Implications of local ties in spatial equilibrium

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Abstract

The percentage of people who were born near where they live, a proxy for people's local ties, varies greatly across the United States. In areas with higher levels of these local ties, migration is less responsive to changes in local labor demand. Across a wide class of models of spatial equilibrium, lower migration elasticities make subsidies to local areas more efficient, since they change fewer people's locations. These two facts suggest that subsidies to areas with a declining populations are more efficient than subsidies to other areas. A parametric model illustrates how local ties develop in areas with declining populations, and provides a mechanism that reallocates people's local ties to reflect changing economic geography. Areas with declining population house mostly people who were born locally, since these people are willing to endure the lower wages, lower amenities, and higher rents that go along with a declining population. People outside are reluctant to move in after small changes in wages, since real wages are well below national averages. The process of reallocating local ties takes several generations, depending on the size of a shock.

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In spatial equilibrium, a marginal worker will be equally well off, no matter where she lives (Rosen (1979) and Roback (1982)). But, most people have strong preferences about where they want to live. Kennan and Walker (2011), for example, find that people are willing to pay around $20 thousand per year to live in the place where they were born.[1] Do these preferences have implications for spatial equilibrium? In this paper I use reduced form regressions, a sufficient statistics approach, and a parametric model to examine the importance of these local ties in spatial equilibrium.

The main finding is that local ties are particularly important in places that are losing population, since they lead to lower migration elasticities. Some people will pay substantial amounts to live near where they were born, so they make up most of the population in areas where population is declining. This selection means that, on average, fewer people migrate after changes in labor demand, and migration elasticities are lower. People who remain are less responsive to wages, leading to abnormally large declines in real wages. Lower levels of real wages make it difficult to pull people in from other places, since an increase in wages will still lead to relatively modest real wages.

Migration elasticities determine the distribution of welfare in spatial equilibrium, so they are extremely important for policy. After adverse events, migration acts as a form of insurance, cushioning residents wages by lowering the supply of labor. After a local subsidy, however, this can be undesirable. If a subsidy attracts people, then the increase in labor supply can undo its benefits. Using a sufficient statistics approach, I show how the migration elasticity determines the welfare impacts of a subsidy across a wide class of models of spatial equilibrium. I estimate migration elasticities across areas with different levels of local ties to show how they can have meaningful impacts on the costs of a simply local subsidy, like the substantial subsidies that the US tax code gives to rural areas (Albouy (2009)).

There are interesting dynamics around the formation of local ties in particular areas. Strong local ties tend to be the result of population decline, since few people move to shrinking areas. Areas where population is increasing, however, tend to have residents with weaker local ties, since most residents were born somewhere else, and moved there. Eventually, however, these residents either have children, or they form ties on their own. This means that more people are becoming tied to growing places, and this higher level of local ties itself implies a future increase in population. In the future there will be more people with idiosyncratic attachments to growing places than there were in the past. This tends to increase each area's growth rate in the future. There is a unique

[1] Large migration frictions are a common feature in the literature. Bound and Holzer (2000), Notowidigdo (2011), Molloy, Smith and Wozniak (2011), Saks and Wozniak (2011), Ganong and Shoag (2012), Kaplan and Schulhofer-Wohl (2013), Yagan (2013), Chetty et al. (2014), and Huttunen, Møen and Salvanes (2015) (among others) have emphasized how migration appears to be surprisingly limited, particularly among people without college degrees. Several other structural models of individual migration decisions, including Coate (2013), Kleemans (2015), Oswald (2015), and Diamond (2016) have also found that people tend to have strong preferences for living close to where they were born.

steady state, but it takes a long time to reach it.[2]

Local ties can represent many different things, but the most obvious local ties are people's connections to local friends and family. People build social networks in particular areas that help them to socialize, as well as to find jobs, insure against hard times, and navigate various information assymetries. Children often provide care for elderly parents, and several studies have suggested that there are important advantages for young children of having parents nearby.[3]

I establish the relationship between migration elasticities and levels of local ties using two types of labor demand shifters. The first, developed by Bartik (1991), projects national changes in employment onto local areas using employment shares in various industries based on the assumption that the initial industry shares are unrelated to changes in local labor supply (Goldsmith-Pinkham, Sorkin and Swift (2017)). The second, developed by Autor, Dorn and Hanson (2013), projects the impact of competition with Chinese firms onto local areas, also based on initial industry shares. After these labor demand shocks, I find that 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.

To show the importance of different migration elasticities for welfare, I use a sufficient statistics approach to analyze the impact of a local subsidy, meant to represent a number of policies that have different impacts across areas. In a general model of spatial equilibrium, a cash subsidy to an individual area will decrease welfare in proportion to its impact on where people live, which is measured by the migration elasticity. This generalizes several previous discussions of place based policies, since it provides general conditions that imply that the distortion will be a function of the size of the subsidy times the migration elasticity.[4] In addition to place based policies, the dynamic applies to other policies that are more generous to particular areas. The most obvious is the bias towards low productivity, high amenity, often declining areas that Albouy (2009) argues is inherent in the US income tax code.

To give some idea of how local ties develop, and how they impact spatial equilibrium in the long term, I analyze a parametric model of spatial equilibrium. In the model, people to have a distribution of preferences about their homes, and this leads to the selection dynamics that I mentioned above. Mobile people move to growing areas, while immobile people stay in their birth places. So, people with strong ties make up a larger proportion of the population in areas with declining populations. I calibrate the distribution of these ties, using indirect inference, to match differences in locals and non-locals' migration decisions across areas. When I allow the distribution

[2]Rappaport (2004) finds a similar dynamic, where even very small migration frictions can imply that adjustments take a long time in models of migration. Empirical studies by Bartik (1993) and Beaudry, Green and Sand (2014) also find that migration adjustments appear to be similarly slow.

[3]There are several relevant literatures in economics on many of these phenomena. Topa (2011) provides an overview of the literature on local networks and job referrals, which emphasizes the importance of both large social networks and geographic proximity in finding a job. Several papers examine how proximity can help to facilitate intergenerational transfers, either from parents to children, or children to parents. Examples include Konrad and Kunemund (2002), Hank (2007), Rainer and Siedler (2009), Kaplan (2012), and Coate (2013), Huttunen, Møen and Salvanes (2015), and Coate, Krolikowski and Zabek (2017).

[4]The formula are similar to those in Kline and Moretti (2014b).

of local ties to evolve with the distribution of current population, the model has a steady state where the distribution of local ties is irrelevant. An economy is unlikely to ever be very close to the steady state, however, since it can take several generations for ties to be fully re-allocated after a shock.[5]

This paper connects several literatures where both migration and spatial equilibrium play important roles. The most direct is the literature on the impact of internal migration on labor markets. Seminal papers in this literature include Sjaastad (1962), Blanchard and Katz (1992), Bound and Holzer (2000), Kennan and Walker (2011), and Moretti (2013). A very closely related literature examines the impacts of place based policies, including Glaeser and Gottlieb (2008), Busso, Gregory and Kline (2013), Kline and Moretti (2014b), and Neumark and Simpson (2015). Another relevant literature examines the determination of wages and rents in response to differences in productivity and amenities in spatial equilibrium, including Rosen (1979), Roback (1982), Topel (1986), and Albouy (2009). A literature on economic convergence within countries, including Barro et al. (1991), Alesina and Barro (2002), and Ganong and Shoag (2012), also emphasizes spatial equilibrium in a similar spirit.

The main contribution of this paper is to integrate several facts emerging from micro studies with aggregate spatial equilibrium. Several models, following from Kennan and Walker (2011), have begun to give a much more intricate picture of various factors affecting migration, including the importance of gross flows of migrants. One important fact that has emerged from these papers has been that people appear to value living in particular places, for seemingly idiosyncratic reasons. For example, Gregory (2013), finds that home owners were willing to pay significant amounts to continue living in New Orleans after Hurricane Katrina. Cadena and Kovak (2016) find that immigrants to the United States are much more likely to migrate for economic reasons than people who were born in the US. This highlights the importance of a relatively small group of migrants, as opposed to a larger group of people living closer to their homes, in establishing spatial equilibrium.

Several papers have also incorporated a more micro founded view of migration into models of spatial equilibrium within countries, though none have focused on local ties. Many of these have focused on modeling advances. For example, Coen-Pirani (2010), Davis, Fisher and Veracierto (2013), and Monras (2015) model gross flows of migrants, a distinction that is important for thinking about the importance of local ties. Another important advance was the estimation of a structural demand system, including endogenous amenities, by Diamond (2016). Like Diamond (2016), I use a mixed logit model with random coefficients, but unlike that paper I do not attempt to fully estimate it. Instead I rely on indirect inference to identify important parameters and a sufficient statistics approach.

Another important, related literature has focused on the measurement and implications of frictions in the supply of housing in particular areas. It can be difficult to supply new housing because of geography (Saiz (2010)) and zoning (Gyourko, Saiz and Summers (2008)). Ganong and Shoag (2012) and Hsieh and Moretti (2015), for example, argue that this is an important factor

[5] I do not model endogenous amenities.

limiting migration into more productive areas. Similarly, the durability of the existing housing stock can make the supply of housing quite inelastic in the short term (Glaeser and Gyourko (2005) and Notowidigdo (2011)).[6]

Local ties influence migration in a way that is distinct from the durability of housing, despite the fact that both can lead to small migration elasticities in places where population is declining.[7] The main piece of evidence for this is that labor demand shocks do not appear to have different effects on the price of housing in areas with different levels of local ties; this suggests that areas with stronger local ties do not necessarily have lower housing supply elasticities. Similarly, when I include several controls for the level of house prices, I still find that areas with higher levels of local ties have lower levels of migration after a shock.

Local ties can have meaningfully different implications than durable housing stocks. Even if housing is durable, it still depreciate at least 3 percent per year, and it is built in very specific lots. For example, it seems apparent that local ties should be more important than durable housing in the city of Detroit, whose population has declined by more than half since 1950. In the process of that decline, much of the housing stock has been destroyed either by nature, by vandalism, or through demolitions by the city.[8] The city's decline in population has not been accompanied by a decline in the population of the broader metropolitan statistical area, which has actually gained population since 1950. One explanation for the relative stability of the population of the MSA, and of many other MSA's, is that people's local ties kept them close to family and friends in the area, but not necessarily the city itself.

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 sufficient statistics analysis that links migration and welfare. Section four presents a way to endogenizing people's local ties to model longer term dynamics. Section five combines the model and the reduced form analysis to estimate labor supply elasticities and derive quantitative implications for policy. The final section concludes.

[6]Yet another related literature examines if householders holding negative equity on mortgages, after episodes of falling housing prices, discourage people from moving after negative shocks in particular areas. This literature includes Henley (1998), Ferreira, Gyourko and Tracy (2010), Modestino and Dennett (2012), and Valletta (2013), among others. Several papers find some effects, but these are generally fairly modest, especially for labor market outcomes (where the actions of renters can undo the actions of home owners).

[7]Ramey and Shapiro (2001) also show how business capital can also be quite durable, which would lead to similar dynamics on some, but not all, dimensions as a friction due to people's reluctance to move from their homes. For example, it is not clear why the durability of local business capital would lead to people leaving the labor force in larger numbers. Rappaport (2004), however, shows how this friction can lead to very slow population adjustments.

[8]The city has actually paid to destroy vacant housing, since many argue that it increases crime and poses a danger to public safety (e.g. Kurth and MacDonald (2015)). This destruction has left much of the city composed of green spaces, with occasional single family homes placed in oddly compact lots.

1 How local ties vary across areas

This section establishes two, perhaps under appreciated, stylized facts. The first is that areas have residents with very different levels of local ties. The second is that these local ties are primarily due to different levels of population growth, since areas grow by attracting people with weaker local ties. In later sections, I show how these differences are empirically important, and I introduce a model to trace out their implications over the long term.

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.[9] 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.

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)). In addition to the ACS, I use a measure of the impacts of international trade on local labor markets, coming from Autor, Dorn and Hanson (2013), and 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 spec-

[9] 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.

ifications 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 in the past year. I report prices in 2007 dollars using the PCE deflator, and I weight all wages using labor supply weights. Appendix A provides more details.

Breaking changes into locals and outsiders

To show the effects of people's local ties, I break changes in population into changes in the population of people who were born nearby and the population of people who were born elsewhere, including people born in 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 many different areas. 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, which implies that any increase in population will be accompanied by an increase in the number of migrants equal to about three quarters of that amount. 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 4.

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, fewer than 20 percent of residents were born in the same state, while more than 80 percent of residents were in others.

Figure 3 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 increased 100 percent between 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.[10] 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 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 4, 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.[11] 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 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

[10]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.

[11]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 (Arons (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.

