have had domestic market alternatives, or perhaps imports are not particularly good substitutes for the kinds of products produced in rural areas, consistent with Lawrence (2008) and Edwards and Lawrence (2010).

Panel B reports the results of regressions where we create an alternative domestic-only industry mix employment shock term that is created by differencing out the trade shocks:

(14) DomINDMIX = INDMIX + IMPORTSH – EXPORTSH,

where we add the negative import employment shock and subtract out the positive export shock to produce the domestic industry mix employment growth effect. The coefficients (and their t-statistics) for the trade variables are now their *total* impacts on the dependent variable, including any unique trade-shock effects, not the differential or incremental effects relative to the common INDMIX shock as used above (where the coefficients were combined in interpretation of total trade effects). Because the import (export) employment shock is predicted to be a negative shock, the import coefficient would be expected to be *negative (positive)*.

For both the 1990s and post-2000, domestic industry mix employment shocks generate the same positive statistically significant results as for the common employment shocks. For the 1990s, the import employment shock is now associated with negative and statistically significant results, in which the difference from Panel A is that the import coefficient now reflects the total effects of imports (as opposed to indicating whether they have a statistically different effect from the average employment shock). These results illustrate that it is not that imports do not have a statistical effect on total employment in Panel A, just that import shocks generally are not statistically different from the common employment shock.

For 2000-2010, there are similar findings for export employment shocks in both metro and nonmetro samples in Panel B compared to Panel A *(in A, the total export effect obtained by adding the industry mix and relative export coefficients together)*. The nonmetropolitan import results indicate that import shocks are statistically significantly different from the common average shock in Panel A, but the gross effect is statistically insignificant in Panel B. In Panel B, the extent to which international and domestic shocks differ in their total effects is inferred by simply comparing the sizes of their coefficients.

Overall, based on (1) the much larger standard deviation of domestic industry mix employment growth compared to the corresponding employment-translated trade shocks (in Table 1) and (2) the estimated coefficients in the employment growth equations, shocks arising from domestic (rather than international trade) sources were by far the most responsible for the variation in employment growth across U.S. counties. Notably, this pattern essentially remains unchanged from the 1990s to post-2000. Yet, while trade shocks appear to have similar employment effects relative to equal-sized common shocks, they could have differential effects on other local economic outcomes if the public's expectations of future trade effects differ from their contemporaneous effects. Thus, we next gauge public expectations by examining whether trade shocks differentially affect population movements (and local labor supply).

Population Growth. Panel C shows the population growth regression results. The industry mix results in column 1 show that 1990-2000 metro county population growth responded roughly in proportion to the shock, increasing by one percent for every one percent job change in industry mix employment, while column 3 shows a somewhat smaller nonmetro population response of about 0.75. The population response falls to just under 0.2 during 2000-2010 in the metro and nonmetro samples. Migrants appeared to fill most all of the newly created jobs in the 1990s, but after 2000, jobs-based interregional migration appears to have greatly diminished, implying that the response was primarily through local labor adjustments (Partridge et al., 2012; Molloy et al., 2013).

Model 2 (Panel C) adds the export and import employment change variables to Model 1. For the 1990s, the trade variables are statistically insignificant in the population growth regressions, except for the positive and significant nonmetropolitan import share coefficient. Because larger imports both imply greater predicted job losses (Equation (12)), and reduce the industry mix growth variable (Equation (8)), the positive coefficient implies that in the 1990s, import-based shock impacts on local nonmetropolitan economies had a *lesser* negative effect on population growth than did a generic equal-sized common shock. For 2000-2010, positive export shocks are associated with lower population inflows than the common positive employment shock in both MSA and nonmetropolitan counties. Import employment shocks are associated with more population loss relative to losses following a similar-sized common shock, though the nonmetro coefficient is smaller and insignificant.[7] We now assess other indicators to appraise their responses

[7] We do not weight by county population because our primary interest is in how trade affects the typical MSA and nonmetropolitan county, not necessarily the typical metro and nonmetro resident. Nonetheless, we also performed county population-weighted regressions. The results are fairly similar to the unweighted results, with the exception that the industry mix coefficient is much more positive and statistically significant for MSA counties post-2000. In addition, we experimented with using total job growth as an explanatory variable rather than the industry mix term in instrumental variables estimation, where the industry mix variable serves as the instrument for job growth. Not surprisingly, the IV results were almost identical to those when directly using industry mix.

as well as their consistency with the employment and population growth results.

Employment/Population Ratio. Panel D reports the results for the change in the employment/population ratio (emp/pop). For shocks to directly affect an area's original residents some combination of unemployment and labor force participation needs to change; together these responses are evident in changes in the emp/pop ratio. Recall from the previous section that the ratio is calculated for adults and is from a different source than is total employment (by place of residence, not place of work) and population; so, the change in the ratio cannot necessarily be obtained from the results in Panels A and C. Model 1 again only includes the common industry mix employment shock; whereas, Model 2 adds the trade-specific shock variables, where, as before, the industry mix coefficient is not much affected by the addition of the trade variables.

The common employment shock had little influence on the emp/pop ratio in the 1990s as migrants took most of newly created jobs or left if there were job losses (see Panel C). Yet, post-2000, it appears that many existing residents gained work after a positive shock, especially in nonmetro areas, consistent with a declining migration response to economic shocks. Import employment shocks are associated with statistically significantly greater declines in the emp/pop ratio in the 1990-2000 MSA and nonmetropolitan samples compared to a common negative shock. Especially in the nonmetropolitan results, this is not unexpected because import shocks are associated with smaller population responses. Export shocks are positive but statistically insignificant in the metropolitan sample, and they are positive and statistically significant at the 10% level in the nonmetro sample.

In both the MSA and nonmetropolitan samples, positive export employment shocks are associated with statistically significantly larger increases in the emp/pop rate during the 2000-2010 period than the average shock — i.e., not only did the average shock (including exports) have a larger impact post 2000, but there were also additional export-specific effects. While population was not specifically responsive to export shocks, the remaining labor force became more intensively employed. Import employment shocks exert a significant negative additional effect (beyond the average negative shock effect) on the emp/pop ratio in metropolitan areas.

There are a few noteworthy implications of the Table 2 results. First, import shocks augmented negative migration effects beyond the common shocks after 2000, consistent with the narrative of imports becoming more ‘harmful’ with the rise of low-wage competitor nations such as China. Second, the export effect is consistent with anticipatory migration effects to further productivity improvements and possible fiercer future foreign competition reducing domestic employment needs. Many households may no longer wish to reside in places with high exposure to international trade, regardless of export or import orientation, because of the anticipated future employment loss risks. Public perceptions about the negative effects of trade dependence appear to extend beyond imports and low-wage competitors, but to trade in general. Third, import competition does not in general have the same incremental negative effects on migration in rural areas, perhaps due to a competitive advantage of lower land and labor costs or because of more domestic alternatives in response to foreign competition.

Change in Poverty Rates. Increased trade has *a priori* ambiguous income distribution effects, depending on how skill composition is affected and how these spillovers manifest themselves in the broader local economy. Job losses among low-skilled workers in import-competing industries could reduce wages across the local economy with the ensuing increase in available labor supply for low-skilled nontraded sectors, increasing poverty rates. These effects among the less skilled may be especially persistent in local economies because of lower geographical mobility of less-skilled workers (Bound and Holzer, 2000). Conversely, growth in the export sector may be associated with up-skilling of existing workers and more-intensive hiring of higher skilled workers. Thus, areas intensive in sectors subject to positive export shocks may have lower poverty rates.

To examine the distributional issues, Panel A of Table 3 reports the results for the change in the poverty rate as the dependent variable for 1990-2000 and 2000-2010. Models 1 and 2 are as before. In both periods, and for both metropolitan and nonmetropolitan counties, average or common positive employment shocks significantly reduce poverty in Model 1, with the coefficient only insignificant during the 1990s with Model 2. The magnitude of the industry mix coefficient in Model 1 more than doubles after 2000 for MSA counties, most likely because of less geographical mobility of workers; fewer in-migrants competed for new jobs or there was less offsetting net out-migration following negative employment shocks.

In the 1990s, according to Model 2, import-based shocks are associated with statistically significantly higher poverty rates than are the common or average employment shocks in both metro and nonmetro counties, while export shocks are associated with relatively lower poverty rates. During 2000-2010, export shocks reduce poverty more relative to the average shock in MSA counties, but not in nonmetropolitan counties. But the impact of the average or common shock more than doubled post-2000, indicating that overall export shocks continued to reduce poverty. Increases in job losses associated with import competition again are positively related to higher poverty rates compared to the average economic shock, but in contrast to the 1990s neither relative import effect is statistically significant.

The larger population response associated with imports appears to have limited the poverty effects in metropolitan areas post-2000, while the stronger poverty effect of exports is likely related to the more limited population response to export shocks, and larger emp/pop rate responses. Thus, for the lower tail of the distribution, increased foreign import competition after 2000 had no more adverse effects than a common shock. These results are somewhat supportive of polarization theories of the labor market that mid-skilled workers bear most of the costs of recent trade and technological patterns (Autor and Dorn, 2013a) because lower-skilled workers cannot be outsourced or do not actively work in traded sectors. Yet, as the statistically significant industry mix term shows, employment shocks affect poverty rates; it is just that imports have no significant additional effects during the 2000-2010 period.

Median Household Income. Because poverty relates to the lowest tail of the income distribution, we also examine the percentage change in median household income (Panel B of Table 3).[8] For both models and samples, the coefficient on the industry mix variable is positive and

[8]For the percentage change in median household income model, we also include a wage mix variable that corresponds to the industry mix term we used to capture employment growth shocks. Specifically, using the county's initial four-digit industry composition to predict the expected wage growth rate if all of the industry wage rates grew at their respective national rate, which should be exogenous in the same manner as the industry mix employment variables. Likewise, we also include the log of the initial-period average wage to account for any

significant. However, the trade variables are all statistically insignificant for the1990s indicating that trade employment shocks had effects similar to an average employment shock. Post-2000, export shocks had significantly larger positive effects on median household income, while imports had no statistically different effect. The export result is consistent with the previously found lower migration (labor supply) responses in counties that are intensive in export industries, skill-upgrading, or changes in total number of hours.

