Implications of local ties in spatial equilibrium

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Abstract

Local ties lead people to stay in declining areas. Using the share of people who were born in the same state that they live in as a proxy for local ties, I find that aggregate migration responses are smaller in areas where people's local ties are stronger. I develop a spatial equilibrium model where people have idiosyncratic ties to their "homes" and use it to derive welfare implications. In the model, declining areas attract fewer outsiders and have lower net migration elasticities. The lower migration elasticities in declining areas imply that welfare can decline by more without a migration response. They also imply that locally focused programs, like place based policies, lead to smaller dead weight losses.

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In spatial equilibrium, migration tends to equalize welfare across space. If people move "enough," then wages and housing prices will make the marginal worker indifferent across areas (Rosen (1979) and Roback (1982)). Most workers are not marginal, however. People tie themselves to individual areas through families and connections that they accumulate over time. Several recent studies have found substantial differences in outcomes across space and modest migration responses.[1] Do idiosyncratic ties to local areas have implications for these outcomes?

There are reasons to believe that local ties are important. Previous studies have shown a large home bias in people's migration decisions and other studies have examined several mechanisms. Kennan and Walker (2011), Huttunen, Møen and Salvanes (2015), and Diamond (2016), using distinct classes of models, have found that home bias is an important feature of the data. A home bias could represent many things, but some of the most obvious candidates are people's extended families and their networks of friends. Several studies have shown how parents' locations place restrictions on the mobility of children. Other studies have shown that employment referral networks tend to be both geographically concentrated and important for employment outcomes.[2]

To provide some reduced form evidence about the aggregate implications of residents' local ties, I begin by examining the impact of changes in the demand for labor in individual Commuting Zones (CZ's, explained below). I use two plausibly exogenous instruments for local labor demand. The first, developed by Bartik (1991), projects national changes in employment onto local areas, under the assumption that these changes are driven by changes in demand or productivity that affect all domestic firms in an industry. The second, developed by Autor, Dorn and Hanson (2013), projects the impact of competition with Chinese firms onto local areas, under the assumption that Chinese entry into the market is driven by factors within China. Wages, labor force participation, and unemployment change by more in areas with stronger local ties. In areas with weaker ties, however, population adjusts by more, presumably through migration.

I build a Rosen (1979) and Roback (1982) style model of spatial equilibrium to examine the mechanisms driving these effects and derive aggregate implications for welfare. I allow people to have a distribution of preferences about their homes and calibrate this distribution, using indirect inference, to match differences in locals and non-locals' migration decisions across areas. In the model, people's local ties limit population adjustments. In declining areas people have stronger levels of local ties and this keeps them from leaving, despite large changes in real wages. These different migration elasticities are easily predictable from the proportion of locals, and they have important implications for welfare.

Migration elasticities are important for welfare in spatial equilibrium and for the welfare impacts

[1] Bound and Holzer (2000), Notowidigdo (2011), Molloy, Smith and Wozniak (2011), Saks and Wozniak (2011), Kaplan and Schulhofer-Wohl (2013), and Chetty et al. (2014) have all emphasized either large differences in important outcomes or limitations in migration across areas. One common theme is that migration may be particularly low for low skilled workers. Barro et al. (1991) and Blanchard and Katz (1992) find some role for migration, but that it is somewhat modest and Bartik (1993) suggests that local shocks can have impacts on labor force participation that are quite long lasting, which suggests that migration plays a limited role in adjustments.

[2] Examples of papers examining parents and children are Konrad and Kunemund (2002), Hank (2007), Rainer and Siedler (2009), Kaplan (2012), and Coate (2013). Topa (2011) provides an overview of the literature on local networks and job referrals.

of local policies. Migration can insure residents against decreases in local welfare; if a person moves, then the migrant will enjoy higher welfare in a new place and residents will earn higher wages and pay less for housing. Places with lower migration elasticities will suffer larger decreases in welfare after equal sized shocks. This dynamic is important for policy; local policies will generate a deadweight losses that are proportional to the extent that they distort people's migration decisions.

To examine the implications of heterogeneous migration elasticities, I derive analytic formulas for the welfare impacts of local policies.[3] Migration elasticities pin down the deadweight losses of local subsidies. In my model migration elasticities are also important for policies that attempt to create jobs by buying goods from local firms. Higher migration elasticities make each policy less effective in terms of its impact on welfare in a specific area. The intuition for this result is simple – if people's migration decisions about an area were fixed, then local policies would not distort them.

To show implications for local policies, I estimate migration elasticities based on the impacts of local labor demand shocks on wages, rents, and population. I use a method of moments procedure, similar to Suárez Serrato and Zidar (2014), that transforms coefficients from linear regressions into parameters in the model. For example, the general equilibrium migration elasticity is given by the (log) population response over the (log) wage response after a labor demand shock. The estimates suggest that deadweight losses are much smaller in areas with higher levels of local ties. The models' calibration, which uses an entirely different set of moments, has a similar implication.

Migration and migration elasticities are vital for several important questions, and their corresponding literatures, in economics. My results qualify the extent that migration can facilitate convergence within countries and currency unions. Rosen (1979) and Roback (1982) show how migration will tend to equalize welfare in spatial equilibrium, while more recent studies by Albouy (2009) and Moretti (2013) show how these dynamics can explain many more recent developments across space. Similarly, several papers in macroeconomics have emphasized migration in terms of the optimal size of currency unions (Mundell (1961)) and convergence within countries (Barro et al. (1991), and Alesina and Barro (2002)). There also is a large literature on the effects of local economic conditions on workers including impacts on wages and migration itself.[4]

This paper builds off several recent advancements in the literature on migration. The intuition for this effect is similar to the intuition presented by Cadena and Kovak (2016), who show how migrants from outside the US are much more responsive to local shocks than natives of the US. Another influence is the increasing appreciation of gross flows of migrants by Coen-Pirani (2010), Kennan and Walker (2011), Davis, Fisher and Veracierto (2013), and Gregory (2013), among others. I emphasize gross flows of people out of their home areas, and build a model of how these these gross flows out of growing, and declining, areas might be understood in aggregate. My analysis also provides a model of why people in declining areas tend to feel strongly about them. This

[3] My formulas are similar to those in Kline and Moretti (2014b) and apply in very general circumstances. Neumark and Simpson (2015) and Kline and Moretti (2014c) provide an overview of several place based policies. An allowance for place based policies targeting stagnating areas is explicitly written into the founding documents of the European Union (Burda and Hunt (2001), Decressin and Fatás (1995), and Boltho, Carlin and Scaramozzino (1997)).

[4] Seminal papers include Sjaastad (1962), Topel (1986), Blanchard and Katz (1992), Bound and Holzer (2000), and Kennan and Walker (2011).

supports the findings by Gregory (2013) that the residents of New Orleans, a city that has been mostly stagnant economically, are willing to pay large amounts to continue living there.

The paper also adds to recent examinations of slower than expected migration. Molloy, Smith and Wozniak (2013) and Kaplan and Schulhofer-Wohl (2013) have found that interstate migration has been declining over time. My study suggests that this decline, even if it is not driven by people's higher level of local ties, might have implications for how migration might change over longer time frames, since people seem to accumulate ties to places where they have lived. Another branch of the literature, including Glaeser and Gyourko (2005), Notowidigdo (2011), Ganong and Shoag (2012), and Gyourko, Mayer and Sinai (2013), has emphasized how a combination of inelastic housing supply and a higher willingness of the well off to pay for expensive housing, typically via non-homothetic preferences, helps explain low migration rates from declining areas.

The remainder of the paper proceeds as follows: Section one provides some background on the data and examines the relationship between population growth and residents' local ties, which motivate the following sections. Section two presents reduced from regressions that measure how areas with different levels of local ties respond to labor demand shocks. Section three presents a formal model of worker migration to highlight the mechanism and derive some theoretical implications. Section four presents estimates of migration elasticities and the impact of local policies. Section five presents a way to endogenizing people's local ties to model longer term dynamics. Section six concludes.

1 How local ties vary across areas

Across growing and declining areas, there are big differences in peoples' levels of local ties. Intuitively, migrants have fewer local ties, so areas that house former migrants will have lower average levels of local ties. I show in this section how areas grow by attracting people who were born in other places, and how this relates to measures of residents' local ties. Changes in the number of people who were born in an area occur much more slowly. Over time, since population flows are quite persistent, differences in migration rates lead to large differences in two proxies for residents local ties – the percentage of people in a state who were born nearby and the number of years the average householder has lived in their house.

To show how these differences can play out in specific cases, Figure 1 shows population changes in two fairly typical commuting zones – Minneapolis and Atlanta.[5] In 1970, each had a similar population, but since 1980 Atlanta has grown much faster, and it is now almost 50 percent larger. Initially, the share of people who were born locally (in the same state) was about the same across areas, roughly two thirds. Since 1980, however, people born outside of Georgia have increasingly moved to Atlanta. In 2008, less than half of Atlanta's population was born in Georgia, while Minneapolis still contains mostly people who were born in Minnesota. Presumably, differences in people's origins have had important cultural and economic effects on the two cities.

[5]Throughout this paper I use commuting zones, as defined by Tolbert and Sizer (1996), as my unit of observation. These are described in the following subsection and Appendix A.

The rest of this section shows how these patterns apply to places besides just Atlanta and Minneapolis. First I briefly describe the data that I use in this and in following sections. Then I show how changes in the number of people born in an area are much slower than changes in the number of outsiders. Since growth happens by outsiders moving in, growing places have many more people who were born outside the local area. This is intuitive and unsurprising, except for the magnitude of the effect. There are large differences across areas in the proportion of people who were born in the same state and in the average time a householder has lived in their house. In later sections, I show how these fairly striking differences translate into differences in how local economies respond to both policies and local shocks.

Data

Data come, predominantly, from the decennial census and ACS (via Ruggles et al. (2010)). Some additional data: a measure of the impacts of international trade on local labor markets, come from Autor, Dorn and Hanson (2013) and some analyses in the Appendix come from the NBER vital statistics database. In the remainder of this section, I briefly lay out my justification for using census data, I describe the unit of analysis, and give a brief description of how I processed the data. The data and processing are more fully described in Appendix A.

I use data from the US Census because they provide information about migration, labor supply, wages, and housing rents for a large sample in each year. From 1980 through 2000 I use 5 percent samples of the population, and for the American Community Survey I use 2006-2008 (three year) estimates that include roughly 1 percent of the population in each year. Large sample sizes are important for measuring outcomes accurately in small areas. None the less, my preferred specifications are weighted by initial population to place more emphasis on larger commuting zones where things are more precisely measured (as in Bound and Holzer (2000)). The use of the census means that adjustments occur over a minimum of approximately 10 years (8 years for 2000-2008), matching my focus on longer term processes.

The geographic entity that I use as a unit of observation is a 1990 Commuting Zone, as described in Tolbert and Sizer (1996). Using a procedure developed by David Dorn (Autor and Dorn (2013)), I map publicly available geographic identifiers for each year in the IPUMS to the geographic boundaries of Commuting Zones (CZ's). CZ's are desirable here because they encompass places where people both live and work, according to 1990 commuting data, and because they cover the entire United States. I restrict to CZ's in the continental United States for comparability with prior studies and because migration processes are more comparable within the continental US.

I use a person's place of birth as my primary measure of their local ties. In the data, respondents are asked to report their state of birth (or country, if they were born outside the US), which is the measure that I use. The coarseness of this measure, relative to my unit of observation, does not appear to be a big concern. Other studies have found that people value living close to their birth places according to different geographies. For example, Diamond (2016) finds that people have attachments to census divisions as well as states, and Bartik (2009) reports similar results for

MSA's using the PSID. No matter the geographic detail, a person's place of birth is still only a proxy for their local ties. Some people quickly moved away from their places of birth, and some did not develop strong connections. Robustness checks, using an alternative measure of local ties, reassuringly give similar results.

I compute statistics at the level of CZ's using a sample of adults. My sample includes 22-64 year old adults not living in group quarters (barracks and dorms). In computing wages I exclude unpaid family workers and workers who did not work for pay last year. I report prices in 2007 dollars, using a PCE deflator, and weight all wages using labor supply weights. More details are available in Appendix A.

Breaking changes into locals and outsiders

To show the effects of people's local ties, I breaks changes in population into changes in the population of people who were born nearby and the population of people who were born elsewhere, which includes other states and countries. The population of outsiders increases by more than the population of people born locally in places that are growing. Very few areas are actually losing people; some areas appear to be unappealing to outsiders, however, which leads their populations to stagnate.

To compare the importance of outsiders moving in against locals staying, or additional children being born, Figure 2 plots the changes in total population and changes in the population born somewhere else, each expressed as a percentage of the initial population. Each variable covers the period from 1980 to 2008, and the graph includes commuting zones in the continental US. The graph shows how much of the increase in population (on the x axis) is due to increases in outsiders moving in (on the y axis). Mechanically, if the only reason population changes was because more people were born, then each dot would be on the light grey line on the x axis, and all of the population change would be due to changes in the excluded population group of locals. Conversely, if there was no variation in locals staying, then all changes in population would be due to outsiders, and each dot would be on the light grey 45 degree line. If the two contributed equally then points would be centered on the middle (22.5 degree) light grey line.

Figure 2 shows that outsiders drive population changes in areas besides the two plotted earlier. Dots on the graph are much closer to the 45 degree line; most are above the middle line. According to a regression with population weights, the slope is 0.74, suggesting that about three quarters of population increases are due to increases in the number of outsiders, presumably because more choose to move in. The unweighted number is lower, but still well above one half. The dots, additionally, are within a relatively narrow cone, suggesting that there is a stable relationship between the changes in the number of outsiders and the number of locals. This would be the case if both populations value underlying amenities in the same way, but that one is more responsive than the other.

The importance of outsiders in population changes is important in two ways. First, it suggests that areas have much different levels of outsiders, a fact that I establish in the remainder of this section. Second and more importantly, it suggests that the preferences of outsiders, or people choosing to live in locations that are unfamiliar to them, drive spatial equilibrium. This distinction will be an important element of my modeling strategy, which I lay out in Section 3.

Connecting population growth and local ties

There are substantial differences both in the percentage of residents who were born near where they currently reside and the amount of time that people have spent in their houses, which suggests that local ties vary quite substantially across the United States. These differences in residents' experience in an area are the result of the large and persistent differences in population growth rates across the United States that have been documented by Blanchard and Katz (1992), among others. Areas grow by attracting outsiders, so growing areas have many outsiders. Declining areas retain a similar percentage of local children, regardless of local conditions. In some areas, less than 20 percent of residents were born in the same state, while more than 80 percent of residents were in others. Mapping these differences shows an interesting pattern: In the west, fewer people were born in the same state. In Appalachia, the Deep South, and parts of the Upper Midwest, residents are more likely to have been born nearby.

Figure 4 shows the empirical relationship between of net changes in population from 1980 to 2008 and the amount of experience residents have in the areas where they live, as of 2008. Panel A shows population growth on the horizontal axis and the percent of residents who were born in the state where they currently live on the vertical axis. There is a robust negative relationship between the two. On average, in a commuting zone whose population has increased by 100 percent more, from 1980 to 2008, about 30 percent less of the population will have been born in the same state. The scale of the differences are quite large. Several commuting zones have doubled or more in size and have less than a quarter of the populations born locally. Most commuting zones, though, have similar populations to 1980 and have more than half of their populations born in the same state. Panel B shows a similar trend for the amount of time people have lived in their houses.[6] Since the majority of moves are local, this statistic shows some supporting evidence that people in growing areas have lived in the same neighborhoods, in addition to the same area, for less time. In a commuting zone that has grown by 100 percent more, people have lived in their houses for about 3 fewer years.

Table 1 shows that these relationships are robust to omitting weights and including controls. According to each specification, areas that have grown more have residents that have less experience in the area. The magnitude of the main effects are somewhat smaller than in the figure, but they are still quite meaningful. Areas whose population has doubled have 20 percent fewer locals, as a proportion of their population, and have people who have lived in their houses for approximately 2 years less (the last columns are scaled by 100 for readability). Since population growth is quite

[6]This statistic comes from the census question asking how long the "householder," in whose name the residence is owned/rented, has been living at the residence. The statistic reports this number for all people 16-65, using person weights, so it does not necessarily reflect how long the specific individual has lived at that address.

persistent, it is difficult to disentangle if the effects are due to more or less recent population growth, but separating out growth in different time periods suggests that there is a relationship even with growth over longer time frames. For example, growth from 1980 to 1990 appears to have an effect that is stronger than growth from 2000 to 2008, at least in terms of point estimates. The (adjusted) coefficients are not different in terms of statistical significance, however.

A map of the percentage of residents born in the same state, shown in Figure 5, shows interesting geographic patterns. Broadly, the share of people born in the same state is much smaller in the West, particularly the Southwest. This is despite western states having higher populations and larger geographic areas. Areas with the highest percentage of residents born in the same state tend to be rural, and they are concentrated in the Deep South, in Appalachia, the Upper Midwest, and other parts of the Rust Belt. The map's scale shows, once again, that the differences are quite large. For example, parts of Michigan, Louisiana, and other states have more than 80 percent of their populations born in the same state.[7] In other areas, including commuting zones surrounding Denver, Colorado and Phoenix, Arizona, fewer than a quarter of residents were born in the state where they live. Appendix Figure A6 shows a similar pattern for the amount of time people have spent in their residences.

2 Reduced form results

To test if local ties influence outcomes in spatial equilibrium, this section presents examines the impact of changes in labor demand in areas with different levels of local ties using a series of reduced form regressions. I quantify impacts by decomposing the demand shift into impacts on population, residents' labor supply, wages, and rents. I use two plausibly exogenous shift-share instruments to isolate impacts on labor demand. The first, developed by Bartik (1991), uses changes in total industry employment at the national level during the 1980s. The second, developed by Autor, Dorn and Hanson (2013), uses changes in industry level demand for final goods due to increased trade with China in the 1990s and early 2000s.

The results suggest that areas with different levels of local ties adjusted to labor demand shocks over different margins. Areas with lower levels of local ties adjusted their populations, in keeping with standard models of spatial equilibrium. Areas with higher levels of local ties, however, adjusted the size of their labor force, their wages, and their unemployment rates, as would be expected if people had limited geographic mobility. Rents changed by similar amounts in each area, suggesting that the differences are due to preferences about migration, not necessarily differences in local housing markets. If anything, the similar rent responses, with larger population responses, seem to suggest that housing supplies might be more elastic in declining areas.

[7] This includes the Isle de Jean Charles in Louisiana, which is notable for a $48 million (Jackson (2016), 2016 dollars) grant to resettle approximately 65 residents. A 2012 movie, Beasts of the Southern Wild, was filmed nearby (Making et al. (2012)) and set in a similar community. It depicts a forced migration of residents from a fictional island, presumably in southern Louisiana. The movie, and presumably the experiences of the residents involved, present an argument about the importance of residents' local ties for their migration decisions.

Outcomes

To understand how areas adjust to labor demand shocks, I decompose labor demand shocks between price and labor supply margins.[8] This allows me to distinguish between population re-allocation, the standard mechanism in Rosen (1979) and Roback (1982) style models, and other possible adjustments, including people moving out of the labor force and wage changes. To compare the importance of each, I scale changes in different labor supply margins so that each represents percent changes in the number of employed workers. To illustrate, the number of people outside the labor force is about six times as large as the number of people who are unemployed. This means that if one percent of people outside the labor force started to work, and the number of jobs was constant, then the number of unemployed people would have to increase by about six percent.

Figure 3 illustrates the effects of a labor demand shock on employment and wages.[9] Initially the local labor market is at equilibrium at point A, the intersection of the initial labor demand curve, L_{D1}, and the labor supply curve, incorporating all margins of adjustment, L_S. A labor demand shock of size A-B affects the local labor market, however and shifts labor demand to L_{D2}. This leads to an increase in wages and employment at the new equilibrium, point F at the intersection of L_S and L_{D2}. The size of the wage increase, from A to D, will depend on both the elasticity of labor demand and labor supply, coming from all margins. So, for a constant labor demand elasticity, an area with more elastic labor supply will have a smaller increase in wages. This smaller increase in wages is because employment can change by more in places where labor supply is more elastic.

In addition to effects solely on employment and wages, Figure 3 also separates out the equilibrium change due to migration. The curve $L_{S\text{Mig}}$ illustrates changes in employment, around the initial equilibrium at point A, due to people moving in and out, while the horizontal distance from between $L_{S\text{Mig}}$ and L_S shows adjustments in all other margins. The equilibrium size of the migration adjustment, in terms of employment, is the horizontal distance from D to E in the diagram, since this is the change in employment due to the migration response after the equilibrium change in wages. So, by seeing how big the distance from D to E is relative to the total change in employment, D to F, it is possible to decompose the importance of migration, labor force participation, and possibly other distinct processes that will adjust the labor supply.

Formally, if we assume a constant elasticities of labor demand (η_D), labor supply due to migration ($\eta_{S\text{Mig}}$, and labor supply due to other adjustments ($\eta_{S\text{Other}}$) then the size of the equilibrium changes will be simple functions of the three elasticities and the size of the labr demand shock, $B - A$. The change in wages $(F - C)$, will be $\frac{B-A}{\eta_D+\eta_{S\text{Mig}}+\eta_{S\text{Other}}}$, while the change due to migra-

[8]For these regressions, and throughout the paper, I do not distinguish between increases and decreases in any of my outcomes. This is because the reallocations that I study involve large gross flows of people into and out of employment, unemployment, the labor force, and specific local areas. So, even if moving into and out of areas involve separate concerns, and most residents are reluctant to move, there will still be no discontinuity as the net flow of population becomes negative. This is a well known fact about employment dynamics, and **?** documents this fact for migration, noting that most population changes are driven by the behavior of people moving in, while a roughly constant proportion of people move out. Responses in the model, which are continuous but vary depending on the net migration of people from their homes, illustrate this dynamic.

[9]For conceptual clarity, I am omitting effects on rents. Including rents would complicate the analysis, but should deliver a similar intuition.

tion $(E-F)$ will be $\eta_{S\text{Mig}}\frac{B-A}{\eta_D+\eta_{S\text{Mig}}+\eta_{S\text{Other}}}$ and the total change in employment $(F-D)$ will be $(\eta_{S\text{Mig}}+\eta_{S\text{Other}})\frac{B-A}{\eta_D+\eta_{S\text{Mig}}+\eta_{S\text{Other}}}$. If changes in employment due to population are large relative to total changes in employment, then it suggests that migration is particularly elastic in particular areas. This result applies regardless of the size of the labor demand shock, or the labor demand elasticity.

To measure the size of changes in employment due to migration, labor force participation and unemployment, I log linearize the accounting identity that the number of employees in a place is equal to the population, minus the number of people not in the labor force and the number of people who are unemployed. This allows me to compare changes in population (mainly due to migration), changes in labor force participation, and changes in unemployment rates in terms of their effect on total employment.

$$\begin{aligned} \text{E} =& \quad \text{P} - \text{NILF} - \text{U} \\ \Delta E =& \quad s_p\Delta p - (s_n\Delta n + s_u\Delta u) \end{aligned}$$

I include estimates of the effect of labor demand shocks on employment due to changes in population (Pop), the people not in the labor force (NILF), unemployment, and three other outcomes. The first is the effect on wages, which decreases with more elastic labor supply and labor demand.[10] The second is the effect on local rents. Rents play an important role in the Rosen (1979) and Roback (1982) analysis of spatial equilibrium and in the model that I present later. One concern is that some areas will be unable to build housing to accommodate additional population, so rents will rise and lower changes in population. I show rents as a rough gauge of how much changes in housing prices might affect the equilibrium. Third, as an additional measure of the size of the labor force participation response, I include the labor force participation ratio, entered as a percentage. Unlike the other measure of labor force participation (NILF, which is the scaled log change in people outside the labor force) the labor force participation rate controls for total population in the denominator, so it will not mechanically decrease if people move to the area.

Each margin has different welfare implications. If population flows are strong, and other margins are little changed, then labor demand shocks will have small impacts on welfare according to typical models of spatial equilibrium. Migrating workers are roughly indifferent between possible locations and workers who stay receive roughly the same wages and have about the same ability to find a job. If higher labor demand increases wages and pull workers into work from unemployment or being outside the labor force (due to weak demand), however, then a labor demand shock will have meaningful impacts on welfare.

[10] In my specifications I do not attempt to compute real wages. Instead I present separate results for nominal wages and rents (for housing). These could be combined to compute a proxy; Albouy (2009) suggests that local rents can proxy for 1/2 of local consumption, while national accounts suggest that about 1/3 of consumption is spent on housing and utilities.

Shifters

I use two separate shift share instruments to isolate a plausibly exogenous labor demand shocks. Each works on the assumption that changes at the national level will affect a CZ proportionate to its pre-existing industrial structure, measured by its employment shares in particular industries at the beginning of the period. The idea is that whatever drives the national changes is presumably not due to supply factors within the CZ's that are affected. The first, Bartik (1991), instrument is perhaps the most straightforward in that it simply takes changes in industrial employment at the national level (excluding the CZ in my case) and projects them onto CZ's. The second, Autor, Dorn and Hanson (2013), instrument isolates the effects of Chinese manufacturing competition.