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, so the differences are not driven by much larger changes in rents in declining areas.

Outcomes

To understand how areas adjust to labor demand shocks, I decompose the impacts of labor demand shocks between prices and labor supply.[12] This allows me to distinguish between population reallocation, 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 5 illustrates the effects of a labor demand shock on employment and wages.[13] 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 5 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 migra-

[12]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 Monras (2015) 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.

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

tion 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 labor 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 migration ($E - F$) 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.[14] 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.

Shifters

I use two separate shift share instruments to isolate 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 $t-1$.[15]

The Bartik instrument is a good choice in that it has enough variation to ensure some power, and in 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

[14] 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.

[15] 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.

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.

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

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.[16]

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

[16] 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.

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 ($\mathbf{1}_H = 1$).[17] Roughly 10 year changes in the outcomes are linear functions of these shifters and an extensive series of controls:

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

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.[18] 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.[19] 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:

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

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

[17] 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.

[18] 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.

[19] 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.

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. 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.[20]

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

[20]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.

areas with higher levels of ties.[21] 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.

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.[22] 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.

[21] 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.

[22] 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.

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 make migration slower in places where people have higher ties, and that these have implications for welfare.[23] 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 model's structure, combined with these estimates, to calculate migration elasticities after Bartik shocks in the 1980's and increases in Chinese trade in the 1990's and early 2000's.

3 Connecting migration to welfare

Migration elasticities determine local levels of welfare in spatial equilibrium. Higher migration elasticities imply that equal sized changes in labor demand will have smaller effects on wages and other margins of adjustment, like people dropping out of the labor force. Migration also impacts welfare after a subsidy to a particular area. If migration is large enough, then it will undo the effects, in terms of welfare, of a local subsidy. The literature on place based policies, surveyed by Glaeser and Gottlieb (2008) and Neumark and Simpson (2015), very much emphasizes this dynamic.

Here I use a sufficient statistics approach, applicable to most models of spatial equilibrium, to show how migration determines the welfare implications of spending in local areas. The logic

[23]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 4, 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.

is straightforward, and it relates to arguments originally made by Harberger (1964); a subsidy to a local areas induces misallocations in the form of people moving into that area, when they would prefer to live other places. This misallocation, as it turns out, is actually the only effect on total welfare, since the envelope theorem will apply to any model that begins in undistorted equilibrium.[24] The application of the envelope theorem, and the summing of total welfare, mean that this is actually a fairly straightforward application of the sufficient statistics techniques (Chetty (2009)).

To show that migration elasticities are sufficient statistics for welfare, consider the effects of a local stimulus in a general model of spatial equilibrium. For simplicity, I focus on a cash transfer to an area.[25] In the model, I have five actors: workers, landlords, local firms, a national firm, and a national government. The model is in undistorted spatial equilibrium, before a subsidy is enacted for a particular area, paid for with lump sum taxes levied on other areas.

I add up the welfare of each agent, each converted to a money metric, to provide a measure of total welfare in the economy. For many of the agents, utility can already be thought of in terms of a money metric – profits. For workers, however, I need to convert utility into a money metric. To do this, I use an indirect compensation function, as defined in Varian (1984). Using this construct gives me a measure of equivalent variation due to a change in prices.

For worker i, the indirect compensation function, $m_i(w_1, r_1, g_1; w_0, r_0, g_0)$, is a function of an initial menu of wages (w_0), rents (r_0), and governmental subsidies (g_0) across areas, as well as another, counterfactual menu of new wages (w_1), rents (r_1), and subsidies (g_1). $m_i(w_1, r_1, g_1; w_0, r_0, g_0)$ measures the additional income needed, at the initial wages, rents, and subsidies to have equal utility as at a new set of wages, rents, and subsidies. E.g. it measures equivalent variation the change in

[24]To my knowledge, the first paper to note that the envelope theorem applied in spatial equilibrium was Busso, Gregory and Kline (2013). Kline and Moretti (2014b) present the idea in the context of a particular parametric model, that provides a good amount of intuition about the effects. Some models, such as the one contained in Suárez Serrato and Zidar (2014), do contain distortions that make the envelope theorem inapplicable. Presumably, however, the literature on analyzing dead weight losses in the presence of other distortions, enjoyably reviewed in Hines (1999), could also give some guidance.

[25]Other programs should have similar dynamics in terms of migration, so I have not focused on them here. The most obvious distinction is that other consumption focused programs would have a cost that might not exactly equal its benefit to residents. E.g. the public goods that they provide may be worth more, or less, than the cost of providing them. The welfare implications of polcies that focus on increasing local firm productivity, or drawing local firms, will similarly depend on migration elasticities, as I show in the context of my parametric model below. I do not attempt to expand my argument to them here, but it should be a straightforward exercise.

wages, rent, and subsidies.[26]

For local landlords, local firms, and national firms, profits will vary depending on the price of inputs and outputs. Landlord's profits are an increasing function of the level of rents, $\pi_j^H(r_{1,j})$, where j denotes a local area. The assumption is that landlords will develop all parcels of land where the cost is lower than $r_{1,j}$, and gain positive profits off the cheapest parcels of land to develop. In keeping with much of the literature, they do not use labor in the production process. Local firm profits depend on the cost of labor locally, as well as the price of the local good that they sell, $\pi_j^Y((w_{1,j}, p_{1,j})$. Similarly, the national firm's profits depend on the price of the tradeable consumption good (normalized to one), relative to the local goods used to make it (p_1).

Taking all of these components, and adding in the cost of providing subsidies ($\sum_j g_{1,j} N_{1,j}$, which ignores distortions in raising the tax revenues for a subsidy), gives the total amount of welfare in the model. Note that I have allowed all of these sub-components to have very general functional forms:

$$W(w_1, r_1, p_1, g_1) = \sum_i m_i(w_1, r_1, g_1; w_0, r_0, g_0) + \sum_j \left[\pi_j^H(r_{1,j}) + \pi_j^Y(w_{1,j}, p_{1,j}) - g_{1,j} N_{1,j}\right] + \pi^Y(p_1) \tag{3}$$

In this setup, the relevant comparative static is the effect of an increase in $g_{1,j}$, relative to $g_{0,j} \equiv 0$, on total welfare. An increase in $g_{1,j}$ is literally a cash subsidy to a local area, like the implied subsidy inherent in the income tax system (Albouy (2009)), but it could also be thought of as a program that benefits residents exactly as it costs to implement. In this way they could be programs to improve public spaces, investments in public schools, investments in residential streets, or even programs to pay the college tuitions of the area's children (e.g. the Kalamzoo promise program in Kalamazoo Michigan). These programs may have higher, or lower, values to residents than the cost of implementing them. None the less, I assume that these costs and benefits balance out, since it is a reasonable starting point for studying a general program, without basing too many conclusions on the specific details of its implementation.

The effect of an increase in $g_{1,j}$ on total welfare is the total derivative of equation 3 with respect to this increase in $g_{1,j}$, so it takes into account migration, as well as readjustments due to changes in equilibrium prices. As originally noted by Busso, Gregory and Kline (2013), however, the envelope

[26] Compensation functions, also called money-metric utility functions, are described in a more general context in Varian (1984) and more formally in Chipman and Moore (1980) . In this case, I use what Chipman and Moore (1980) calls "generalized equivalent variation" to measure welfare, since I am interested in changes from a fixed equilibrium. I follow the literature on spatial equilibrium in performing this money metric aggregation while describing distributional effects by showing impacts on workers, landlords, and firms separately. Note that converting to a money metric and aggregating can be more problematic that it may at first appear. For example, converting to a money metric treats money going to all people equally, ignoring differences in marginal utilities of income and preferences about equality. These different marginal utilities are highlighted in Glaeser, Gyourko and Saiz (2008) and distinguishes their setup from later work. Blackorby and Donaldson (1990) formalizes this point and summarizes a large body of work in welfare economics that identifies other problems with the approach, even where equalizing transfers are feasible. Allowing different weights, based on either equality concerns or some idea of marginal utility, might allow local subsidies to increase social welfare, which they never do in this framework. Determining appropriate social welfare weights, of course, is problematic (e.g. Arrow (1950)).

theorem will apply in this case. Each agent will only want to make very small adjustments in their behavior, since the small change in prices brought on by the program will still leave them quite close to an optimum. This means that I can ignore the effects of re-optimization, since these will have minimal impacts on welfare.[27]

The first equation below shows the other effects, which are due to two different types of changes. The first change is in the number of people in the area, which will increase the subsidy payment, since now there are more people to compensate. The envelope theorem, however, means that we do not need to consider differences in people's welfare as they move, since people who chose to migrate feel that the new area is only marginally better. The second change is in various prices. The changes in prices will mean that some actors will do better than others. For example, if wages fall in response to increased population, then local firms will have lower costs that are exactly equal to the lower level of compensation for local workers. I break out formula for each actor in the appendix.

$$\begin{aligned}\frac{dW}{dg_{1,j}} = & \sum_{j'}\left[\left(H_{j'} - N_{j'}h_{j'}\right)\tfrac{dr_{1,j'}}{dg_{1,j'}} + \left(N_{j'} - N_{j'}\right)\tfrac{dw_{1,j'}}{dg_{1,j'}} + \left(Y_{j'} - Y_{j'}\right)\tfrac{dp_{1,j'}}{dg_{1,j'}}\right] + \left(N_{j'} - N_{j'}\right) - \tfrac{dN_j}{dg_{1,j}}g_{1,j} \\ = & -\tfrac{dN_j}{dg_{1,j}}g_{1,j}\end{aligned}$$

where $H_{j'}$ is the total amount of housing, $N_{j'}$ is the total population, $Y_{j'}$ is the total production of the local good, and $h_{j'}$ is the total amount of housing purchased per worker in area j'. Each of these terms measures the total amount of a good purchased (housing, labor, and the final good) in area j' and multiplying it by the change in its price. Note that I have omitted the before and after subscripts for simplicity.

Since both the buyer and the seller are on equal terms here, however, the transfers all cancel out and the welfare impact only depends on a single term. This term, $(N_{j'} - N_{j'})$ gives the subsidy payment to workers in the area, minus the cost of that payment for people already residing in the area.

The fact that the price changes only entail transfers from one party to another means that all of these effects will cancel, leaving only the effect of population changes on the tax necessary to finance the subsidy. This happens in the second line, and it makes the connection to Harberger (1964). The welfare impact of the subsidy is negative and equal to the size of the distortion that it induces in people's choices about where they would like to live, since some of the subsidy goes to paying to relocate people to places they would not otherwise live.

Figure 6 gives a graphical interpretation of this distortion. It plots the total population of an area, on the x axis, against the subsidy paid to residents, on the y axis. The shaded triangle, labeled DWL, gives the size of the welfare loss, or the dead weight loss. This triangle is the integral of the additional population attracted by the subsidy times the subsidy payment that goes to making

[27] While this model is quite general, it does not include some other dynamics, like frictional unemployment. Schmieder and von Wachter (2016) show how this logic can be extended to frictional unemployment, and how adjustments in terms of search effort (and job finding rates) would similarly drop out of the calculation.

them indifferent towards living there. Since they gain no utility from this portion of this subsidy, this portion does not increase anyone's welfare.

In a wide class of models of spatial equilibrium, the welfare implications of a local subsidy are proportional to the subsidy's effect on migration. Even in models where there are other distortions, or where the programs are more complicated, this will be an important effect. Noting this regularity, and its limits, gives a simple way of thinking about how various public policies impact the distribution of welfare across areas. It formalizes the idea that we should be concerned about population reallocation in response to local subsidies. In a world where areas have different migration elasticities, the formula shows whether it is feasible to change welfare through governmental action in a particular area.

The rest of this paper goes into more depth to attempt to understand why there may be different migration elasticities across areas in the US, and to measure these migration elasticities and convert them into estimates of the size of the distortions created by particular policies.

4 Model

A parametric model formalizes and extends the intuitions laid out above. It specifies how areas develop different levels of local ties, how different levels of local ties lead to different migration elasticities, and how local ties may be reallocated over time. The model also allows me to distinguish between equilibrium in the steady state and in the short and medium run. Previous shocks have no relevance for the model's steady state, since ties are able to be completely reallocated, as with models that do not include local ties. The steady state takes a long tie to reach, however, and ties are extremely relevant in the interim.

In the model, different levels of local ties are a consequence of population growth, and local ties lead to different migration elasticities across areas. In the short run, negatively shocked areas can become unattractive to outsiders, while still retaining workers with local ties. This makes their migration elasticities low; outsiders are reluctant to move in and locals are reluctant to move out.[28]

Local ties can be reallocated, but the reallocation takes several generations.[29] People move to areas after favorable shocks, and they have children who become tied to these areas. In this way, children's local ties reflect these changes in local productivity and amenities. Permanent subsidies are undesirable, since they keep population from being fully reallocated. Subsidies that last for a generation, however, can subsidize areas without affecting migration by very much. Similarly, if changes in amenities or productivity are only temporary, then it may be socially desirable to retain the previous distribution of local ties.