Average Wages. Panel C of Table 3 assesses the average change in wages for 1990-2000 and 2000-2010. Model 1 shows that the industry mix coefficient is statistically significant during the 2000-2010 period but not during the 1990s. The post-2000 results are consistent with the declining overall migration response to economic shocks, where the effects of shocks are manifested in smaller labor supply shifts and larger wage increases. In Model 2, the only insignificant industry mix coefficient is for nonmetro areas during the 1990s, while the post-2000 effects remain larger.

The export employment shock coefficient is statistically insignificant, suggesting that much of the positive export-median household income response may be because of higher employment rates. Conversely, the import coefficient is positive and statistically significant in both the metro and nonmetro samples during the 1990s. Thus, there is evidence of skill upgrading in import-intensive sectors, where manufacturing plants with increased exposure to imports from low-wage countries switch production to more capital-intensive activities (Bernard, 2006), and a net reduction in emp/pop rates to leave median household incomes unchanged during the period.[9]

ADH (2013b) found that import competition from China was inversely associated with wages. In one sense, this is consistent with our findings in that negative shocks—whether due to imports or domestic shocks —are associated with falling median household income. Yet, greater imports have lesser effects on wages than do average or common shocks. What is different is that ADH focused on China and we consider trade in general. We also more fully control for all employment

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disequilibrium or convergence effects. These two additions do not measurably affect our key results.

[9]We consider as additional outcome variables, changes in educational attainment by examining the change in the percent of the adult population with less-than a high school degree, exactly a high school degree, some college, and bachelor's degree or higher. However, these results were inconclusive, perhaps because the categories were too broad to adequately represent the skills distribution, and we do not report them

shocks affecting local areas. [10]

4.4. Tests of Robustness and Alternative Hypotheses

Importance of Controlling for Domestic Demand Shifts.

Table 4 shows the results when the overall industry mix shock variable is omitted from the model. This specification is closer to those in previous studies that did not account for potential correlation with omitted labor demand shocks and are suggestive of the size of the associated omitted variable bias that were hypothesized by ADH. (2013b).

Panel A reports the results for total employment growth. We find that during the 1990s, imports are much more strongly negatively and statistically significant than what would be expected from the corresponding employment growth results in Panel B, Model 2, Table 2, suggesting that omitting local shocks greatly increases the estimated negative effects of imports during the period. For 2000-2010, we see that the results are closer to those in the corresponding results in Table 2, though the effects of imports are a little smaller than expected.

The results in Panel B of Table 4 suggest that import employment shocks were associated with population losses in both MSA and nonmetro counties during the 1990s, but export shocks are insignificant. Not controlling for industry mix shocks makes it appear that imports have more negative population effects than suggested by the corresponding results in Panel C in Table 2. For the 2000-2010 period, the results are fairly close to what would be expected by adding the industry mix effect to the export coefficient in Table 2 and subtracting it from the import coefficient.

The specifications in Panels C, D, and E respectively use the change in the emp/pop rate,

[10]In results not shown we also considered 2000-2007 and 2007-2010 separately. The effect of export shocks on job growth is significantly negative in the pre-recession period, consistent with exports having lower positive employment shock impacts compared with common shocks, and positive during the recession (though only statistically significant in nonmetro counties). Only pre-recession in nonmetro counties are import shocks negatively related to total job growth. The negative link between population growth and export employment shocks existed through the decade, but the larger negative impact that import-specific shocks had on population growth did not exist in the Great Recession period. The declining magnitude of the industry mix shock coefficient between the two periods suggests that while the falling responsiveness of migration to employment shocks began pre-recession, it accelerated during the recession. The positive export shock coefficients on employment rates continue to suggest that people avoid export-intensive locations or did not out-migrate following negative shocks. For MSA counties, export employment shocks were associated with differentially falling poverty rates both before and during the recession, but with rising poverty rates pre-recession and falling poverty rates during the recession for nonmetro counties. Import shocks were associated with rising metro poverty rates pre-recession, but not during the recession, while there was no clear nonmetro pattern.

change in the poverty rate, and the percent change in median income as the dependent variables. With the exception of a smaller than expected negative association between the drop in the poverty rate and the export employment shock in the nonmetro 2000-2010 model, the results are as expected from Table 2. In short, omitting other shocks from the model only meaningfully affects the 1990-2000 results for population growth and employment growth, in which the omitted variable bias appears to contribute to an overstated negative import effect in Table 4 (also supporting ADH's hypothesis, at least for the 1990-2000 period).

Endogeneity and Omitted Variable Bias.

We have noted that the industry mix term has long been the workhorse exogenous instrument for local demand shifts. Yet, a reviewer pointed out that if there are supply shifts such as immigrants move to counties with a concentration of low-wage exporters, producing more job and export growth (which would be reflected in the industry mix and our export variable), but may produce other effects that are correlated with the residual. At first glance, the possibility does not seem very likely. For example, our finding that population was so strongly inversely associated with exports post 2000 suggests that there are not net positive labor supply shifts associated with exports. Our average domestic shock results also are generally insensitive to adding the trade variables (compare Models 1 and Models 2 in Table 2), further suggesting that there is not a strange correlation between industry mix and trade variables that could be related to other supply shocks. Likewise, Card and Lewis (2005) also found that surges in low-wage Mexican immigrants to particular locations were not associated with changes in industry composition such as predicted by the Hecksher-Olin model. With the rise of low-wage Asian exporters, it makes it even more difficult for low-wage U.S. exporters to thrive. Yet, to directly assess this possibility we considered three strategies: (1) a novel strategy that combines matching and IV, (2) a more traditional IV approach, and (3) assessing the sensitivity of the results after adding an immigration share variable.

The mixed matching/IV strategy first uses the Mahalanobis distance approach to find matches for MSA and nonmetro counties based on their initial-period 1990 or 2000 industry mix growth, population, farm share, and manufacturing share. To ensure that there are no spillovers, we set a minimum geographic distance between matches to be at least 150 miles (the average match was 870miles in 1990 and 890 miles in 2000). We then use the matched county's 1990-2000 or 2000-2010 values for industry mix, exports, and imports as instruments for the county of interest when applying instrumental variables, which is akin to ADH (2013b) using other countries trade values as instruments. The hybrid matching IV results are reported in Table 5. First, Appendix Table 2 reports that the corresponding first-stage F-statistics range from 17.8 for the 1990-2000 nonmetro import variable to a high of 1,649 for the 2000-2010 nonmetro industry mix variable, showing the instruments are very strong. These results are generally very similar to the OLS results in which the general narrative of trade shocks not having statistical differences from domestic shocks (except slightly more negative post 2000) and exports being related to modestly positive economic results that are associated with population declines. As a sensitivity analysis, we used the values from the two nearest county matches, but the results were generally the same. A key advantage of using the two nearest matches is we can conduct a Sargan test for over-identification. The null hypothesis that the residual is correlated with the explanatory variables can be rejected in a large majority of cases at the 5% level, supporting the identification strategy.

The second approach uses a more traditional IV in which we use the 1985-1990 industry mix shock to instrument for the 1990-2000 industry mix shock and the 1995-2000 industry mix as an instrument for 2000-2010 industry mix. The results reported in Appendix Table 4 show that results for the industry mix shock and the trade shock variable coefficients are often of much larger magnitude (implausibly so), especially in the employment growth results in Panel A. However, the general pattern tends to play out with trade generally having statistically insignificant differences from the average industry mix trade shock. Yet, exports continue to have positive links to other other 2000-2010 economic outcomes such as being negatively associated with poverty rates and positively related to employment-population rates, though again much of this appears related to the strong statistically significant negative association between exports and population growth.

Our third approach to assess whether supply shifts and immigration are affecting the results is to simply add recent (lagged) immigration flows to the base model to capture the scale of the immigration and related network effects that attract more immigrants. For the 1990-2000 model, we add the 1990 population share that immigrated between 1985-1990 and the 2000 population share that immigrated between 1995-2000 for the 2000-2010 models. We are not specifically addressing immigrant causality in these models, but rather just appraising the sensitivity of the results (not shown for the sake of brevity). The industry mix and trade shock variable results were virtually unchanged, suggesting they are not too sensitive immigration. In addition, the immigration variable results are typically statistically insignificant.

To control for county growth fixed effects and remove potential omitted variable bias, we next estimate first-difference models that specify the variables as their 2000-2010 minus 1990-2000 values. We caution that if there are differences across the decades, the first differencing would not pick it up. As shown in the first two columns of Panel A in Table 6, consistent with Table 2, industry mix positively and significantly affects total employment growth and there is only one significant differential trade effect, a negative export impact in MSA counties. Industry mix also is associated with higher population growth, emp/pop rates, median income, and average wages, as well as lower poverty. The differential trade effects for the other outcome variables generally follow the patterns in Tables 2 and 3, supporting our original conclusions. The main exception is that imports are inversely associated with poverty and positively linked to median income and emp/pop rates. In Panel B of Table 6, the industry mix shock term is omitted, consistent with the models in Table 4. These results suggest that the trade variable results are often quite instable, further illustrating that not fully accounting for the demand shocks could bias the estimates.

To further assess if there are omitted variable bias, we also estimated a fixed effects (within) model by dividing the sample into five-year differences: 1990-1995, 1995-2000, 2000-2005; 2005-2010 (not shown for brevity). The resulting patterns are similar to the ten-year difference results in Table 6. The between estimates from this panel are close to those in Tables 2 and 3, which is as expected since they reflect cross-sectional effects. Exports (imports) have positive (negative) differential impacts on metro and nonmetro county emp/pop rates. Exports (imports) also negatively (positively) affect poverty, though the import impact in MSA counties is insignificant.

In contrast to Tables 2 and 3, imports have a significant negative differential total employment effect in nonmetro counties and a significant positive effect on population in metro counties. Though while our main conclusions remain unchanged, we note that using five-year periods could increase the noise of the estimates, which may affect these results.

Although there are some differences in results in panel estimation, our preferred specification is allowing coefficients to differ across the periods (Tables 2 and 3). For one, U.S. trade patterns changed post-2000, particularly with China. Perhaps, as or more important, the dynamics of local labor markets changed post-2000. Well documented is the decline in migration responses to labor demand shifts (Partridge et al., 2012; Molloy and Wozniak, 2013), which greatly affects the responsiveness of other outcomes to labor demand shifts (Blanchard and Katz, 1992).