Bartik instrument

The commonly used Bartik (1991) instrument projects industry level employment changes outside of a CZ onto it using the CZ's share of employment in each industry at the beginning of the period. For area j from period $t-1$ to t the instrument can be written as follows:

$$\hat{\Delta L}_{j,t} = \sum_{i \in \text{ind}} \left(\frac{L_{i,-j,t} - L_{i,-j,t-1}}{L_{i,-j,t-1}} \right) \frac{L_{i,j,t-1}}{L_{j,t-1}}$$

The instrument computes the average of changes in industry level employment outside the CZ (the term in brackets), weighted by the area's share of employment (the second term) in period $t-1$.[11]

The Bartik instrument is a good choice in that it has enough variation to ensure some power and that it also can be thought of as plausibly exogenous. To make the case for exogenity stronger, I only use the instrument in the 1980's because the instrument's logic of projecting industry level trends onto local areas is particularly compelling in the 1980's. Many of the changes in the 1980's are due to national changes that led to a decline in manufacturing employment. The instrument has a good amount of power since manufacturing tends to be spatially concentrated. At the same time, few industries are so concentrated that a single CZ makes up an excessively large proportion of total employment. I rely on the more specific trade shifter that I describe below to provide some evidence from later periods.

Trade instrument

The trade instrument uses a similar shift share strategy, but focuses on a very specific process – increased competition with Chinese manufacturers. Autor, Dorn and Hanson (2013) document that imports from China to the United States increased significantly over the 1990's and early 2000's as China entered the World Trade Organization and emphasized an export-led development strategy.

[11] Bartik (1991), Blanchard and Katz (1992), and Bound and Holzer (2000) include changes in employment within the region in question in their calculation of industry wide changes in national employment which simplifies the calculation of the instruments. I follow more recent papers, however, and calculate "leave one out" Bartik instruments by excluding each local labor market in question from the nationwide changes used to project employment changes in each industry.

$$\hat{\Delta L}_{j,t} = \sum_{i \in \text{ind}} \frac{-\Delta M_{i,t}}{L_{i,t-1}} \frac{L_{i,j,t-1}}{L_{j,t-1}}$$

Again, the equation computes a weighted average using an area's share of employment in a particular industry $\left(\frac{L_{i,j,t-1}}{L_{j,t-1}}\right)$ as weights. In this case, however, the quantity in parenthesis is different. Instead I measure the size of Chinese import competition in a particular industry, modified by a negative sign to make it have the same sign as above. Specifically, $\Delta M_{i,t}$ measures the dollar value increase in imports coming from China in industry i in thousands of dollars. The results of this instrument, then, can be interpreted as the effect of an increase in imports from china equal to one thousand dollars per worker.[12]

The exclusion restriction for this instrument is more credible than a Bartik specification since it isolates changes due to a single change that was driven by factors outside the United States. Businesses in China increased exports to the US for reasons that are likely to be unrelated to supply shifts in parts of the US. To bolster the case even further, I follow Autor, Dorn and Hanson (2013) in instrumenting for Chinese import penetration in the US using Chinese import penetration in other countries.

Specification

I examine differences in responses to labor demand shocks using two different specifications. I estimate each at the CZ level, removing time invariant characteristics of CZ's by first differencing all variables. The bins specification separates CZ's into two bins, those with low and high levels of local ties, and estimates effects for each bin. This is my preferred specification, since it allows an easy interpretation of the magnitudes involved. To allow for more straightforward hypothesis testing and to show that the effect is not dependent on the cutoff between two bins, however, I also present a triple differences specification. The triple difference specification allows the impact on individual CZ's to vary linearly, but continuously, with differences in the CZ's local ties.

Bins

My preferred specification estimates the effect of labor demand shocks separately for areas with high and low levels of local ties by separating them into two bins. The first bin contains labor markets where less than 60 percent of workers were born in the same state ($\mathbf{1}_L = 1$), and the second contains areas where more than 60 percent of workers were born locally ($\mathbf{1}_H = 1$).[13] Roughly 10 year changes in the outcomes are linear functions of these shifters and an extensive series of controls:

[12] Autor and Dorn (2013) present their regressors using different notation and with a different ordering of terms. For this exercise I use the variables from their published dataset, so I am mechanically using the same variation. I differ from their notation and ordering for presentational reasons, to maintain continuity with the Bartik formula.

[13] I chose 60 percent because it creates roughly two equal sized groups in most years. Earlier versions used 50 percent and the second specification does not rely on a specific cutoff. The cutoff is mainly designed to produce precise coefficient estimates.

$$\Delta y_{j,t} \quad = \quad \alpha_t + (\beta_L \mathbf{1}_L + \beta_H \mathbf{1}_H)\Delta\hat{L}_{j,t} + \gamma_L \mathbf{1}_L + \gamma_H \mathbf{1}_H + \gamma_X X_{j,t-1} + \epsilon_{j,t} \qquad (1)$$

Here $\Delta\hat{L}_{j,t}$ is the labor demand instrument and the β coefficients show the effect of these shocks for the specified subset of local labor markets. In addition, α_t is a dummy for the time period where the regressions encompass multiple time periods, and X are the controls.[14] I follow much of the literature by estimating this equation in first differences, which controls for time invariant effects. In the cases with only two periods, this is exactly equivalent to using fixed effects, but in cases with more than two periods, it relies on slightly different assumptions.[15] In this and the triple difference specification, I report standard errors that are clustered by the state the CZ had the plurality of its population within.

Triple difference

To allow for more straightforward hypothesis testing and to show that the results are robust to different cutoffs, I also use a triple difference specification. The triple difference specification implies that that the effect of the labor demand shock varies linearly with the shore born locally:

$$\Delta y_{j,t} \quad = \quad \alpha_t + \beta_{\text{Main}}\Delta\hat{L}_{j,t} + \beta_{\text{Inter}}\Delta\hat{L}_{j,t}\Delta\text{ShLocal} + \gamma_{ShLocal}\Delta\text{ShLocal} + \gamma_X X_{j,t-1} + \epsilon_{j,t} \quad (2)$$

I regress an outcome ($\Delta y_{j,t}$) on a labor demand shifter ($\Delta\hat{L}_{j,t}$) multiplied by the de-meaned share of local workers (ΔShLocal, which measures average levels of local ties), the direct effect of both, and controls for the time period α_t, if there are multiple time periods. The coefficient of interest is β_{Inter}, which represents how the effect varies with changes in residents' average level of local ties. In this framework, tests that effects vary across areas are tests that β_{Inter} is different from zero. Since the share local term is de-meaned, the coefficient on the labor demand shifter (β_{Main}) represents the effect for an area with an average share of workers born locally.

Results

Summary statistics

To show some basic characteristics of the sample, Table 2 reports summary statistics for the major outcomes, some covariates that I use as controls, and the plausibly exogenous labor demand shocks. Panel A reports statistics about the levels of variables among all 722 continental CZ's in 1980, while Panel B shows outcomes and labor demand shocks in the form they enter the regression equations.

[14] In addition to dummy variables for each bin of local labor markets, I control for the share of working age adults outside the labor force, unemployed, foreign born, having entered the state in the past five years, and the share of adults who are under 35 and 50 to 64. Generally, specifications are not sensitive to the choice of controls.

[15] Wooldridge (2002) notes that first differencing is preferred when the outcome is a random walk, while fixed effects is preferred when the outcome has serially uncorrelated errors.

First I show the scaling factor (if applicable) and the mean and standard deviation among all CZ's (unweighted). Next I show the mean broken out by areas with high and low levels of local ties. Unless otherwise noted, the statistics are computed either in 1980 or from 1980 to 1990 for the scaled log changes.

The first two columns of Panel A show that the average CZ has a modest population, most people 22-65 are employed, and that most people were born in the same place. The average unweighted population of a continental CZ was 162 thousand people in the sample, but the standard deviation is quite large, in accordance with Zipf's law. Most people are employed, but about 30 percent of adults 22-64 were outside of the labor force. The average CZ had about 66 percent of its residents living in the state of their birth as of 1980 but the standard deviation of this number was relatively large, in keeping with the previous discussion.

Areas with different levels of local ties also differ in terms of other covariates. Panel A shows that CZ's high ties tend to be smaller, in keeping with the relationship between population stagnation and higher levels of local ties. CZ's with high ties tend to have slightly older, less educated populations who earn lower wages and pay less money in rent. Somewhat surprisingly, they also have higher labor force participation. Differences in these covariates suggest that it is important to control for level differences across areas, which the first differences specification does.

Panel B shows that population changes have large impacts on employment, much more so than other categories. The standard deviation of scaled population changes are roughly three times as large as changes in people in the labor force and nine times changes in unemployment. The table also shows the impact of women entering the labor force in greater numbers from 1980 to 1990, since the labor force participation rate grew by five percent on average.

Bartik instrument

Specifications using Bartik instruments from 1980 to 1990, shown in Table 3, show strong migration responses in areas with low levels of local ties, and smaller responses in areas with higher levels of local ties. Differences in the coefficients on population are statistically and economically significant in both specifications, as are differences in the number of people outside the labor force. There is little evidence of differences in other coefficients. Put together, the changes suggest that migration is less responsive to labor demand shocks in places with high local ties, in keeping with the intuition that local ties are a barrier to migration.

The most striking difference in Table 3 is the response of total population in each area. The bins specification for areas with low levels of local ties, shown in Panel A, show that population changes add two percentage points to the stock of potential workers after a one percent increase in predicted local labor demand. Alongside this, however, the number of people outside of the labor force increases by about 0.5 percent of the initial workforce, leaving a 1.5 percentage point increase in employment. For areas with higher levels of local ties, the population response is muted, equal to only about 0.5 percent of the workforce and there is no discernible change in the number of people outside the labor force. The triple difference specification confirms these results. The interaction term is scaled by 100 for readability, so the roughly 30 percent difference between the average high and low ties area implies a 1.3 percentage point smaller change due to population changes, and 0.3 percentage point smaller change due to people entering the labor force, in an area with higher ties. The two specifications appear to match quite well, as expected.

Differences between high and low ties areas in Table 3 suggest that adjustments are different in areas where people have strong local ties. The population changes are one quarter as large in areas with stronger ties, and the difference is statistically significant at the one percent level. This suggests that areas with lower ties can adjust after changes in labor demand by absorbing additional population, as in Blanchard and Katz (1992). Areas with higher ties, however, adjust along other margins. In the bins specification, areas with high levels of local ties have a statistically significant increase in labor force participation rates after a positive shock, mirroring Bartik (1993), who finds that residents benefit from local labor demand shocks.[16]

Differences in age structure, differences in educational attainment, or developments in the housing market do not appear to drive these differences between areas with high and low levels of local ties. Appendix Table A9 includes separate interactions with the local age structure, local educational attainment, the initial percent of residents employed, and several measures of initial rents. It shows that the main results I outlined above are robust to including these, and appear to actually grow if other interactions are included. Another piece of evidence that suggests that these effects are driven by local ties themselves is the near equal sized impacts on wages and rents. If, for example, differences between growing and declining areas were due to housing being inelastically supplied in declining areas because housing is durable, then rents should increase by much more in areas with higher levels of ties.[17] While the estimates for wages and rents in Table 3 are imprecise, there is little evidence that these differences are very large in this context, at least.

[16] One somewhat puzzling result is that an increase in labor demand increases the number of people outside the labor force in areas with low ties. Appendix Tables A6 and A7 separate the effect out for men and women to show that the effect is driven by women. According to Table A7, areas with few locally born workers experience increases in the number of adult women outside of the labor force that are roughly 1/3 the size of the increase in population. This relative size suggests that women migrated in and remained outside of the labor force, likely because of their partner. This supports a literature on "tied migration," including Sandell (1977) and McKinnish (2008), that finds that women often drop out of the labor force after moves. The 1/3 figure is also consistent with average labor force participation rates among women in the 1980's, which are between 50 and 60 percent. Impacts on the labor force participation rates, which control for changes in population due to migration, are never significantly negative in Tables 3, A6, and A7.

[17] Glaeser and Gyourko (2005) and Notowidigdo (2011) emphasize the importance of durable housing in declining areas. Durable housing can lead to inelastic housing supply in areas where population is declining. Since houses depreciate slowly, decreases in labor demand (and amenities) can lead to very low rents, which keep people in the area. This is particularly true for poorer residents, since poor people spend a higher share of their incomes on housing. This mechanism is most important over short time frames and fine geographies, however. Over longer time frames, like the time frames associated with changes in residents' local ties, even small depreciation rates can lead to substantial decreases in the housing stock. Another factor to consider is that the size of households has been declining (Albouy and Zabek (2016)) so housing stocks would have to expand house a population that remained constant (few areas have consistently declined in population). Previous examinations by Rappaport (2004) and Davis, Fisher and Veracierto (2013) have also found that durable housing plays a modest role.

Trade instrument

Regressions using the trade instruments, shown in Table 4, also show that areas with low ties adjust in terms of population, while places with higher ties adjust along other margins. The bins specification shows that a \$1,000 per worker decrease in import competition from Chinese firms leads to an increase in population equal to 1 percent of the initial workforce.[18] The number of workers outside the labor force increases by about one quarter as much, but this difference is statistically indistinguishable from zero. The effect on labor force participation, which controls for population, is a fairly precise zero. Interestingly, wages appear to be barely affected, but rents jump substantially. In places with high levels of local ties, however, people enter the labor force. Population changes are negative, though small and statistically insignificant, and the stock of workers outside the labor force decreases by about 1 percent of the initial workforce. Changes in the number of unemployed workers are also meaningful, at 0.2 percent of the workforce particularly if one considers that the value is scaled. Putting these together, the effect on the labor force participation ratio are substantial. The \$1,000 decrease in competition leads to a roughly 0.75 increase in the percent of workers in the labor force. In addition, wages increase substantially in places with high local ties – by 0.8 percent in response to the \$1,000 per worker decrease in competition.

The results in Table 4 are robust to using the triple difference specification and the magnitudes of each are also in line with the bins specification. The estimated interaction terms are negative for population, the number of people outside the labor force, and unemployment, though the interaction with population is imprecisely estimated and statistically indistinguishable from zero. Effects on wages and labor force participation increase with higher ties, in keeping with the limited population response. Each suggests substantial losses for the local population as Chinese firms entered the market in the 90's and early 2000's, keeping with Autor, Dorn and Hanson (2013) and Feler and Senses (2015). Interestingly, these losses appear to be highly concentrated in areas where workers have higher levels of local ties and were either unwilling or unable to migrate.

The findings are also robust to including other possible differences as interactions, if anything they appear to be strengthened by them. Appendix Table A10 shows that including the same interactions with age structure, educational attainment, the percent employed, and several measures of rents seem to preserve, and perhaps strengthen the findings. The estimated impacts on rents are also quite similar, which suggests that the housing markets in each area respond in similar ways.

Summary

Areas where people have higher levels of ties respond to labor demand shocks in different ways. In areas where people have higher levels of ties, population changes are smaller, people move into or out of the labor force, and wages change by more. All of these suggest that there are forces that

[18] Since the median exposure to Chinese import competition is roughly \$1,000 per worker, the coefficients show the effect in terms of the exposure of a fairly typical area. The mean, shown in Table 2, is higher because the measure is particularly large in some rural areas. It is more than \$15,000 per worker in some areas and maxes out at \$43,000 per worker in Murray, Kentucky. The results are are weighted by population and are robust to dropping several of these areas.

make migration slower in places where people have higher ties, and that these have implications for welfare.[19] To see how these differences can emerge in spatial equilibrium, the next section presents a model that incorporates a flexible specification of people's ties to their homes. It shows how declining areas are unappealing to most people born outside, but still are appealing to a considerable fraction of people who have strong local ties. Thus, high average levels of local ties emerge endogenously. I use the model, and generalize it using a sufficient statistics approach, to examine the welfare implications of different migration elasticities. I also use the models structure, combined with these estimates, to calculate migration elasticities during the episodes above.

3 Model

In this section I develop a model that extends the Rosen-Roback framework to match the facts about the migration of locally and non locally born workers. I include a worker level preference term for a worker's home, which I empirically proxy with their place of birth, in addition to the typical terms describing workers' distributions of preferences about each area. This extension allows the model to match some of the facts I discussed above. I also show how these modifications deliver new implications for migration elasticities, growth, and place based policies.

The key innovation that allows me to fit the facts about migration of locally and non-locally born people is that workers have a relatively flexible distribution of preferences for their home areas relative to other areas. Previous studies have used a home area specific fixed effect, implying that all people want to live in their home area, to match people's high likelihood of residing in their birthplaces. I include a random coefficient on a person's home, which allows for people to prefer their home areas on average, but for some people to prefer to live elsewhere. This allows me to match how locals and non-locals respond to shocks in addition to locals' high average likelihoods of living in their homes.

I designed the model's timing to separate two distinct processes: 1) a period of long term population changes and 2) the comparative statics of both policy responses and subsequent shocks. I model the first period of long term population changes as a large change in local firms' productivity. In response to the equilibrium changes in wages, some residents choose to leave their homes and some new residents who were born elsewhere decide to move into the area. I calibrate the model to make sure that locals and non-locals migration decisions match the basic demographic facts I documented above. The second period contains my comparative statics exercises: the government

[19] This appears to be true in terms of population increases and decreases, since the specifications do not distinguish between these two margins. It would be difficult to credibly identify asymmetric effects in this context, since my instruments are not the only factors leading to population growth and decline. For example, a positive shock to labor demand might be in a place that is shrinking. Also, in the data, gross flows of people into and out of CZ's appear to be much larger than net flows, and people are still moving to places that are declining. This implies that there is not a discontinuous change in the profile of the marginal migrant as population changes turn negative. In my model, presented in Section 3, effects of labor demand shocks are actually symmetric locally. This is because people born in an area might reside elsewhere, but wish to return. In declining areas these "exiles" are a larger proportion of people who might consider moving in, and the preferences of this group of marginal people changes continuously. Kennan and Walker (2011) also emphasize that return migration makes up a large percentage of gross migration flows, so this mechanism is supported by the data.

introduces different place based policies in the local area and exogenous shifters change either local productivity or demand for the local good.[20]

The model's specific mechanisms showcase the natural, almost mechanical, implications of population growth for future migration elasticities. If workers feel strongly about their homes, as the data suggest, then an area that experienced a very negative shock in the first period can still house many native workers despite its low productivity. If the area receives another negative shock in the second period, then it will 1) have workers who are very unlikely to migrate and 2) only be attractive to a small subset of workers living in other places, most of whom still consider the place to be their home. The result of this exercise is that the migration elasticity in this area will be quite low.

The model facilitates conclusions about the equilibrium impacts of place based policies and subsequent shocks based on a place's aggregate migration elasticity. Since declining areas have lower migration elasticities, place based policies policies will involve substantially lower deadweight losses. The intuition is that changes in people's migration decisions tend to undo place based policies, so these policies are more effective in places where they do not induce these changes. Declining areas with low migration elasticities are much more exposed to positive and negative shocks in terms of residents' welfare. Intuitively, this is because migration acts as a kind of "insurance" against local labor market risk in that people can move out and experience more favorable prices because their neighbors moved out.[21]

Household problem

For a person of type i, living in area j, and with home area k, utility in time t is Cobb-Douglas in a final consumption good $c_{.j.}$ (with a price normalized to one) and housing $h_{.j.}$:

$$u_{ijk} = (1-\alpha^H)\ln(c_j) + \alpha^H \ln(h_j) + A_j + \mathbb{1}(k=j)\mu_i + \xi_{ijk}$$

With a corresponding budget constraint (taking into account governmental transfers, $\kappa g_j - T_j$):

[20] The model does not include mobility costs separate from the worker specific preference for their home, which means that each period is in something like a "middle term" equilibrium. Moves in each period occur without specified mobility costs (and there is no saving), so workers solve a static model conditional on their homes and preferences about it. The absence of moving costs makes the model much more tractable, and is a fairly common simplifying assumption (e.g. Busso, Gregory and Kline (2013) and Suárez Serrato and Zidar (2014)).

A shock to amenities would generate similar population response, so to some extent this is without loss of generality. Shocks to productivity and amenities will have different impacts on wages and rents and it may be possible to identify these (as in Albouy (2009)). I do not attempt to disentangle them here since the issues I highlight are relevant in either case.

[21] These conclusions apply to most policies, since they disproportionately affect particular areas. Anti-poverty programs, for example, do not adjust for differences in local prices (e.g. Albouy (2009)). Infrastructure and military spending similarly tend to be focus on particular areas because each exhibit large economies of scale. Also note that place based policies are the most policy relevant in declining areas. For example, the governing documents of the European Union explicitly allows national governments to pursue place based policies to "promote the economic development of areas where the standard of living is abnormally low" but bars them in most other circumstances (Article 107 of EU (2012)).

$$c_j + r_j h_j = w_j + \kappa g_j$$

Here I have omitted time subscripts for tractability and because the problem is static once one considers workers' home areas. The μ_i term is a random coefficient describing a worker's preference for their home, or "home bias," that depends on on the worker's unobserved type i. In this context it allows me to specify the distribution of preferences for home and match the stylized fact that locally born workers are unresponsive to changes that drive population growth in their birthplaces.[22]

κg_j is the net amount of the consumption good provided by the government and $\kappa > 0$ denotes either losses from governmental inefficiency, or the higher marginal utility of publicly provided goods (net of governmental inefficiency). People also gain utility from general local amenities A_j and a type 1 extreme value person and area specific error term ξ_{ijk}. Keeping with much of the literature estimating Rosen (1979) and Roback (1982) style models, I assume workers inelastically supply one unit of labor once they choose their location. The budget constraint also takes into account the rent to reside in a particular area is r_j.

The indirect utility function is log linear:

$$u_{ijk} = \ln(w_j + \kappa g_j) - \alpha^H \ln(r_{.j.}) + A_j + \mu_i \mathbb{1}(k = j) + \xi_{ijk}$$

Given a Type I Extreme Value assumption about the person area specific innovation, the likelihood of person of type i with home k locating in area j is:

$$\psi_{ijk} = \frac{\exp(\omega_{ijk}/\sigma_\xi)}{\sum_{j' \in J} \exp(\omega_{ij'k}/\sigma_\xi)}$$

Where ω_{ijk} is the person's utility excluding the logit error term and the σ_ξ term is a measure of the variance of the iid draw.

There are $N_{..k} = 1$ people whose home is each of $J = K$ areas, and that there is a density of $N_{i.k}$ workers of type i whose home is k. Similarly N_{ijk} is the density of workers of type i living in j and whose home is k so $N_{ijk} = \psi_{ijk} N_{i.k}$ and $\sum_{i' \in I} \int_{j' \in J} N_{i'j'k} = N_{..k}$.

Local goods firms

Local good varieties for each area are produced by (a representative) perfectly competitive firm in each area, called the local goods producer. The local goods producer combines capital, K_j which is supplied in a national financial market at interest rate ρ as well as labor, $N_{.j.}$ to produce y_j of the area specialty, which may only be produced in that area. The production function is parameterized as:

[22] Details of my empirical implementation of the μ_i term are provided in the calibration section. Train (2009) provides a very readable introduction to logit and mixed logit (random coefficient) models, including details of their development in describing substitution patterns in consumer demand for products, most notably automobiles.

$$
\begin{aligned}
y_j &= f(B_j, K_j, N_{.j.}) \\
&= B_j K_j^{\alpha^Y} N_{.j.}^{1-\alpha^Y}
\end{aligned}
$$

B_j is a area specific productivity term. The solution to this fairly standard problem implies the local wage can be written as a function of aggregate prices and parameters:

$$w_j = (1-\alpha^Y)(p_j B_j)^{\frac{1}{1-\alpha^Y}} \left(\frac{\alpha^Y}{\rho}\right)^{\frac{\alpha^Y}{1-\alpha^Y}}$$

Final consumption goods firms

Consumption goods are bought either by consumers as Y^C or the government as Y^G. A perfectly competitive final consumption goods firm with the following production function produces Y^C:

$$Y^C = \left(\sum_{j' \in J} \phi_{j'}^{\frac{1}{\eta^Y}} (y_{j'}^C)^{\frac{\eta^Y - 1}{\eta^Y}}\right)^{\frac{\eta^Y}{\eta^Y - 1}}$$

Where the j' index the goods produced in each area, η^Y is the Armington elasticity (of substitution) between the local varieties, and ϕ_j is a demand shifter for each area's differentiated good.

Government

The government balances its budget in each period and the following equation holds in aggregate.

$$\sum_j g_j N_{.j.} = 0$$

The subsidy to workers living in a particular area represents subsidies, such as infrastructure spending (federal highway funding and other transportation funding), spending on social welfare, governmental support for higher education, and other policies that differentially affect certain areas. Since many states contain multiple commuting zones it may also represent school funding formulas that equalize revenues across the state or other state provided services.