[28]Since there are always gross flows of locals moving out and outsiders moving in, migration elasticities are symmetric across small positive and negative shocks. So, a small increase and a small decrease in wages and/or amenities will have an effects that are of approximately equal magnitude. Population changes have a non-linear relationship with the size of the underlying changes, however. In general, the first half of a decrease in productivity will change population by more than the second half, since the migration elasticity will smaller for the second half.

[29]Rappaport (2004) finds that reallocation can occur very slowly in models with relatively small frictions to capital, or labor, reallocation in the form of convex adjustment costs.

The remainder of this section presents the model, its calibration, and its implications in the short and long run. First, I present the model's setting, the various agents who interact in the model, the problems agents solve, and the resulting equations that describe the model's equilibrium. Next, I show how migration elasticities incorporate both the traditional mechanism of rents rising to discourage additional migration, and also local ties affecting migration, through a term connected to how selected the average resident is. This illustrates how local ties form, and how they impact migration elasticities. The following section presents the model's calibration, using indirect inference and off the shelf parameters. The final two subsections present the short and long run implications of including local ties in the model. The short and long run implications link the model to my reduced form results and provide longer term implications of including local ties in a model of spatial equilibrium.

Setting, agents, and equilibrium

The model is in spatial equilibrium, with a large number of areas, indexed by j, that individual workers, indexed by i, are free to move between in each period. Workers have ties to their home areas, indexed by k. I model these ties using a parametric distribution of amenity values that workers enjoy if they live in their homes (where $j = k$). Each area also has an amenity value, a_j, that applies to both locals and outsiders. Local firms offer wages, w_j, based on levels of local productivity, and the prices a national firm pays to combine local goods into a tradeable consumption good. Landlords charge rents, r_j, based on the scarcity of land in an area. The interesting counterfactual relates to the impact of government subsidies, g_j.

I distinguish between equilibrium in the short and long run. In the short run, people's local ties are fixed, so population adjustments are limited by people's local ties. In keeping with my empirical approach, I assume that these are proportional to where people were born, and that the initial distribution of population determines these birth places. In the long run, however, I allow local ties to adjust with population changes, and I show that this leads to a steady state.

Worker's problem

For a worker of type i, living in area j, and with home area k, utility is Cobb-Douglas in a final consumption good c_j (with a price normalized to one) and housing h_j.[30]

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

With a corresponding budget constraint (taking into account government subsidies, (g_j):

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

The μ_i term is a random coefficient describing a worker's preference for their home. μ_i depends on on the worker's unobserved type i; it allows me to specify the distribution of preferences for

[30]I have omitted time subscripts for parsimony, because the problem is static once one considers workers' local ties.

residing in one's home, or the distribution of people's local ties. I assume that all areas have the same initial distribution of local ties. A sorting process, similar to the one I document in Section 1, will make it so that some areas will have residents who have stronger local ties, however.[31]

The government provides a net subsidy, g_j, to workers. People also gain utility from general local amenities A_j and an area specific error term ξ_{ij}. Following 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 above implies a log linear indirect utility function.

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

If ξ_{ij} is distributed type one extreme value, then the likelihood that a person of type i, with home k, locates in area j, which I denote with ψ_{ijk}, takes on a very convenient form.

$$\psi_{ijk} = \frac{\exp(\omega_{ijk}/\sigma_\xi)}{\sum_{j' \in J} \exp(\omega_{ij'k}/\sigma_\xi)} \tag{4}$$

where ω_{ijk} is the worker's utility in area j, excluding ξ_{ij}, and the σ_ξ term is a measure of the variance of ξ_{ij}.

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, with local labor, N_j, to produce Y_j of the local good. The production function is parameterized as:

$$\begin{aligned} Y_j &= f(\theta_j, K_j, N_j) \\ &= \theta_j K_j^{\alpha^Y} N_j^{1-\alpha^Y} \end{aligned}$$

θ_j is a area specific productivity term.

National firm

A perfectly competitive national firm produces the tradeable consumption good out of each local good. It buys each local good at a price of p_j, and sells the tradeabale good at a price of one.

[31]Details of my empirical implementation of the μ_i term are provided in the calibration section. I use a normal distribution, with a mean and variance that I calibrate using indirect inference. Train (2009) provides an introduction to logit and mixed logit (random coefficient) models, including details of their development in describing substitution patterns in consumer demand for products.

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

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

Government

The government can provide subsidies (net of taxes) to workers living in each area, g_j. The subsidy represents programs that are either directly or indirectly targeted to certain areas, as well as the taxes that pay for them. The largest subsidies are likely to be due to a lack of adjustments for local prices in both the tax code (Albouy (2009)) and in means based programs (Notowidigdo (2011)).[32] Spending on transportation infrastructure, grants to provide utilities, state and federal grants for education, and explicitly place based policies, like federal neighborhood improvement grants, could also be included in g_j. For simplicity, I assume that these programs are valued by residents at the cost it takes to provide them.

Since the government has to balance its budget, the following equation must hold.

$$\sum_j g_j N_j = 0$$

Housing market

The housing good h_j in a local area represents both housing and non-tradeable local goods and services. 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, who develop plots of land that can be turned into housing at monotonically increasing marginal costs.[33] 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:

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

Where η^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:

[32] The subsidies are likely the most policy relevant in declining areas. Albouy (2009) notes that progressive tax rates subsidize people living in less productive places, since they do not adjust for local prices. A similar argument applies to other means tested programs. This bias is often by design. For example, the governing documents of the European Union explicitly allow national governments to pursue place based policies to "promote the economic development of areas where the standard of living is abnormally low" (Article 107 of EU (2012)).

[33] Another interpretation of the absentee landlord assumption is that households own their houses but effectively rent their houses to themselves each period. Most notably, this assumption it abstracts from the investment motive for owning a home. Zhang (2016) gives some analysis of the investment role of housing, separating it out from consumption choices, to some extent. There is a more applied literature on a specific implication of the financial role of housing – housing lock in. In the appendix, I give a brief overview of the literature on housing lock in.

$$H_j^D = \frac{\alpha^H w_j N_j}{r_j}$$

Equilibrium

Equilibrium is a set of prices and quantities (p_j, w_j, r_j, N_j) where markets clear, and agents have solved their individual problems. It obeys the following equations:

Labor market supply and demand locally:

$$N_j = \sum_{j' \in J} \sum_{k' \in K} \psi_{i'jk'} N_{i'k'} \tag{5}$$

$$w_j = (1 - \alpha^Y)(p_j \theta_j)^{1/(1-\alpha^Y)} \left(\frac{\alpha^Y}{\rho} \right)^{\alpha^Y/(1-\alpha^Y)} \tag{6}$$

Equilibrium in the housing market and equilibrium in the market for the local good:

$$r_j = \left[\alpha^H w_j N_j \right]^{\frac{1}{1+\eta^H}} \tag{7}$$

$$\theta_j N_j \left(\frac{p_j \theta_j \alpha^Y}{\rho} \right)^{1/(1-\alpha^Y)} = Y \frac{\phi_j}{p_j^{\eta^Y}} \tag{8}$$

Migration responses

The migration elasticity, analytically derived from the motel and shown below, reveals the influence of local ties as well as the more typical influences of housing supply in a Rosen-Roback framework.

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

There are two distinct factors that determine the elasticity: The first term is the traditional Rosen-Roback mechanism of increases in wages causing increases in rents. 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 term measures the influence of worker preferences, and it is inversely proportional to residents' local ties. To see this, strip away the effects of prices by considering the impact of an increase in log wages, with rents unchanged.

$$\frac{d \ln(N_j)}{dln(w_j + g_j)} = \frac{(1 - \bar{\psi}_j)}{\sigma_\xi} \tag{10}$$

The denominator shows a dynamic that is typical in models of spatial equilibrium; migration elasticities decrease when people have stronger idiosyncratic preferences. The spread of the person by area is given by σ_ξ, so as the spread widens, the migration elasticity decreases.

The numerator shows how local ties influence migration elasticities, since it is a decreasing function of $\bar{\psi}_j$. Equation 4 defines $\bar{\psi}_j$: it is the ratio of ω_{ijk} terms in area j over the sum of $\omega_{ij'k}$ terms in every area, averaged over all residents of area j. Intuitively $\bar{\psi}_j$ will be higher if more residents are inframarginal, or if they greatly prefer area j over all other areas. This implies that areas with many locally born residents will have lower migration elasticities, since these residents tend to have higher values of μ_i, so they have idiosyncratically high preferences to reside in area j. I show how this is the case both for the calibrated model and in empirical regressions later in the paper.[34]

Calibration

To calibrate the model I use a mixture of off the shelf parameters as well as an indirect inference procedure. 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.[35]

I implement the indirect inference procedure in two steps. First, I set the share of people who are foreign born, as well as the spread of ξ. These two parameters, along with the two parameters defining the distribution of μ_i, are the only parameters in the model that will affect the moments that I target. I set σ_ξ to 0.4, which produces average elasticities close to those found by Suárez Serrato and Zidar (2014) and I assume that 13 percent of workers are foreign born, based on current population statistics.[36] The second step is to simulate a series of productivity draws and match the estimated relationship of locals staying and outsiders moving in, shown in Appendix Table A4, as well as approximately 65 percent of workers staying in their homes. Table 5 shows the implied

[34] The functional form of ξ_{ijk} tends to work against this result. For individuals, the logit error structure implies that workers with a 50 percent probability of residing in an area (based on observables) will be the most responsive to changes in real wages. This is at odds with the findings in the first section that workers are unresponsive to changes in general amenities of their home areas, and that workers have a roughly 50 percent change of living in their home state. Since the structure of the logit model seems to make an unrealistic functional form assumption about individual migration elasticities, it is particularly important that the μ_i terms have a distribution of values. If the μ_i terms all had the same value, then this would actually make the migration elasticities of locals higher than those of outsiders.

[35] 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.

paramters.

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^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^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^H is the functional form of the supply curve. It is possible that the housing supply curve is kinked since housing is a durable good. Glaeser and Gyourko (2005) and Notowidigdo (2011) argue that this is an important concern, particularly for small areas and for rapid declines. However, Davis, Fisher and Veracierto (2013) find that it plays a limited role.

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 all the same at the beginning of the model, so they all have an equal (normalized) population. Across all of these areas I set the location specific terms (A_j, θ_j, 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.[37]

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 3 I plot population changes (this time due to changes in local productivity A_j) and the share of locals. The black line shows the model's predictions, while the grey circles show values for all continental CZ's. The model does a fairly good job of predicting this relationship.[38]

[36]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.

[37]For the exercises below, however, I present responses after shifting one of these values, θ_j in one area.

[38]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.

Short run implications

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.[39] 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. Thus, deadweight losses from a regional subsidy will be three times larger in this area.

Long run implications

This subsection specifies how the model re-allocates local ties, to examines the implications of local ties in the long run. I allow local ties to be formed in proportion to current population, as the population is gradually replaced with children who grow up in areas that their parents have moved into. Since this takes time, it means that one time shocks can have effects well into the future. There is an initial response to each shock, and then a long, delayed response as local ties develop in proportion to the shock. Eventually, the model reaches a steady state, where ties have been re-allocated according to each area's productivity and amenities.

The main implication of including this process is that it is extremely slow. The model takes several generations to approach a steady state after a permanent shock. This is so long that even relatively modest levels of mean reversion in productivity and/or amenities can overturn the result that subsidies to places are undesirable after a negative shock. Even if negative shocks are permanent, a generation long program to subsidize specific areas will not change migration by very much.

Method The law of motion for the number of people born in area k, specified below, implies that ties are formed proportionate to the population of each area. The first term specifies that a fixed proportion, s_D, of the population will effectively die and have their ties reallocated in each period. The additional s_D ties are allocated according to the current population. For area k, current population is $\sum_{k'} N_{kk'}$. The $\frac{s_D}{1+s_F}$ term specifies the s_D ties are reallocated so that there is a constant population where a constant proportion is foreign born.

[39] 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.

$$N'_k = N_k(1 - s_D) + \sum_{k'} N_{kk'} \frac{s_D}{1 + s_F}$$

To keep the model simple, I assume that the destruction of local ties is random, and that workers do not have preferences about the distribution of local ties. $s_D N$ workers die in each period, to be replaced with children whose preferences they do not seek to influence. This is very helpful in terms of making the model tractable. Since the deaths are random, there is no impact on the shape of the distribution of μ_i. Since workers do not attempt to influence the distribution of local ties, I can continue to solve the model according to the earlier equations, which are specified conditional on the current distribution of local ties.