Further Exploring the Domestic Demand Effects.

Firstly, we separate the sectors used to construct the industry mix measure into two distinct groups: 1) sectors corresponding to those used in calculating international trade shocks in Equations (10) and (11); and 2) non-traded sectors. The industries are then used to construct two corresponding industry mix measures. For one, this will isolate the effect of the shift to services from product cycle and productivity effects in sectors related to international trade, aiding in the interpretation of the industry mix variable.

The empirical results (not shown) hardly changed from replacing the industry mix variable with the two distinct industry mix measures in the regressions corresponding to Tables 2 and 3. The coefficients on the two industry mix are similar; for metropolitan areas, the industry mix coefficients were statistically indistinguishable at the 5 percent level in all Model 2 specifications, where for nonmetropolitan areas in one-half of the Model 2 specifications, the industry mix coefficients were statistically indistinguishable based on Wald tests.[11] This further suggests that not only does it *not* matter whether the shock is domestic or trade-based, but it also does not matter whether the shock emanates from a trade-related sector or not. Rather it is the size of the shock that

[11]The unweighted means across counties for the trade sector industry mix variable for 1990-2000 and 2000-2010 are -0.006 and -0.045. For the non-trade industry mix variable the corresponding means are 0.172 and 0.078. The ranges and standard deviations also are larger for the non-traded industry mix variable.

seems to matter for local economies.

Secondly, we add a variable that reflects the county's predicted productivity growth rate based on its composition of industries. Its construction follows that of the industry mix measure, except that the national growth in industry value added relative per employee is used in place of employment using U.S. Bureau of Labor Statistics productivity data. The variable then measures the predicted level of productivity growth if all of the county's industries grew at the national growth rate. Its inclusion helps assess whether national industry productivity trends influence our industry mix and trade employment shock measures. The correlations between the productivity and indmix variables for the counties are 0.34 and -0.45 for 1990-2000 and 2000-2010, respectively.[12] Thus, some of the variation in the industry mix variable is likely attributable to national industry productivity shocks, where the link is consistently negative for traded-goods sectors (i.e., fast traded-goods productivity growth is associated with less traded-goods employment growth).

In unreported results, the productivity mix variable negatively affects both total employment and population growth, in which it is only significant for population growth, and only insignificant for employment growth, in MSA counties post-2000, supporting our hypothesis that productivity growth is not necessarily seen a panacea by some of the public. The total employment growth patterns for the other variables mirror those in Table 2. Post-2000, the industry mix coefficient becomes insignificant for population growth in MSA counties. For the employment rate, during the 1990s, all the industry mix and trade variables become insignificant for metro counties, while the export variable becomes insignificant for nonmetro counties. Post-2000, the positive metro export effect on the emp/pop rate becomes insignificant and the positive nonmetropolitan import effect becomes significant. The negative effect for the industry mix variable on poverty becomes statistically significant for both metropolitan and nonmetropolitan counties during the 1990s, while the significant trade effects become insignificant for MSA counties and the export effect becomes insignificant for nonmetro counties. The only changes for median income are the positive export

[12]Between the trade-sector based industry mix variables the productivity measure, the correlations are -0.22 and -0.46, while for the non-trade sector based industry mix variable, the corresponding correlations are 0.48 and -0.30.

effect for nonmetropolitan areas post-2000 becoming insignificant and the positive import effect in nonmetro areas becoming significant. Overall, the productivity results suggest that few of the significant effects in Tables 2 and 3 are attributable to the transmission of national industry productivity shocks to regions based on their industry compositions, though some of the differential trade effects appear related to industry productivity shocks.

Thirdly, we create an alternative employment shock variable based on national occupational or skill-based changes in employment rather than industry-based. Occupational changes may be driven by new technologies and other factors that induce up-skilling of the labor force. Accounting for occupational skill structure also addresses the concern that our results for common and foreign shocks may be related labor supply shifts that are in the residual (e.g., low-skilled domestic workers and immigrants possibly sorting to areas with labor-intensive exporters). We construct the predicted employment growth if the county's occupations grew at their respective national occupational growth rates.[13] In unreported results, we add this occupational mix shock employment growth rate variable to the base population growth, employment growth, and employment rate models to assess the robustness of the results. Generally, the industry mix and trade shock coefficients are essentially unchanged by the inclusion of the occupational employment shocks, further suggesting that sorting of workers or mismeasured common demand shocks do not underlie our results. The occupational employment shocks generally are insignificant, especially in the 1990s, but one notable result was that it is positive and statistically significantly related to higher employment rates, higher median household incomes, and lower poverty rates in the 2000-2010 period.

Finally, the population growth results suggest that households may be avoiding the most trade-impacted areas because of anticipation of future job losses in import-competing and export industries (McLaren et al., 2010). It may be that trade simply proxies for negative reactions to risk

[13]The occupational mix employment growth rate is akin to the industry mix measure. Specifically, we use the 1990 and 2000 Census to derive the initial occupational structure for each county based on 14 occupations. Then along with U.S. Department of Labor data, we calculate the national employment growth rates for each of the 14 occupations. Then for each county, we sum across all 14 occupations the product of the initial county occupation share and the corresponding national growth rate for the occupation.

from shocks in general—i.e., the previous patterns are not from a particular aversion to trade-intensive industries, but to risk in general. To test this hypothesis, we create a risk-measure based on the county's industry composition that is akin to the industry mix variable by deriving for each four-digit industry the standard deviation of its national annual percent change in job growth for the decade. This measures the national variability in job growth for an industry. We then sum across all industries the product of standard deviation of national annual industry employment growth and the county's initial-year employment share in the industry. The result is the predicted *variation* in job growth assuming the local industries are just as variable as they are at the national level. We then include this variable in the base population growth, employment growth, and emp/pop models in sensitivity analysis (not shown). If simple risk aversion explains the results, especially post 2000, we would expect the trade coefficients to greatly diminish in magnitude.

The unreported population growth results suggest that the risk measure is insignificant in the 1990-2000 period, but is positive and statistically significant for 2000-2010. Likewise the emp/pop measure was negatively associated with the risk measure, in which we would expect a positive link if labor supply was depressed due to out-migration from risky locations. The import and export shock coefficients were slightly reduced in magnitude. This leaves an aversion to trade-intensive sectors (rather than risk specifically) as a possible explanation for the population growth results.

Using Counties versus Commuting Zones (CZs) as Our Unit of Observaton.

Our choice of counties as the unit of observation follows a long tradition in U.S. regional and urban research, especially due to their fixed boundaries allows comparability over time. Counties generally have functional governments, unlike (say) metro areas or CZs. Especially in nonmetropolitan counties, they often approximately act as functional economic areas in which 75% of resident workers also worked in their county of residence in 1990 and 69% in 2000 using the 1999 MSA definitions (Partridge and Rickman, 2006), rising to 77% and 71% with the 2003 definitions.[14] Even considering MSA counties that are part of larger MSA labor markets, the

[14]These figures are based on the 1999 MSA definitions, using the 2003 definitions are adjusting metro areas after the 2000 Census, the nonmetro figures rise to 77% and 71%.

respective shares that lived and worked in their county was 66% and 63%. Also, using counties allows us to capture heterogeneities within metro areas in terms of their labor force and industry compositions. One disadvantage of counties is that they are not necessarily functional economic areas, unlike metro areas, which are designed explicitly by capturing labor market areas with at least a 25% commuting threshold between counties and the principle core of the metro area (OMB, 2015). Yet, the 25% threshold is relatively low compared to other developed countries (e.g., Canada uses a 50% threshold), producing geographically large areas that may include large outlying rural areas. Besides not having functional region-wide governments, using metropolitan areas and not counties would omit within-metro area heterogeneity, while greatly reducing the degrees of freedom. Also, we would not be able to consider rural areas.

Another possible geographical area that we could use are commuting zones (CZs) produced by the U.S. Department of Agriculture's Economic Research Service. While CZs have long been known by regional and urban researchers, they have only been very recently been used by researchers (e.g., ADH, 2013b). Probably the reason why they have not been used is that unlike MSAs with the explicit intent to create labor market areas with at least some minimum commuting threshold consistent with economic theory, these CZs are constructed by *athoeretic* cluster algorithm that mechanically produces CZs that regularly have very low commuting rates, certainly too low to be described as labor market areas.[15] Census 2000 data show that the *average* county in a rural or nonmetropolitan CZ had only 11.6% of its workforce work in any other county of the CZ (with the rate being only 3% at the 25th percentile, 7% at the median, and 16$^{\%}$ at the 75th percentile), compared to 38.8% for a metro county in a metropolitan CZ. Thus, for nonmetro county CZs, cross-commuting is generally well below the 25% threshold used to set MSAs, which is likely too low to define labor market areas, as already noted. Another reason is that CZs combine rural nonmetro counties (with low rural-urban commuting rates, by definition) with metro counties,

[15]There are dozens examples of nonmetro counties that are merged with MSAs, even though as noted above, they have commuting rates below 25%, or they would have been part of official metro area in the first place. Likewise, some metropolitan areas are broken up into multiple CZs for no coherent economic reason. Finally, numerous nonmetropolitan counties are merged into CZs without clear economic connections or even a central place with more than a few thousand people.

creating much more heterogeneity than desired. Thus, we do not use CZs as our base area.

To assess whether our results are affected by our use of CZs versus counties, we reproduce the models used for Table 2 for CZs in Appendix Table 5 where we pool the metro/nonmetro samples as well (mostly because there is often no clear way to divide the CZ sample). These results show that the common average shock results are relatively similar to the base results in Table 2. Yet, the CZ trade shock results can vary from the base results. For 1990-2000, the trade variables in the CZ sample are much more apt to be statistically significant, while this is not the case in the 2000-2010 sample. So while our base conclusions are not directly refuted for the most part, these results are less clear, though with the way CZs are constructed, it is not surprising the results are sometimes hard to interpret. Likewise, Appendix Table 6 reports the CZ results in which we omit the common average shock term to correspond to the results in Table 4. These results can greatly vary from the CZ trade results in Appendix Table 5, suggesting that omitting the common average shock causes significantly more bias when using CZs, though we leave the question as to why using these CZs produces such unstable results to future research.