The government produces using the same production technology as the private firm. However, it does not minimize costs in the same way that the firm does. Instead, it applies a scaling factor, $\pi_j > 0$ to each area's price. $\pi_j < 1$ means an area is a preferred producer, while $\pi_j > 1$ means the opposite. The government still pays the same price for the good but this discount incorporates "externalities" from the governments perspective. For ease of notation I normalize the π terms so that $\sum_{j' \in J} \pi_{j'} \frac{p_{j'} y_{j'}^G}{Y^{G*}} = 1$. This imposes the constraint that if a particular area has a positive preference, then a weighted combination of other areas must be less preferred.

The government's (modified) cost minimization problem gives the following equation:

$$y_j^G = \frac{Y^{G*}\phi_j}{(p_j\pi_j)^{\eta^y}}$$

The only difference from the normal equation is the π_j term, which represents the wedge between the government's view of the goods' price, as inferred from its purchase decisions, versus the market's.

Housing market

The housing good h_j in a local area represents both housing and non-tradeable local goods and services that are influenced by real estate prices. The price of the housing good, r_j is determined by supply and demand in the local area.

Housing is supplied by landlords, assumed to be absentee,[23] who develop plots of land that have a distribution of marginal costs for producing one unit of housing. I parameterize these using the following supply function, which gives the cumulative sum of all housing units that would be rented out for rent r_j:

$$H_j^S = F(r_j) = B_j^H r_j^{\eta_j^H}$$

Where $B_j^H = 1$ is a productivity term and η_j^H is the local housing supply elasticity. The consumer problem implies (suppressing tax terms) that workers will demand housing as a fixed proportion of their income:

$$H_j^D = \frac{\alpha^H w_j N_{.j.}}{r_j}$$

Equilibrium

Equilibrium is a set of prices and quantities (p_j, w_j, r_j, $N_{.j.}$) that satisfy the following equations:

Labor market supply and demand locally:

$$N_{.j.} = \sum_{j' \in J} \sum_{k' \in K} \psi_{i'jk'} N_{i'.k'} \tag{3}$$

$$w_j = (1-\alpha^Y)(p_j B_j)^{1/(1-\alpha^Y)} \left(\frac{\alpha^Y}{\rho}\right)^{\alpha^Y/(1-\alpha^Y)} \tag{4}$$

Housing supply and demand:

[23]This assumption is almost ubiquitous in the literature. Another interpretation is that households own their houses but effectively rent their houses to themselves each period. This will be true if transaction costs of buying and selling houses are small. Important divergences will occur from this if transaction costs are large, if there are credit constraints in terms of buying and selling houses. Large transaction costs of buying and selling houses are another reason for frictions in population adjustments, as is durable housing, examined by Glaeser and Gyourko (2005).

$$r_j = \left[\frac{\alpha^H w_j N_{.j.}}{B_j^H} \right]^{\frac{1}{1+\eta_j^H}} \tag{5}$$

Local good supply and demand:

$$y_j = B_j N_{.j.} \left(\frac{p_j B_j \alpha^Y}{\rho} \right)^{1/(1-\alpha^Y)} \tag{6}$$

$$y_j = y_j^G + y_j^C = \left[\frac{Y^G}{\pi_j^{\eta^Y}} + Y^C \right] \frac{\phi_j}{p_j^{\eta^Y}} \tag{7}$$

$$1 = \sum_{j' \in J} \pi_{j'} \frac{p_{j'} y_{j'}^G}{Y^G}$$

A useful simplification combines equations 4, 6, and 7 to show labor demand without p_j or y_j terms:

$$w_j = (1-\alpha^Y) \left[\left(\frac{Y^G}{\pi_j} + Y^C \right) \frac{\phi_j B_j^{\eta^Y - 1}}{N_j} \right]^{\frac{1}{1+(1-\alpha^Y)\eta^Y}} \left(\frac{\rho}{\alpha^Y} \right)^{\frac{1/(1+(1-\alpha^Y)\eta^Y) - \alpha^Y}{1-\alpha^Y}}$$

Reduced form effects in the model

Since the model is log-linear. It is possible to simplify the above equations into a linear system relating changed in observable outcomes, $y = [\Delta \ln(w_j), \Delta \ln(N_j), \Delta \ln(r_j)]')$ to an observable innovation Δz and a structural error term ϵ:

$$Ay = B\Delta z + \epsilon$$

Where:

$$A = \begin{bmatrix} 1 & \frac{1}{1+(1-\alpha^Y)\eta^Y} & 0 \\ -\frac{(1-\bar{\psi}_j)}{\sigma_\xi} & 1 & \frac{\alpha^H (1-\bar{\psi}_j)}{\sigma_\xi} \\ -\frac{1}{1+\eta_j^H} & -\frac{1}{1+\eta_j^H} & 1 \end{bmatrix}$$

The equation can be inverted into a reduced form for the observable innovation: $y = A^{-1}B\Delta z + A^{-1}\epsilon$

Since I use shifters to labor demand in subsequent sections, I solve for $A^{-1}B$ where $B = [\gamma, 0, 0]'$. The parameter γ represents the scale of the innovation, which is not directly measurable from the data sources I have available. The resulting equation is as follows, which gives some insight into the impact of local labor demand shocks:

$$A^{-1}B = \frac{\gamma}{|A|} \begin{bmatrix} \left[1 + \frac{\alpha^H(1-\bar{\psi}_j)}{\sigma_\xi(1+\eta_j^H)}\right] \\ \frac{(1-\bar{\psi}_j)}{\sigma_\xi}\left[1 - \frac{\alpha^H}{(1+\eta_j^H)}\right] \\ \left[\frac{(1-\bar{\psi}_j)}{\sigma_\xi(1+\eta_j^H)} + \frac{1}{(1+\eta_j^H)}\right] \end{bmatrix} \tag{8}$$

Migration responses

The general equilibrium effect of an increase in wages on the number of workers in area j (the migration elasticity) is:

$$\frac{d\ln(N_j)}{d\ln(w_j)} = \frac{[1+\eta_j^H - \alpha^H]}{1+\eta_j^H + \alpha^H(1-\bar{\psi}_j)/\sigma_\xi}\frac{(1-\bar{\psi}_j)}{\sigma_\xi} \tag{9}$$

There are two distinct factors that determine the elasticity: The first is the traditional Rosen-Roback mechanism of increases in wages causing increases in rents, which appears as the first term in equation 9. Rents increase because higher wages lead to higher demand for housing both from new residents and from current residents who spend some of their increased wages on housing. The second factor has to do with the level of connections of individual residents to the local area.

This decomposition is shown through computing the impact of a real wage increase in area j, which will increase the utility of all residents in the area $\omega_j = \ln(w_j + \kappa g_j) - \alpha^H \ln(r_{.j.}) + A_j$:

$$\frac{d\ln(N_{.j.})}{d\omega_j} = \frac{(1-\bar{\psi}_j)}{\sigma_\xi} \tag{10}$$

The above equation follows directly follows from the logit structure, as shown in Train (2009). The numerator is a decreasing function of $\bar{\psi}_j$, the ratio of ω_{ijk} terms of residents in area j against the sum of ω_{ijk} terms in each other area, $\bar{\psi}_j$. I provided a definition of $\bar{\psi}_j$ in equation 3. Intuitively $\bar{\psi}_j$ will be higher if most residents are inframarginal – they find that there is no other area quite like area j, so a small change in real wages will not make much of a difference. My previous demographic section implies that for a significant fraction of the population, there is no place like home. This implies that areas with many locally born residents will have lower miration elasticities. I show how this is the case both for the calibrated model and in empirical regressions later in the paper. [24]

[24] Note that for individuals, the logit error structure implies that people with a roughly 50 percent probability of residing in an area (based on observables) will be the most responsive to changes in local utility. This is very directly at odds with the findings in the first section that workers are at once unresponsive to changes in general amenities of their home areas, and have a roughly 50 percent change of living in their home state. This makes the random coefficients μ_i terms particularly attractive for this context.

Welfare implications

This section derives welfare impacts of particular policies. Define total welfare as the sum of individual welfare and landlords profits in each area, converted into utility terms at the marginal utility of income in the area the funds are collected in:

$$W = VN_{...} + \sum_j \lambda_j \left[r_j H_j - \int_0^{H_j} F_j^{-1}(x)dx \right]$$

Here $V = E_{\xi,i',k'}\left[\max_{j'}\{u_{i'j'k'}\}\right]$ is the average expected utility across all types, $N_{...} = JN_{.j.}$ is the total number of workers, $F^{-1}(x)$ gives the rental price needed to produce x units of housing in area j, and λ_j is the marginal utility of workers in area j. Valuing landlord profits at the marginal utility of residents in area j is necessary to keep total utility constant when money is transfered from workers to landlords, or vice versa.

Implications of a local subsidy

Consider a subsidy to area j that increases g_j. With a slight abuse of notation, let dg_j represent a percent change in the sum of wages and taxes net of transfers. For simplicity, assume that the subsidy is small enough that it only has impacts in area j, which is itself only a small part of the overall economy.

$$\left.\frac{dN_{...}V}{dg_j}\right|_{T_j=0,g_j=0} = \lambda_j \kappa N_{.j.} \left[1 - \alpha^H \frac{d\ln(r_j)}{dg_j} \right]$$

Note that the second term represents payments that go to landlords, which will depend on the housing supply elasticity and the migration elasticity. As in Busso, Gregory and Kline (2013), however, there is no direct effect of the migration response, except indirectly through changes in rents.

Similar logic applies to landlords, so their benefit is simply the increase in rents. This is given by the increase in demand from new residents and old residents who now spend more money on housing:

$$\left.\frac{d\ln(r_j)}{dg_j}\right|_{T_j=0,g_j=0} = \frac{\frac{d\ln(w_j)}{dg_j} + \frac{d\ln(N_j)}{dg_j}}{1+\eta_j^H}$$

The changes in rents are then fully absorbed by the landlords, so the change in overall welfare will be:

$$\frac{dW}{dg_j} = \lambda_j \kappa N_j$$

Ignoring inefficiency in how funds are raised, the cost of the program to a first order is given by:

$$\frac{dg_j N_{.j.}}{dg_j} = N_{.j.}\left(1 + g_j \frac{d\ln(N_{.j.})}{dg_j}\right)$$

Even if $\kappa = 1$, there is a deadweight loss term of $N_{.j.} g_j \frac{d\ln(N_{.j.})}{dg_j}$. This term gives the cost of expanding the program to cover the new migrants that are attracted by the program (since they are marginal, they are made no better off by moving).

Figure 6 gives a graphical interpretation of this cost. The y axis plots workers' valuations of area j against the next best alternative. They will live in area j if this value is above 0. The x axis represents the distribution of workers, ordered with the workers who most prefer j the furthest to the left. Before the subsidy $N_{.j.}$ workers live in area j – these are the target of the subsidy. The subsidy raises utility in area j, so new workers are induced to migrate up to the point where the new line crosses zero. These new workers receive the subsidy, however, and the cost of the subsidy minus their benefit from receiving it is the shaded triangle marked "DWL" in the diagram.

The deadweight loss triangle can be computed, assuming a fixed elasticity of labor supply in response to government subsidies. Because of the earlier abuse of notation, $\frac{d\ln(N_{.j.})}{dg_j} = \frac{d\ln(N_{.j.})}{d\ln(w_j)}$, so:

$$N_{.j.} \int_0^{dg_j} x \frac{d\ln(N_{.j.})}{dx} dx = \frac{1}{2} \frac{d\ln(N_{.j.})}{d\ln(w_j)} (dg_j)^2 N_{.j.} \tag{11}$$

The key determinant of the efficiency of this policy is the elasticity of migration with respect to wages.

Government procurement A similar dynamic exists for government procurement shocks. Since they have the effect of increasing local wages, they can be thought of as equivalent to spending (which increases effective wages since workers inelastically supply labor). This change in wages will affect the welfare of local workers much like governmental spending does:

$$\left.\frac{dN_{...}V}{d\ln(\pi_j)}\right|_{T_j=0,g_j=0} = N_{.j.}\lambda_j \left[\frac{d\ln(w_j)}{d\ln(\pi_j)} - \alpha^H \frac{d\ln(r_j)}{d\ln(\pi_j)}\right] \tag{12}$$

As before the second term will be fully captured by landlords:

$$\frac{d\ln(r_j)}{d\ln(\pi_j)} = \frac{1}{1+\eta_j^H} \frac{d\ln(w_j)}{d\ln(\pi_j)} \left[1 + \frac{d\ln(N_j)}{d\ln(w_j)}\right]$$

The total welfare impact is:

$$\left.\frac{dW}{d-\ln(\pi_j)}\right|_{T_j=0,g_j=0} = N_{.j.}\lambda_j \frac{y_j^G}{[y_j^G + y_j^C]} \frac{1}{\left[1 + (1-\alpha^Y)\eta^Y + \frac{d\ln(N_j)}{d\ln(w_j)}\right]}$$

The welfare effect is increasing in the size of the area, the area's reliance on governmental demand, and the elasticity of substitution of the local good, which is a measure of how much demand from the private sector will decrease given a price increase. As earlier, the effect is decreasing in the size of the labor supply response.

Calibration

To calibrate the model I use a mixture of off the shelf parameters as well as an indirect inference procedure to match some of the stylized facts I documented in the first section. The most important parameters are the two variance terms for the idiosyncratic error distributions (μ_i and ξ). These determine how important idiosyncratic factors are in workers preferences for their birth areas and for other areas. I set the variance of non-local term, ξ, based on estimates in the literature provided by Suárez Serrato and Zidar (2014). For μ, I use an indirect inference procedure to match a regression coefficient relating worker's decisions to stay in the areas of their birth with the change in log population in that area. This regression is shown in Appendix Table A4. It is very much related to the estimates in Figure 2, in that it is driven by the relationship between people staying and outsiders moving in. I set the mean of μ so that roughly 65 percent of workers stay in the area where they are born. This roughly matches the national share of workers who stay in their state of birth.[25]

Specifically, I begin by setting σ_ξ to 0.4, which produces average elasticities close to those found by Suárez Serrato and Zidar (2014). I also set the distribution of home locations to match the percentage of the US population that is foreign born. Within the model foreign born workers have $\mu_i = 0$ for all areas, since these workers were not born in any area of the US. The model does not feature migration across international borders, however, so they only choose across local labor markets in the United States. The assumption underlying this choice is that changes in any one individual area will affect the attractiveness of the country as a whole by a very small amount. From here, I am able to exactly (up to computational error) match the two moments I described. The values necessary for this are listed in the first rows of Table 5.

The other parameters are set according to the literature, with their values shown in Table 5. Three important parameters are the Armington elasticity (η^Y), the share of housing/local goods in overall consumption (α^H), and the elasticity of supply for housing (η_j^H). For η^Y I follow Feenstra, Obstfeld and Russ (2014) and choose an Armington elasticity of 4. I set α^H (the share of locally produced / housing goods in consumption) based on Albouy (2009). This value is larger than the share of housing consumption according to the consumer expenditure survey and national accounts, since it accounts for other non-tradeable goods. This choice will make changes in rents larger and more important for welfare.

I set η_j^H to be equal to roughly the middle of the estimates in Green, Malpezzi and Mayo (2005). There is a substantial literature showing that housing supply elasticities vary significantly based on local geography and zoning (Most prominently Saiz (2010) and Glaeser and Gyourko (2002)). This literature focuses heavily on particular cities, often on the coasts, that have had large increases in house prices and wages but small changes in population. A concern with η_j^H is the functional form of the supply curve. It is possible that the housing supply curve is kinked since housing is a

[25] Empirically I calculate the normal distribution of μ_i using Gaussian quadrature with 100 nodes, which provides a good approximation with moderate computational effort. Also, note that in future versions of the paper I plan to target the relationships in Figure 2, because they are more straightforward and describe the same relationships. This calibration is the result of an earlier draft of the paper.

durable good. Glaeser and Gyourko (2005) and Notowidigdo (2011) argue that this is an important concern for short term decline, while Davis, Fisher and Veracierto (2013) suggest that it plays a limited role, even in the short term.

Other parameters are relatively standard. For the exercise below, I set J so that there are 722 areas, which matches with the number of local labor markets in my data and implies that consumers have many options. Areas are symetic at the beginning of the model in that they all have an equal (normalized) population. Across all of these areas I set the location specific terms (A_j, B_j^H, B_j^Y, and ϕ_j) to be identically equal to one. These represent demand and supply shifters that have impacts on the levels of wages, rents, and amenities but not on responses to them, which are the focus on the exercises below. Estimating these parameters is beyond the scope of this exercise, though Albouy (2009) and Diamond (2016) present estimates for metropolitan areas.[26]

Figure 7 shows the calibration in terms of a moment that I do not target – the relationship between population changes and the share of locals as a percentage of total population. As with Figure 4 I plot population changes (this time due to changes in local productivity A_j) and the share of locals. The black line shows the mode's predictions, while the grey circles show values for all continental CZ's. The model does a fairly good job of predicting this relationship.[27]

Empirical predictions

To see the implications of the sorting process I simulate a large shock to local productivity in the first period. The shock will change local population as well as the share of local workers, as in Figure 7.[28] The dotted line in Figure 9 plots the share of local workers and the solid line plots the value of $\bar{\psi}_j$, an important parameter describing the elasticity of migration in the local area. These two lines track each other quite precisely, suggesting that the share of local workers is a good proxy for $\bar{\psi}_j$ and that this should have important implications for migration responses to local shocks.

Figure 10 shows the implication hinted at in the earlier figure. It plots the migration elasticity derived in equation 9 for different areas. Panel A plots it against population growth in the first period and Panel B plots it against their share of locally born workers.

According to Figure 10, an area with a local share of 20 percent has a migration elasticity of around three, but one with a share of 80 percent has a migration elasticity below one. For the same sized change in wages the first, previously growing, area will grow by three times as much. Similarly, deadweight losses from a regional subsidy will be three times larger in this area, according to equation 11. The figure also shows how estimates of the elasticity of migration may be misleading if they are drawn from areas with a different history of growth or decline.

[26] For the exercises below, however, I present responses after shifting one of these values, B_j^Y in one area.

[27] In future versions of the paper this figure and the corresponding indirect inference procedure will more precisely match the figures and tables presented before by using the same time period, sub-sample of workers etc. My apologies to the reader that these do not match in this version.

[28] For the purposes of this exercise I leave all parameters constant besides local productivity in the affected area, so other areas are unaffected by any changes.

4 Parameter estimates

This section uses the reduced form of the model, equation 8, to estimate the implied migration elasticities and the corresponding welfare trade offs for place based policies.[29] The migration elasticities are important for the processes of growth and decline and for the effectiveness of place based policies. I also include tables describing the implications of particular migration elasticities for the effectiveness of place based policies as well. I use the reduced form of the model, as opposed to a full simulated method of moments or maximum likelihood procedure because I believe this procedure makes it clearer what moments are driving the parameters that I estimate and why. Unlike with other procedures, my formulae are robust to changes in many other parts of the model and in some cases the derivation makes it clear what restrictions drive identification.

Methodology

The parameter estimates are all functions of estimating the reduced form of the model, equation 8, in much the same way as the simple reduced form regressions, equation 1:

$$\begin{bmatrix} \Delta\text{Wages} \\ \Delta\text{Population} \\ \Delta\text{Rents} \end{bmatrix} = \alpha + \left(\begin{bmatrix} \beta_{H,\text{Wages}} \\ \beta_{H,\text{Population}} \\ \beta_{H,\text{Rents}} \end{bmatrix} \mathbf{1}_H + \begin{bmatrix} \beta_{L,\text{Wages}} \\ \beta_{L,\text{Population}} \\ \beta_{L,\text{Rents}} \end{bmatrix} \mathbf{1}_L \right) \begin{bmatrix} \Delta L & 0 & 0 \end{bmatrix} + \gamma_L \mathbf{1}_L + \gamma_H \mathbf{1}_H + \gamma_X X + \epsilon \tag{13}$$

In keeping with the earlier section I include the same controls X. The only difference is that I estimate these regressions as a seemingly unrelated regression to incorporate possible correlation in the error term, ϵ.

In the following paragraphs I describe how I am able to estimate the model's parameters from the β terms above. All proofs are in the appendix.

General equilibrium migration elasticity The simplest parameter to estimate is the general equilibrium migration elasticity, which is simply the log change in population over the log change in wages induced by the instrument (where $J \in \{L, H\}$). The results almost directly follows form the definition of a migration elasticity and an (exogenous) shock to labor demand:

$$\frac{(1-\bar{\psi}_j)}{\sigma_\xi} \left[\frac{1+\eta_j^H - \alpha^H}{1+\eta_j^H + \alpha^H (1-\bar{\psi}_j)/\sigma_\xi} \right] = \frac{\beta_{J,\text{Population}}}{\beta_{J,\text{Wages}}}$$

Proof. See appendix □

[29] This follows Suárez Serrato and Zidar (2014).

Results

The exercise confirms the finding, from both the reduced form regressions and the calibrated model, that migration elasticities are substantially lower in areas with a high average level of local ties and that these have meaningful impacts on local policies. First I show the reduced form parameter estimates, which differ only slightly from the reduced form regression results. Then I show the implied migration elasticities and test to see if they differ across areas with high and low levels of local ties. Finally, I apply the formulas developed in the model section to quantify how important these differences in migration elasticities are for the welfare impacts of place based policies.

The β coefficients estimated from equation 8 are quite similar to the reduced from regression results. Appendix table A11 shows the estimates of the β's that I use for the parameter estimation results. They vary slightly from the estimates in the reduced form specification in that I used before. The main difference is that here I use Chinese trade with other countries (projected onto local CZ's) a regressor in the OLS regression, rather than as an instrument for the projection of Chinese trade with the US onto local areas, which is the preferred specification in Autor, Dorn and Hanson (2013). I do this because here I am interested in the simple reduced form parameters and not in the interpreting the causal effect of an given dollar increase in Chinese import competition. The standard errors also do not correct for clustering, but they do correct for cross equation correlations of error terms in the later examples.

Estimated elasticities

Estimates of general equilibrium elasticities in Table 6 confirm the earlier results. According to the Bartik regression, areas with low levels of local ties have migration elasticities around 5. The trade specification suggests the elasticity should be around 4. Areas with high levels of local ties have lower migration elasticities. For the Bartik specification the calculated elasticity is around 1, while the estimate is negative in the trade specification.

Implications for place based policies

To quantify the importance of the differences in migration elasticities I calculate the welfare impacts of place based policies in Table 7. Panel A calculates the deadweight losses of a subsidy to an area, which I report as a percentage of the subsidy's size. Panel B shows how much a governmental preference of an area's goods (increase in π_j) will increase welfare in that area, ignoring the costs to the government from the program. For comparability, I scale each entry in Panel B by the welfare impact of the program in an areas with a migration elasticity of six.[30]

Both Panels of Table 7 show that general equilibrium migration elasticities have important implications for the welfare impacts of place based policies. Where migration elasticities are high,

[30] I constructed Panel A by applying equation 11 and Panel B by application of equation 12. For Panel B, where the result depends on one other parameter (α^Y, the capital share of local firms) I use the baseline calibrated value of 1/3.

place based policies can result in substantial dead weight losses. Dead weight losses would counteract 15% of a subsidy of 5% of people's income in a area with a migration elasticity of 6. If the area had a lower migration elasticity, say of 0.5, then the dead weight loss would be more than an order of magnitude smaller. As with all dead weight losses, these depend on the size of the program. A similar, though more modest dynamic applies to governmental procurement: Governmental procurement increases welfare roughly twice as much in areas with migration elasticities around 0.5 compared with migration elasticities around 6.

5 Long term dynamics

This section presents a simple, somewhat stylized, process where I allow local ties to develop endogenously. Up until this point, I have focused on more medium term concerns and I have treated people's ties as fixed. An interesting question, however, is what happens if people's local ties change as they move to new places? This gives a much longer term view of the model's dynamics, including a useful conception of steady state in the model. It shows how this impediment to population reallocation can cause one time changes to be felt over long periods of time. It also allows a more complete analysis of welfare impacts: For example, it allows one generation's movements to pay dividends in their children's outcomes.

Like most predictions over long time frames, the analysis comes with several caveats. The two most obvious relate to the persistence of local shocks in general and the simple model I propose to describe how people form local ties. The first possible concern is that I assume that processes are persistent. To some extent this is to focus on population reallocations, since population reallocation will be less important if processes are only temporary or if productivity is mean reverting. Locally focused programs may fade with flagging political will. Kline and Moretti (2014a) note that the Tennessee Valley Authority, one of the largest place based policies in US history, followed this pattern. Second, it depends on how local ties are formed and there is little evidence that I know of to describe this process. I make the simplifying assumption that these ties are formed proportionate to population, this would be invalid if ties are inherited, if parents have preferences about their children's ties that differ from what I assume, or if communities are endogenously stronger or weaker in a way that I do not model. Even if I have appropriately specified how these ties are formed, it also is not clear that policymakers would value the welfare of a future population with much different preferences from the current population. They might, for example, prefer the places where they live.