While it is a strong assumption, there are reasons to suspect that workers lack strong preferences about the distribution of local ties after s_D has arrived. One way of rationalizing this is to assert that parents act as if their children will have the same preferences that they do, or that their choices about where to live have a very small impact on their children's local ties.[40] Another is to assert that parents are think about forming local ties in a way that is myopic, behaving as if either they can not influence their family's local ties, or they cannot forecast future conditions well enough to make such a long term decision.

The model will be in a steady state if the following equation is satisfied. Essentially, the number of people who were born in the area is equal to the population over one plus the share of foreign born people in the country. It is straightforward to show that it is stable and unique.

$$N_k = \frac{\sum_{k'} N_{kk'}}{1 + s_F}$$

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 θ_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 of how long these adjustments take to play out, I set s_D to equate to an 80 year lifespan. I use the model'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

[40] Bruce Springsteen's song "My Hometown," from the album Born in the U.S.A., shows how this might be true. The song ends with the singer driving his son around his hometown, after he has decided to move the family. He tells his son that this town is "your hometown," regardless of where the family goes.

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.[41] If this is true, then I can show losses in utility due to distortions in people's birth places as:

$$\mathrm{CS}_{ijk} \frac{N_{ijk}^S - N_{ijk}}{\mathrm{MU}_{ijk}} \tag{11}$$

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 11) 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.[42] I present 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

[41] 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.

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

5 Parameter estimates

This section uses the reduced form of the model to estimate the implied migration elasticities and the corresponding welfare trade offs for place based policies.[43] 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 migration elasticity is a function function of the reduced form of the model, the model analogue to the reduced form regressions that I presented earlier:

$$\begin{bmatrix} \Delta\text{Wages} \\ \Delta\text{Population} \\ \Delta\text{Rents} \end{bmatrix} = \alpha + \left(\begin{bmatrix} \beta_{H,\text{Wages}} \\ \beta_{H,\text{Population}} \\ \beta_{H,\text{Rents}} \end{bmatrix} \mathbf{1}_H + \begin{bmatrix} \beta_{L,\text{Wages}} \\ \beta_{L,\text{Population}} \\ \beta_{L,\text{Rents}} \end{bmatrix} \mathbf{1}_L \right) \begin{bmatrix} \Delta L & 0 & 0 \end{bmatrix} + \gamma_L \mathbf{1}_L + \gamma_H \mathbf{1}_H + \gamma_X X + \epsilon \tag{12}$$

I include the same controls X as in earlier sections, and I use a cluster bootstrap, by state, to obtain standard errors that take into account the data's clustering as well as the correlation of coefficients across specifications. I use equation by equation OLS, which is the same as a seemingly unrelated regression in this case.

The migration elasticity, is simply the effect of the demand shift, in terms of the log change in population, divided by the log change in wages induced by the shifter. The results almost directly follows form the definition of a migration elasticity and an (exogenous) shock to labor demand:

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

Proof. See appendix □

[42] 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).

[43] 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.

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.

The estimated migration elasticities in Table 6 confirm the earlier intuition, and are of a similar magnitude to the estimates from the model. 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.

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.

Table 7 shows that migration elasticities are important determinants of the welfare impact of a place based policy. Where migration elasticities are high, 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.

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.[44]

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.

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[44]Examples of studies of direct policies include Busso, Gregory and Kline (2013) (Enterprise Zones), Kline and Moretti (2014a) (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.

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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 7: Impacts of place based policies

Size of subsidy	**Migration elasticity** 10	**5**	**2.5**	**1**	**0.5**	**0**
20%	100.0	50.0	25.0	10.0	5.0	0.0
10%	50.0	$\boxed{25.0}$	12.5	$\boxed{5.0}$	2.5	0.0
5%	25.0	12.5	6.3	2.5	1.3	0.0
1%	5.0	2.5	1.3	0.5	0.3	0.0

Note: The table shows the size of deadweight losses brought on by a subsidy for differently sized migration elasticities (columns) and per person subsidies. The deadweight losses are measured as a percentage of the size of the subsidy, and the size of the subsidy is as a percentage of per capita income. The highlighted values are the dead weight losses that would apply for a 10 percent subsidy to an area with low ties, and the same subsidy to an area with high ties.

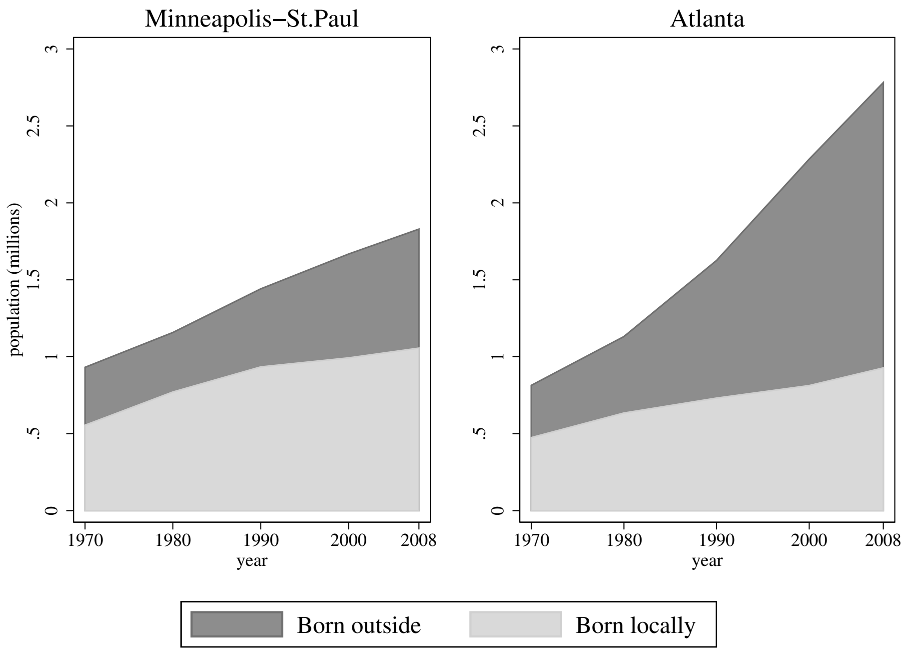
Table 8: Preference distortion calculations

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 11) 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)

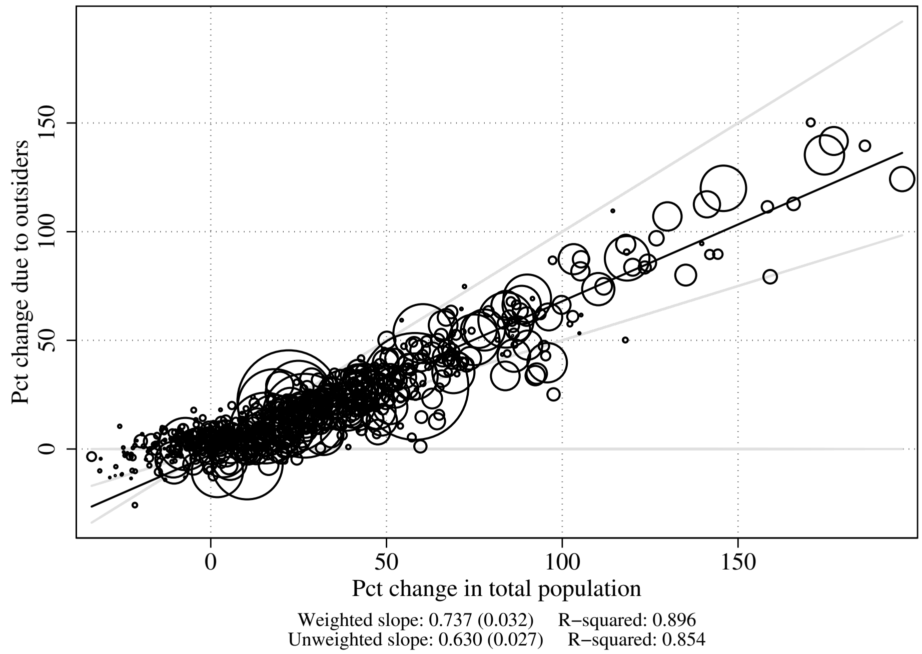
Figures

Figure 1: Population changes in two commuting zones



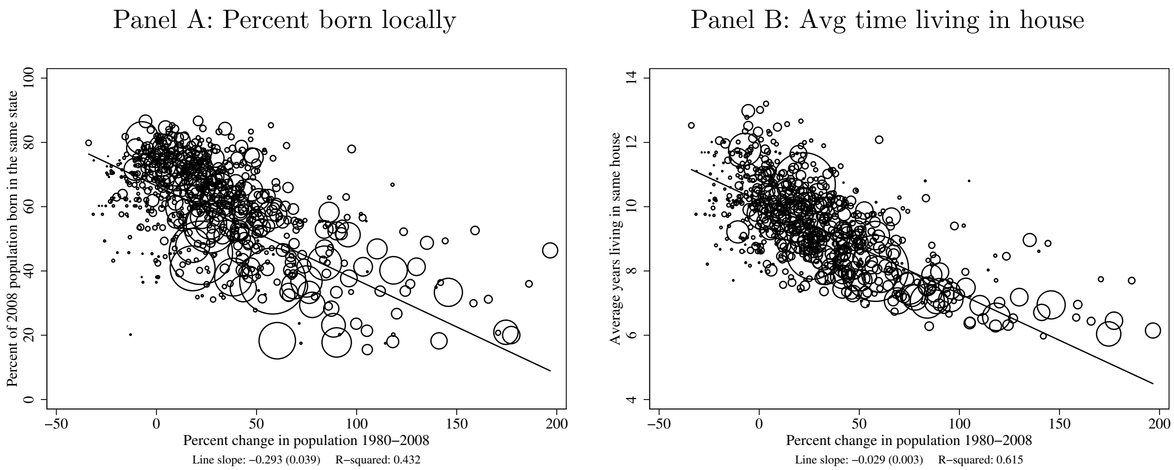
Notes: Data are from the long form decennial census and the ACS 3 year estimates (2006-2008) and are weighted to be nationally representative. Minneapolis-St.Paul and Atlanta are 1990 commuting zones 21501 and 9100. Locals are people who are born in the state they are living in (Minnesota or Georgia),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

Figure 2: Changes in population due to outsiders moving in



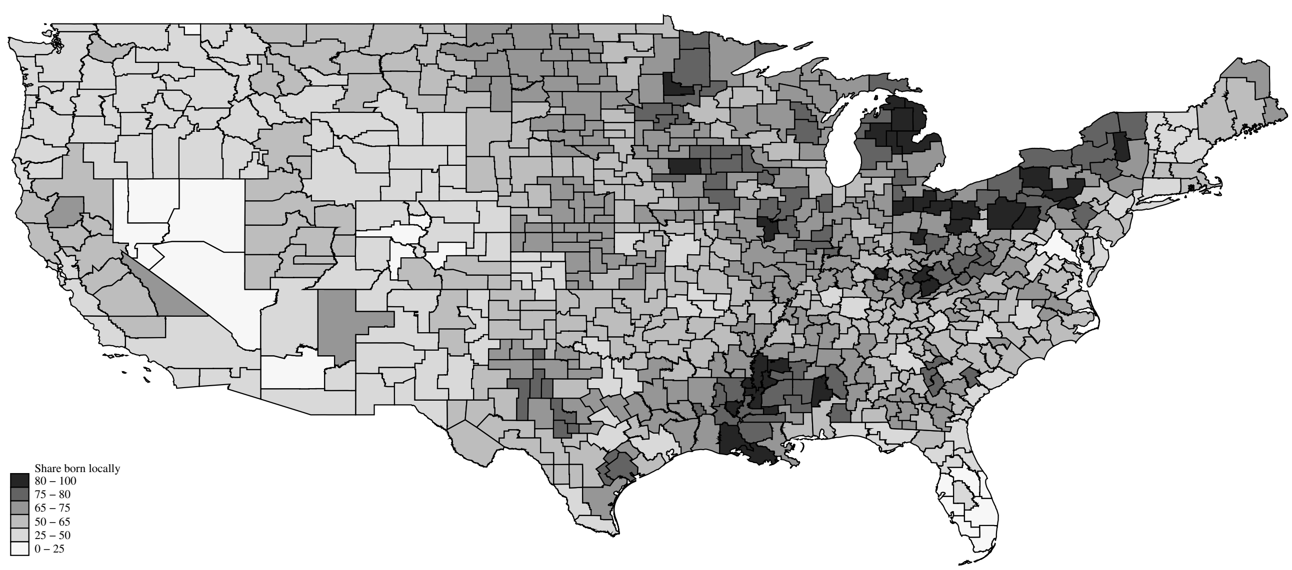
Notes: Plotted are the percentage change in population from 1980 to 2008 (x-axis), and the change in the number of people in the commuting zone who live outside their state of birth as a percentage of the total population (y-axis). Data are from the 1980 decennial census and the ACS 3 year estimates (2006-2008) and are weighted to be nationally representative. The unit of observation is a commuting zone within the continental United States. To make the figure easier to read, it does not include a small number of commuting zones where the total change in population was over 200 percent. The reported coefficients include them, however, with robust standard errors in parenthesis.