5. Summary and Conclusion

In this paper we compared MSA and nonmetropolitan county impacts of employment shocks between 1990-2000 and 2000-2010 on a range of labor market outcomes, with the latter period representing the period of increased trade exposure to developing countries. Shocks are differentiated between common shocks that include both domestic and international shocks and those specifically attributable to changes in U.S. imports and exports. Measuring the county's trade exposure in terms of employment related to national-level growth of exports and imports allows us to assess whether there is a trade-specific impact relative to domestically-based impacts. Moreover, controlling for domestic shocks that may arise in the same industries where trade exposure is high reduces bias if the domestic and international trade shocks are correlated. Productivity gains through labor-saving innovations and the evolution of product cycles affect local labor market outcomes regardless of whether the competitive pressures are of domestic or foreign origin.

The employment and population growth results show that both metro and nonmetro counties benefited from higher concentrations of industries with more rapid national employment growth. Significantly different trade effects were mostly absent for job growth, except for imports in the post-2000 period in non-metro areas, where import increases had an offsetting effect to common negative shocks, contrary to expectations of negative effects of greater dependence on industries experiencing increased import competition. Relative to common shocks, export-based shocks have somewhat different effects post-2000 for population growth in both metro and non-metro counties. The positive regional population effect of positive national shocks is muted if that job growth was in export sectors; in the 1990-2000 period export shocks did not have a significantly different effect from average shocks. This finding suggests that people are increasingly avoiding trade dependent regions in expectation of future employment reductions.

Import shocks also had different pre- and post-2000 effects on population growth, but with opposite patterns for metro and non-metro counties. For metro counties, import employment shocks had a significant negative impact post-2000, relative to common shocks (where import increases enter as a *negative* change). The 'negative' impact suggests that greater import dependence is more "harmful" to regional population growth relative to a common or average negative employment shock. Pre-2000 import shocks did not have different impacts from common shocks in MSA counties. Conversely, in nonmetro counties, import dependence did not have different effects relative to common shocks post-2000, though there is some evidence of an offsetting positive effect of import dependence (relative to an average or common negative shock) pre-2000. Export sector dependence being more detrimental to population growth than dependence on sectors facing import competition is consistent with expectations regarding potential job losses occasioned by productivity improvements in export dependent sectors.

Emp/pop rate impacts of shocks reflect the extent to which responses are primarily from local labor market changes in participation and unemployment rates, rather than migration. Post-2000, increases in exports have a larger impact on the emp/pop rate relative to a general positive employment shock. This would be consistent with more of the new labor demand being met from the local labor pool, rather than from in-migration. Also post-2000, imports have a greater negative effect on the emp/pop rate than would a common or general negative shock in MSAs.

Our assessment of how trade impacts poverty indicates that there was little differential effect of increased trade post-2000. This, perhaps, is not surprising in that the lowest-skilled may not be readily out-sourced, and corroborates findings of Autor and Dorn (2013). Interestingly, it is during the 1990s where increased exposure to exports and imports was associated with larger poverty responses in both metro and nonmetro areas in the expected directions. Median household income increased more post-2000 in areas with greater export dependence. Yet, there is no evidence of export-specific impacts on average wages beyond overall industry mix growth impacts in either period for both metro and non-metro areas. Thus, income effects may have been transmitted through higher employment rates in regions with high export exposure rather than by higher average wages. Import-specific impacts on wages are insignificant post-2000, though positive and significant in the 1990s, possibly related to skill upgrading and shifts to more productive activity.

In summary, regarding our main research question of whether export and import-specific employment demand shocks have differential effects than the average or common employment shocks, we conclude that there is some evidence that trade shocks, especially through export-based industries, have a trade-specific negative effect on population growth and that this is apparent primarily post-2000. This pattern is somewhat surprising because regional employment growth generally did not display trade-specific impacts. We also found that export demand shocks have a positive effect on employment rates post-2000 but the negative impact of import shocks evident in the 1990s is no longer present post-2000. Poverty, median income and wages exhibit little by way of trade-specific impacts relative to the general or common shocks post-2000.

Importantly, our results also reveal the relative sizes of the impacts of domestic and international demand shocks in terms of regional economic outcomes. Generally, trade impacts on employment and population are small relative to those generated by domestic shocks. Regional variations in job and population growth were primarily the result of domestic shocks, particularly in sectors not directly related to international trade. Although small by comparison, trade-specific impacts on regional economies are increasing with greater exposure to trade, and sensitivity to trade shocks may increase especially if the population growth effects are driven by expectations formed on the basis of observed trade effects. The negative population growth responses to exports suggest that households believe that trade exposure will significantly impact local economies.

Place-based policies to stimulate local labor demand or retrain adversely affected workers in the region may be needed when population is less responsive to trade shocks. However, despite much of the public perception that trade has large effects on economic outcomes, to date it is domestic shocks that have the largest impacts, which implies at least on a local level, it still matters more to the worker what is happening to sectors within the nation than to what is happening in Shanghai or Bangalore. National policies to retrain displaced workers for employment in expanding sectors may be in order rather than changes in international trade policy.

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Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Metropolitan Areas					
Industry mix emp. growth 1990-2000	1053	0.168	0.054	-0.209	0.355
Industry mix emp. growth 2000-2007	1053	0.073	0.037	-0.123	0.2
Industry mix emp. growth 2007-2010	1053	-0.04	0.019	-0.144	0.047
Industry mix emp. growth 2000-2010	1053	0.031	0.05	-0.226	0.258
Domestic Indmix empgrw 1990-2000	1053	0.179	0.049	-0.209	0.364
Domestic Indmix empgrw 2000-2007	1053	0.076	0.036	-0.129	0.2
Domestic Indmix empgrw 2007-2010	1053	-0.045	0.021	-0.165	0.039
Domestic Indmix empgrw 2000-2010	1053	0.028	0.05	-0.267	0.256
Total employment growth 1990-2000	1053	0.289	0.366	-0.185	7.672
Total employment growth 2000-2007	1053	0.125	0.16	-0.353	1.358
Total employment growth 2007-2010	1053	-0.028	0.052	-0.196	0.272
Total employment growth 2000-2010	1053	0.096	0.183	-0.382	1.678
Export impact1990-2000	1053	0.008	0.005	-0.005	0.048
Export impact 2000-2007	1053	0.001	0.002	-0.016	0.029
Export impact 2007-2010	1053	0.003	0.004	-0.007	0.051
Export impact 2000-2010	1053	0.004	0.006	-0.02	0.073
Import impact1990-2000	1053	0.019	0.012	0.0004	0.074
Import impact 2000-2007	1053	0.003	0.005	-0.012	0.052
Import impact 2007-2010	1053	-0.002	0.003	-0.035	0.005
Import impact 2000-2010	1053	0.001	0.006	-0.037	0.05
Median HH. income chg. 1990-2000	1053	0.47	0.114	0.198	1.122
Median HH. Income chg. 2000-2010	1053	0.198	0.092	-0.143	0.533
Less than high school chg. 1990-2000	1053	-6.968	3.309	-19.262	4.613
Less than high school chg. 2000-2010	1053	-5.066	2.37	-15.2	1.7
High school chg. 1990-2000	1053	-0.589	2.867	-10.49	9.428
High school chg. 2000-2010	1053	0.326	2.346	-8.6	14.4
Some college chg. 1990-2000	1053	3.748	2.382	-4.551	11.426
Some college chg. 2000-2010	1053	1.61	2.214	-5.9	10.3
College and above chg. 1990-2000	1053	3.807	2.261	-2.752	19.029
College and above chg. 2000-2010	1053	3.135	1.945	-9.1	13.4
Employment population ratio 1990	1053	0.468	0.059	0.122	0.76
Employment population ratio 2000	1053	0.485	0.056	0.154	0.676
Employment population ratio 2007	1053	0.477	0.056	0.129	0.678
Employment population ratio 2010	1053	0.448	0.053	0.149	0.61
Poverty rate 1990[a]	1053	13.268	6.261	2.18	56.84
Poverty rate 2000[a]	1053	11.554	5.193	2.117	35.871
Poverty rate 2000[b]	1053	10.882	4.436	1.7	31.7
Poverty rate 2007[b]	1053	12.708	4.943	2.4	34.5
Poverty rate 2010[b]	1053	14.712	5.194	3.5	35.8
Population growth rate 1990-2000	1053	0.181	0.18	-0.123	1.921
Population growth rate 2000-2007	1053	0.09	0.116	-0.649	0.825
Population growth rate 2007-2010	1053	0.026	0.037	-0.094	0.559
Population growth rate 2000-2010	1053	0.121	0.149	-0.453	1.12

Notes: [a]Poverty rate data from the Census of population; [b]Poverty rate data from US Census Bureau SAIPE.