Methods I allow the distribution of birth places to follow the distribution of population in a natural way – I assume that a fixed proportion (s_D) of people die each period and are replaced according to the current population distribution. Following the earlier solution, people maximize their utility while they are alive. This means that, each persons' decisions are static conditional on their u_i and place of birth k. Formally, I apply the following law of motion to the distribution of people's birth places:

$$N'_{..k} = N_{..k}(1 - s_D) + N_{.k.}\frac{s_D}{1 + s_F}$$

The number of people who were born in area k in the next period is equal to the number of people who survive plus the number who are newly born there. The number of people newly born in area k is equal to the current population times a scaling factor that makes it so population is constant nationally and that the share of the population that is foreign born (s_F) is constant. Similarly, since deaths are random and new people are assumed to be born with the same distribution of tastes (i), the distribution of tastes conditional on being born in an area is constant over time.

The assumption that people do not behave altruistically towards future generations (implicitly their children) is important for tractability. It also incorporates important aspects of the real world. It rules out cases where parents choose to migrate away from areas they they enjoy but they would prefer that their children not grow accustomed to. One way of rationalizing this is to assert that parents act as if their children will have the same preferences that they do. Another is to think that parents do not have enough information about future economic conditions for these to affect their location decisions past their lifetimes. Yet another is to assert that the social planner has a more long term perspective on welfare than individuals do.

Given the above, the model's steady state is where people's places of birth do not change over time. This implies that the distribution of people's places of births across domestic areas is proportional to population:

$$N_{..k} = \frac{N_{.k.}}{1 + s_F}$$

It is straightforward to show that the steady state of the model is stable and unique.

Dynamic responses to productivity shocks To see how shocks play out over time, I present the model's response to a large negative shock to productivity (I decrease B_j by $\frac{1}{2}$). In the first period, this is the same as the initial shocks I showed before, but this time I allow the distribution of people's places of birth to adjust in subsequent periods. To provide a gauge at how long these adjustments take to play out, I set s_D to equate to an 80 year lifespan. I use the mode's baseline calibration for the other parameters.

Figure 11 below shows the reaction of population, the distribution of people's birth places, and the common utility terms (due to wages, rents, and the amenity term). The solid black line shows percentage deviations from the initial value of each term, while the horizontal grey line shows the steady state level. It takes 440 years for the population born in the area to be within 0.1 percent of this value.

Population and the common utility terms jump down immediately after the shock, but they adjust much more slowly to their steady state values since the population born in the area decreases much more slowly. The initial drop in population is too small – for this shock only 50 percent of the eventual change in population. The common utility terms, however, over-shoot by roughly 1/3, which shows how people's attachments to places can lead to large losses in utility after shocks. Note that the logit error term leads areas to have a lower steady state level of utility after a decrease in productivity or amenities. This is because even in steady state, some people are willing to pay more to live in the place because of their idiosyncratic enjoyment of it.

Reassessing the role of subsidies The model allows a more complex analysis of subsidies to declining areas. Up until now, the analysis has considered the impact of a subsidy on the current generation. In the model, however, people are better off if they are born in more desirable locations, since their idiosyncratic preferences lead them to better paying jobs and more desirable general amenities. Subsidies that keep people's parents in declining areas will lead more people to be born in these areas. This might create a kind of growth trap as their children continue to prefer these areas.

To assess this dynamic, I simulated the model numerically using the same decrease to productivity as I used earlier, but this time I included a governmental subsidy equal to 10 percent of the average wage level before the productivity shock. To calculate utility losses, I assume that all people are born with the same baseline level of utility, and only vary in their preferences for particular locations.[31] I this is true, then I can show losses in utility due to distortions in people's birth places as:

$$\mathrm{CS}_{ijk}\frac{N^S_{ijk} - N_{ijk}}{\mathrm{MU}_{ijk}} \tag{14}$$

Where the superscript S denotes the concept under the solution with the subsidy. Intuitively this is the difference of the average consumer surplus (CS) that people would receive if they were born according to the distribution of types in the 1) subsidy case minus 2) the case with no subsidies. The denominator is an adjustment for the marginal utility of each individual. So, intuitively this should be a negative number, since the subsidies will induce more people to have preferences for declining areas that offer lower benefits to residents.

Table 8 shows the present discounted value of these utility changes (in dollar terms) first due to differences in people's birth places (equation 14) and second due to the original formula for dead weight loss, which includes all factors except changes in the distribution of where people are born.[32] I plot these for several discount rates, beginning with the discount rate in the model (five percent) and ending with a discount rate of one percent, which might be more appropriate for a social planner. The misallocation of birth places is a particularly large concern for very low discount

[31] Levels of utility are generally not identified in models of locational choice, so for this and for other metaphysical reasons, this is a difficult assumption to test.

rates. In this sense, a nostalgia for particular places can be costly.

6 Conclusion

In this paper I examined how people's ties to declining areas impact migration elasticities and the processes of growth and decline more broadly. I confirm previous findings that people feel strongly about their birth places, which I use as a proxy for most workers' "homes." Using both reduced form regressions and a model of spatial equilibrium, I show how these connections can lead to lower migration elasticities in declining areas. The model shows how heterogeneous migration elasticities have important implications for welfare and for place based policies. The results suggest that declining areas have lower levels of welfare than otherwise might be expected in spatial equilibrium and that targeted place based policies may be particularly effective in declining areas. These results differ substantially from the story of utility equalization in the benchmark model of Rosen (1979) and Roback (1982).

Low migration elasticities in declining areas suggest that migration should not equalize utility across areas within countries, leaving room for governmental interventions. In this paper I have focused on place based policies and I have modeled them in a somewhat reduced form way, abstracting from details specific to their implementation. This is not to say that these details are unimportant. Several excellent papers have rigorously evaluated individual place based policies that show promise for equalizing welfare in the absence of migration. Indirect place based policies, which Neumark and Simpson (2015) define as policies that seek to move people into more healthy areas, may also play a role. My findings suggest that these policies face a difficult battle in convincing people to move from declining areas, but they are also consistent with some barrier to certain people's migration that may be possible to eliminate. One example might be the lack of social networks in places with more opportunities, which Yannay Spitzer (2015) emphasizes in the context of international migration.[33]

A better understanding of why people have local ties would also be of much use to policymakers and to researchers. If, for example, people have strong local ties because they need to care for elderly relatives, then it might be reasonable to address these by providing them as governmental services or improving people's ability to buy them in the marketplace. If people have emotional connections to places, on the other hand, then it may not be as reasonable to expect people to move. Local ties do, however, appear to have important effects in spatial equilibrium.

[32] As shown in Train (2009), the consumer surplus term can be written in a convenient functional form – the so called log sum – so long as income enters the utility term linearly. This second assumption is not valid in this model, since people have log utility over wages. None the less, I use this form as a first pass to compute the term. In future versions of the paper I plan to include the correct solution, determined using a computationally intensive Markov Chain Monte Carlo (MCMC) procedure detailed in McFadden (1999).

[33] Examples of studies of direct policies include Busso, Gregory and Kline (2013) (Enterprise Zones), Kline and Moretti (2014c) (The Tennessee Valley Authority), and Bartik and Sotherland (2015) (The Kalamazoo Promise Scholarship program). The Gautreaux (Rubinowitz and Rosenbaum (2000)) and Moving to Opportunity (Ludwig et al. (2013), Chetty, Hendren and Katz (2015)) programs are prominent examples of indirect place based policies, though they move people at a level of geography below the level that I focus on here.

References

Albouy, David. 2009. "What Are Cities Worth? Land Rents, Local Productivity, and the Capitalization of Amenity Values." NBER Working Paper 14981.

Albouy, David, and Mike Zabek. 2016. "Housing Inequality." National Bureau of Economic Research Working Paper Series, No. 21916.

Alesina, Alberto, and Robert Barro. 2002. "Currency Unions." The Quarterly Journal of Economics, 117(2): 409–436.

Autor, David, and David Dorn. 2013. "The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market." American Economic Review, 103(5): 1553–1597.

Autor, David, David Dorn, and Gordon Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." American Economic Review, 103(6): 2121–2168.

Barro, Robert, Xavier Sala-i Martin, Olivier Jean Blanchard, and Robert E Hall. 1991. "Convergence across states and regions." Brookings papers on economic activity, 107–182.

Bartik, Timothy. 1991. "Who Benefits from State and Local Economic Development Policies?" Kalamazoo, MI:W.E. Upjohn Institute for Employment Research.

Bartik, Timothy. 1993. "Who Benefits from Local Job Growth: Migrants or the Original Residents?" Regional Studies, 27(4): 297–311.

Bartik, Timothy. 2009. "What proportion of children stay in the same location as adults, and how does this vary across location and groups?" Upjohn Institute Working Paper 09-145.

Bartik, Timothy, and Nathan Sotherland. 2015. "Migration and Housing Price Effects of Place-Based College Scholarships." Upjohn Institute working paper, 15(245).

Becker, Gary. 1960. "An economic analysis of fertility." In Demographic and Economic Change in Developed Countries. , ed. George Roberts, 209–240. National Bureau of Economic Research.

Becker, Gary, and H Gregg Lewis. 1973. "On the Interaction between the Quantity and Quality of Children." Journal of Political Economy, 81(2): S279–88.

Berry, Brian J L, and Donald C Dahmann. 1977. "Population Redistribution in the United States in the 1970s." Population and Development Review, 3(4): 443–471.

Black, Dan A, Natalia Kolesnikova, Seth G Sanders, and Lowell J Taylor. 2013. "Are children normal?" The Review of Economics and Statistics, 95(1): 21–33.

Blanchard, Olivier, and Lawrence Katz. 1992. "Regional evolutions." Brookings Papers on Economic Activity, 23(1): 1–73.

Blatter, Marc, Samuel Muehlemann, and Samuel Schenker. 2012. "The costs of hiring skilled workers." European Economic Review, 56(1): 20–35.

Boltho, Andrea, Wendy Carlin, and Pasquale Scaramozzino. 1997. "Will East Germany Become a New Mezzogiorno?" Journal of Comparative Economics, 24(3): 241–264.

Bound, John, and Harry J. Holzer. 2000. "Demand shifts, population adjustments, and labor market outcomes during the 1980s." Journal of Labor Economics, 18(1): 20–54.

Bricker, Jesse, and Brian Bucks. 2013. "Household Mobility over the Great Recession: Evidence from the U.S. 2007-09 Survey of Consumer Finances Panel."

Burda, Michael C., and Jennifer (Jennifer Anne) Hunt. 2001. "From reunification to economic integration: Productivity and the labor market in Eastern Germany." Brookings Papers on Economic Activity, 32(2): 1–92.

Busso, Matias, Jesse Gregory, and Patrick Kline. 2013. "Assessing the Incidence and Efficiency of a Prominent Place Based Policy." American Economic Review, 103(2): 897–947.

Cadena, Brian C., and Brian K. Kovak. 2016. "Immigrants equilibrate local labor markets: Evidence from the great recession." American Economic Journal: Applied Economics, 8(1): 257–290.

Carrington, William J, Enrica Detragiache, and Tara Vishwanath. 1996. "Migration with Endogenous Moving Costs." The American Economic Review, 86(4): 909–930.

Chetty, Raj, Nathaniel Hendren, and Lawrence F Katz. 2015. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." American Economic Review, , (August): 90.

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez. 2014. "Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States." Quarterly Journal of Economics, 129(4): 1553–1623.

Coate, Patrick. 2013. "Parental Influence on Labor Market Outcomes of Young Workers." Unpublished Manuscript.

Coen-Pirani, Daniele. 2010. "Understanding gross worker flows across U.S. states." Journal of Monetary Economics, 57: 769–784.

Coulson, N. Edward, and Lynn M. Fisher. 2009. "Housing tenure and labor market impacts: The search goes on." Journal of Urban Economics, 65(3): 252–264.

Davis, Morris A., Jonas D. M. Fisher, and Marcelo Veracierto. 2013. "Gross Migration, Housing and Urban Population Dynamics." FRB of Chicago Working Paper 2013-19.

Decressin, Jörg, and Antonio Fatás. 1995. "Regional labor market dynamics in Europe." European Economic Review, 39(9): 1627–1655.

Diamond, Rebecca. 2016. "The Determinants and Welfare Implications of US Workers' Diverging Location Choices by Skill: 1980-2000." American Economic Review, 106(3): 479–524.

Donovan, Colleen, and Calvin Schnure. 2011. "Locked in the House: Do Underwater Mortgages Reduce Labor Market Mobility?"

EU. 2012. "Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union." Official Journal of the European Union, 55(C 326): 1–407.

Farber, Henry S. 2011. "Job Loss in the Great Recession: Historical Perspective from the Displaced Workers Survey, 1984-2010." National Bureau of Economic Research Working Paper Series, No. 17040(5696): 1984–2010.

Feenstra, Robert C., Maurice Obstfeld, and Katheryn N. Russ. 2014. "In search of

the Armington elasticity." Nber, , (September): 1–44.
Feler, Leo, and Mine Z Senses. 2015. "Trade Shocks and the Provision of Local Public Goods."
Ferreira, Fernando, Joseph Gyourko, and Joseph Tracy. 2010. "Housing busts and household mobility." Journal of Urban Economics, 68(1): 34–45.
Ganong, Peter, and Daniel Shoag. 2012. "Why Has Regional Convergence in the U.S. Declined?" SSRN Electronic Journal.
Glaeser, Edward, and Joseph Gyourko. 2002. "The Impact of Zoning on Housing Affordability." NBER Working Paper No. 8835.
Glaeser, Edward, and Joseph Gyourko. 2005. "Urban Decline and Durable Housing." Journal of Political Economy, 113(2): 345–000.
Green, Richard K., Stephen Malpezzi, and Stephen K Mayo. 2005. "Metropolitan-Specific Estimates of the Price Elasticity of Supply of Housing, and Their Sources." The American Economic Review, 95(2): 334–339.
Gregory, Jesse. 2013. "The Impact of Post-Katrina Rebuilding Grants on the Resettlement Choices of New Orleans Homeowners." Unpublished manuscript.
Gyourko, Joseph, Christopher Mayer, and Todd Sinai. 2013. "Superstar Cities." American Economic Journal: Economic Policy, 5(4): 167–199.
Hank, Karsten. 2007. "Proximity and Contacts between Older Parents and Their Children: A European Comparison." Journal of Marriage and Family, 69(1): 157–173.
Henley, Andrew. 1998. "Residential Mobility, Housing Equity and the Labour Market." The Economic Journal, 108(447): 414–427.
Hudomiet, Péter. 2014. "The role of occupation specific adaptation costs in explaining the educational gap in unemployment."
Huttunen, Kristiina, and Kjell G Salvanes. 2015. "Job Loss, Family Ties and Regional Mobility." IZA Discussion Paper, , (8780): 0–54.
Huttunen, Kristiina, Jarle Møen, and Kjell G Salvanes. 2015. "Job Loss and Regional Mobility."
Jackson, Ted. 2016. "Stay or go ? Isle de Jean Charles families wrestle with the sea."
Kaplan, Greg. 2012. "Moving Back Home: Insurance against Labor Market Risk." Journal of Political Economy, 120(3): 446–512.
Kaplan, Greg, and Sam Schulhofer-Wohl. 2013. "Understanding the long-run decline in interstate migration." Federal Reserve Bank of Minneapolis Working Paper 697.
Kennan, John, and James Walker. 2011. "The effect of expected income on individual migration decisions." Econometrica, 79(1): 211–251.
Kleiner, Morris M., and Alan B. Krueger. 2013. "Analyzing the extent and influence of occupational licensing on the labor market." Journal of Labor Economics, 31(2): S173–202.
Kline, Patrick, and Enrico Moretti. 2014a. "Local Economic Development, Agglomeration Economies, and the Big Push: 100 Years of Evidence from the Tennessee Valley Authority."

The Quarterly Journal of Economics, 129(1): 275–331.

Kline, Patrick, and Enrico Moretti. 2014b. "People, Places, and Public Policy: Some Simple Welfare Economics of Local Economic Development Programs." Annual Review of Economics, 6(1): 629–662.

Kline, Patrick, and Enrico Moretti. 2014c. "People, Places and Public Policy: Some Simple Welfare Economics of Local Economic Development Programs." Annual Review of Economics, 6: 629–62.

Konrad, K.A., and H. Kunemund. 2002. "Geography of the family." American Economic Review, 92(4): 981–998.

Lindo, Jason M. 2010. "Are Children Really Inferior Goods?: Evidence from Displacement-Driven Income Shocks." Journal of Human Resources, 45(2): 301–327.

Ludwig, Jens, Greg J. Duncan, Lisa A. Gennetian, Lawrence F. Katz, Ronald C. Kessler, Jeffrey R. Kling, and Lisa Sanbonmatsu. 2013. "Long-term neighborhood effects on low-income families: Evidence from moving to opportunity." Vol. 103, 226–231.

Making, The, Southern Wild, The New, and York Times. 2012. "A Mythical Bayou ' s All-Too-Real Peril."

McFadden, Daniel. 1999. "Computing Willingness-to-Pay in Random Utility Models." In Trade, Theory and Econometrics: Essays in Honour of John S. Chipman. , ed. J Moore, R Riezman and J Melvin, 73–105. London:Routledge.

McKinnish, Terra. 2008. "Spousal Mobility and Earnings." Demography, 45(4): 829–849.

Modestino, Alicia Sasser, and Julia Dennett. 2012. "Are American homeowners locked into their houses? The impact of housing market conditions on state-to-state migration."

Molloy, Raven, Christopher L Smith, and Abigail Wozniak. 2011. "Internal Migration in the United States." Journal of Economic Perspectives, 25(3): 173–196.

Molloy, Raven, Christopher L Smith, and Abigail Wozniak. 2013. "Declining Migration Within the US: The Role of the Labor Market."

Moretti, Enrico. 2013. "Real wage inequality." American Economic Journal: Applied Economics, 5(1): 65–103.

Mundell, Robert A. 1961. "A theory of optimum currency areas." The American Economic Review, 657–665.

National Center for Health Statistics. 2014. "Data File Documentations, Natality."

Neumark, David, and Helen Simpson. 2015. "Place-Based Policies." In Handbook of Regional and Urban Economics. Vol. 5, 1197–1287.

Notowidigdo, MJ. 2011. "The incidence of local labor demand shocks." NBER NBER Working Paper 17167.

Oswald, Andrew J. 1996. "A conjecture on the explanation for high unemployment in the industrialized nations: Part 1." Warwick economic research papers, , (475).

Rainer, Helmut, and Thomas Siedler. 2009. "O Brother, Where Art Thou? The Effects of Having a Sibling on Geographic Mobility and Labour Market Outcomes." Economica,

76(303): 528–556.
Rappaport, Jordan. 2004. “Why are population flows so persistent?” Journal of Urban Economics, 56(3): 554–580.
Roback, Jennifer. 1982. “Wages, rents, and the quality of life.” The Journal of Political Economy, 90(6): 1257–1278.
Rosen, Sherwin. 1979. “Wage-based indexes of urban quality of life.” In Current Issues in Urban Economics. , ed. Mahlon Straszheim and Peter Mieszkowski. Baltimore, MD:Johns Hopkins University Press.
Rubinowitz, Leonard S, and James E Rosenbaum. 2000. Crossing the class and color lines : from public housing to white suburbia. Chicago:University of Chicago Press.
Ruggles, Steven, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. 2010. “Integrated Public Use Microdata Series: Version 5.0.”
Saiz, Albert. 2010. “The geographic determinants of housing supply.” The Quarterly Journal of Economics, 125(3): 1253–1296.
Saks, RE, and Abigail Wozniak. 2011. “Labor reallocation over the business cycle: new evidence from internal migration.” Journal of Labor Economics, 29(4): 697–739.
Sandell, Steven H. 1977. “Women and the Economics of Family Migration.” The Review of Economics and Statistics, 59(4): 406–414.
Schmutz, Benoît, and Modibo Sidibe. 2016. “Frictional Labor Mobility.”
Scott, James C. 1998. Seeing like a state : how certain schemes to improve the human condition have failed. New Haven:Yale University Press.
Sjaastad, Larry A. 1962. “The Costs and Returns of Human Migration.”
Suárez Serrato, Juan Carlos, and Owen Zidar. 2014. “Who Benefits from State Corporate Tax Cuts? A Local Labor Markets Approach with Heterogeneous Firms.” NBER Working Paper 20289.
Tolbert, Charles M., and Molly Sizer. 1996. “U.S. Commuting Zones and Labor Market Areas: A 1990 Update.” Rural Economy Division, Economic Research service, U.S. Department of Agriculture Staff Paper AGES-9614, Washington, DC.
Topa, Giorgio. 2011. “Labor markets and referrals.” Handbook of Social Economics, 1(1 B): 1193–1221.
Topel, Robert. 1986. “Local labor markets.” The Journal of Political Economy, 94(3): S111–S143.
Train, Kenneth E. 2009. Discrete choice methods with simulation. . Second ed., New York:Cambridge University Press.
Valletta, Robert G. 2013. “House lock and structural unemployment.” Labour Economics, 25: 86–97.

Willis, Robert. 1973. "A new approach to the economic theory of fertility behavior." Journal of Political Economy, 81(2).

Wooldridge, Jeffrey M. 2002. Econometric Analysis of Cross Section and Panel Data. Vol. 58 of MIT Press Books, Cambridge, MA:MIT Press.

Yannay Spitzer. 2015. "The Dynamics of Mass Movements."

Tables and figures

Tables

Table 1: Population changes and measures of local ties

	Percent of CZ born in same state					Average years living in same house				
1980-2008 pct chg in population	-0.21	-0.18	-0.28	-0.23		-2.31	-1.94	-2.71	-2.12	
	(0.03)	(0.03)	(0.03)	(0.03)		(0.19)	(0.21)	(0.25)	(0.22)	
2000-2008 pct chg in population					-0.16					-3.18
					(0.18)					(1.71)
1990-2000 pct chg in population					-0.32					-2.98
					(0.15)					(1.09)
1980-1990 pct chg in population					-0.44					-3.10
					(0.11)					(0.94)
Weighted	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Controls	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
Observations			722					722		
R^2	0.319	0.517	0.438	0.731	0.746	0.425	0.526	0.609	0.732	0.752

Notes: Data are from the decennial census and ACS and cover the continental United States. Regressions are weighted by initial population and standard errors in parenthesis are clustered by state (a CZ is in a state if the plurality of its population resides there). All share variables are multiplied by 100 to make them into percentage points. Controls, measured in 1980, are share college educated, share employed, share foreign born, share born in Mexico, and log population.

Table 2: Summary statistics

Panel A: Levels of covariates

	Mean	StD	Low Ties	High Ties
Population (thous)	162.2	453.9	282.6	117.4
NILF (thous)	43.1	116.3	73.7	31.7
Unemployed (thous)	6.5	18.9	10.6	5.0
Real wages (hourly)	15.1	1.8	16.1	14.8
Real rents (monthly)	475.8	77.5	539.5	452.1
Pct in labor force	71.5	4.4	71.2	71.6
Percent locals	66.4	16.2	44.0	74.8
Average time in house	8.5	1.4	7.0	9.1
Percent college edu	33.5	8.3	40.5	30.9
Percent foreign born	2.7	3.4	5.1	1.9
Percent under 35	42.7	3.5	44.8	41.9
Percent over 50	27.1	3.0	25.4	27.7

Panel B: Outcomes and regressors

	Scaling	Mean	StD
Population	145	8.11	18.38
NILF	39	-5.86	5.92
Unemployed	6	0.97	2.04
Real wages	100	-2.84	6.19
Real rents	100	7.36	11.21
Pct in labor force		5.13	1.91
Bartik shock (80-90)		12.94	4.24
Trade shock (90-00)		-1.18	1.78
Trade shock (00-08)		-2.64	3.02

Notes: The tables show unweighted summary statistics for the sample of 722 continental CZ's. Unless otherwise specified, the statistics refer to values in 1980. The first columns show the mean and standard deviation among all CZ's, the next two show means for areas with low and high ties (above or below 60 percent locals), and the final three show the scaling parameter and the scaled log change in the variable, except for the percent in the labor force where the value is simply the percent change. Note that the shock variables are themselves scaled log changes, but these statistics appear in the first columns instead. The variables are grouped into outcomes, controls, and regressors that are used in the reduced form regressions.