Figure 3: Population changes and measures of local ties



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 4: 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 5: Effects of a labor demand shock along multiple margins

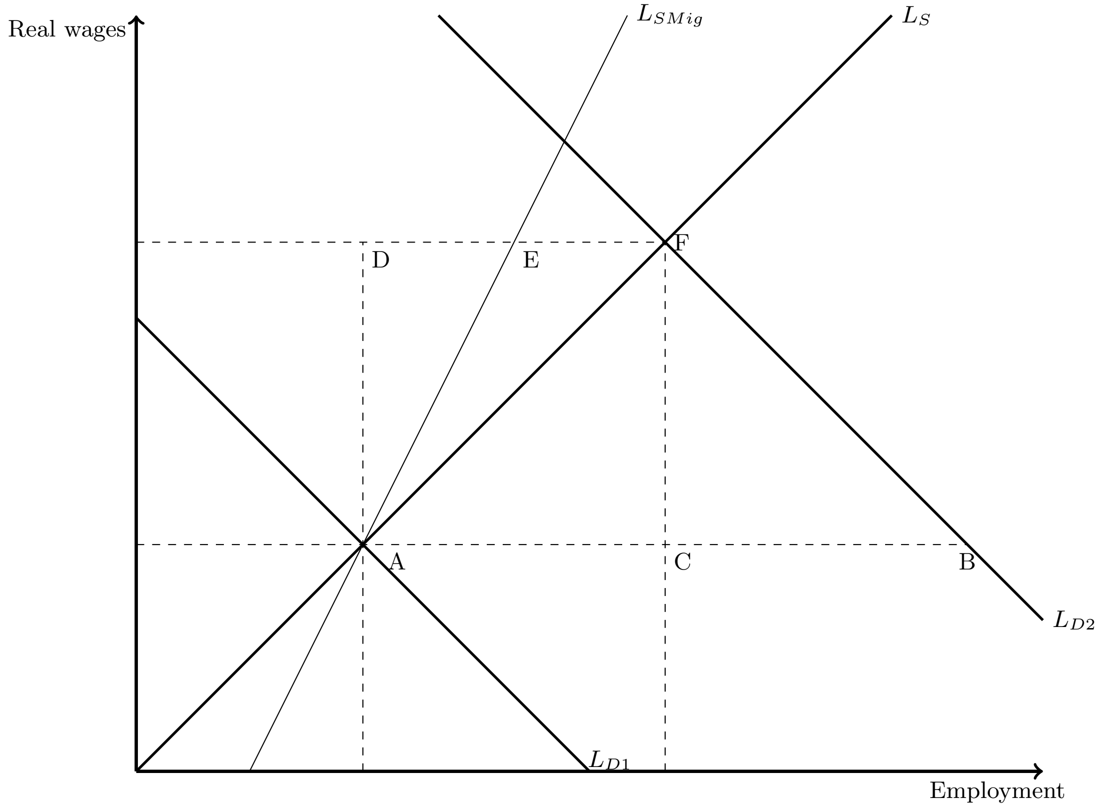


Figure 6: Dead weight loss due to a location specific subsidy

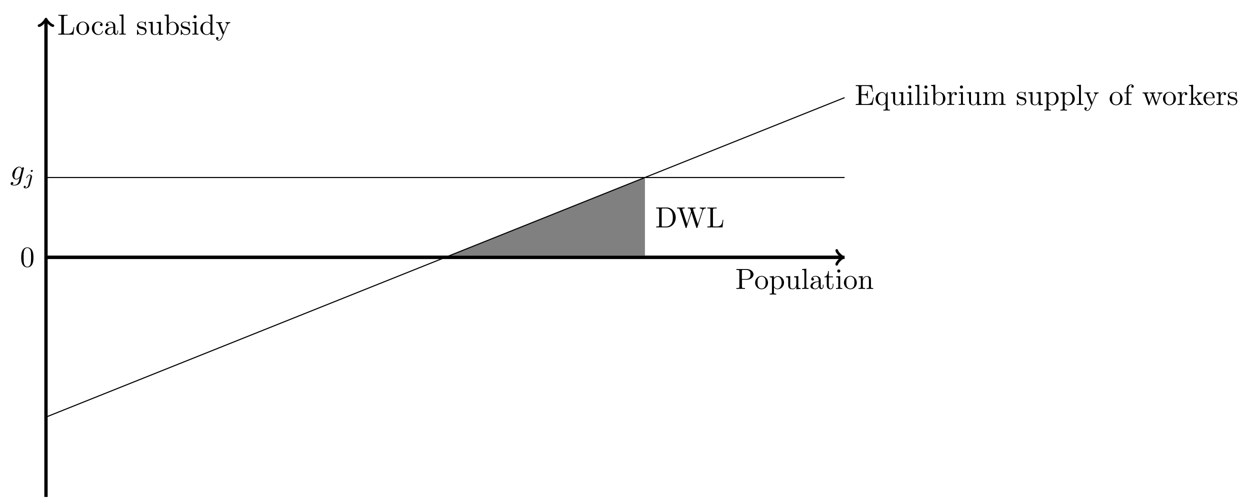
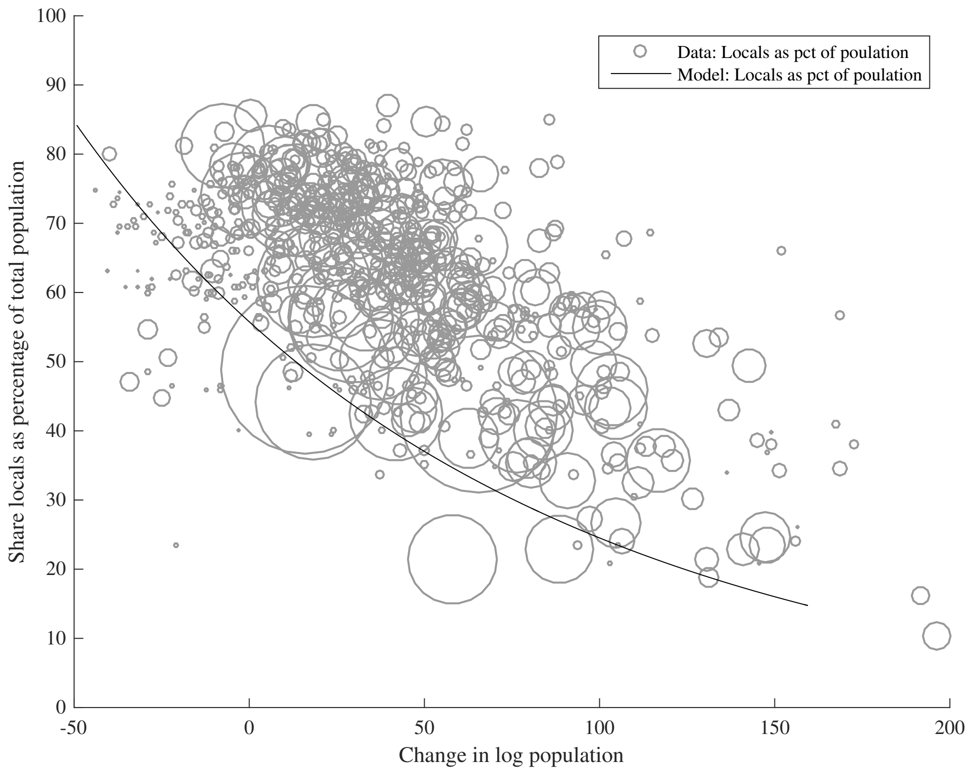
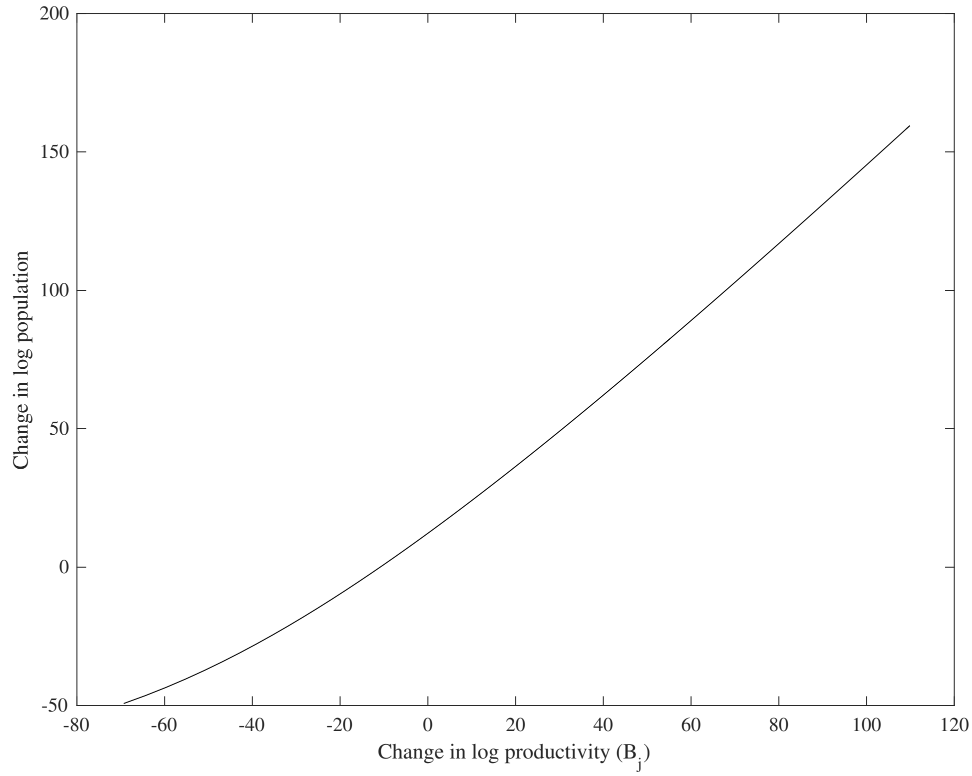


Figure 7: Share locals and population changes



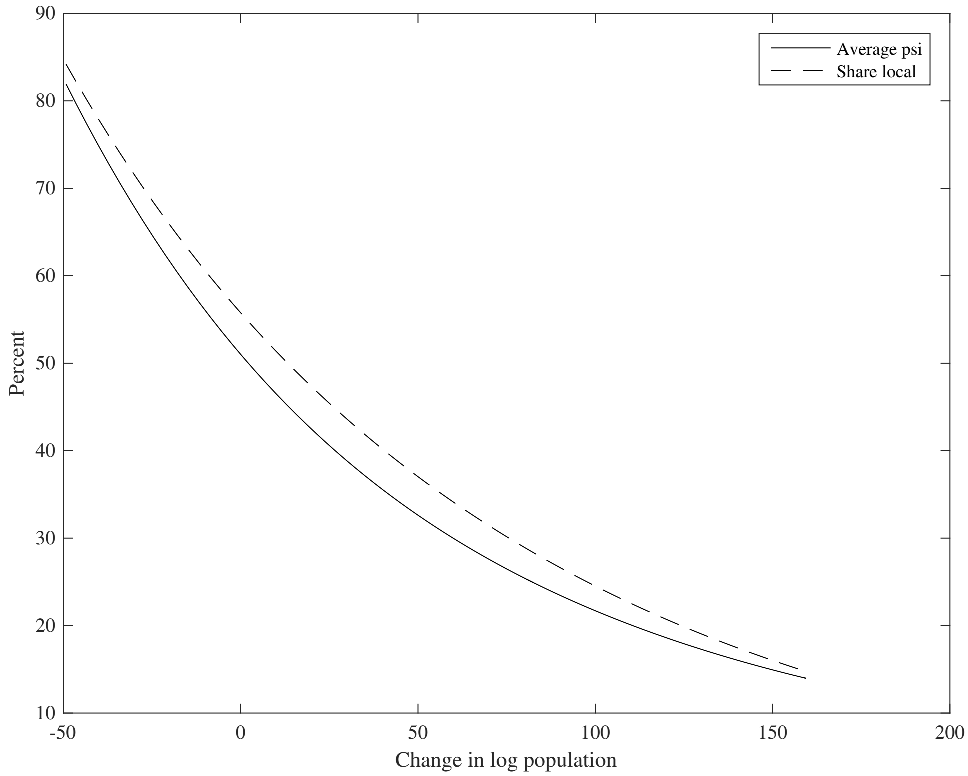
Note: The black line is model predicted share of local workers after an increase in productivity that generates the population change listed. A change in amenities will have the same effect, since workers only differ in their preferences for particular areas.