Table 1: Descriptive statistics (continued)

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Non-Metropolitan Areas					
Industry mix emp. growth 1990-2000	1971	0.13	0.047	-0.085	0.351
Industry mix emp. growth 2000-2007	1971	0.05	0.043	-0.16	0.269
Industry mix emp. growth 2007-2010	1971	-0.036	0.024	-0.146	0.093
Industry mix emp. growth 2000-2010	1971	0.015	0.058	-0.243	0.336
Domestic Indmix empgrw 1990-2000	1971	0.145	0.042	-0.126	0.356
Domestic Indmix empgrw 2000-2007	1971	0.053	0.04	-0.103	0.269
Domestic Indmix empgrw 2007-2010	1971	-0.044	0.026	-0.16	0.087
Domestic Indmix empgrw 2000-2010	1971	0.008	0.057	-0.202	0.335
Total employment growth 1990-2000	1971	0.165	0.175	-0.394	1.312
Total employment growth 2000-2007	1971	0.033	0.12	-0.283	0.963
Total employment growth 2007-2010	1971	-0.014	0.082	-0.328	0.754
Total employment growth 2000-2010	1971	0.019	0.143	-0.382	1.113
Export impact1990-2000	1971	0.009	0.01	-0.01	0.283
Export impact 2000-2007	1971	0.002	0.003	-0.01	0.046
Export impact 2007-2010	1971	0.007	0.006	-0.003	0.082
Export impact 2000-2010	1971	0.01	0.008	-0.01	0.117
Import impact1990-2000	1971	0.025	0.013	0.0005	0.08
Import impact 2000-2007	1971	0.005	0.006	-0.015	0.054
Import impact 2007-2010	1971	-0.002	0.004	-0.038	0.01
Import impact 2000-2010	1971	0.003	0.007	-0.034	0.055
Median HH. income chg. 1990-2000	1971	0.504	0.123	0.05	1.117
Median HH. Income chg. 2000-2010	1971	0.24	0.113	-0.054	0.957
Less than high school chg. 1990-2000	1971	-8.254	3.396	-18.933	8.439
Less than high school chg. 2000-2010	1971	-6.063	3.049	-20.5	7.5
High school chg. 1990-2000	1971	0.976	3.405	-10.811	14.398
High school chg. 2000-2010	1971	1.304	3.276	-9.8	18.6
Some college chg. 1990-2000	1971	4.713	2.394	-10.023	22.311
Some college chg. 2000-2010	1971	2.603	2.768	-12.8	15.3
College and above chg. 1990-2000	1971	2.57	1.934	-7.305	15.801
College and above chg. 2000-2010	1971	2.152	2.253	-7.4	16.6
Employment population ratio 1990	1971	0.432	0.058	0.195	0.844
Employment population ratio 2000	1971	0.455	0.063	0.19	0.808
Employment population ratio 2007	1971	0.46	0.074	0.191	0.836
Employment population ratio 2010	1971	0.443	0.079	0.183	0.837
Poverty rate 1990[a]	1971	18.531	7.998	2.402	63.118
Poverty rate 2000[a]	1971	15.5	6.616	2.925	52.319
Poverty rate 2000[b]	1971	14.608	5.643	2.7	42.2
Poverty rate 2007[b]	1971	16.402	6.345	3.1	49.3
Poverty rate 2010[b]	1971	17.917	6.358	3.2	49.1
Population growth rate 1990-2000	1971	0.074	0.134	-0.272	0.882
Population growth rate 2000-2007	1971	0.01	0.08	-0.313	0.79
Population growth rate 2007-2010	1971	0.006	0.028	-0.175	0.264
Population growth rate 2000-2010	1971	0.017	0.1	-0.38	0.898

Notes: [a]Poverty rate data from the Census of population; [b]Poverty rate data from US Census Bureau SAIPE.

Table 2: Employment Shock Impacts on Employment Growth, Population Growth and Employment/population Ratio, Metro and Non-Metro, 1990-2000 and 2000-2010

	Metro				**Non-metro**			
	1990-2000		**2000-2010**		**1990-2000**		**2000-2010**	
Panel A:Total emp. growth model								
Model 1								
Industry mix emp.	2.14***	(7.76)	1.61***	(10.38)	1.38***	(12.68)	0.94***	(14.81)
Model 2								
Industry mix emp.	2.07***	(6.68)	1.62***	(10.52)	1.46***	(10.76)	0.96***	(14.03)
Export impact	-0.61	(-0.37)	-1.04	(-1.17)	0.21	(0.72)	0.7	(1.02)
Import impact	-0.73	(-0.59)	-1.11	(-1.54)	0.67	(1.37)	1.12**	(2.54)
Panel B:Total emp. growth model								
Model 1								
Domestic industry mix emp.	2.22***	(7.41)	1.6***	(9.54)	1.41***	(10.15)	0.93***	(13.72)
Model 2								
Domestic industry mix emp.	2.07***	(6.68)	1.62***	(10.51)	1.46***	(10.76)	0.96***	(14.03)
Export impact	1.46	(0.89)	0.59	(0.67)	1.67***	(5.63)	1.66**	(2.42)
Import impact	-2.79**	(-2.52)	-2.74***	(-4.03)	-0.81**	(-1.94)	0.15	(0.36)
Panel C:Population model								
Model 1								
Industry mix emp.	1.03***	(8.09)	0.18*	(1.67)	0.75***	(8.62)	0.18***	(3.16)
Model 2								
Industry mix emp.	1.05***	(8.41)	0.24**	(2.44)	0.83***	(8.08)	0.17***	(3.33)
Export impact	-1.32	(-1.35)	-3.97***	(-3.75)	-0.18	(-0.93)	-1.77***	(6.32)
Import impact	0.42	(0.52)	-1.91***	(-2.59)	0.69*	(1.96)	-0.35	(-1.16)
Panel D:Emp./pop. model								
Model 1								
Industry mix emp.	-0.03	(-1.09)	0.22***	(6.11)	0.03	(1.14)	0.42***	(13.6)
Model 2								
Industry mix emp.	-0.06*	(-1.85)	0.21***	(6.13)	-0.001	(-0.02)	0.43***	(13.44)
Export impact	0.25	(0.95)	0.57**	(2.11)	0.127*	(1.71)	0.97***	(3.62)
Import impact	-0.35**	(-2.48)	-0.56**	(-2.04)	-0.29***	(-2.73)	0.34	(1.59)

Notes: Robust t-statistics from the STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively. In all models, control variables include: distance to nearest or actual Urban Center; incremental distance to a MA; incremental distances to MA> 250,000, > 500,000, and > 1,500,000 population; county population 1990/2000; population of nearest or actual MA 1990/2000; county area (sq. miles); amenity dummy variable represented by a 1 to 7 scale (USDA);proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes; state fixed effects; demographic variables including five ethnicity shares; four education shares; %females; % married; and % with a work disability.

Table 3: Employment Shock Impacts on Poverty, Income, and Wages, Metro and Non-Metro, 1990-2000 and 2000-2010

	Metro				Non-metro			
	1990-2000		2000-2010		1990-2000		2000-2010	
Panel A:Poverty model								
Model 1								
Industry mix emp.	-3.75**	(-2.24)	-7.58***	(-4.67)	-6.65***	(-3.69)	-6.88***	(-5.53)
Model 2								
Industry mix emp.	-1.98	(-1.13)	-6.74***	(-4.08)	-3.61	(-1.56)	-6.63***	(-5.68)
Export impact	-26.1*	(-1.71)	-38.13***	(-2.82)	-17.38*	(-1.72)	-7.84	(-0.98)
Import impact	22.26**	(2.42)	5.34	(0.48)	26.89***	(3.21)	11.36	(1.18)
Panel B:Median HH income model								
Model 1								
Industry mix emp.	0.35***	(4.27)	0.4***	(5.57)	0.39***	(6.17)	0.61***	(8.87)
Model 2								
Industry mix emp.	0.33***	(4.15)	0.37***	(5.16)	0.45***	(5.52)	0.6***	(8.67)
Export impact	-0.51	(-0.78)	1.49***	(2.82)	0.19	(0.73)	0.98**	(2.28)
Import impact	-0.11	(-0.22)	-0.17	(-0.33)	0.48	(1.59)	-0.16	(-0.49)
Panel C:Average wage model								
Model 1								
industry mix emp.	0.12	(1.12)	0.67***	(4.85)	-0.02	(-0.32)	0.76***	(8.43)
Model 2								
industry mix emp.	0.26**	(2.05)	0.7***	(5.03)	0.09	(1.05)	0.78***	(8.62)
Export impact	0.28	(0.26)	-0.22	(-0.16)	0.18	(0.76)	0.38	(0.83)
Import impact	1.47*	(1.79)	1.29	(1.61)	0.9**	(2.41)	0.8	(1.59)

Notes: For the 1990-2000period, poverty data are from the 1990 and 2000 decennial census; for 2000-2010, they are from SAIPE. Robust t-statistics from STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively. In all models, control variables include: distance to nearest or actual Urban Center; incremental distance to a MA; incremental distances to MA> 250,000, > 500,000, and > 1,500,000 population; county population 1990/2000; population of nearest or actual MA 1990/2000; county area (sq. miles); amenity dummy variable represented by a 1 to 7 scale (USDA);proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes; state fixed effects; demographic variables including five ethnicity shares; four education shares; %females; % married; and % with a work disability; wage mix growth for the corresponding period are included as a control variable for both the median hh income, and wage models; log value of median hh income at the initial of the period, and log value of wage level at the initial of the period are included in the median hh income, and wage models as a control variable, respectively.

Table 4: Gross Trade Demand Shock Impacts on Employment Growth, Population Growth and Employment/population Ratio, Metro and Non-Metro, 1990-2000 and 2000-2010

	Metro				**Non-metro**			
	1990-2000		**2000-2010**		**1990-2000**		**2000-2010**	
Panel A: Total emp. growth model								
Export impact	1.66	(0.98)	-1.38	(1.36)	0.73**	(2.45)	1.01	(1.35)
Import impact	-5.1***	(-4.79)	-2.03*	(-1.83)	-2.09***	(4.97)	-0.33	(-0.53)
Panel B: Population model								
Export impact	-0.17	(-0.18)	-3.59***	(3.54)	0.11	(0.71)	-1.76**	(6.11)
Import impact	-1.78**	(-2.32)	-2.1***	(-2.64)	-0.87***	(2.91)	-0.61**	(1.96)
Panel C: Emp./pop. model								
Export impact	0.18	(0.69)	0.83***	(2.86)	0.13*	(1.69)	1.05***	(3.92)
Import impact	-0.22*	(-1.68)	-0.7**	(-2.04)	-0.29***	(-3.36)	-0.24	(-0.94)
Panel D: Poverty model								
Export impact	-28.27*	(1.83)	-50.1***	(-3.49)	-18.66*	(-1.76)	-9.9	(-1.18)
Import impact	26.45**	(3.06)	11.7	(1.26)	33.7***	(5.33)	21.1*	(1.95)
Panel E: Median HH income model								
Export impact	-0.16	(-0.24)	2.02***	(3.79)	0.33	(1.11)	1.3**	(2.39)
Import impact	-0.82*	(-1.71)	-0.37	(-0.81)	-0.36	(-1.49)	-0.93**	(-2.82)

Notes: For the 1990-2000period, poverty data are from the 1990 and 2000 decennial census; for 2000-2010, they are from SAIPE. Robust t-statistics from the STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively. In all models, control variables include: distance to nearest or actual Urban Center; incremental distance to a MA; incremental distances to MA> 250,000, > 500,000, and > 1,500,000 population; county population 1990/2000; population of nearest or actual MA 1990/2000; county area (sq. miles); amenity dummy variable represented by a 1 to 7 scale (USDA); proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes; state fixed effects; demographic variables including five ethnicity shares; four education shares; %females; % married; and % with a work disability; wage mix growth for the corresponding period, and log value of the wage level at the initial of the period are included as a control variables in the median hh income model.