Table 3: Bartik shocks by share born locally

Panel A: Bins specification

	Pop	NILF	Unemp	Wages	Rents	LFP
Bartik: Low ties	2.11	0.48	-0.05	0.26	0.25	0.05
	(0.56)	(0.17)	(0.05)	(0.24)	(0.33)	(0.03)
Bartik: High ties	0.53	0.00	0.05	0.29	0.29	0.08
	(0.32)	(0.08)	(0.03)	(0.21)	(0.25)	(0.03)
P-val: No diff	0.01	0.02	0.08	0.92	0.93	0.28
R^2	0.58	0.52	0.67	0.35	0.54	0.36
Observations			722			

Panel B: Triple difference specification

	Pop	NILF	Unemp	Wages	Rents	LFP
Interaction	-4.24	-1.10	0.04	0.95	0.48	0.02
	(1.34)	(0.44)	(0.12)	(0.67)	(0.98)	(0.07)
Main effect	1.24	0.20	0.02	0.26	0.20	0.07
	(0.28)	(0.08)	(0.03)	(0.16)	(0.22)	(0.02)
Percent locals	0.32	0.05	0.00	-0.02	-0.23	0.01
	(0.25)	(0.08)	(0.02)	(0.15)	(0.17)	(0.02)
R^2	0.60	0.55	0.66	0.37	0.55	0.36
Observations			722			

Notes: OLS regression coefficients, weighted by initial population, are plotted for either the main effect plus a linear interaction term with the demeaned share locally born, or the coefficient separately estimated for less than or greater than 50 percent locally born CZ's. Controls, measured in 1980, are: the birth share variable used in the interaction term, the share of working age adults outside the labor force, unemployed, foreign born, having entered the state in the past five years, and the share of adults who are under 35 and 50 to 64. Wald test are presented for the hypothesis that the effect is constant across states with high and low in state birth shares. Data are from the decennial census from 1980 to 1990 including all CZ's in the continental US. Variables are in percentage changes, except for the linear interaction terms, which are proportions (divided by 100). Log numbers of people (unemployment, labor force exits, and log population) are scaled by their ratio to the number of employed workers and wages are residualized according to the text. Standard errors in parenthesis are clustered by state (determined by the plurality of the population is in that state).

Table 4: Import shocks by share born locally

Panel A: Bins specification

	Pop	NILF	Unemp	Wages	Rents	LFP
Trade: Low ties	1.06	0.30	0.03	0.09	1.37	-0.01
	(0.52)	(0.21)	(0.06)	(0.25)	(0.28)	(0.10)
Trade: High ties	-0.13	-1.10	-0.20	0.64	1.19	0.78
	(0.41)	(0.22)	(0.06)	(0.18)	(0.57)	(0.17)
P-val: No diff	0.02	0.00	0.00	0.08	0.78	0.00
R^2	0.47	0.62	0.63	0.12	0.18	0.54
Observations			1444			

Panel B: Triple difference specification

	Pop	NILF	Unemp	Wages	Rents	LFP
Interaction	-2.01	-3.84	-0.70	2.11	-0.79	2.45
	(2.50)	(0.97)	(0.25)	(1.07)	(2.20)	(0.54)
Main effect	0.43	-0.34	-0.07	0.30	1.29	0.33
	(0.43)	(0.16)	(0.04)	(0.15)	(0.28)	(0.11)
Percent locals	-0.39	-0.21	-0.03	-0.04	-0.10	0.08
	(0.10)	(0.04)	(0.01)	(0.04)	(0.09)	(0.02)
R^2	0.49	0.63	0.63	0.14	0.18	0.55
Observations			1444			

Notes: Two stage least squares estimates using Chinese trade with other countries in each industry to instrument for trade with the US only. Coefficients are plotted for either the main effect plus a linear interaction term with the demeaned share locally born, or the coefficient separately estimated for less than or greater than 50 percent locally born CZ's. Controls, measured in the beginning of each period, are: the birth share variable used in the interaction term, the share of working age adults outside the labor force, unemployed, foreign born, having entered the state in the past five years, the share of adults who are under 35 and 50 to 64, and a year fixed effect. Wald test are presented for the hypothesis that the effect is constant across states with high and low in state birth shares. Data are from the decennial census (1990 and 2000) and ACS (2008) including all CZ's in the continental US. Variables are in percentage changes, except for the linear interaction terms, which are proportions (divided by 100). Log numbers of people (unemployment, labor force exits, and log population) are scaled by their ratio to the number of employed workers and wages are residualized according to the text. Standard errors are parenthesis and clustered by state (determined by the plurality of the population is in that state) and all results are weighted by population.

Table 5: Parameter values

	Description	Value	Reason
σ_ξ	Perference spread	0.4	Suárez Serrato and Zidar (2014)
μ_{μ_i}	Preference for home	3.72	Indirect inference
σ_{μ_i}	Preference for home spread	5.52	Indirect inference
η^Y	Armington elast	4	Feenstra, Obstfeld and Russ (2014)
α^Y	Capital share	0.33	Standard
ρ	Real interest rate	0.05	Standard
η^H	Housing supply elasticity	10	Green, Malpezzi and Mayo (2005)
α^H	Non-tradeable share of cons	0.5	Albouy (2009)
J	Number of areas	722	Number of CZ's
s_F	Share foreign	13%	US population

Table 6: Parameter estimates from reduced form regressions

	Bartik Estimate	Trade Estimate
Pooled	2.46	0.04
	(1.40)	(0.80)
High ties	1.10	-0.83
	(0.77)	(0.57)
Low ties	5.07	3.82
	(5.26)	(7.48)
Ratio of GE elasticities	0.22	-0.22
	(0.23)	(0.46)

Note: General and Partial equilibrium migration elasticities are shown above. Each is calculated based on seemingly unrelated regression coefficients as described in the text. The two columns correspond to estimates based on the Bartik and Trade specifications discussed above. The PE ratio is an estimate of $[1+(1-\bar{\psi_j})\sigma_\xi]/[1+(1-\bar{\psi_{j'}})/\sigma_\xi]$ where j' corresponds to the estimate for an area with 60 percent of residents born locally. Standard errors in parenthesis are calculated based on pairs cluster bootstrapping across states (10,000 iterations) and applying the delta method to the covariance matrix of the parameter estimates.

Table 8: Preference distortion calculations

Discount rate	5	4	3	2	1
Preference distortion	39.589	57.866	89.31	152.79	335.37
DWL given birth places	3.4613	3.4801	3.5125	3.5789	3.7757

Note: Shown are the present discounted value, for several discount rate, of the utility changes (in dollar terms) due to differences in people's birth places (equation 14) and second due to dead weight losses keeping people's birth places constant. As shown in Train (2009), the consumer surplus in the first row term can be written as so called log sum that I report here if income enters the utility term linearly. This is not valid in this model, since people have log utility over wages. The utility terms may be misleading, but their magnitude should still be informative. In future versions of the paper I plan to include the correct solution, determined using a computationally intensive Markov Chain Monte Carlo (MCMC) procedure detailed in McFadden (1999)

Table 7: Impacts of place based policies

Panel A: Deadweight losses from subsidies

Size of subsidy	**8**	**6**	**4**	**2**	**1**	**0.5**	**0.2**
20%	80.0	60.0	40.0	20.0	10.0	5.0	2.0
10%	40.0	30.0	20.0	10.0	5.0	2.5	1.0
5%	20.0	15.0	10.0	5.0	2.5	1.3	0.5
1%	4.0	3.0	2.0	1.0	0.5	0.3	0.1

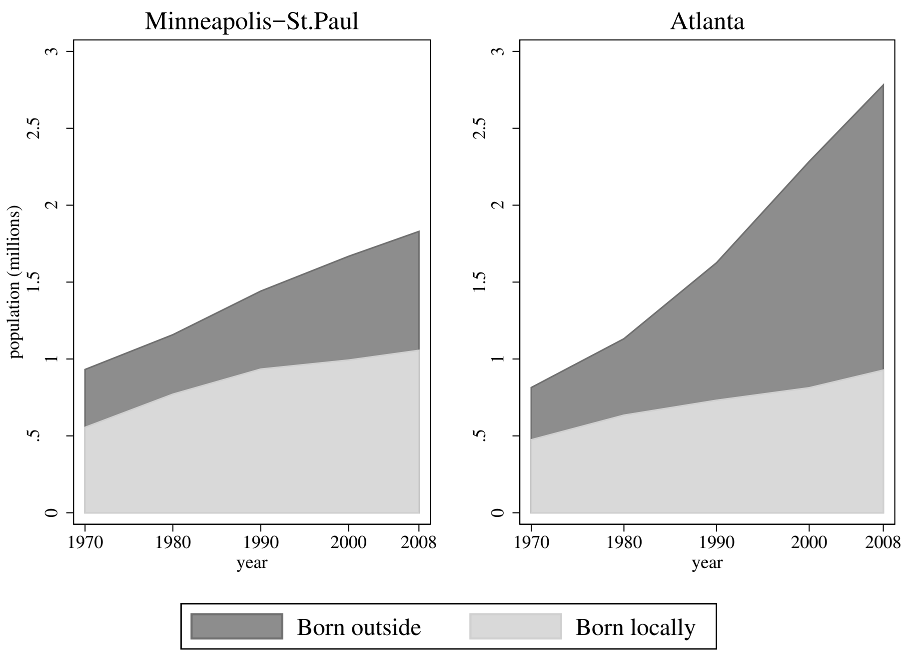
Panel B: Welfare impacts of procurement

Armington elasticity	**8**	**6**	**4**	**2**	**1**	**0.5**	**0.2**
12	85	100	122	157	184	201	212
9	83	100	125	167	201	223	239
6	82	100	129	180	226	258	282
3	80	100	133	200	267	321	365

Note: Deadweight losses and welfare improvements brought on by a governmental preference for the area's goods, according to equations 11 and 12 are shown. Each figure varies in terms of general equilibrium migration elasticities (columns) and different sized subsidies (measured in percentage of per capita income) and Armington elasticities (each by row). For the second panel I assume my baseline calibrated value of 1/3 for the capital share among local firms, α^Y, and scale each row as the percentage of the response with a migration elasticity of 6.

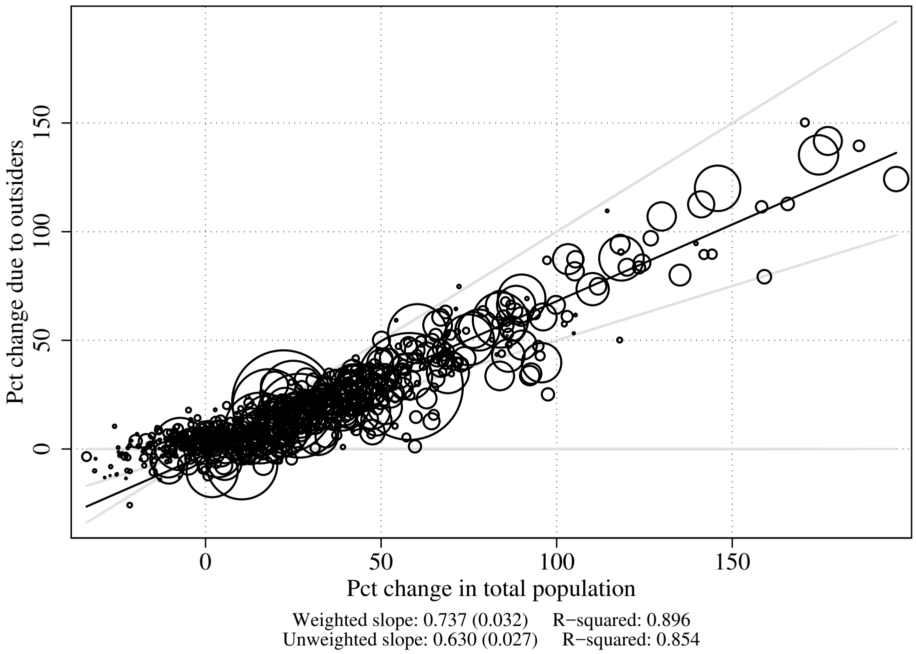
Figures

Figure 1: Population changes in two commuting zones



Notes: Data are from the long form decennial census and the ACS 3 year estimates (2006-2008) and are weighted to be nationally representative. Minneapolis-St.Paul and Atlanta are 1990 commuting zones 21501 and 9100. Locals are people who are born in the state they are living in (Minnesota or Georgia), while outsiders are born in other states or countries.

Figure 2: Changes in population due to outsiders moving in



Notes: Plotted are the percentage change in population from 1980 to 2008 (x-axis), and the change in the number of people in the commuting zone who live outside their state of birth as a percentage of the total population (y-axis). Data are from the 1980 decennial census and the ACS 3 year estimates (2006-2008) and are weighted to be nationally representative. The unit of observation is a commuting zone within the continental United States. The figure (including the regression line) excludes the small number of commuting zones where the total change in population was over 200 percent for readability. The reported coefficients include them, however, with robust standard errors in parenthesis.

Figure 3: Effects of a labor demand shock along multiple margins

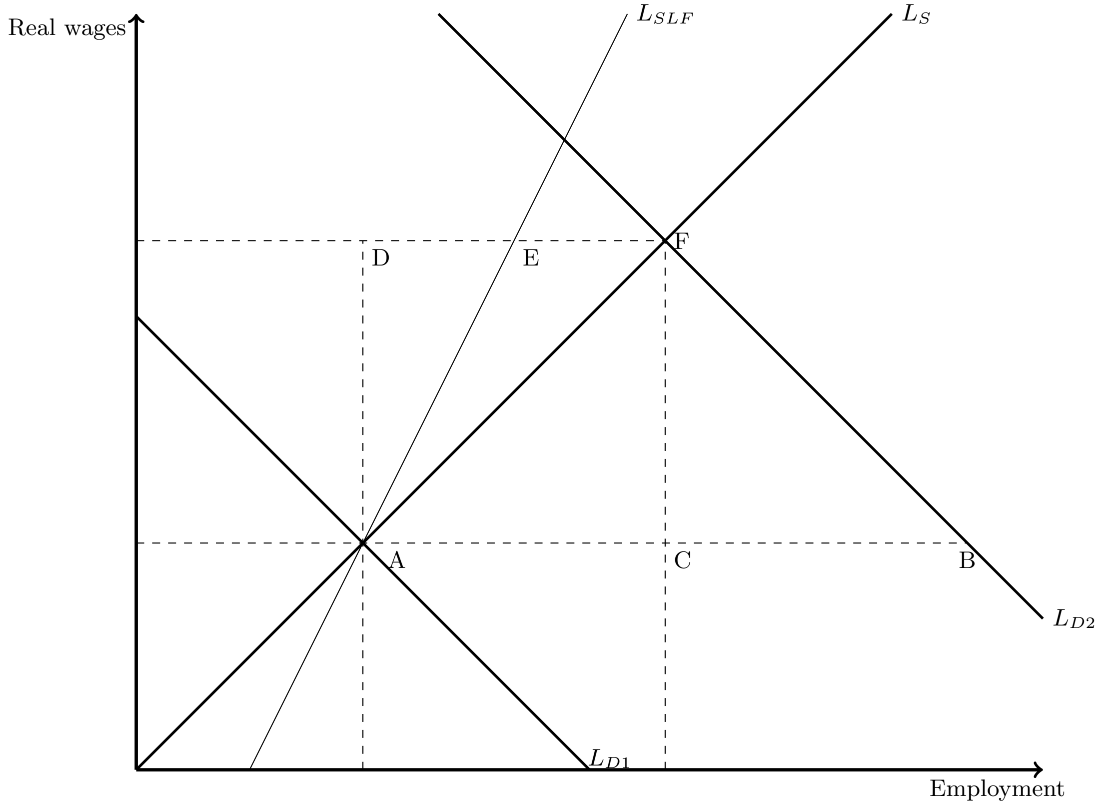
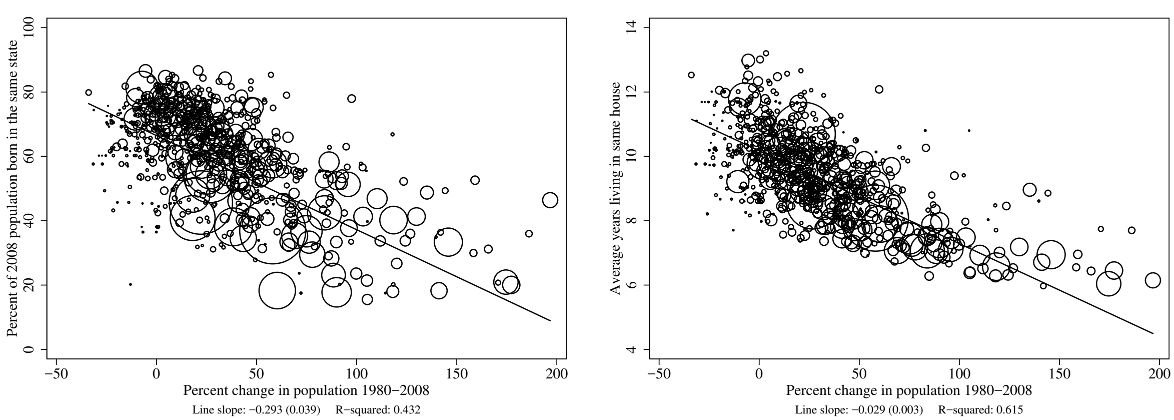


Figure 4: Population changes and measures of local ties

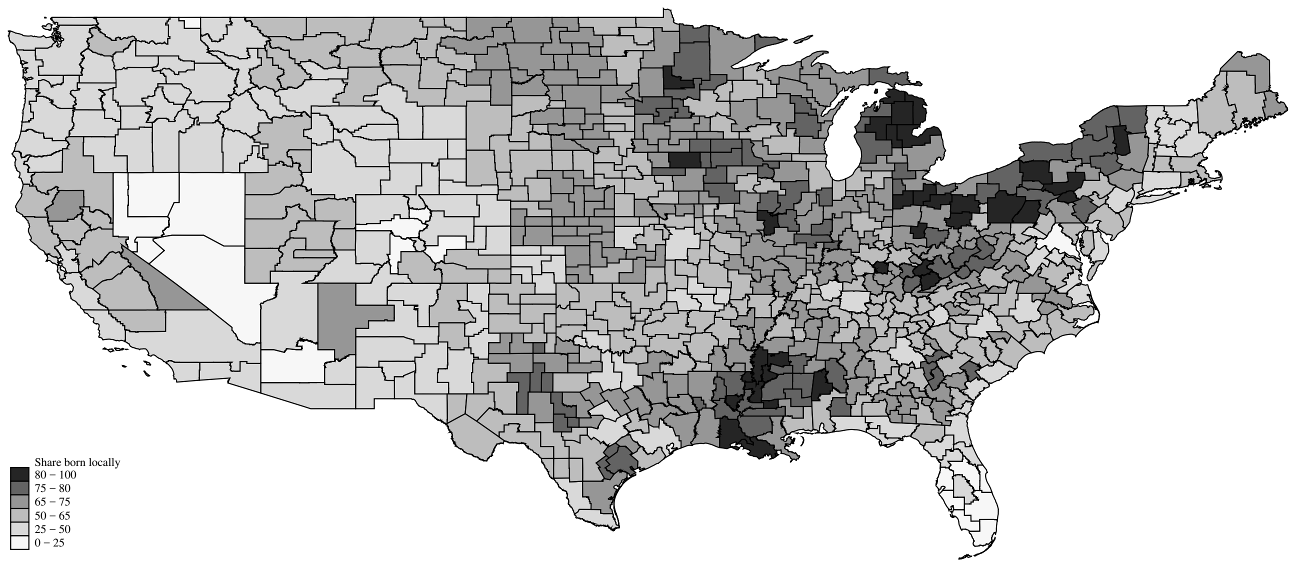
Panel A: Percent born locally

Panel B: Avg time living in house



Notes: Data are from the 1980 census and 2006-2008 ACS. Each circle is a commuting zone and its radius is proportional to its population in 1980. The line is a weighted least squares regression, using the population weight. The standard error is clustered by state (a CZ is in a state if the plurality of its population resides there). Share variables are multiplied by 100. The figures omit the few commuting zones that grew more than 200 percent over the period, for visual clarity. These commuting zones are included in the regressions in table 1.

Figure 5: Percent of residents born in the same state



Notes: The 722 commuting ones in the continental US are shaded according to the percent of residents who were born in their current state. Darker shades mean more were born locally. Data are from responses to the 2006-2008 ACS, via IPUMS. The statistics restrict to people 22 to 64 and exclude people living in group quarters.

Figure 6: Dead weight loss due to a location specific subsidy

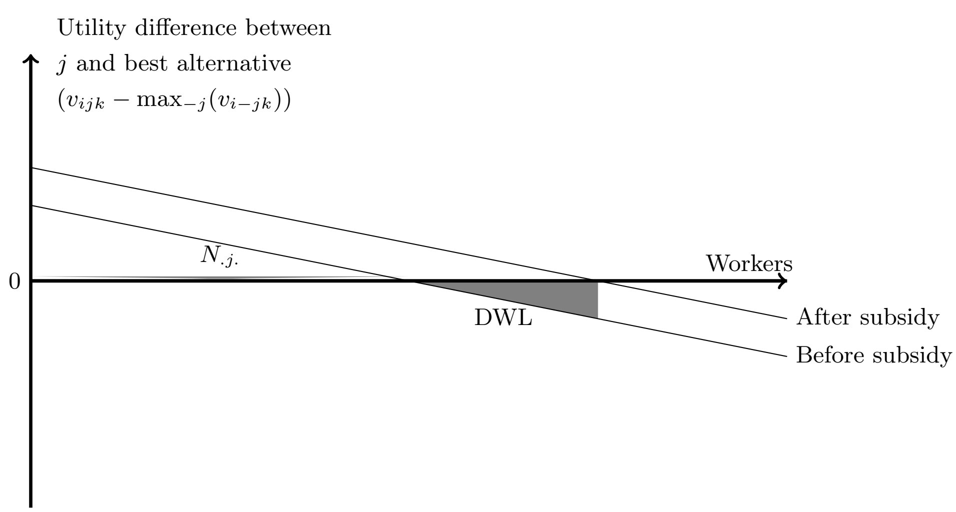
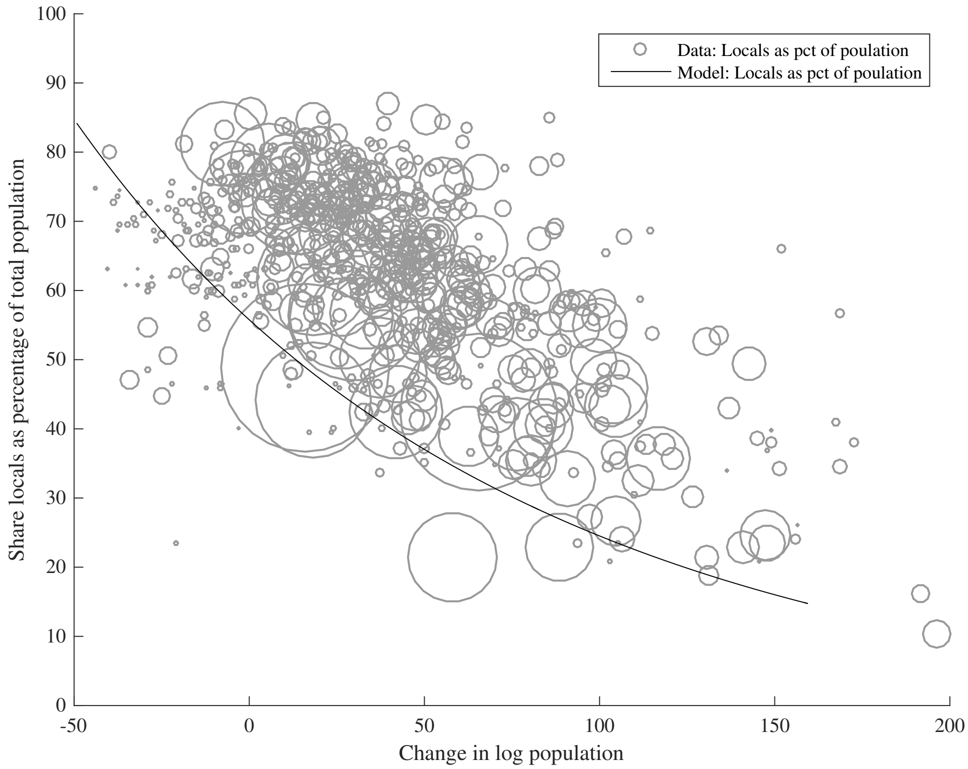
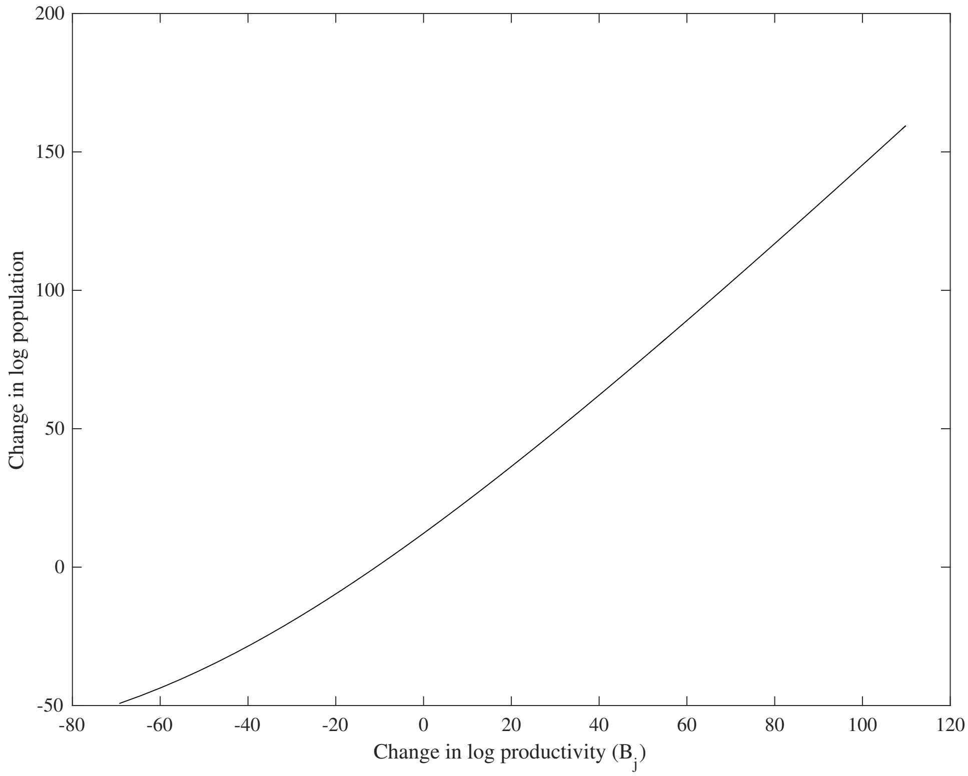


Figure 7: Share locals and population changes



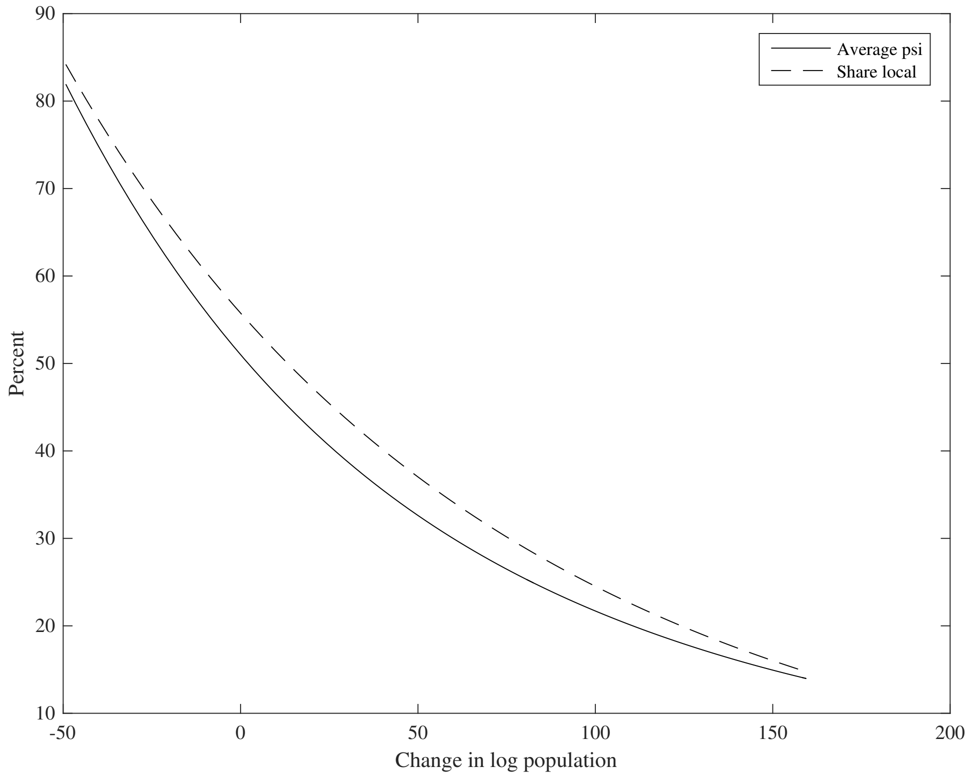
Note: The black line is model predicted share of local workers after an increase in productivity that generates the population change listed. A change in amenities will have the same effect, since workers only differ in their preferences for particular areas.