Figure 8: Effects of productivity increases



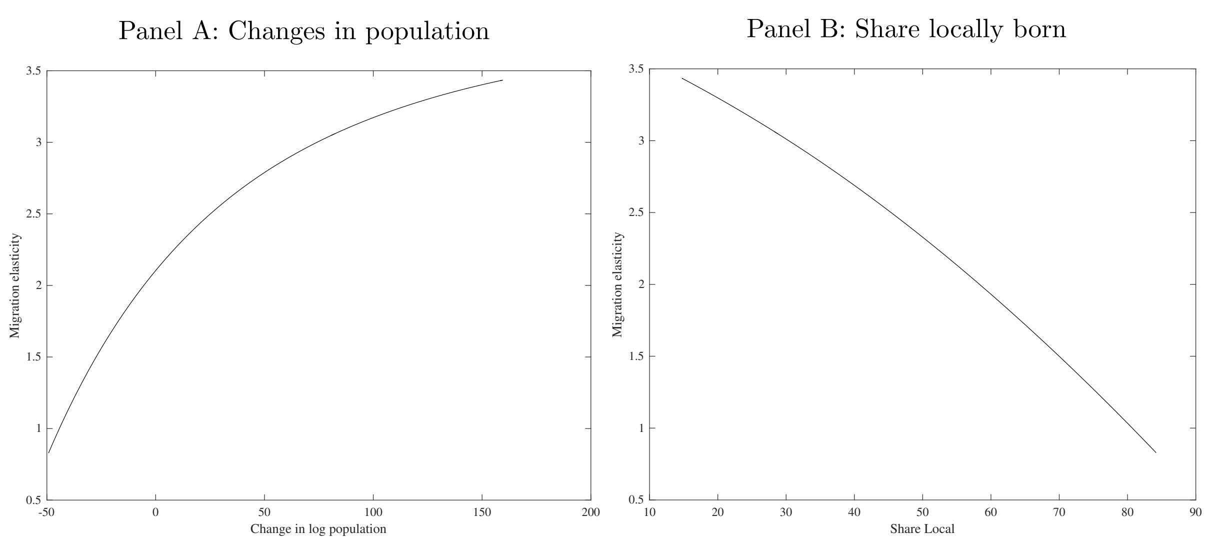
Note: This plots the population response to productivity increases or decreases in one area of the model, while all other areas are unchanged as are all other parameters.

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.

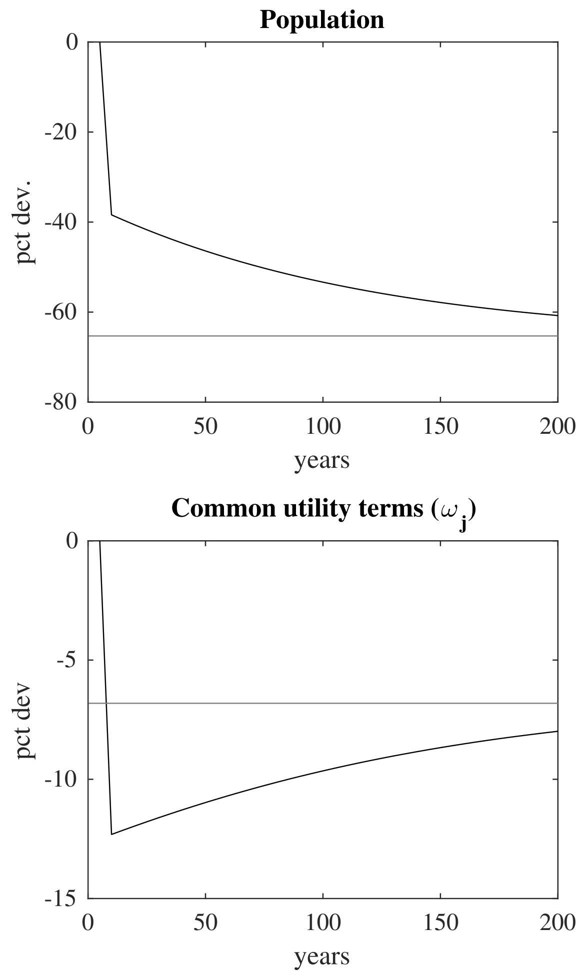
Figure 10: Migration elasticities in the second period



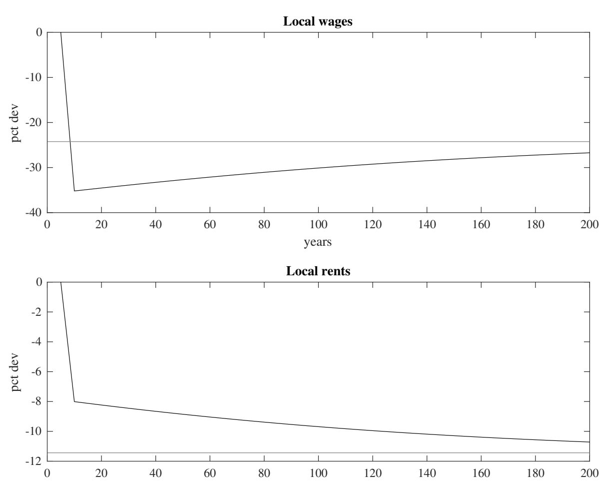
Note: The y axis represents migration elasticities as derived in equation 9 while the x axis shows the relevant changes in log population and the share of locals of the shocked area's total population. Differences in share local and log population are a result of the changes in local productivity plotted 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.[45]

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

[45]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.[46] 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

[46] 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.[47] 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.[48]

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.

[47]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.

[48]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 Full details of the sufficieint statistics derivation

the following are the equilibrium conditions and the effect of a change in g_j on welafre for each actor in the model presented in the main paper. Note that I ommit the 1 and 0 subscripts, except for equations that involve the indirect compensation function. This is for simplicity, and since the equations would apply in either scenario.

Household

Household i maximizes utility subject ot a budget constraint:

$$\max_{j,c_j,h_j} u(c_j, h_j, a_j) + \xi_{ij}$$
$$\text{s.t. } g_j + w_j = c_j + r_j h_j$$

Where c_j is the level of tradable consumption in area j, h_j is its housing (non tradable) consumption in j, a_j is the local amenity level, w_j is the wage, r_j is the rent, and g_j is the net governmental transfers. ξ_{ij} is an arbitrary distribution of areas specific preferences household i for area j. Workers inelastically provide labor, though this can also be relaxed.

The first order conditions are:

$$\begin{aligned}\frac{\partial u}{\partial c_j} &= \lambda_j \\ \frac{\partial u}{\partial h_j} &= \lambda_j r_j\end{aligned}$$

Where λ_j is the marginal utility of consumption in area j.

To have comparability between households and other ators, I measure households' welfare using an indirect compensation function (Varian (1984)), using initial prices. Chipman and Moore (1980) calls this "generalized equivalent variation." The compensation function is defined in the model as $m_i(w_1, r_1, g_1; c_{0,j}, h_{0,j}, g_{0,j}, j_0) \equiv e(w_1, r_1, g_1; u(c_{0,j}, h_{0,j}, g_{0,j}) + \xi_{ij_0})$ where $e(\cdot;\cdot)$ is the more common expenditure function, giving the expenditure necessary to equal the initial level of utility, and the subscripts 0 and 1 denote initial values (0) and values after some change (1).[49] To get to the indirect compensation function, one simply replaces the initial level of utility with the indirect utility function, at initial prices:

$$m_i(w_1, r_1, g_1; w_0, r_0, g_0) \equiv e(w_1, r_1, g_1; v(w_0, r_0, g_0))$$

After a change in g_j, each of the arguments in the function change. Luckily the envelope theorem applies (Small and Rosen (1981), Kline and Moretti (2014b), and Chetty (2009)) so the change in utility is equal to the change in expenditures at the initial levels of consumption, holding location (j_0) fixed:

$$\frac{dm_i(w_1, r_1, g_1; w_0, r_0, g_0)}{dg_{1,j}} = \mathbb{1}(j_0 = j) + \frac{dw_{1,j_0}}{dg_{1,j}} - h_{0,j_0}\frac{dr_{1,j_0}}{dg_{1,j}}$$

The increase in the subsidy is the first term, but it only appears if the subsidy would apply in the area the household was living in initially. The second term is the change in earnings, and the final is the effect of the change in rents, given the initial level of housing consumption. There is no effect on tradeable good consumption, since it is the numeraire.

Landlords

Landlords make the difference between the rent that they charge and their cost of providing housing, $c_j(H_j)$ where H_j is the total amount of housing in areas j. $c_j(H_j)$ is (quasi) monotonically

[49] If utility that is linear in income, as in Busso, Gregory and Kline (2013) and Kline and Moretti (2014b), then the compensation function, at current prices, is the utility.

increasing, since land becomes increasingly costly to develop into good housing as there is less and less available land.

$$\pi_j^H = \max_{H_j} r_j H_j - \int_0^{H_j} c_j(x)dx$$

This gives a simple FOC:

$$r_j = c_j(H_j)$$

Landlord welfare is π_j^H. After a change in subsidies, total profits will change in the following way (based on the envelope theorem):

$$\begin{aligned}\frac{\partial \sum_{j'} \pi_{j'}^H}{\partial g_j} &= \textstyle\sum_{j'} \frac{\partial \pi_{j'}^H}{\partial r_{j'}} \frac{\partial r_{j'}}{\partial g_j} \\ &= \textstyle\sum_{j'} H_{j'} \frac{\partial r_{j'}}{\partial g_j}\end{aligned}$$

Local firms

A local firm produces local output Y_j and sells it at price p_j. It employs local labor and buys capital on a national market at interest rate ρ. The firm's profit, which it maximizes, is:

$$\pi_j^Y = \max_{N_j, K_j} p_j Y_j(N_j, K_j) - w_j N_j - \rho K_j$$

So, the first order conditions are:

$$\begin{aligned}\frac{\partial Y_j}{\partial L_j} &= \frac{w_j}{p_j} \\ \frac{\partial Y_j}{\partial K_j} &= \frac{\rho}{p_j}\end{aligned}$$

The welfare of firms are their profits, π_j^Y. Again, because of the envelope theorem, they are only affected in terms of prices after a subsidy into the local area:

$$\begin{aligned}\frac{\partial \sum_{j'} \pi_{j'}^Y}{\partial g_j} &= \textstyle\sum_{j'} \frac{\partial \pi_{j'}^Y}{\partial w_{j'}} \frac{\partial w_{j'}}{\partial g_j} + \frac{\partial \pi_{j'}^Y}{\partial p_{j'}} \frac{\partial p_{j'}}{\partial g_j} \\ &= Y_j \frac{\partial p_{j'}}{\partial g_j} - N_{j'} \frac{\partial w_{j'}}{\partial g_j}\end{aligned}$$

The final goods firm

There is a national firm that takes local output Y_j and produces the numeraire tradeable consumption good (Y).

$$\pi^Y = \max_{\text{all } Y_j} Y(Y_1, Y_2, \ldots, Y_J) - \sum_{j'} p_{j'} Y_{j'}$$

So, the first order conditions are, for all j areas' goods:

$$\frac{\partial Y}{\partial Y_j} = p_j$$

The welfare of these firms are their profits, π^Y. π^Y may be affected by the subsidy to the areas, since these firms have to pay for their inputs:

$$\begin{aligned} \frac{\partial \pi^Y}{\partial g_j} &= \sum_{j'} \frac{\partial \pi^Y}{\partial p_{j'}} \frac{\partial p_{j'}}{\partial g_j} \\ &= -Y_j \frac{\partial p_{j'}}{\partial g_j} \end{aligned}$$

Aggregation

I aggregate the welfare of households, landlords, and each type of firm by measuring each in monetary terms and adding each up. There is a continuom of households, and $N_{0,j}$ of them live in area j initially, I need to cumulate the effect across all of these housholds. There is one (representative) landlord and local firm per area, and onle one national firm. Adding these up gives the formulation in the main paper. The welfare result, similarly, can be obtained by simply ading up all of the effects on the welfare of various actors.

D 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.[50]

[50] 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.

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 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.[51] 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

[51] 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.

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.[52] 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.

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

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

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.[53]

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.[54]

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 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

[53] 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.

[54] 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.

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. A 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.

E 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.