Table 5: Empirical results based on county matching

	Metro		Non-metro	
	1990-2000	**2000-2010**	**1990-2000**	**2000-2010**
Panel A:Population model				
Model 1				
Industry mix emp.	0.46*** (2.59)	0.22* (1.68)	0.58*** (4.22)	0.15** (2.57)
Model 2				
Industry mix emp.	0.39* (1.89)	0.29** (1.97)	0.71*** (4.24)	0.15*** (2.61)
Export impact	-2.79 (-1.3)	-8.66*** (-2.29)	-1.87 (-0.51)	-2.13*** (-4.61)
Import impact	-0.63 (-0.71)	-4.65 (-1.18)	0.65 (1.36)	-1.9*** (-2.77)
Panel B:Total emp. growth model				
Model 1				
Industry mix emp.	1.22*** (2.04)	1.07*** (5.57)	0.86*** (4.47)	0.73*** (7.51)
Model 2				
Industry mix emp.	0.98 (1.35)	1.08*** (5.61)	0.93*** (3.93)	0.72*** (7.67)
Export impact	-4.41 (-0.96)	-0.98 (-0.56)	0.1 (0.2)	0.93 (1.14)
Import impact	-2.09 (-1.14)	-0.11 (-0.03)	0.35 (0.6)	-0.18 (-0.16)
Panel C:Total emp. model				
Model 1				
Domestic industry mix emp.	1.15* (1.66)	1.09*** (5.6)	0.96*** (4.09)	0.71*** (7.17)
Model 2				
Domestic industry mix emp.	0.98 (1.35)	1.08*** (5.61)	0.93*** (3.93)	0.72*** (7.67)
Export impact	-3.43 (-0.85)	0.1 (0.1)	1.03 (0.2)	1.65** (2.01)
Import impact	-3.07** (-2.16)	-1.19 (-0.28)	-0.58 (-1.17)	-0.9 (-0.81)
Panel D:Emp./pop. model				
Model 1				
Industry mix emp.	0.04 (1.11)	0.17*** (4.69)	0.07 (1.47)	0.35*** (9.74)
Model 2				
Industry mix emp.	0.03 (0.86)	0.16*** (3.57)	0.01 (0.4)	0.34*** (9.53)
Export impact	-0.1 (-0.15)	1.42** (2.01)	-0.33 (-0.26)	0.96*** (2.75)
Import impact	-0.05 (-0.37)	1.12 (0.97)	-0.36*** (-2.63)	0.74* (1.71)

Table 5: continued

	Metro		Non-metro	
	1990-2000	**2000-2010**	**1990-2000**	**2000-2010**
Panel A:Poverty model				
Model 1				
Industry mix emp.	5.37 (1.21)	-5.78*** (-3.58)	-9.88*** (-3.1)	-6.93*** (-5.34)
Model 2				
Industry mix emp.	6.4 (1.37)	-5.98*** (-2.99)	-5.16 (-1.35)	-6.88*** (-5.28)
Export impact	6.73 (0.4)	-6.16 (-0.22)	-45 (-0.7)	-8.81 (-0.76)
Import impact	17.6 (1.53)	-25.29 (-1.19)	26.43** (2.46)	-4.19 (-0.21)
Panel B:Median HH income model				
Model 1				
Industry mix emp.	0.21* (1.73)	0.28*** (3.84)	0.36*** (3.52)	0.39*** (7.01)
Model 2				
Industry mix emp.	0.19 (1.55)	0.3*** (3.58)	0.46*** (3.5)	0.37*** (6.6)
Export impact	-2.91 (-1.15)	0.16 (0.19)	1.23 (0.5)	1.54** (2.18)
Import impact	-0.19 (-0.35)	3.28 (1.21)	-0.5 (-1.18)	-0.46 (-0.67)
Panel C:Average wage model				
Model 1				
industry mix emp.	0.12 (0.85)	0.55*** (4.03)	-0.1 (-0.43)	0.54*** (6.77)
Model 2				
industry mix emp.	0.31* (1.66)	0.53*** (3.7)	0.24 (1.53)	0.54*** (6.49)
Export impact	-5.09* (-1.94)	0.75 (0.5)	-5.07* (-1.8)	0.05 (0.1)
Import impact	1.75* (1.86)	-2.55 (-0.65)	1.62*** (3.73)	-0.25 (-0.18)

Notes: The instruments for the current period industry mix emp. variable, export impact variable, and import impact variable are derived by finding the closest match for the county of interest and substituting the matched county's values as exogenous instruments. For the 1990-2000 period, poverty data are from the 1990 and 2000 decennial census; for 2000-2010, they are from SAIPE. Robust t-statistics from STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively. In all models, control variables include: distance to nearest or actual Urban Center; incremental distance to a MA; incremental distances to MA> 250,000, > 500,000, and > 1,500,000 population; county population 1990/2000; population of nearest or actual MA 1990/2000; county area (sq. miles); amenity dummy variable represented by a 1 to 7 scale (USDA);proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes; state fixed effects; demographic variables including five ethnicity shares; four education shares; %females; % married; and % with a work disability; wage mix growth for the corresponding period are included as a control variable for both the median hh income, and wage models; log value of median hh income at the initial of the period, and log value of wage level at the initial of the period are included in the median hh income, and wage models as a control variable, respectively.

Table 6: Ten-year First Difference Results

	Full Model				Trade Variables			
	Metros		Nonmetros		Metros		Nonmetros	
Panel A: Total emp.								
Industry mix emp.	2.45***	(3.08)	1.44***	(14.09)				
Export impact	-5.84**	(-2.53)	-0.09	(-0.16)	1.22	(1.41)	1.87***	(2.79)
Import impact	0.16	(0.1)	-0.01	(-0.01)	1.3	(0.88)	1.54***	(2.95)
Panel B:Total emp.								
Domestic mix emp.	2.45***	(3.08)	1.44***	(14.09)	NA		NA	
Export impact	-3.39**	(-2.1)	1.35***	(2.41)	NA		NA	
Import impact	-2.29	(-0.99)	-1.44***	(-3.03)	NA		NA	
Panel C:Population								
Industry mix emp.	0.24**	(2.15)	0.32***	(4.1)				
Export impact	-2.95***	(-5.5)	-0.06	(-0.26)	-2.27***	(-4.26)	0.38***	(1.96)
Import impact	0.36	(0.82)	-0.14	(-0.4)	0.47	(1.13)	0.21	(0.61)
Panel D:Emp./pop.								
Industry mix emp.	0.21***	(7.12)	0.28***	(11.05)				
Export impact	-0.2	(-1.26)	0.29*	(1.74)	0.39***	(2.95)	0.75**	(2.45)
Import impact	0.47***	(4.13)	1.08***	(8.63)	0.58***	(4.75)	2.48***	(9.17)
Panel E: Poverty								
Industry mix emp.	-8.75***	(-4.88)	-9.88***	(-7.06)				
Export impact	-29.49**	(-2.15)	-12.81	(-1.43)	-53.93***	(-3.98)	-26.21***	(-2.34)
Import impact	-17.44*	(-1.86)	-62.58***	(-8.8)	-21.77**	(-2.23)	-73.2***	(-9.06)
Panel F: Median Inc.								
Industry mix emp.	0.61***	(7.2)	0.49***	(10.92)				
Export impact	1.34***	(2.84)	0.27	(1.37)	2.35***	(4.89)	-1.09***	(-6.86)
Import impact	1.3***	(3.48)	1.93***	(8.77)	1.97***	(4.78)	1.82***	(9.49)
Panel G: Wage Rate								
Industry mix emp.	0.7***	(7.51)	0.53***	(5.96)	NA		NA	
Export impact	0.01	(0.01)	0.24	(0.9)	NA		NA	
Import impact	2.56***	(5.31)	2.78***	(8.87)	NA		NA	

Notes: Robust t-statistics from the STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively.

Figure 1:

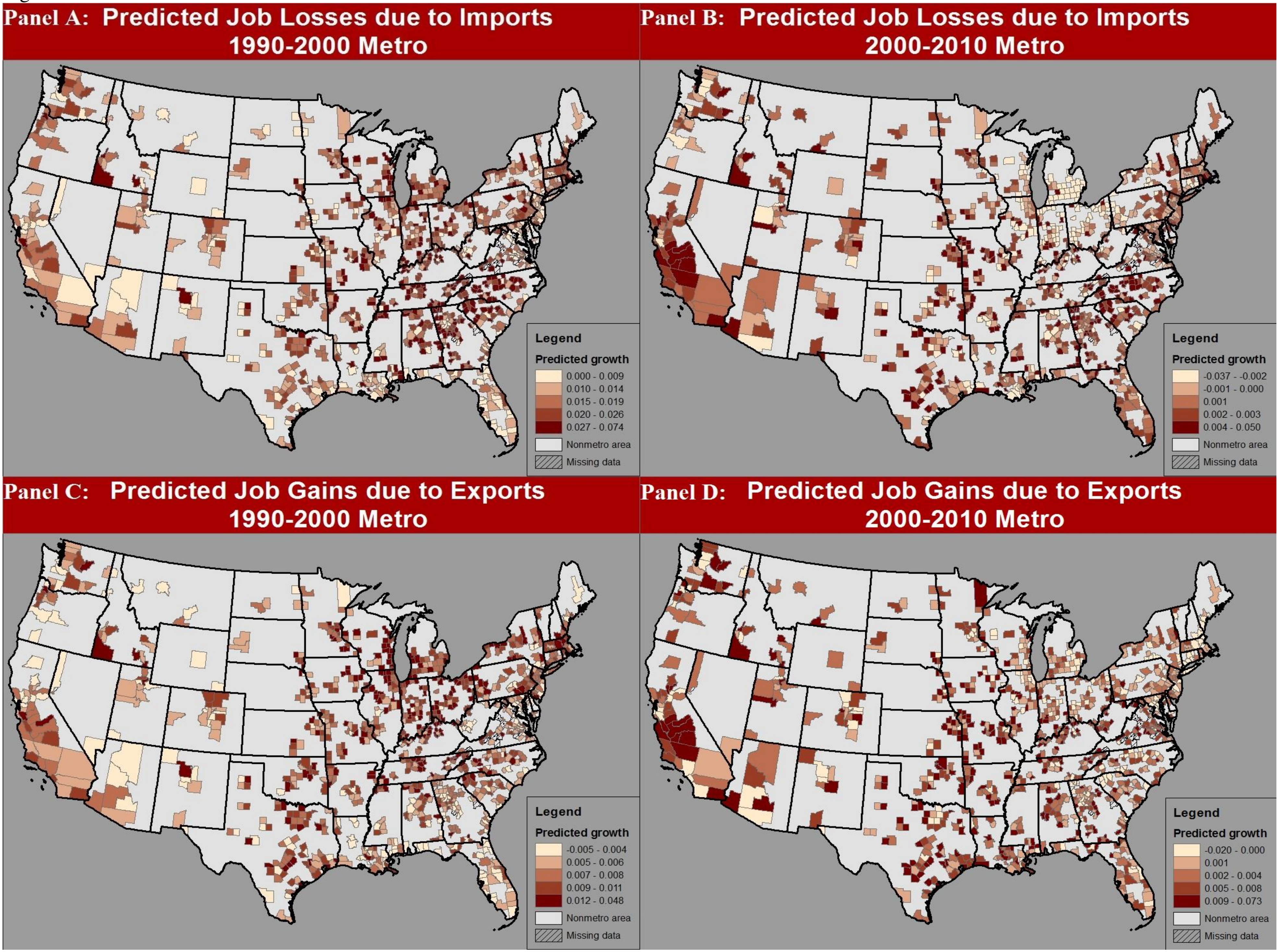
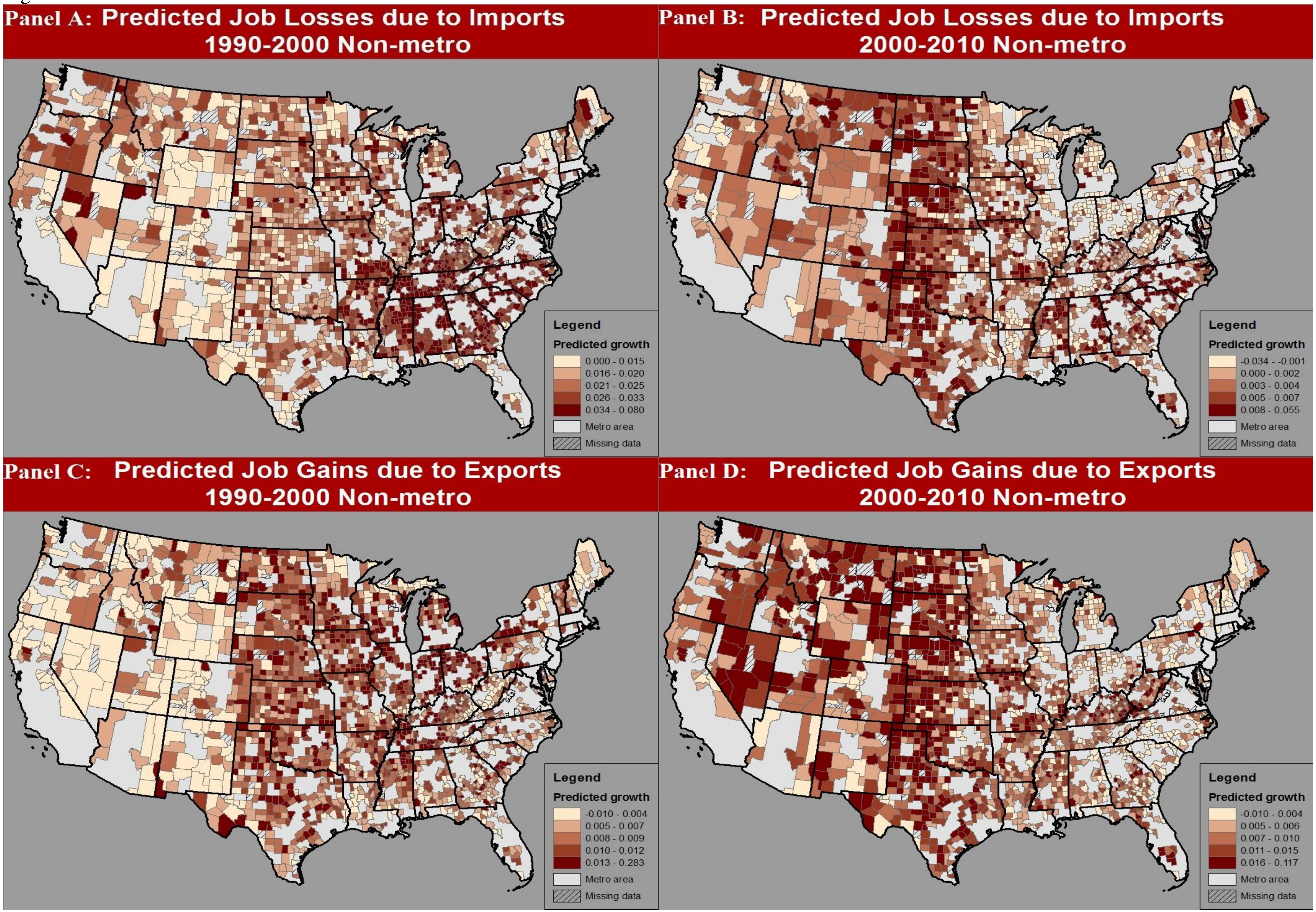

Panel A: Predicted Job Losses due to Imports
1990-2000 Metro
Legend
Predicted growth
0.000 - 0.009
0.010 - 0.014
0.015 - 0.019
0.020 - 0.026
0.027 - 0.074
Nonmetro area
Missing data
Panel B: Predicted Job Losses due to Imports
2000-2010 Metro
Legend
Predicted growth
-0.037 - -0.002
-0.001 - 0.000
0.001
0.002 - 0.003
0.004 - 0.050
Nonmetro area
Missing data
Panel C: Predicted Job Gains due to Exports
1990-2000 Metro
Legend
Predicted growth
-0.005 - 0.004
0.005 - 0.006
0.007 - 0.008
0.009 - 0.011
0.012 - 0.048
Nonmetro area
Missing data
Panel D: Predicted Job Gains due to Exports
2000-2010 Metro
Legend
Predicted growth
-0.020 - 0.000
0.001
0.002 - 0.004
0.005 - 0.008
0.009 - 0.073
Nonmetro area
Missing data

Figure 2:


Panel A: Predicted Job Losses due to Imports
1990-2000 Non-metro
Legend
Predicted growth
0.000 - 0.015
0.016 - 0.020
0.021 - 0.025
0.026 - 0.033
0.034 - 0.080
Metro area
Missing data
Panel B: Predicted Job Losses due to Imports
2000-2010 Non-metro
Legend
Predicted growth
-0.034 - -0.001
0.000 - 0.002
0.003 - 0.004
0.005 - 0.007
0.008 - 0.055
Metro area
Missing data
Panel C: Predicted Job Gains due to Exports
1990-2000 Non-metro
Legend
Predicted growth
-0.010 - 0.004
0.005 - 0.007
0.008 - 0.009
0.010 - 0.012
0.013 - 0.283
Metro area
Missing data
Panel D: Predicted Job Gains due to Exports
2000-2010 Non-metro
Legend
Predicted growth
-0.010 - 0.004
0.005 - 0.006
0.007 - 0.010
0.011 - 0.015
0.016 - 0.117
Metro area
Missing data

Appendix:

Table 1: Correlations for the industry mix, export, and import employment shock variables:

1990-2000:							
Metro				**Non-metro**			
	Indmix emp.	Export impact	Import impact		Indmix emp.	Export impact	Import impact
Export impact	-0.177	1		Export impact	-0.061	1	
Import impact	-0.543	0.528	1	Import impact	-0.581	0.223	1
Dom-indmix emp.	0.986	-0.173	-0.413	Dom-indmix emp.	0.955	-0.229	-0.395
2000-2010:							
Metro				**Non-metro**			
	Indmix emp.	Export impact	Import impact		Indmix emp.	Export impact	Import impact
Export impact	-0.114	1		Export impact	0.061	1	
Import impact	-0.170	0.295	1	Import impact	-0.189	0.244	1
Dom-indmix emp.	0.990	-0.203	-0.090	Dom-indmix emp.	0.987	-0.056	-0.113

Appendix Table 2: First stage F-stats of Matching model:

	F-stats	Prob. > F
1990-2000		
MSA		**0**
Indmix	**499.6**	**0**
Export	**147.2**	**0**
Import	**1162.9**	**0**
Non-MSA		
Indmix	**421.1**	**0**
Export	**17.83**	**0**
Import	**1455**	**0**
2000-2010		
MSA		
Indmix	**967.7**	**0**
Export	**314.8**	**0**
Import	**30.6**	**0**
Non-MSA		
Indmix	**1649.1**	**0**
Export	**1541.8**	**0**
Import	**212.2**	**0**

Notes: The F-statistics for the first-stage null hypothesis that the exogenous instruments equals zero. The endogenous variables are industry mix, export, and import employment shocks and the instruments are derived from the corresponding values of a matched county. See the text for more details.

Appendix Table 3: Empirical results for models that use industry mix emp. variable from prior period as instrument for current industry mix emp. variable.