Figure 8: Effects of productivity increases



Note: This plots the population response to productivity increases or decreases in one area of the model, while all other areas are unchanged as are all other parameters.

Figure 9: Share locally born and ψ_j

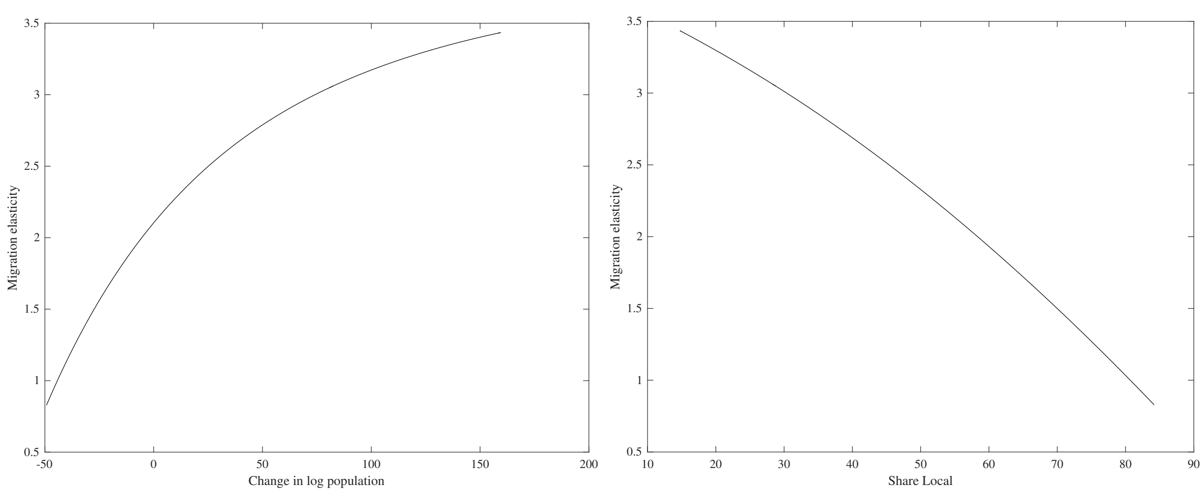


Note: This plots $\hat{\psi}_j$ and share local values after productivity shocks to one local area that produce the changes in log population show on the x axis.

Figure 10: Migration elasticities in the second period

Panel A: Changes in population

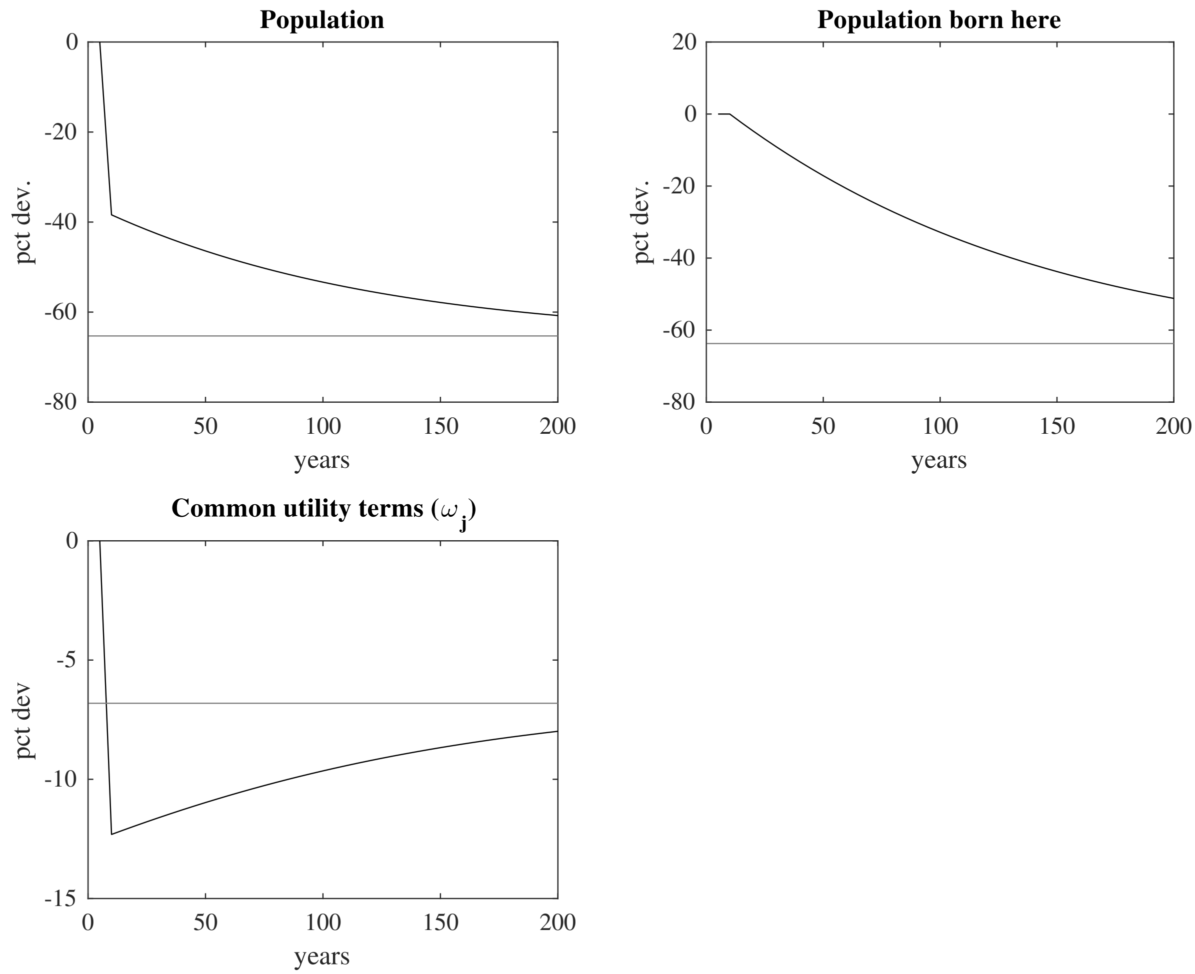
Panel B: Share locally born



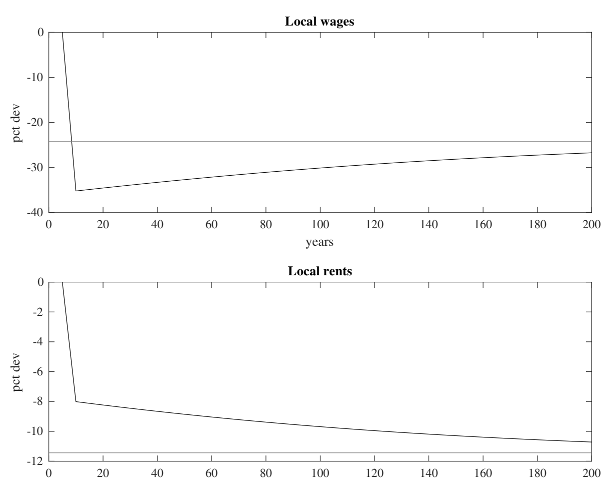
Note: The y axis represents migration elasticities as derived in equation 9 while the x axis shows the relevant changes in log population and the share of locals of the shocked area's total population. Differences in share local and log population are a result of the changes in local productivity plotted in figure 8.

Figure 11: Long term dynamics with endogenous local ties

Panel A: Population and welfare



Panel B: Wages and rents



Note: Plotted are percent deviations from the initial value (zero). The grey line is the steady state value. The years are scaled so that the average lifespan of an agent in the model is 80 years.

A Data

A

The data comes primarily from the decennial census and ACS as collected by IPUMS at the University of Minnesota (Ruggles et al. (2010)). Data on the impact of trade on individual local labor markets comes from Autor, Dorn and Hanson (2013), and the vital statistics data comes from the NBER. I restrict my sample to prime-aged (16-64 inclusive) people not living in group quarters (barracks and dorms). In computing wages I exclude unpaid family workers and workers who did not work for pay last year. Generally, I aggregate these data up to the Commuting Zone (Tolbert and Sizer (1996)) level and perform my analyses at this level, except in some cases where I focused on states to better match Vital Statistics and migration data.

IPUMS

The data from the US Census comes via the IPUMS sample detailed in Ruggles et al. (2010). I use several PUMS samples: For 1970 I use the form 1 one percent sample at either the state or metro level, depending on whether the analysis uses states or commuting zones. For 1980, 1990, and 2000 I use the five percent samples. For 2008 I use the ACS 3 year estimates from 2006 to 2008. For the bulk of specifications I exclude people residing in group quarters, such as military barracks or dormitories. The only exception is the growth accounting by state that I performed in section two. In that case I include people residing in group quarters because this exclusion might cause me to lose young adults born 16 to 21 years earlier. For worker wages I exclude unpaid family workers and only include people who worked last year. In regressions using commuting zone data in 1970 I exclude 1990 commuting zone number 24600 because I suspect its geographic definition was mis-coded.[34]

I also compute "labor supply weights" following Autor, Dorn and Hanson (2013) that weight each worker by their total hours worked last year, and I exclude the top and bottom 1 percent of wages from the computation. All wages are deflated using the personal consumption expenditure chain type price index available from the Federal Reserve Bank of St.Louis via their FRED service. The reference year is 2007.

Vital Statistics

I use datasets containing the data from the US vital statistics (National Center for Health Statistics (2014)) that were created Jean Roth at the NBER and are available publicly in the NBER website. The only cleaning that I perform on the data is to collapse it (weighting by whether it is a 1 of 2 or full sample for the state year combination I am concerned with) at the state level and convert the alphabetic numbering of states to standard fips codes. To exactly match 16 to 21 year olds as

[34]Using the commuting zone crosswalks from David Dorn suggests that its population in 1970 was ten times larger than its population in 1980.

of the census data in 1990, I also exclude entries for certain years where the person born would report being 15 or 22 at the time of the survey date.

Population change accounting

To investigate demographic changes (births, deaths, aging, and migration) underlying the growth of local areas, I combined data from the US vital statistics with data from the US Census IPUMS to compare the variance of birth rates, aging, and gross migration rates across US states.[35] I focus on people over 16 and under 65.

I compute four quantities that show the main drivers of population changes: Births, people aging out of the population 16 to 65, gross in-migration (immigration), and gross out-migration (emigration). Since the census long form asks about migration relative to where a worker was living five years ago, I focus on each over the past five years to make them comparable. Thus, I focus on births 16 to 21 years before the census date, the total number of people in the state aged 55 to 60 in the previous census, the number of current residents living elsewhere five years ago, and the number of people living in the state five years ago, but living elsewhere now. I focus on changes in population between 1980 and 1990, which is the first period where I can use readily available data from the Vital Statistics.

Birth locations

The best available data I have access to concerns workers' states of birth. Unfortunately, this is the most detailed geography that the census bureau asks for, so it is impossible to determine precisely what local labor market a respondent was born in without using an outside data source. Consequently, I tally the proportion of residents of a local labor market who are living in the state of their birth. For large states with many local labor markets (California and Texas are examples) this should lead me to overshoot the proportion of residents living in the area of their birth. For labor markets that cut across state lines (New York for example) I would be understating the proportion of residents living in the same area they were born in since a resident could be in a different state, but the same commuting zone they were born in. On the one hand, imprecision in the measure of the proportion of residents born in the same local labor market is a concern. It is important to note that in a world where areas are not unique islands, the ideal geographic construct may be different in terms of work, family, and other considerations. For example, a worker may prefer to live further away from her parents compared with her work and a worker living in the same state but a different commuting zone as they were born might be almost as constrained as a worker living in the same commuting zone.

Another other issue with the variable is that most births are in hospitals and sometimes children will be born in a hospital in a different state from where their mother lives. Bartik (2009), for example, documents this using data from the PSID. In this situation, the question appears to ask

[35] This analysis is for US states based on the ease of matching Vital Statistics geographic identifiers to states. In principle this analysis could be done with local labor markets using publicly available data.

for the state of the hospital, which is a poor proxy for the concepts I am examining. While this variable is far from perfect, its concordance with other measures of a respondent's local "ties" such as their tenure in their home should suggest that it is still meaningful for this application.

For all of these reasons, I include alternative specifications that use alternative measures of local ties. Generally these results are quite similar.

Local labor markets

I define a local area for this project as a Commuting Zone (CZ) defined by Tolbert and Sizer (1996). Commuting Zones are designed to reflect local labor markets where workers live and work, based on commuting data collected in the 1990 Census.[36] A given CZ can contain multiple states and states can contain multiple CZs. CZs are quite similar to Metropolitan Statistical Areas (MSAs) that are more commonly used, but CZs also include rural areas, covering the entire area of each of the 50 states. They are constructed to be an ideal analogue to the areas in traditional models of migration where workers live and work in the same area. To merge the IPUMS data I use in my specification I use the crosswalks created by David Dorn and available via his academic website. For historical charts, I exclude commuting zone 24600, which I believe may be improperly coded in 1970.

B Growth due to migration and natural changes

As a first step, I decompose of changes in local population into migration and natural changes (births and aging) across states. Table A2 calculates the components of working age (16-64) population changes by continental US states over the period from 1980 to 1990. It uses estimates of migration from 1985 to 1990 from the 1990 census, age structure information from 1980, and birth data from the vital statistics to compare flows due to migration and natural changes.[37]

The main implication of the decomposition in Table A2 is that migration is much more important than natural changes in terms of changes in population across the United States. The standard deviation of net migration across continental US states is nearly four times as large as that of natural changes (13.9 against 3.6 percent). Gross migration into areas also varies much more than any other component, suggesting large differences in areas' abilities to attract workers born elsewhere. This is despite fertility and mortality driving changes in aggregate population. A similar exercise by Berry and Dahmann (1977) produced similar results.

[36] Different Commuting Zones exist following the 2000 census, however I keep with Autor, Dorn and Hanson (2013) and use the 1990 definitions. I do this to keep CZ definitions constant and I use 1990 because it reflects local areas at the beginning of the sample.

[37] I perform the decomposition across states for convenience and because it coincides with my current measure of a person's place of birth. I hope to perform it at the level of commuting zones in a later version based on more detailed data about people's birth places. Additionally, I focus on an age range with relatively low mortality rates in the United States, so differences in morality rates across states should not be large enough to affect the results. More information about the datasets and methodology is contained in the data appendix.

To provide more evidence about the influence of migration relative to natural changes I plot the ratio of gross changes due to migration over gross changes due to natural causes in Figure A2. The figure has two panels: the first plotting flows that increase population, and the second plotting flows that decrease population. In each case a higher value of the ratio means that migration has a larger contribution to a given state's population dynamics. On the x axis I plot the state's log change in population, to show how the importance of migration varies with a state's population growth over the period.

The plots in Figure A2, supporting the earlier evidence, show that migration is more important than natural changes for states that grew. On the left panel, higher population growth is clearly associated with a higher ratio of immigration to births. The relationship is weaker for decreases in population, though it does appear that out migration is important growing states as well as declining ones. For decreases, there is almost no relationship, though a slight positive association emerges if Wyoming is removed from the analysis.

The result that migration drives local growth is consistent with economists understandings both of migration and fertility. Standard models of migration (e.g. Rosen (1979) and Roback (1982)) predict that areas with attractive amenities will gain population. On the other hand, models of fertility have little to say about fertility in one place or the other. Perhaps the closest connection is through a possible income effect, where richer parents will choose to have more children, so long as children are a normal good. A problem with this argument is the emphasis by Becker (1960) on the quality-quantity trade of in child rearing. For example, Willis (1973) and Becker and Lewis (1973) argue that while parents in areas with higher wages will tend to spend more on children, this may lead them to invest more in the "quality" than the quantity of their children. Previous studies, such as Lindo (2010) and Black et al. (2013), have found that local shocks have relatively small (positive) impacts on fertility.

C Discussion of factors that lead to local ties

Residents' preferences for their places of birth, much like people's preferences about living in any location, represent many factors. Disentangling these factors is an active and interesting area with many recent contributions. For example, Kennan and Walker (2011), Coate (2013), and Diamond (2016) use structural micro-economic models to estimate residents' preferences for different areas, including their birth places. Somewhat atypical to this literature, I have remained mostly agnostic about the specific factors that lead workers to have the preferences that I measure, since my basic results do not rely on these distinctions. My reliance on cross sectional snapshots of the population also makes if difficult to credibly disentangle different factors.

The underlying reasons for these measured preferences have implications for possible policy responses, including alternatives to place based policies. One possibility is that the preferences that I measure are the result of other frictions that policies may remove. In this way it may be possible to change their magnitude and move workers out of declining areas. For example, if workers reside in their birth places are because of mobility costs, then it may be cost effective to pay workers to migrate. It may also be possible to move a given community, including most of its members, to a new place with higher productivity in keeping with the spirit of the literature on "dynamic mobility."

In this section I briefly discuss several underlying factors that may lead to these measured preferences. I discuss literatures on social networks, literal migration costs, frictions in the housing market, information frictions, and endogenous human capital formation. I also include a brief discussion of endogenous preference formation. My tentative conclusion is many different stories are consistent with the preference for home areas that I and other researchers have measured. It seems unlikely that inexpensive interventions will induce workers to move out of declining areas much more than they already do. A constructive path for future research would be to directly study these pathways using more detailed micro data.

Networks of people

Some of the most valuable connections people have in a place is the collection of people that they know. These ties are especially strong with parents and members of a person's nuclear family at various points in their lives. Aging parents in particular are a strong tie to particular local areas, as shown by Konrad and Kunemund (2002), Hank (2007), Rainer and Siedler (2009), and others. Friends may also have a meaningful influence. For example, Topa (2011) summarizes a literature on networks and job referrals. Even if workers do not obtain jobs from their contacts, they may rely on friends and family for informal insurance in difficult times (e.g. Kaplan (2012), Huttunen and Salvanes (2015)), or for information about particular services and opportunities that are available locally. Forming new friendships involves significant effort and even if such effort is expended, the returns are uncertain and it can be difficult to form relationships that are as viable as relationships that people gave up by moving.

The most relevant economics literature on this phenomenon is the literature examining "dynamic mobility." Carrington, Detragiache and Vishwanath (1996) shows that large scale migration tends to follow pattern where there tend to be trailblazers who establish links between a sending and destination community. Significant migration occurs only after these links have been formed. They show that this is apparent in the great migration of African Americans from the south to the north of the United States and Yannay Spitzer (2015) shows a similar result for Eastern European Jews migrating to the United States. This pattern emphasizes that network links between sending and destination communities are important, and that people tend to migrate in ways that leverage their social networks.[38]

If networks are important, then a lack of migration might be because residents lack connections in desirable destinations. It is unclear how this limitation may change with the population dynamics I describe. People may be cutoff in areas where they primarily encounter people born in the same place, since this will tend to make their networks more locally focused. However, if links are formed by trailblazers from sending communities, then the opposite may be the case. An area may reach a tipping point where there are enough people who have migrated to establish a second community in another place.

Another explanation, is that people form networks with different numbers of local and non-local links over time. Some people's networks will be local and others will naturally have many links that come from elsewhere. If the proportion of people with local and non-local links is more or less fixed in growing and declining areas, possibly because the two factors above tend to balance out, then this could generate the patterns I find. People with external links may be more likely to migrate, but people with only local links will be unlikely to. Another scenario might be that some people are highly reliant on networks while others are not, or are able to easily form new ones in destination communities. These differences may be correlated with social economic status, but there may also be other important factors.

Migration costs

One explanation is that workers face different mobility costs in different areas that I am not modelling. These different mobility costs may be due to literal differences in the cost of hiring movers or selling a house because of different wage rates, regulation, capital costs, and market thickness in different areas. Credit constraints may also vary so that areas with different shares of locally born workers have different availability of credit.

There are a number of reason why literal mobility costs should play a limited role. The first is the length of the periods that I examine. In the empirical regressions I use a roughly 10 year time frame. This means both that workers have adequate time to save for a move, and also that the move is a small percentage of their consumption over the entire period, so the benefits should be quite large in comparison with the costs. Notably, Blanchard and Katz (1992), suggest that migration responses take roughly 10 years to play out.

A second reason why literal mobility costs may be less important is because gross migration is much larger than net migration. Since people often string together multiple moves, it implies that

[38] As this literature shows, racial and ethnic segregation plays an important role in migration. It is difficult, however, to disentangle how segregation would impact people's local ties or my setup. Minority groups may have a smaller choice set of locations that are open to them – either because of discrimination or because of personal preferences. Bound and Holzer (2000) finds some evidence that less educated blacks are less likely to migrate after a local demand shock. They also note that gross migration rates are lower for blacks, even within education groups. Cadena and Kovak (2016) find that immigrants, who often live in segregated communities, migrate in greater numbers than natives. In my model, a lack of immigrants appears to be lessening migration rates in declining areas since immigrants have weaker local ties. Another consideration is that minorities probably have different preferences about alternative locations than natives do. This will lead them to be more likely to migrate if these places may become desirable after shocks to their original locations.

literal migration costs are a relatively small factor in their decision making. In particular, a person who lives in their state of birth is fairly likely to have lived outside for at least some time. For example, Kennan and Walker (2011) find that roughly 1/4 of all moves in the NLSY79 are back to a respondent's state of residence at age 14. Decennial census data tells a similar story. Among people living in their state of birth in 2000, nearly half had moved at some point over the past five years, and 3.5 percent had moved home from somewhere outside of the state. While the second number is modest, it is much larger than the effects that I observe over a period that is twice as long.