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

$\square$

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

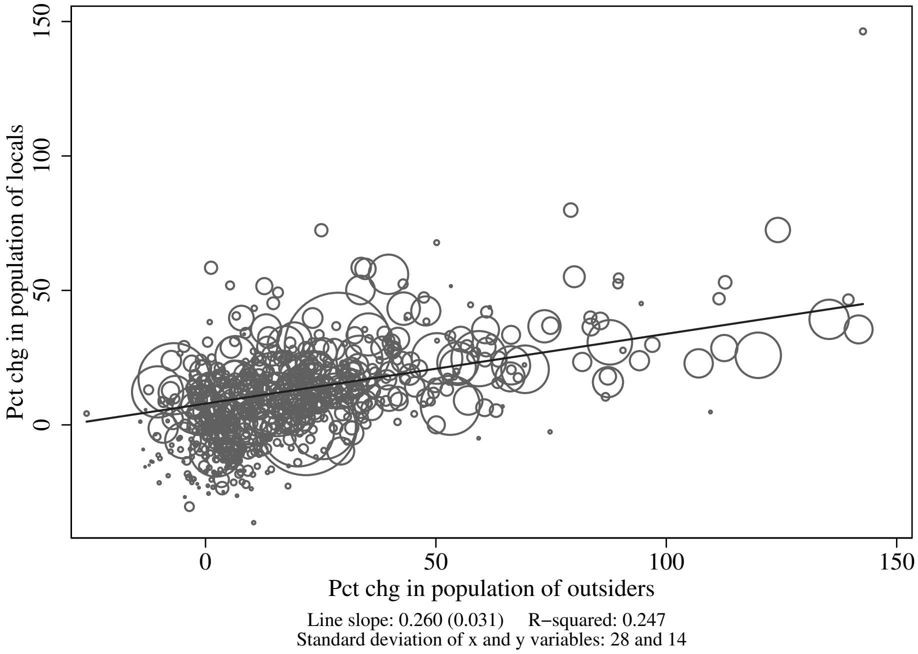
	Population	Wages	Rents
Bartik shock: Low share	1.39	0.27	0.64
	(0.14)	(0.10)	(0.18)
Bartik shock: High share	0.33	0.30	0.53
	(0.11)	(0.08)	(0.13)
Observations	722		
R^2	0.579	0.353	0.477

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

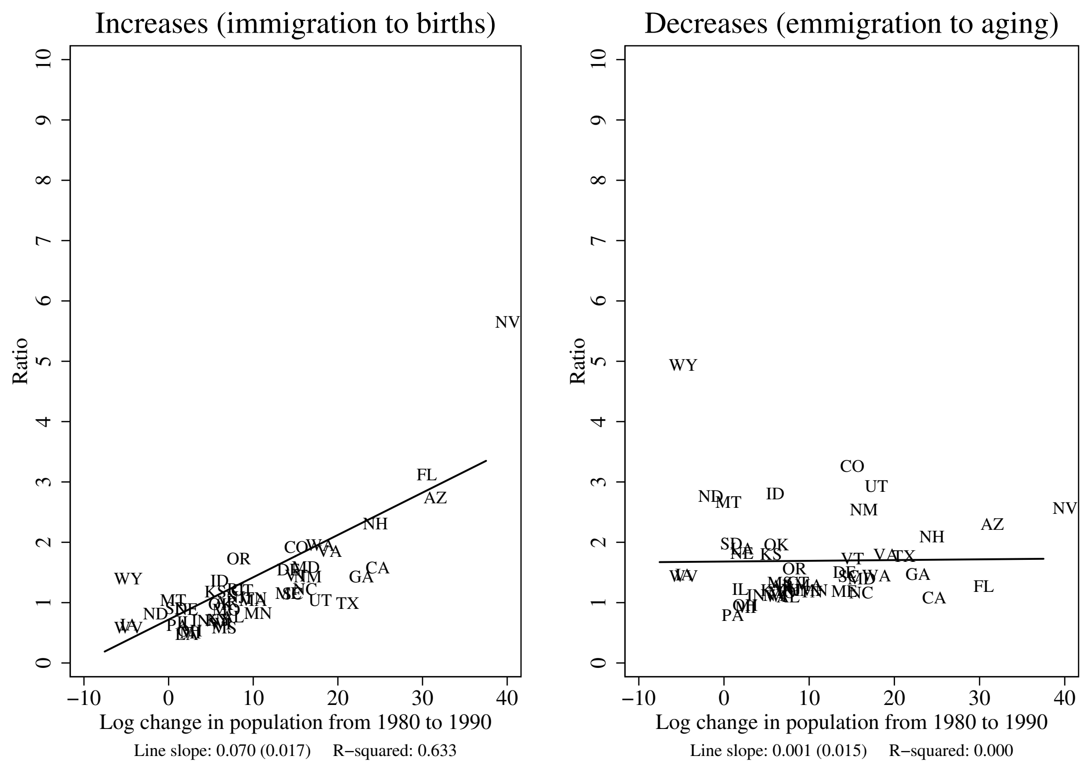
Notes: Seemingly unrelated regression results are shown for regressing the indicated outcomes, measured in 10 year log changes on the labor demand shifter on the right hand side. These are used for estimation of the parameters. All regressions use the same data and include the same controls as the main 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

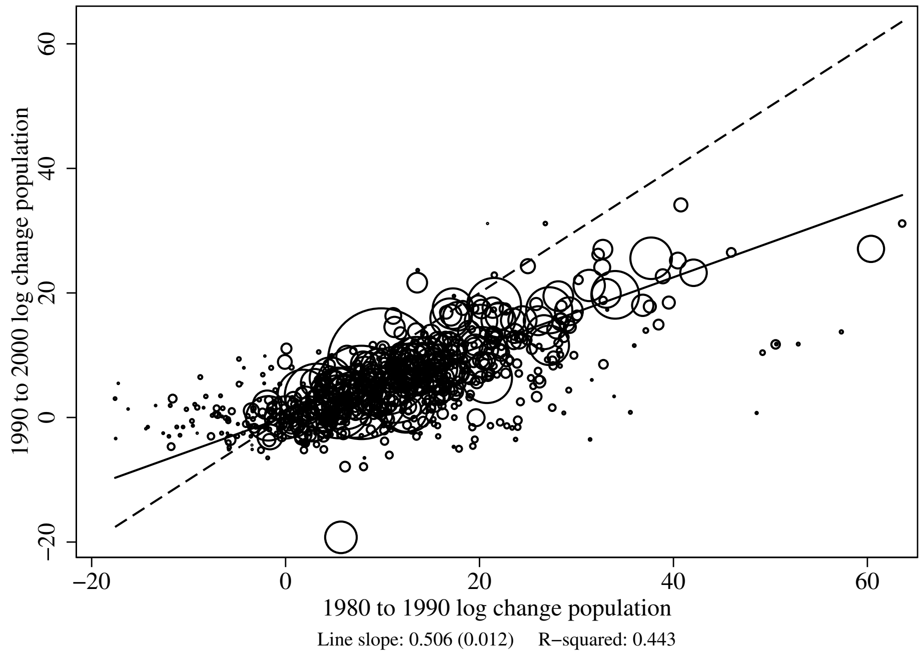
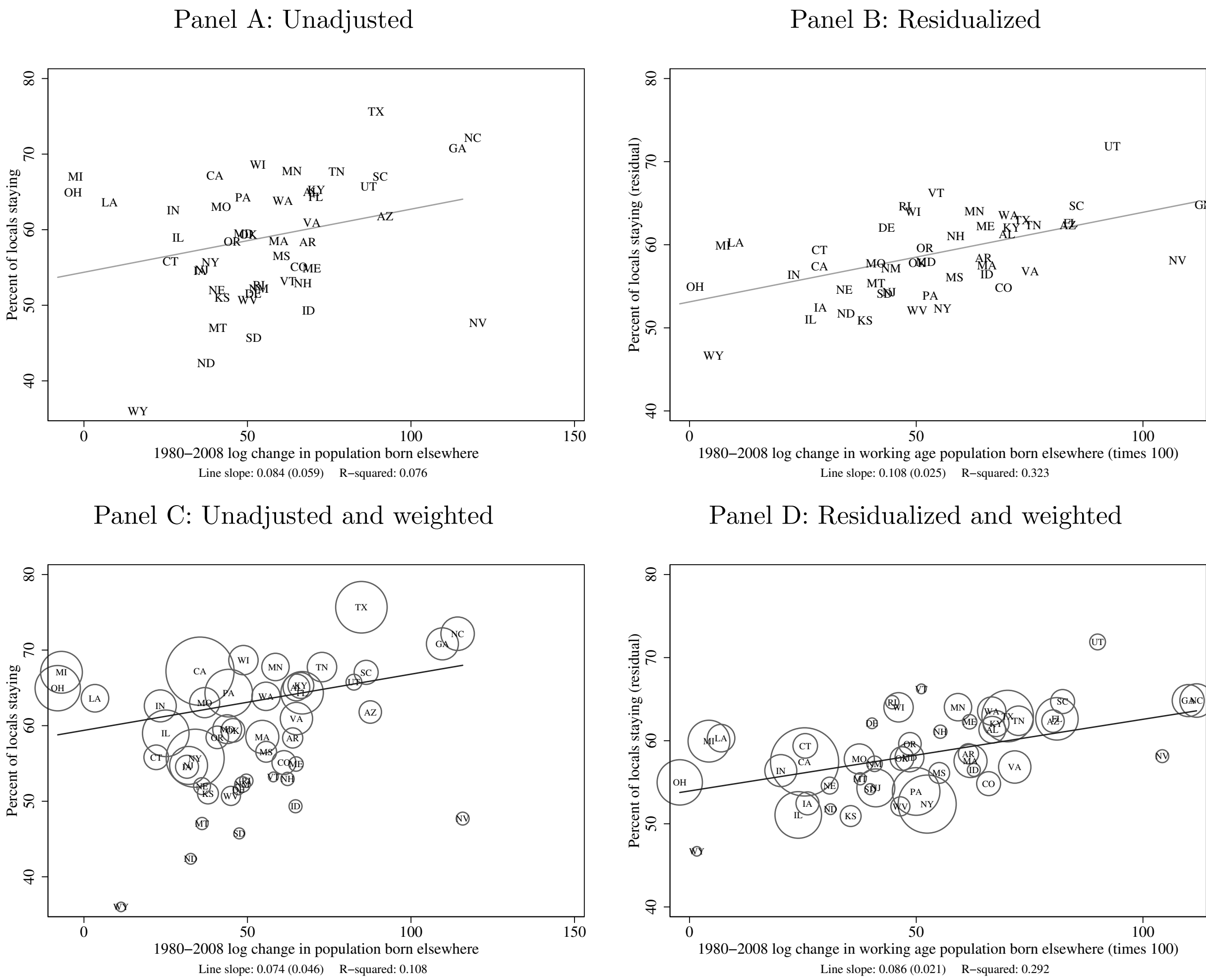