	Metro				Non-metro			
	1990-2000		2000-2010		1990-2000		2000-2010	
Panel A:Total emp. growth model								
Model 1								
Industry mix emp.	3.95***	(3.79)	1.08	(1.23)	3.06***	(9.31)	0.47	(0.88)
First stage F-stat.	21.5		33.2		33.7		14.4	
Model 2								
Industry mix emp.	5.05***	(2.82)	0.96	(1.29)	4.11***	(8.28)	0.85	(1.48)
Export impact	-3.89	(-1.47)	-0.04	(-0.03)	-0.73	(-1.13)	0.7	(1)
Import impact	5.54	(1.46)	-1.49**	(-2.1)	5.69***	(5.98)	0.97	(1.01)
First stage F-stat.	23.4		32.8		26.3		14.7	
Panel B:Total emp. growth model								
Model 1								
Domestic industry mix emp.	2.73***	(2.94)	0.14	(0.39)	1.48***	(7.29)	0.01	(0.02)
First stage F-stat.	870.4		259.5		951.7		236.8	
Model 2								
Domestic industry mix emp.	2.8***	(2.79)	0.51	(1.11)	1.8***	(10.62)	0.35	(1.23)
Export impact	5.33**	(2.58)	2.23	(1.59)	2.58***	(9.11)	1.5*	(1.69)
Import impact	-5.1***	(-4.69)	-2.44**	(-2.04)	-2.36***	(-5.28)	-0.5	(-0.78)
First stage F-stat.	870.4		259.5		951.7		236.8	
Panel C:Population model								
Model 1								
Industry mix emp.	1.33***	(4.14)	3.72***	(3.57)	1.87***	(8.09)	1.43***	(2.89)
First stage F-stat.	21.5		33.2		33.7		14.4	
Model 2								
Industry mix emp.	1.56***	(3.15)	2.47***	(3.21)	2.61***	(7.57)	1**	(2.42)
Export impact	-1.88	(-1.53)	-7.26***	(-3.94)	-0.82*	(-1.76)	-2.07***	(-5.4)
Import impact	1.5	(1.1)	-0.7	(-0.43)	4.06***	(5.78)	0.89	(1.14)
First stage F-stat.	23.4		32.8		26.3		14.7	
Panel D:Emp./pop. model								
Model 1								
Industry mix emp.	-0.1	(-1.56)	-0.74***	(-3.21)	0.03	(0.4)	-0.51	(-1.56)
First stage F-stat.	21.5		33.2		33.7		14.4	
Model 2								
Industry mix emp.	-0.26**	(2.42)	-0.55***	(-2.96)	-0.03	(-0.33)	-0.3	(-1.1)
Export impact	0.46	(1.49)	1.65***	(3.12)	0.14*	(1.84)	1.15***	(3.81)
Import impact	-0.75***	(-2.68)	-1	(-1.49)	-0.36*	(-1.76)	-0.7	(-1.32)
First stage F-stat.	23.4		32.8		26.3		14.7	

Appendix Table 3: continued

	Metro		Non-metro	
	1990-2000	**2000-2010**	**1990-2000**	**2000-2010**
Panel A:Poverty model				
Model 1				
Industry mix emp.	3.61 (0.75)	5.66 (0.54)	-12.95***(-2.3)	-3.83 (-0.49)
First stage F-stat.	21.5	33.2	33.7	14.4
Model 2				
Industry mix emp.	14.68* (1.94)	-1.43 (-0.18)	-11.3 (-1.29)	-3.46 (-0.4)
Export impact	-44.39**(-2.42)	-48*** (-2.71)	-14.64* (-1.7)	-8.83 (-1.08)
Import impact	57.24***(3.42)	10.85 (0.96)	12.3 (0.69)	15.95 (1.17)
First stage F-stat.	23.4	32.8	26.3	14.7
Panel B:Median HH income model				
Model 1				
Industry mix emp.	0.25 (1.16)	-0.7* (-1.81)	1.2*** (6.69)	-2.46 (-1.26)
First stage F-stat.	18.7	29.7	36.4	18.9
Model 2				
Industry mix emp.	0.01 (0.03)	-0.5 (-1.57)	1.76*** (5.88)	-2.41 (-1.34)
Export impact	-0.17 (-0.22)	2.74*** (3.96)	-0.2 (-0.95)	2.56* (1.86)
Import impact	-0.8 (-0.84)	-0.64 (-1.1)	2.9*** (4.41)	-4 (-1.6)
First stage F-stat.	33.2	30.7	39.6	19.7
Panel C:Average wage model				
Model 1				
Industry mix emp.	0.54** (2.17)	-1.29 (-1.51)	0.54** (2.17)	-2.03 (-1.08)
First stage F-stat.	22.5	33.1	36.8	15.5
Model 2				
Industry mix emp.	0.1 (0.22)	-1.09 (-1.55)	1.11*** (2.93)	-2.47 (-0.96)
Export impact	0.45 (0.4)	2.3 (1.38)	-0.1 (-0.46)	2.63 (1.36)
Import impact	1.14 (0.91)	-0.89 (-0.75)	2.72*** (3.84)	-4 (-1.03)
First stage F-stat.	27.1	39.2	49.3	16.1

Note: Predicted Domestic industry mix emp. variable is get according to two steps: 1) first regress current industry mix emp. variable on previous industry mix emp. variable, then get the predicted current period industry mix emp. variable; 2) then Based on equation 14 in the paper: predicted DomINDMIX '= Predicted INDMIX + IMPORTSH – EXPORTSH. Then use the DomINDMIX' as an independent variable in the total employment model. First stage F-stat. for total emp. growth model with Domestic industry mix emp. variable is the F-stat. from the above step 1. See text for details.

Appendix Table 4: Empirical results for base model of using Commuting Zones instead of Counties

	1990-2000		2000-2010	
Panel A:Total emp. growth model				
Model 1				
Industry mix emp.	1.94***	(9.54)	1.04***	(10.13)
Model 2				
Industry mix emp.	2.1***	(9.77)	1.05***	(9.99)
Export impact	-4.14***	(-2.87)	-0.06	(-0.1)
Import impact	1.54*	(1.87)	0.67	(0.95)
Panel B:Total emp. growth model				
Model 1				
Domestic industry mix emp.	2.1***	(9.77)	1.04***	(9.93)
Model 2				
Domestic industry mix emp.	2.1***	(9.77)	1.05***	(9.99)
Export impact	-2.04	(-1.47)	0.99	(1.59)
Import impact	-0.56	(-0.71)	-0.38	(-0.54)
Panel C:Population model				
Model 1				
Industry mix emp.	1.42***	(8.38)	0.28**	(2.58)
Model 2				
Industry mix emp.	1.7***	(9.6)	0.29***	(2.69)
Export impact	-4.02***	(-3.3)	-0.74	(-1.08)
Import impact	2.89***	(4.64)	0.52	(0.77)
Panel D:Emp./pop. model				
Model 1				
Industry mix emp.	0.01	(0.04)	0.51***	(9.11)
Model 2				
Industry mix emp.	-0.05	(-1.07)	0.52***	(8.81)
Export impact	0.51	(1.26)	0.18	(0.5)
Import impact	-0.63***	(-3.31)	0.37	(0.94)

Appendix Table 4: Continued

	1990-2000		2000-2010	
Panel A:Poverty model				
Model 1				
Industry mix emp.	-4.45	(-1.48)	-12.85***	(-6.22)
Model 2				
Industry mix emp.	1.59	(0.48)	-12.79***	(-6.15)
Export impact	-112.5***	(-3.3)	-16.52	(-1.29)
Import impact	59.99***	(3.69)	-15.89	(-0.88)
Panel B:Median HH income model				
Model 1				
Industry mix emp.	0.85***	(6.69)	1.09***	(9.78)
Model 2				
Industry mix emp.	0.86***	(5.85)	1.08***	(9.77)
Export impact	0.37	(0.36)	1.33**	(2.06)
Import impact	0.12	(0.2)	0.26	(0.4)
Panel C:Average wage model				
Model 1				
Industry mix emp.	0.49***	(3.5)	1.28***	(8.08)
Model 2				
Industry mix emp.	0.74***	(4.2)	1.29***	(8.03)
Export impact	-0.21	(-0.22)	1.43*	(1.93)
Import impact	2.19***	(3.42)	1.48	(1.63)

Notes: For the 1990-2000 period, poverty data are from the 1990 and 2000 decennial census; for 2000-2010, they are from SAIPE. Robust t-statistics from STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively. In all models, control variables include: distance to nearest or actual Urban Center; incremental distance to a MA; incremental distances to MA> 250,000, > 500,000, and > 1,500,000 population; county population 1990/2000; population of nearest or actual MA 1990/2000; county area (sq. miles); amenity dummy variable represented by a 1 to 7 scale (USDA);proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes; state fixed effects; demographic variables including five ethnicity shares; four education shares; %females; % married; and % with a work disability; wage mix growth for the corresponding period are included as a control variable for both the median hh income, and wage models; log value of median hh income at the initial of the period, and log value of wage level at the initial of the period are included in the median hh income, and wage models as a control variable, respectively.

Appendix Table 5: Empirical results for Commuting Zone Models based on Trade Variables only

	1990-2000	2000-2010
Panel A: Total emp. growth model		
Export impact	0.05 (0.03)	0.69 (0.99)
Import impact	-1.84** (-2.01)	-0.39 (-0.48)
Panel B: Population model		
Export impact	-0.64 (-0.48)	-0.53 (-0.75)
Import impact	0.16 (0.24)	0.23 (0.34)
Panel C: Emp./pop. Model		
Export impact	2.41** (2.33)	0.55* (1.65)
Import impact	-1.52*** (-2.81)	-0.15 (-0.36)
Panel D: Poverty model		
Export impact	-109.3*** (-3.41)	-25.76* (-1.81)
Import impact	57.43*** (4.08)	-2.95 (-0.16)
Panel E: Median HH income model		
Export impact	-0.22 (-0.46)	1.93** (2.46)
Import impact	0.27 (1.35)	-0.57 (-0.76)

Notes: For the 1990-2000period, poverty data are from the 1990 and 2000 decennial census; for 2000-2010, they are from SAIPE. Robust t-statistics from the STATA cluster command are in parentheses.*, **, and *** indicates significance at 10%, 5%, and 1% level, respectively. In all models, control variables include: distance to nearest or actual Urban Center; incremental distance to a MA; incremental distances to MA> 250,000, > 500,000, and > 1,500,000 population; county population 1990/2000; population of nearest or actual MA 1990/2000; county area (sq. miles); amenity dummy variable represented by a 1 to 7 scale (USDA); proximity (within 50kms) to the Atlantic Ocean, Pacific Ocean, and the Great Lakes; state fixed effects; demographic variables including five ethnicity shares; four education shares; %females; % married; and % with a work disability; wage mix growth for the corresponding period, and log value of the wage level at the initial of the period are included as a control variables in the median hh income model.