A third reason is that, because moving involves paying costs in two separate places, there is a limit on the extent that moving costs can differ by sending areas. Since much of the financing of the move should occur in the area that a worker moves to, not the place they are moving from, a worker's chosen destination should matter more in terms of credit availability than the area they are moving from. Also, even if mobility costs were only paid in the sending area, costs are likely to be lower in declining areas. Wages will tend to be lower, suggesting that movers will cost less, and the typical six percent commission on a real estate sale will also tend to be cheaper in levels.

A final piece of evidence on this channel is the study by Huttunen and Salvanes (2015) examining moves by displaced workers. Their finding that recently displaced (fired or laid off) workers migrate in greater numbers than a control of non-displaced workers suggests that other factors outweigh mobility costs when workers face large earnings losses. They also find that workers tend to move closer to their parents.

Housing frictions

Several theories postulate that home ownership might tie people to local areas in ways besides the impact of durable housing, which I addressed earlier. Homeowners may be less likely to move after a decrease in local housing prices because loss aversion makes them less willing to suffer the capital loss or because it makes it harder for them to afford a new down payment. This effect may dominate the increased number of foreclosures in areas with declines in home prices, and negative economic shocks more broadly. Another theory, originally advanced by Oswald (1996), is that transaction costs of selling a house are large enough depress migration, and therefore increase the unemployment rate.

One concern is that the local ties that I observe are entirely explained by these frictions in the housing market, perhaps as brought about by larger declines in housing prices in declining areas. Tables A9 and A10 addresses this concern by allowing the effect of a local labor demand shock to vary based on local ties and the level and lagged changes in rents. I find that my results are similar and in some cases stronger.

The finding that ties appear stronger than changes in housing prices is not surprising given previous literature on housing lock in. Evidence on the effects of house price declines on migration is mixed.[39] One fairly consistent finding, however, is that effects on the labor market are small. Modestino and Dennett (2012) squares this with their finding of meaningful effects on migration among homeowners by noting that only about 20 percent of migrants are homeowners. Even if home owners are much less likely to move, a somewhat controversial claim, then renters may undo the labor market impacts.

More broadly, there are many reasons to suspect that owning a house will tie people to individual areas. The most obvious is the high transaction costs that are associated with selling a house. This effect is complicated, however, by the fact that people choose to become homeowners knowing these costs. Since many people are inframarginal about migration, and migration is more common among younger household who are less likely to own, the effect may be small. In terms of determining a causal effect, this selection issue has complicated previous investigations, which have produced mixed results.[40] Housing frictions may amplify other ties that people have to places, but available evidence about them is mixed.

Information

Information about relevant alternatives is an important factor in the migration process. The recent literature on migration, following Kennan and Walker (2011), places a great deal of emphasis on information and its ability to explain repeated moves. Within a framework of net migration, limits on information may increase effective mobility costs of people who decide to move. These factors likely interact with other preferences about home, since Kennan and Walker (2011) and Gregory (2013) find that people's preferences about their homes are not completely explained by information frictions. Schmutz and Sidibe (2016) argue that frictions in job finding rates for movers can explain more, though they still find that mobility costs are substantial.

Levels of information may vary across places or among people in a given place giving rise to differences in people's choices. Particular places might have worse information because of physical geography, economic geography, migration patterns, vacation patterns, availability of information resources like the internet, or other factors. Declining areas could be more isolated than other areas, so this may influence the process. Another possibility is that different people within an area are differentially informed about outside opportunities and that this is relatively constant across areas. If this were true then it might behave in a way similar to a difference in costs across residents. It seems that most implications of information for net migration flows will be modeled in my framework, thought with different interpretations.

Establishing how well information about far off alternatives circulates to particular areas appears to be an interesting target for future research. One factor that may limit information's implications in this context is that there are several incentives for "arbitrage" on the part of employers if workers are mis-informed in a particular area, however.

[39] Farber (2011) and Bricker and Brian Bucks (2013) find small or no effects of house price decreases on migration, Molloy, Smith and Wozniak (2011) and Donovan and Schnure (2011) find effects only for small distance moves, and Henley (1998), Ferreira, Gyourko and Tracy (2010), and Modestino and Dennett (2012) find some effects for longer distance moves. Farber (2011), Modestino and Dennett (2012), and Valletta (2013) find that homeowners' negative equity does not appear to affect the labor market.

[40] Coulson and Fisher (2009) is a recent investigation that contains a review of earlier studies.

Endogenous human capital

Another explanation is that workers have location specific human capital. This area specific human capital could be job related skills, or information about the local area. This could mean that workers prefer to leave their birth states, but would suffer large wage losses if they did.

There are several reasons to suspect that workers have substantial location specific human capital. Topa (2011) summarizes a large literature that emphasizes the importance of local social ties for job referrals. These may take many years to form. Local knowledge might also be particularly valuable in if workers interact with specific laws, regulations, business structures, contacts, or natural features.

An emphasis on local human capital, however, is somewhat counter-intuitive given the fairly robust finding that college educated workers are significantly more likely to migrate than less skilled workers. A literature on job specific human capital, including Blatter, Muehlemann and Schenker (2012) and Hudomiet (2014), that suggests that job specific human capital is higher for more skilled workers. In particular, agglomeration effects should lead workers to be less mobile if they have skills that are industry specific and the industry is highly concentrated. An example of this might would be an investment banker in New York.[41]

Location specific human capital might be inversely correlated with overall human capital if it is an inferior good. Unions have historically been more important for low skilled workers and union jobs may be controlled on the basis of local connections. These jobs may be more valuable for less skilled individuals, for example this might be true if unions tend to compress the wage distribution. Local licencing also may bind more in the low skilled labor market. Kleiner and Krueger (2013) suggest that licensing may be moving in such a way that the rise of licencing and fall of unions roughly offset each other in terms of the number of workers affected by either.

There seems to be very limited scope for policy to affect workers' levels of location specific human capital. Referral networks appear to serve a valuable role in conveying information about job applicants and location specific skills are by definition valuable for productivity in particular local areas. Some political institutions, like recent state licencing laws, may be possible to change, but political economy considerations may complicate these efforts. Voters may reward local politicians who enact policies that advantage people with local connections.[42]

Endogenous preferences

Workers may develop preferences for particular places based upon spending time in a place. In particular, many activities involve fixed cost that may have to be paid again if one were to move

[41] Agglomeration effects in training, for example in PhD Economists, may make skilled workers more mobile since they often spend extended periods in unfamiliar locations. Workers in these occupations experience many different areas so they might be expected to have fewer ties to individual areas.

[42] Anthropologist Scott (1998) argues that there is a fundamental political tension between local and central control. This can lead to policies that are intentionally designed to make local knowledge more valuable. He argues that the process of constructing a nation state like France involved replacing these policies. He argues that this process has had many unintended negative consequences.

to a new location. Children may participate in activities, play certain sports, cheer for particular sports teams, or eat certain foods that may only be popular in particular places. For children in particular, some of these affiliations may be malleable, since many take up different sports as adults, but preferences for food may be much more fixed in adulthood. Adults as well may develop particular local affiliations, such as membership in local clubs, knowledge about certain local features like hiking trails, local resources like bookstore, local community groups, or local activities. Patterns of dressing, tastes for home styles and decor, language differences, political affiliations, and many other cultural factors likely contribute to this.

Endogenous preference formation most likely interact with other factors. So, for example, many social relationships may be based around particular local activities. Individual participants may not enjoy specific activities more than alternatives in other places, but they value the social interactions that they get out of these activities, and these might be hard to form elsewhere. Married couples may be tied down by one spouse's like for particular local rituals. Children may find it optimal for parents to move, but parents may be tied to particular places by their preferences for particular local activities. Workers may also be more willing to invest in location specific human capital or make decisions that increase their mobility costs if they enjoy living in their current area.

Policy implications

The main policy implication from this discussion is that it may be possible to remove some of the reasons for some people's unwillingness to migrate. If it were cost effective to induce people to migrate from declining areas without decreasing their welfare by very much, then this would obviously be a solution to a host of local economic problems.

The cheapest friction to eliminate would be a direct mobility cost driven by limited access to credit. Unfortunately, available evidence suggests that this mechanism is unlikely to drive most of the effects that I document. Access to credit could be beneficial in a number of other ways – such as encouraging education, small business formation, and other productive investments – but it appears unlikely to be much more valuable in this area than in others. A reasonable first step in this area would be to allow easier transfer of benefits between different state programs. While available evidence suggests this might have a small impact, it presumably can be done at relatively low cost and it is difficult to imagine how it would harm welfare.

Another possibility would be to create links from declining areas to other growing areas. This could involve encouraging the migration of influential "trailblazers" and their continued integration in sending communities, or by establishing agencies devoted to establishing workers in other places. An problem with this approach is that it would be difficult for any governmental agency to properly assess needs for migration services. It also is not clear that a market failure is at work – an employer in a growing area, for example, would have an incentive to hire workers from declining areas at cheaper wages if it were to recruit in those areas. Such programs might also face political pressure in sending communities since they would be designed to de-populate them and reduce their influence. More subtle policies, such as the integration of local employment agencies, or the standardization of state level credentials would be likely to help. An additional benefit is that these would also improve labor market "fluidity" across all areas, and not necessarily only declining ones.

Many of the other explanations for people's preferences involve factors that are either costly or impossible to adjust. If all preferences are formed in childhood, for example, then an area would only gradually lose its appeal as a smaller and smaller proportion of the population grows up there. The system would eventually return to a "steady state" equilibrium where population reflects the common valuations of productivity and consumption amenities that are common in a Rosen-Roback framework, but this evolution would be much slower than is commonly assumed. Compensatory place based policies might slow this evolution, but since they do not change population by very much, they are likely to have small effects.

D Proofs

General equilibrium migration elasticity

$$\frac{(1-\bar{\psi}_j)}{\sigma_\xi}\left[\frac{1+\eta^H-\alpha^H}{1+\eta^H+\alpha^H(1-\bar{\psi}_j)/\sigma_\xi}\right] = \frac{\beta_{J,\text{Population}}}{\beta_{J,\text{Wages}}}$$

Proof.

$$\frac{\gamma\frac{(1-\bar{\psi}_j)}{\sigma_\xi}\left[1-\frac{\alpha^H}{(1+\eta^H)}\right]}{\gamma\left[1+\frac{\alpha^H(1-\bar{\psi}_j)}{\sigma_\xi(1+\eta^H)}\right]} = \frac{(1-\bar{\psi}_j)}{\sigma_\xi}\left[\frac{1+\eta^H-\alpha^H}{1+\eta^H+\alpha^H(1-\bar{\psi}_j)/\sigma_\xi}\right]$$

□

Appendix tables and figures

Table A1: Association between populations of locals and outsiders

	Pct chg in population born locally			
Pct chg in population born outside	0.36	0.28	0.22	0.16
	(0.05)	(0.04)	(0.04)	(0.03)
Weighted	No	No	Yes	Yes
Controls	No	Yes	No	Yes
Observations		722		
R^2	0.287	0.434	0.215	0.483

Notes: Coefficients are from a regression of changes in the population born locally on the change in population born outside over the period from 1980 to 2008 for the 722 commuting zones in the continental US. Each is measures as a percentage of the initial population (including all people). Data are from the long form 1980 decennial Census and the 2006-2008 ACS. Data are are weighted to be nationally representative. Locals are people who are born in the state they are living in, while outsiders are born in other states or countries.

Table A2: Components of population changes from 1980 to 1990

		StD	Mean	N
Net	Migration	13.78	4.02	48
	Natural changes	3.69	9.96	48
Gross	Immigration	14.82	29.73	48
	Births	2.81	24.55	48
	Emigration	8.97	25.71	48
	Aging	1.48	15.66	48

Notes: Standard deviations and means are expressed as a percentage of the initial population for all continental US states with equal weights. For example, a state with $100,000$ births and $1,000,000$ in initial population would have a value of 10 percent for births. Data are from the decennial census and vital statistics (National Center for Health Statistics (2014)) covering the continental United States. Births are from 1969 to 1974, aging is the population 55 to 60 in the 1980 decennial census, and migration statistics are from the 1990 census. Migration includes moves from abroad but not moves from the state to abroad, since the sample only includes people who are in the United States when the census was conducted. Each is multiplied by two to represent total population movements over 1980 to 1990. Net migration is immigration minus emigration and "natural" changes are births minus aging out of the age range. Immigration and emigration are relative to states, not countries, and population in this context is the population of people aged 16-64.

Table A3: Persistence of population changes

	All	Large	All	Large
Lagged pct chg in population	0.52	0.53	0.35	0.29
	(0.06)	(0.08)	(0.03)	(0.13)
Twice lagged pct chg in population			0.13	0.08
			(0.02)	(0.06)
Thrice lagged pct chg in population			0.04	0.13
			(0.01)	(0.07)
Observations	1444	48	721	16
R^2	0.569	0.678	0.702	0.831

Notes: Results are from an autoregression of changes in population on lags of itself. "All" denotes results using all commuting zones, "Large" denotes commuting zones that had populations of more than 1 million people initially. Data is from the decennial census and ACS. Regressions are weighted by initial population and standard errors in parenthesis are clustered by state (a CZ is in a state if the plurality of its population resides there). Year fixed effects are included for panel regressions.

Table A4: Locally born workers staying and population changes

	Percent of people born in the state staying	
1970-2008 log change in working age population	0.09	0.12
	(0.04)	(0.02)
Controls	No	Yes
Observations	48	48
R^2	0.170	0.762

Notes: Data is from the decennial census and ACS and cover the continental United States. Regressions are weighted by initial population and robust standard errors are in parenthesis. All share variables are multiplied by 100 to make them into percentage points. Controls are share college educated, share employed, share foreign born, share born in Mexico, and log population – all measured in 1970. The share of workers born in the same state includes all adults 16-65 born in that state and living somewhere in the United States from 2006-2008 (the ACS 2008 3 year sample window).

Table A5: Associations between ADH and Bartik instruments

	Bartik	ADH trade exposure	ADH IV
Bartik	1.00		
ADH trade exposure	0.21	1.00	
ADH IV	0.26	0.73	1.00

Note: Correlation coefficients are shown between instrumental variables related to Chinese import competition and Bartik labor demand instruments. The table describes the correlation between a given CZ's Bartik instrument for 1980 to 1990 against its Chinese import exposure for 1990-2000, then again for 2000-2008. I use population weights at the beginning of the period relevant for the Chinese import shock.

Table A6: Bartik shocks by share born locally: Men only

Panel A: Bins specification

	Pop	NILF	Unemp	Wages	LFP
Bartik: Low ties	1.85	0.02	-0.07	0.37	0.15
	(0.47)	(0.06)	(0.05)	(0.24)	(0.03)
Bartik: High ties	0.46	-0.07	0.05	0.32	0.10
	(0.28)	(0.03)	(0.03)	(0.23)	(0.04)
P-val: No diff	0.01	0.20	0.05	0.89	0.32
R^2	0.57	0.20	0.64	0.28	0.35
Observations			722		

Panel B: Triple difference specification

	Pop	NILF	Unemp	Wages	LFP
Interaction	-3.70	-0.17	0.10	0.97	-0.16
	(1.15)	(0.17)	(0.12)	(0.74)	(0.11)
Main effect	1.10	-0.05	0.01	0.33	0.13
	(0.25)	(0.03)	(0.03)	(0.17)	(0.03)
Percent locals	0.30	-0.03	-0.01	0.02	0.03
	(0.23)	(0.03)	(0.02)	(0.16)	(0.03)
R^2	0.59	0.22	0.63	0.31	0.35
Observations			722		

Notes: CZ level results with statistics including only men aged 16-65. Weighted by initial population with clustered (by state) standard errors and controls as in table 3. See table 3 for full notes.

Table A7: Bartik shocks by share born locally: Women only

Panel A: Bins specification

	Pop	NILF	Unemp	Wages	LFP
Bartik: Low ties	2.48	1.01	-0.02	0.05	-0.07
	(0.70)	(0.35)	(0.06)	(0.23)	(0.05)
Bartik: High ties	0.63	0.07	0.05	0.15	0.05
	(0.37)	(0.18)	(0.03)	(0.17)	(0.04)
P-val: No diff	0.02	0.02	0.26	0.72	0.06
R^2	0.59	0.55	0.62	0.45	0.40
Observations			722		

Panel B: Triple difference specification

	Pop	NILF	Unemp	Wages	LFP
Interaction	-4.97	-2.31	-0.07	0.79	0.20
	(1.60)	(0.87)	(0.12)	(0.58)	(0.15)
Main effect	1.46	0.47	0.03	0.07	0.00
	(0.33)	(0.16)	(0.03)	(0.15)	(0.03)
Percent locals	0.35	0.12	0.02	-0.08	-0.02
	(0.29)	(0.15)	(0.02)	(0.13)	(0.03)
R^2	0.62	0.57	0.61	0.46	0.39
Observations			722		

Notes: CZ level results with statistics including only women aged 16-65. Weighted by initial population with clustered (by state) standard errors and controls as in table 3. See table 3 for full notes.

Table A8: Bartik shocks by local average household tenure

Panel A: Bins specification

	Pop	NILF	Unemp	Wages	Rents	LFP
Bartik: Low ties	2.36	0.42	-0.07	0.28	0.88	0.10
	(0.42)	(0.14)	(0.06)	(0.23)	(0.34)	(0.04)
Bartik: High ties	0.43	-0.01	0.03	0.34	0.15	0.07
	(0.27)	(0.08)	(0.03)	(0.19)	(0.26)	(0.03)
P-val: No diff	0.00	0.01	0.11	0.83	0.12	0.52
R^2	0.63	0.60	0.68	0.37	0.55	0.38
Observations			722			

Panel B: Triple difference specification

	Pop	NILF	Unemp	Wages	Rents	LFP
Interaction	-0.55	-0.14	0.01	0.10	-0.06	-0.00
	(0.11)	(0.03)	(0.01)	(0.09)	(0.14)	(0.01)
Main effect	1.16	0.11	-0.02	0.34	0.48	0.11
	(0.28)	(0.07)	(0.03)	(0.18)	(0.23)	(0.03)
Avg time in house	2.69	-0.32	-0.52	0.51	2.85	0.47
	(1.69)	(0.58)	(0.24)	(1.33)	(1.70)	(0.22)
R^2	0.65	0.66	0.69	0.40	0.56	0.41
Observations			722			

Notes: Regression coefficients are plotted for either the main effect plus a linear interaction term with the demeaned average household tenure in the CZ, or the coefficient separately estimated for CZ's with fewer or more than 8 years of average household tenure. Controls, measured in 1980, are: the household tenure variable used in the interaction term, the share of working age adults outside the labor force, unemployed, foreign born, having entered the state in the past five years, and the share of adults who are under 35 and 50 to 65. Results are weighted by initial population with clustered (by state) standard errors and controls as in table 3. See table 3 for additional notes.

Table A9: Bartik regressions including other interactions

	Log population						Log NILF					
Ties interaction	-2.38	-4.24	-4.82	-6.90	-5.51	-5.22	-0.47	-1.10	-1.25	-1.93	-1.52	-1.35
	(1.21)	(1.34)	(1.10)	(1.13)	(1.10)	(1.84)	(0.44)	(0.44)	(0.35)	(0.29)	(0.33)	(0.53)
Bartik shock	0.91	1.24	1.02	1.02	0.91	1.27	0.10	0.20	0.14	0.13	0.09	0.20
	(0.32)	(0.28)	(0.29)	(0.29)	(0.28)	(0.26)	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(0.06)
Percent locals	-0.10	0.32	0.45	0.60	0.49	0.51	-0.05	0.05	0.09	0.14	0.11	0.09
	(0.19)	(0.25)	(0.24)	(0.20)	(0.20)	(0.23)	(0.08)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)
Pct under 35 interaction			27.13						10.05			
			(15.44)						(4.46)			
Pct 50 to 64 interaction			38.09						12.60			
			(13.23)						(4.49)			
Pct college interaction				-9.01						-2.81		
				(2.56)						(0.75)		
Pct employed interaction					-15.23						-5.09	
					(3.68)						(1.13)	
Rents interaction						-1.49						-0.31
						(2.09)						(0.68)
Pos rent chgs interaction						5.09						1.75
						(1.89)						(0.56)
Neg rent chgs interaction						3.63						1.55
						(3.29)						(1.32)
Main Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Observations				722						722		
R^2	0.474	0.604	0.629	0.626	0.637	0.621	0.313	0.547	0.576	0.575	0.593	0.591

Notes: Regressions, as explained in the text, using shift share (Bartik) demand indexes and data from the decennial censuses in 1980 and 1990 for individual commuting zones in the US. In addition to the setup described in table 3, these also control for the main effect of the interaction term, if it is not already included.

Table A10: Trade regressions including other interactions

	Log population						Log NILF					
Ties interaction	-5.87	-2.01	-3.66	-4.91	-2.44	-5.58	-4.80	-3.84	-3.56	-4.78	-3.96	-4.61
	(2.69)	(2.50)	(2.74)	(2.58)	(2.33)	(3.28)	(1.01)	(0.97)	(1.06)	(1.18)	(0.92)	(1.28)
Import shock	0.41	0.43	0.42	0.37	0.45	0.42	-0.33	-0.34	-0.32	-0.36	-0.33	-0.31
	(0.61)	(0.43)	(0.51)	(0.47)	(0.43)	(0.54)	(0.15)	(0.16)	(0.16)	(0.16)	(0.15)	(0.14)
Percent locals	-0.39	-0.39	-0.43	-0.47	-0.41	-0.46	-0.17	-0.21	-0.20	-0.23	-0.22	-0.25
	(0.07)	(0.10)	(0.11)	(0.11)	(0.10)	(0.11)	(0.02)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)
Pct under 35 interaction			-3.47						-1.71			
			(27.94)						(7.85)			
Pct 50 to 64 interaction			10.99						-4.15			
			(27.52)						(7.72)			
Pct college interaction				-6.79						-2.19		
				(3.78)						(1.41)		
Pct employed interaction					-8.78						-2.38	
					(5.36)						(2.22)	
Rents interaction						-1.77						-1.15
						(1.56)						(0.43)
Pos rent chgs interaction						-3.68						1.38
						(2.96)						(1.40)
Neg rent chgs interaction						8.90						2.69
						(5.04)						(1.81)
Main Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Observations				1444						1444		
R^2	0.298	0.485	0.491	0.491	0.488	0.522	0.533	0.629	0.629	0.632	0.628	0.668

Notes: Regressions using a shift share index of trade in final goods' impact on local commuting zones in the US in first differences for the periods form 1990 to 2000 and 2000 to 2008. Data come from the decennial census and three year ACS. In addition to the setup described in table 4, these also control for the main effect of the interaction term, if it is not already included.