Figure A4: Population changes and locally born workers staying



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

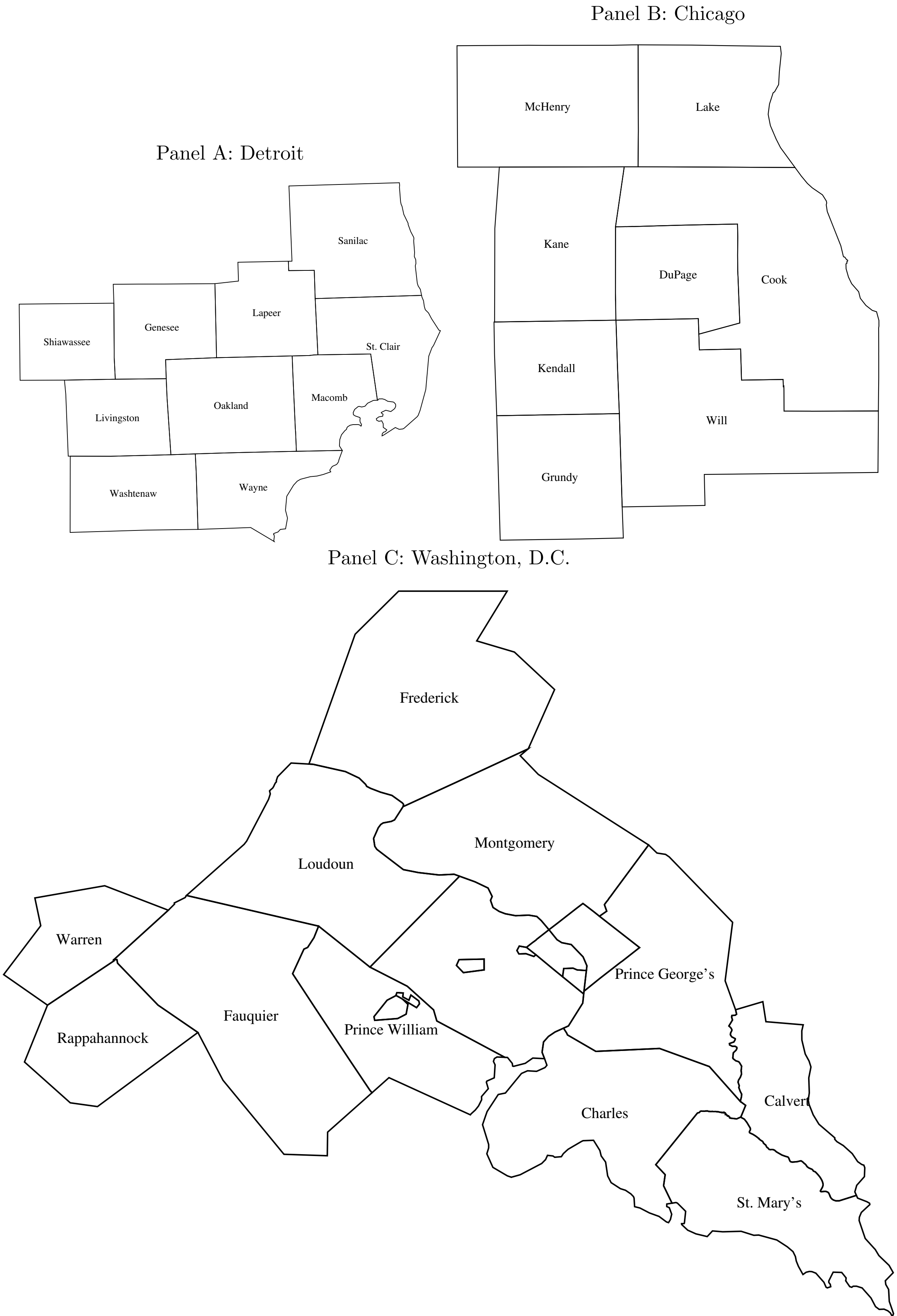
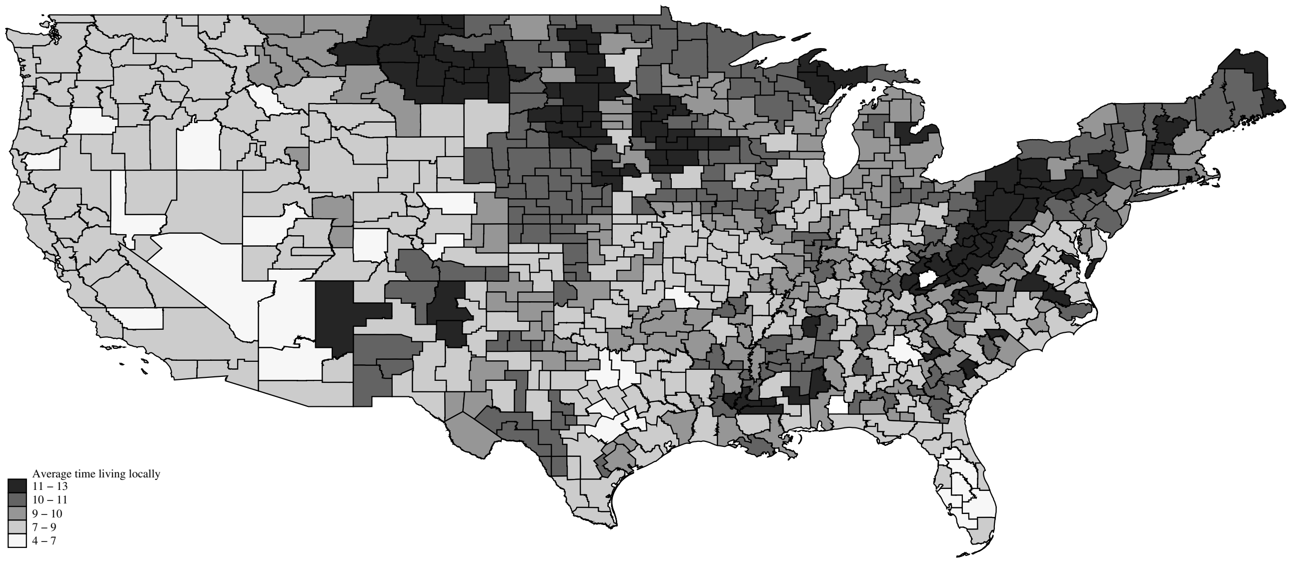


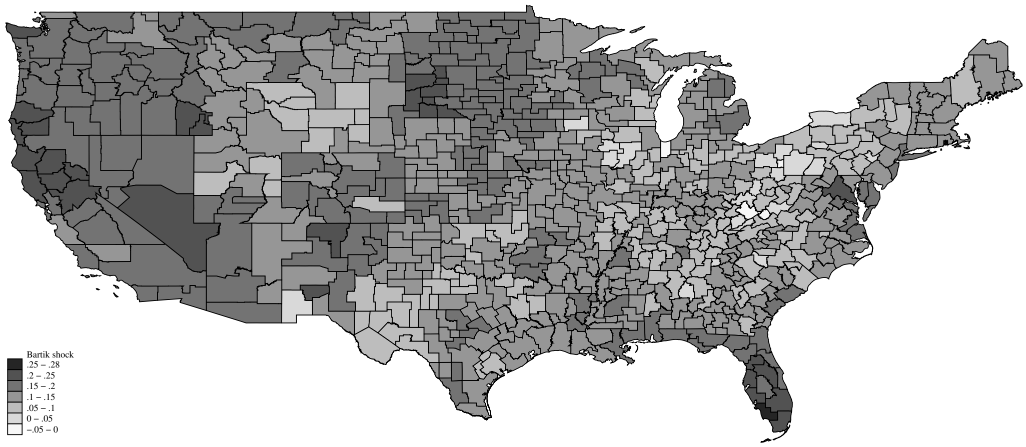
Figure A6: Average time living in the same house as of 2000



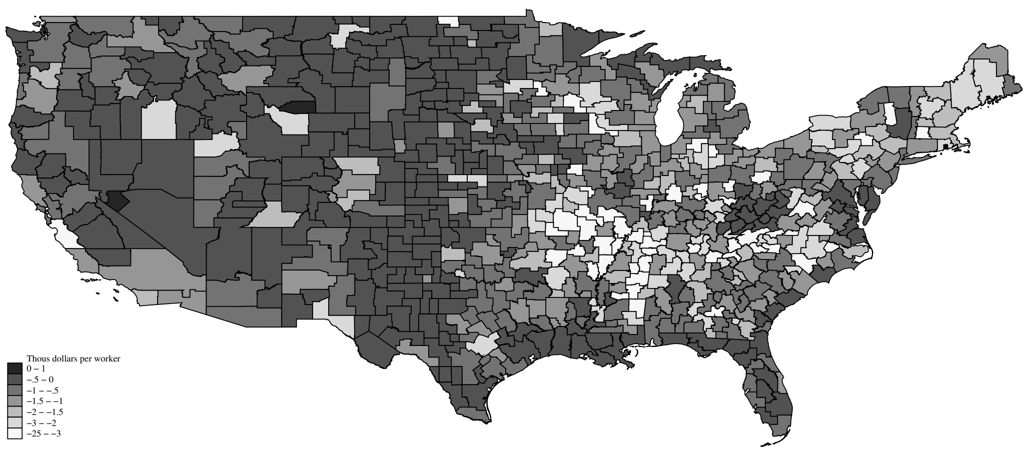
Notes: The 722 commuting ones in the continental US are shaded according to how long the average "householder," in whose name the residence is owned/rented, has been living at their current residence. The statistic is weighted according to the number of adults 16-64, fulfilling other sample restrictions, 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

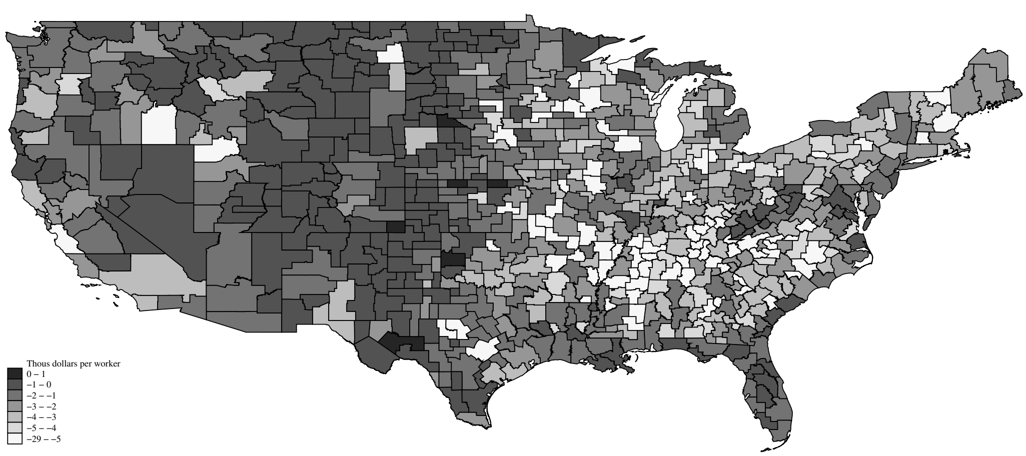
Panel A: Bartik shocks: 1980 to 1990



Panel B: Trade shocks: 1990 to 2000

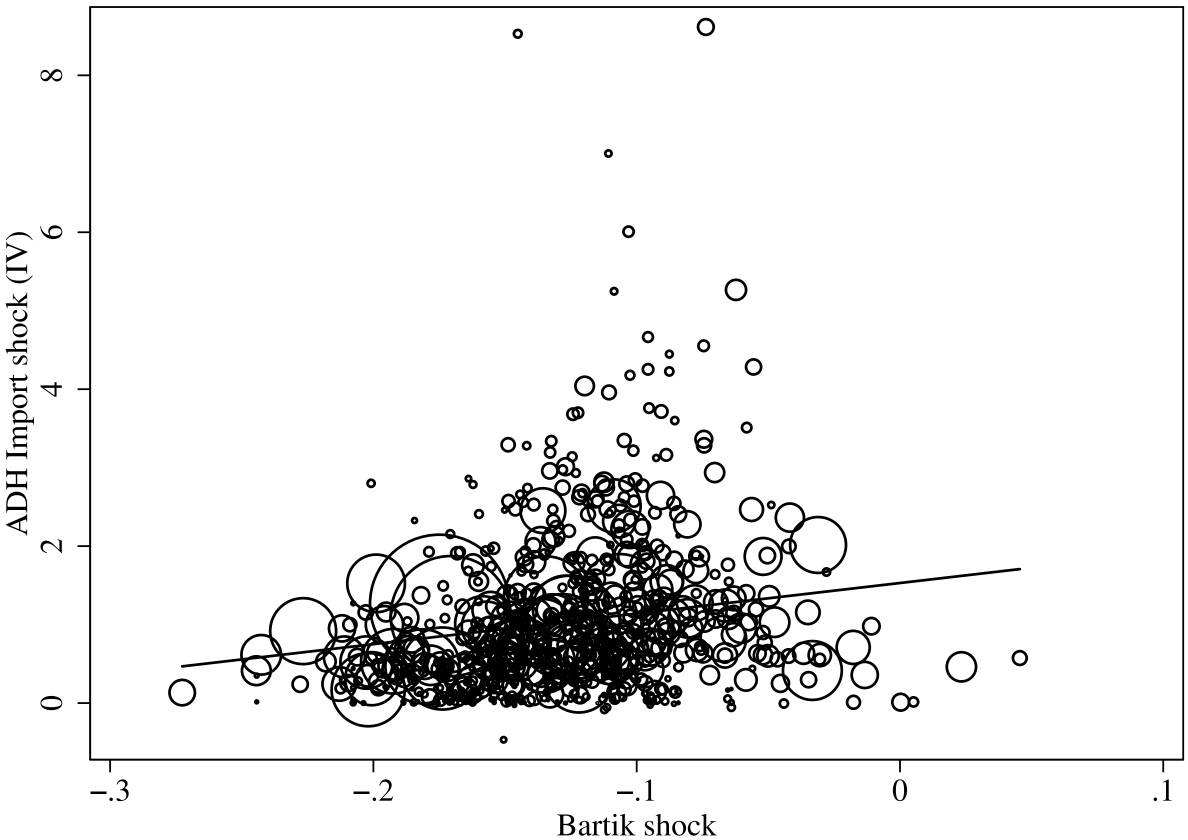


Panel C: Trade shocks: 2000 to 2008



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.