Table A11: Regression coefficients for parameter estimates

Panel A: Bartik

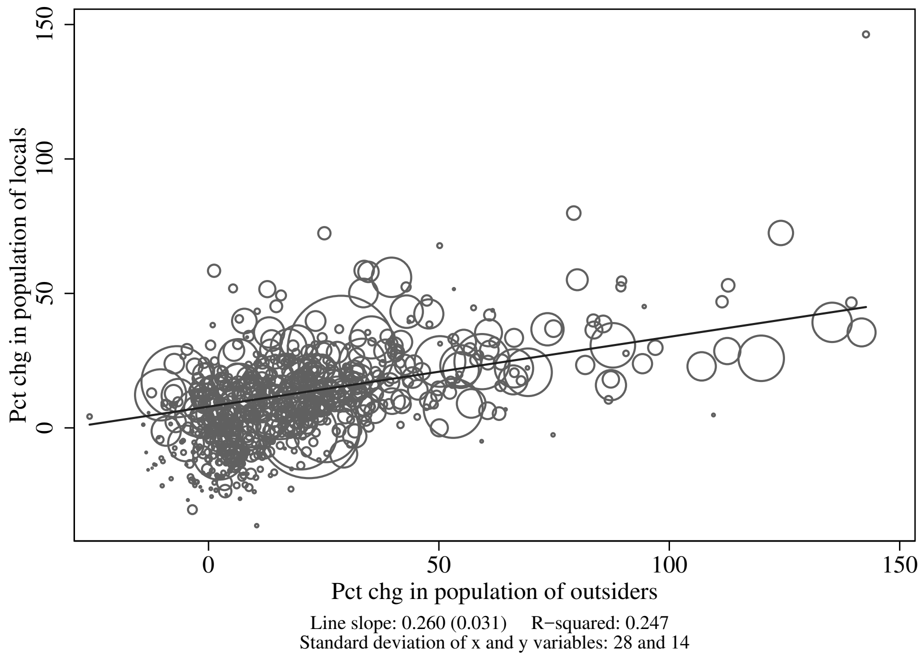
	Population	Wages	Rents
Bartik shock: Low share	1.39	0.27	0.64
	(0.14)	(0.10)	(0.18)
Bartik shock: High share	0.33	0.30	0.53
	(0.11)	(0.08)	(0.13)
Observations	722		
R^2	0.579	0.353	0.477

Panel B: Trade shocks

	Population	Wages	Rents
Trade shock: Low share	0.57	0.15	1.26
	(0.17)	(0.08)	(0.18)
Trade shock: High share	-0.44	0.53	0.90
	(0.16)	(0.08)	(0.17)
Observations	1444		
R^2	0.449	0.143	0.216

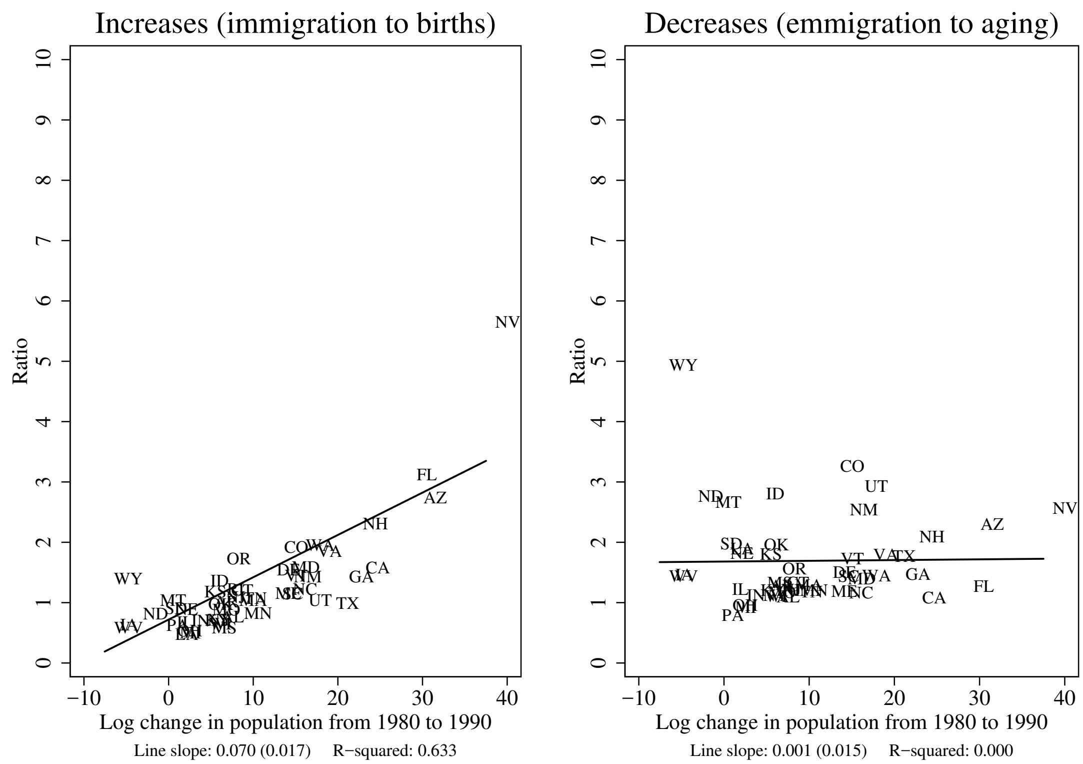
Notes: Seemingly unrelated regression results are shown for regressing the indicated outcomes, measured in 10 year log changes on the labor demand shifter on the right hand side. These are used for estimation of the parameters. All regressions use the same data and include the same controls as the main reduced form results. Since the population changes are not scaled the results do not perfectly match however.

Figure A1: Changes in the population of locals and of outsiders



Notes: Plotted are changes in the total population of people who were born outside of (inside) their current state, from 1980 to 2008, divided by the total population of the commuting zone in 1980 and multiplied by 100. In this way it represents the contribution of this population group to changes in the commuting zone's population. Data are from the long form decennial census and the ACS 3 year estimates (2006-2008) and are weighted to be nationally representative. The unit of observation is a commuting zone within the continental United States. The figure excludes the small number of commuting zones where the each statistic was over 150 so it is easier to read. Regressions in Table A1 include them, however.

Figure A2: Ratios of migration and non-migration population changes



Notes: Data are from the decennial census and vital statistics (National Center for Health Statistics (2014)). Births are from 1969 to 1974, aging is the population 55 to 60 in the 1980 decennial census, and migration statistics are from the 1990 census. The regression line is an OLS regression using each state as an observation. Robust standard errors are in parenthesis.

Figure A3: Correlations between 10 year changes in working age population

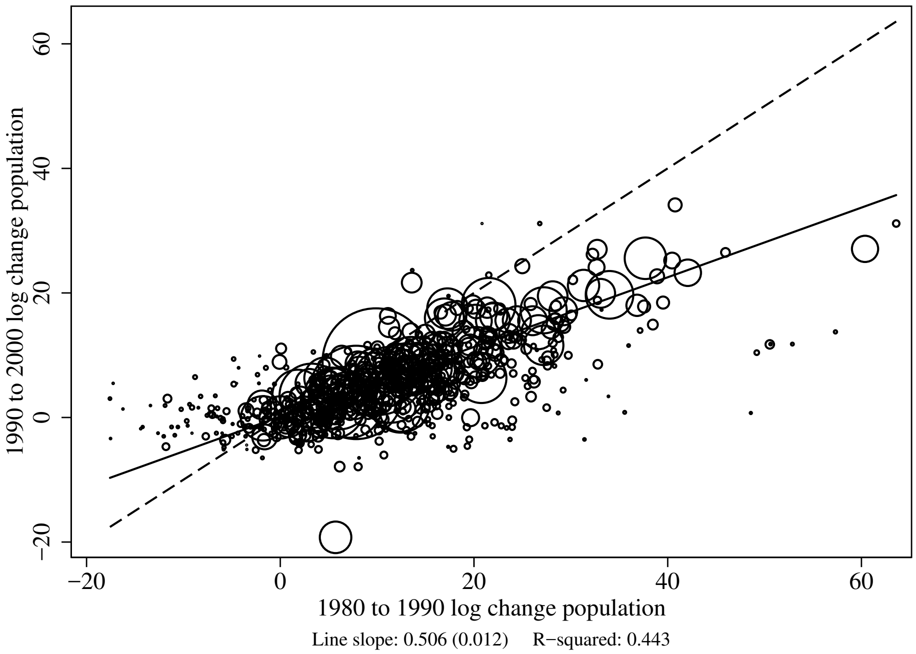
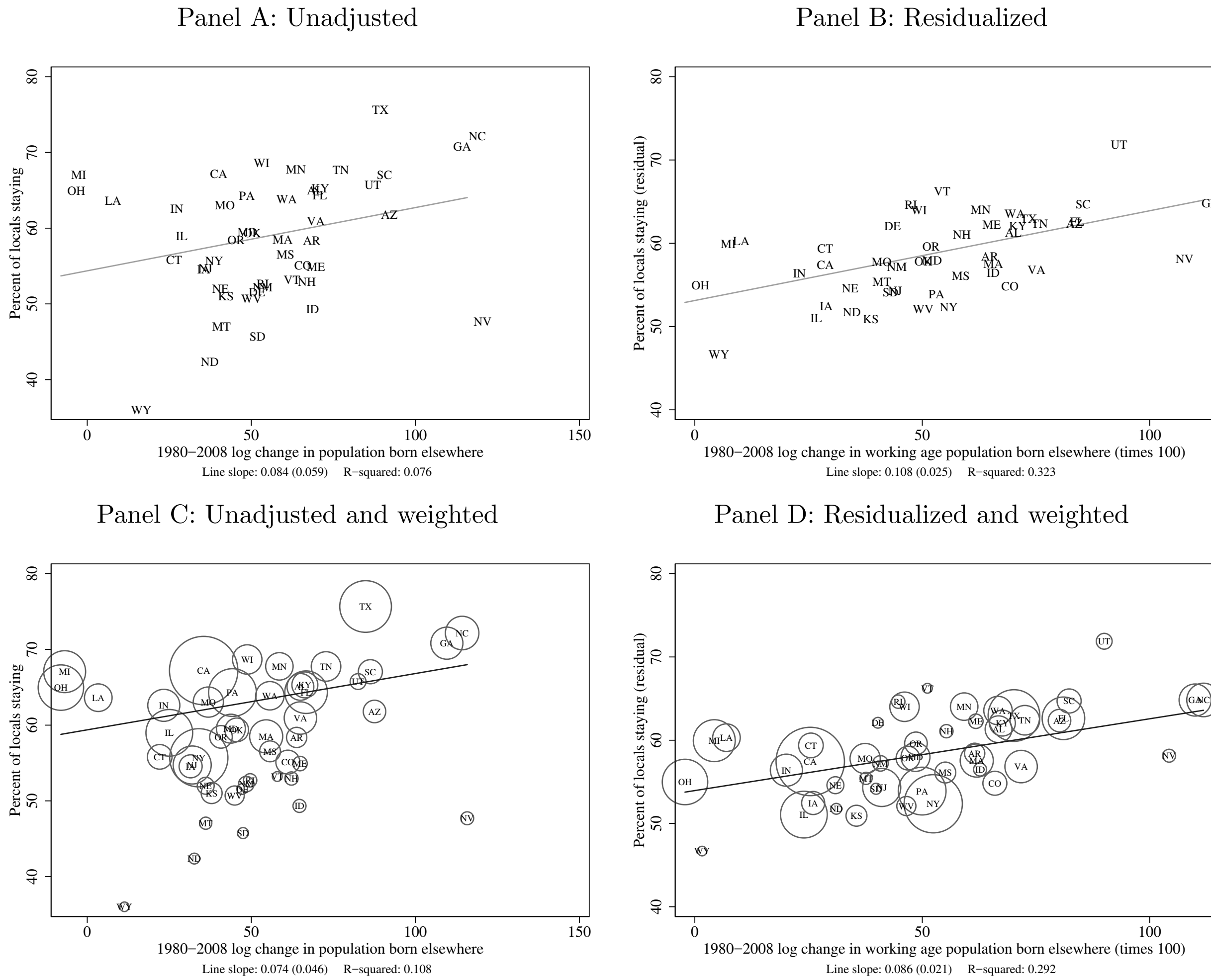


Figure A4: Population changes and locally born workers staying



Note: Plotted are either the observed share born locally, or residuals of a regression of the share locally born residuals on a series of controls, with the constant added back in after. The controls are: share college educated, share employed, share foreign born, share born specifically in Mexico, and population 40 years previously. The line is from an OLS or WLS regression and the standard error is clustered by census division.

Figure A5: Counties making up various commuting zones

Panel A: Detroit

Panel B: Chicago

Panel C: Washington, D.C.

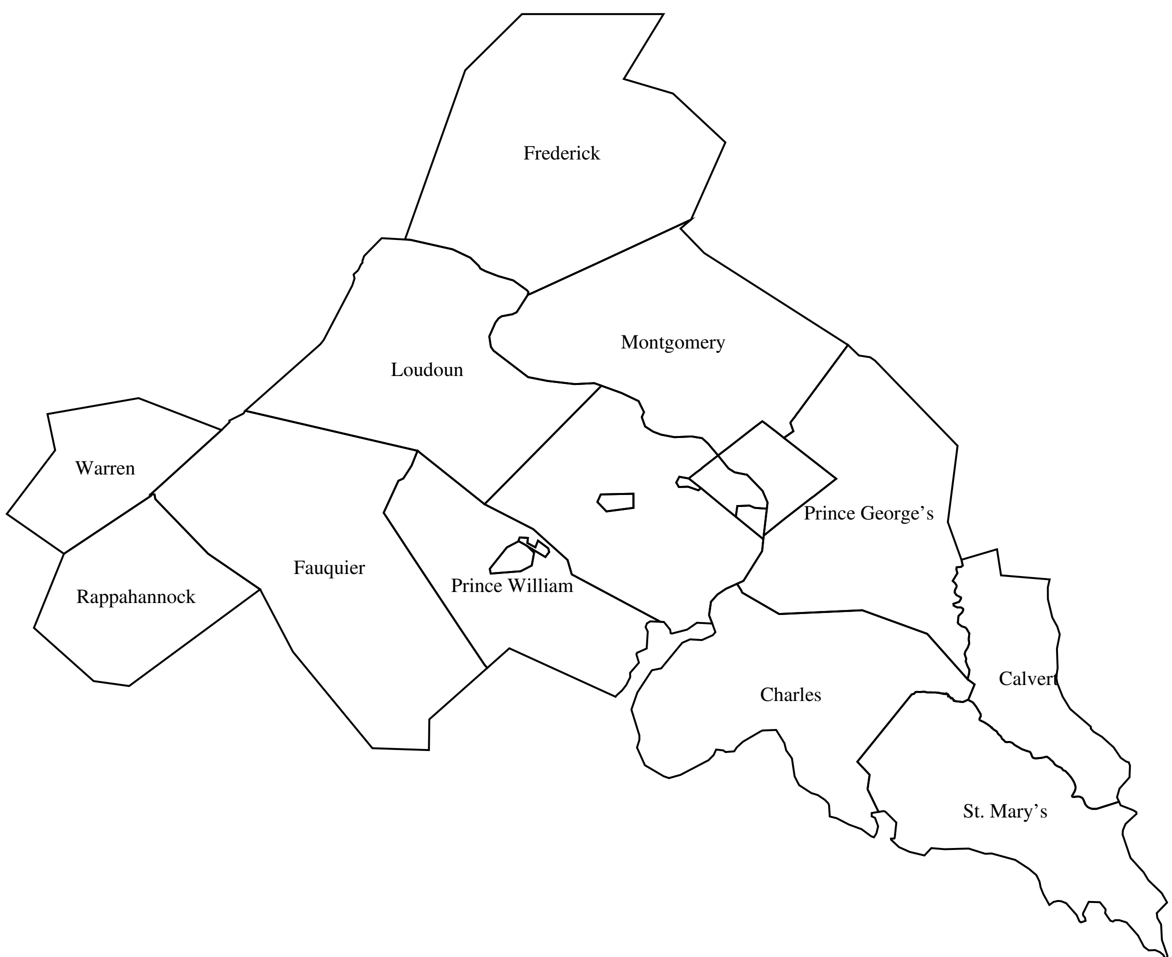
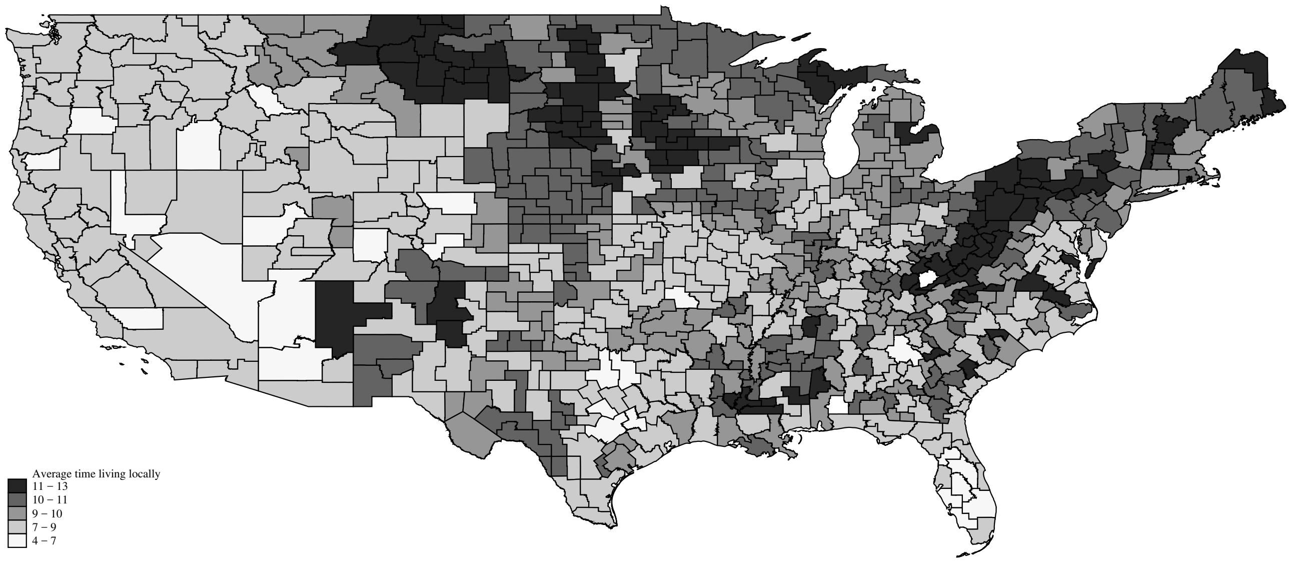


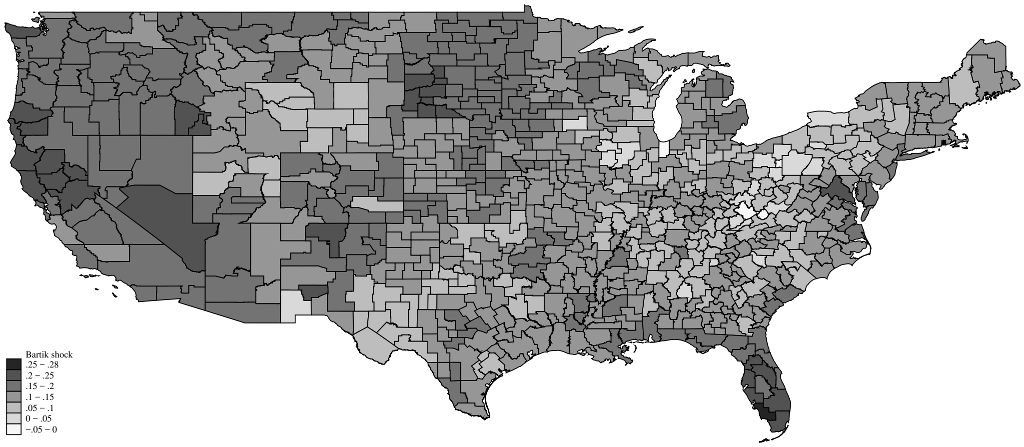
Figure A6: Average time living in the same house as of 2000



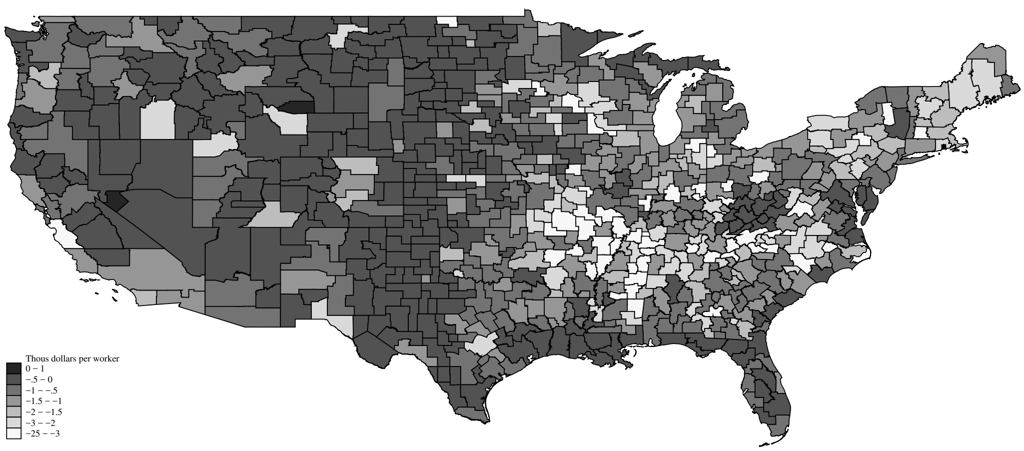
Notes: The 722 commuting ones in the continental US are shaded according to how long the average "householder," in whose name the residence is owned/rented, has been living at their current residence. The statistic is weighted according to the number of adults 16-64, fulfilling other sample restrictions, who live at that residence. Darker shades mean longer average times living in the residence. Data are from responses to the 2000 long form census via IPUMS.

Figure A7: Local labor demand shocks

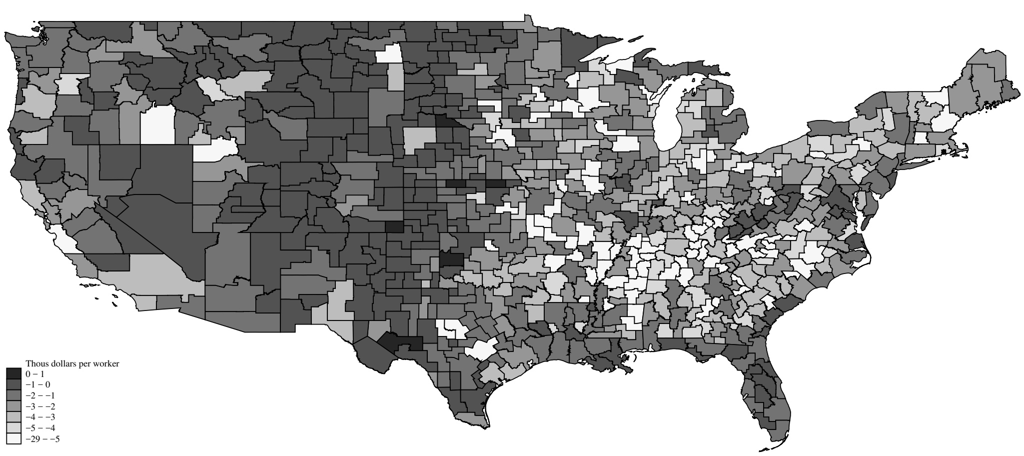
Panel A: Bartik shocks: 1980 to 1990



Panel B: Trade shocks: 1990 to 2000

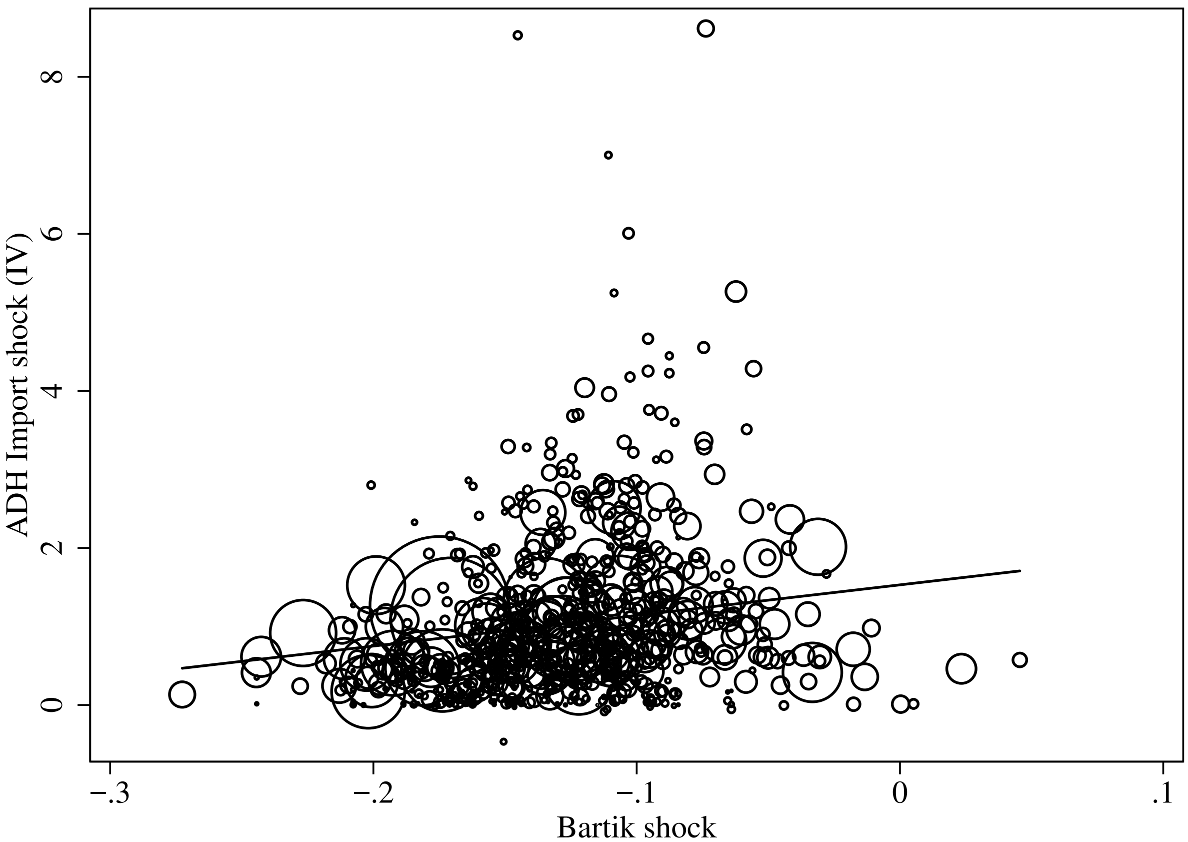


Panel C: Trade shocks: 2000 to 2008



Note: The figure plots commuting zones shaded based on the severity of the local labor demand shock in the period. Data are from the Decennial Census, ACS, and Autor, Dorn and Hanson (2013).

Figure A8: Scatterplot of ADH and Bartik instruments



Note: Scatterplots are shown between instrumental variables related to Chinese import competition and Bartik labor demand instruments. The figure describes the correlation between a given CZ's Bartik instrument for 1980 to 1990 against its Chinese import exposure for 1990-2000. I use population weights at the beginning of the period relevant for the Chinese import shock.