Revitalize or Relocate:

Optimal Place Based Transfers for Local Recessions

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Many regions in the US experience depressed labor demand and high unemployment, even when the rest of the United States does not. How should the US government respond? In this paper, I characterize optimal place-based transfers in a dynamic economic geography model with nominal wage rigidity and compare them to observed government transfers. The key idea at the core of my analysis is that transfers not only have a stimulus effect—by boosting local demand—they also have a migration effect—by encouraging local residents to stay. Analytically, I provide optimal transfer formulas that capture this trade-off and show, perhaps surprisingly, that the optimal transfer to a distressed region may be a tax due to the migration effect. All else equal, transfers should be larger in the short-run and when distressed places are geographically concentrated. Quantitatively, I find that observed transfers are both too small in the short-run and too large in the medium-run, achieving about a third of the gains from the fully optimal response to idiosyncratic local shocks. I conclude by exploring how the US government could have responded to the China trade shock in the 2000s.

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1 Introduction

The Janesville Assembly Plant produced its final car for GM on December 23, 2008.[1] In the following months and years, large numbers of workers lost their jobs. And though a large factory stood empty and many people were willing to work for low wages, no new company moved in to offer lower wages and employment opportunities. Instead, the area fell into a deep recession—a deeper recession than the rest of the US. This is not an isolated case. Autor et al. (2013) report widespread unemployment in regions of the United States that compete directly with Chinese goods, and Topalova (2010) and Dix-Carneiro (2014) note similar transitional pain for regions exposed to foreign competition in India and Brazil, respectively.

These local recessions pose a problem for macroeconomic policy. The traditional tool for fighting recessions is monetary policy, however these hard-hit cities within large nations do not have their own currency. In order to jump start the economy in one city, the government would have to overheat another city. Kenen (1969) offers a solution for a similar problem facing currency unions like the European Union: fiscal policy. If one country is in a recession, a centralized authority can increase spending there through fiscal transfers. Since people spend much of their money locally, such transfers may stimulate the local economy without stimulating the whole currency union. But within a country like the United States where households are mobile, the government might want to encourage households to leave an area in recession to find another job. Should the central government still use fiscal policy to fight local recessions in this setting? And if so, what should those transfers look like?

In this paper, I shed new light on these questions with three contributions. First, I provide new empirical evidence that the national and state governments transfer money to regions after a shock through a variety of tax and transfer programs. Second, I propose a simple economic geography model of local recessions and use it to illustrate the key trade-offs in designing optimal fiscal policy. Finally, I quantify these forces using a dynamic New Keynesian economic geography model, showing what the optimal policy should look like and demonstrating the welfare gains from implementing it.

I start by using local projection methods to illustrate how US commuting zones adjust to an innovation in local unemployment. Controlling for detailed demographic information and the number of weeks worked, log wage earnings drop slowly after a sudden increase in unemployment. Wages drop for 4 years before recovering, consistent with a large body of evidence that documents substantial downward wage rigidity[2]. In line with Kenen (1969)'s

[1]See Goldstein (2017) for a moving account of what happened to Janesville, Wisconsin after the factory closed.

[2]See Grigsby et al. (2021), Hazell and Taska (2020), and Jo (2024)

recommendations, the federal government transfers money through social programs and lower tax rates. Transfers increase by around 3.5% of a commuting zone's original income after the unemployment rate jumps by 10 percentage points. The transfers then slowly decline over the next 15 years.

In the second part of the paper, I turn to assess how effective those transfers are in fighting local recessions. I propose a two-period model of local recessions where wages are rigid, workers are imperfectly mobile across regions, some goods are non-traded, and a national government can set monetary policy and place-based fiscal transfers. I set up the second-best planner's problem where workers are free to live where they would like (subject to migration frictions) and the planner can tax or subsidize certain areas. While the planner cannot directly move people, it can indirectly influence where people want to live by making certain regions more or less attractive with transfers.

Place-based transfers have two macroeconomic effects: a stimulus effect and a migration effect.[3] The stimulus effect comes from the fact that people spend disproportionately on goods and services near them, and so giving a region money will increase demand in the local area. When wages are rigid, there will be an aggregate demand externality leading to first order welfare benefits, as emphasized by Kenen (1969) and formalized by Farhi and Werning (2017). All other things equal, transferring money from a booming area to a busting area will cool down the booming economy while heating up the area in a recession, efficiently putting people back to work. This role for transfers encourages a planner to redistribute funds towards locations in a recession, even if insurance markets are perfect.

The migration effect emerges because transfers influence where people want to live. If the government gives tax breaks to people living in an area, other people will be more likely to move there, and people already living there will be less likely to move out. When output is demand-determined because wages are sticky, this movement of people will have an important impact on underemployment. Each region produces some traded goods for the country and the amount demanded is independent of local spending and population. Consider the GM factory in Janesville. With sticky prices, it needs to build a certain number of cars to meet the demand of the outside world. It only needs a certain number of man-hours to do that. In the short run, that will not adjust so movement of people in and out of the region will change the population without affecting employment in the traded sector. This force implies that, if anything, the federal government should tax hard-hit areas to encourage people to find jobs somewhere else.

[3]Transfers also directly increase utility of people in a region and so have the usual redistribution effect, but that is not my focus in this paper. See Gaubert et al. (2021) and Donald et al. (2023) for in depth discussions of how place-based policy can be used for redistribution.

I derive three analytical results that demonstrate how the migration and stimulus effects interact to shape optimal place-based policy. First, I consider what fiscal transfers should be in a small region that just had a negative shock to the demand of its traded output, like Janesville. Starting from a point with no transfers, a transfer to Janesville improves macroeconomic stability if and only if the local multiplier is larger than per capita earnings multiplied by the semi-elasticity of population to a transfer (holding fixed labor supply); thus, the optimal transfer could be a tax. This might seem counterintuitive since, when there is no migration, transferring money to a region in a recession always helps stimulate the economy, improving welfare. One might have thought that allowing migration would simply mute that effect. In fact, the migration effect can overturn that result, making a place-based transfer counterproductive. This is because government transfers directly increase the utility of living in a location, independent of the stimulus effect, and that increase in utility leads to migration which reduces the employment rate. Therefore, the fully optimal transfer could be positive or negative, depending on the local multiplier and the migration semi-elasticity.

While the previous result provides a clear cut-off to weigh the relative strength of the migration effect versus the stimulus effect, in practice many demand shocks do not hit only one region. Instead, they are spatially correlated. My next result considers what the spatial nature of the shock implies for the optimal transfer. I find that if migrants to and from Janesville disproportionately come from and to areas that are in a recession, then the optimal transfer is larger than that suggested by the local multiplier and the migration semi-elasticity. That is due to the migration effect. If workers disproportionately leave areas in a recession to go to Janesville, that might hurt the recession in Janesville, but it will help the areas that those workers left. Therefore, considering Janesville in a vacuum misses an important effect. When demand shocks are correlated, there might be more scope for the national government to use fiscal transfers to stimulate an entire area.

My final analytical result considers the effects of dynamics on the optimal fiscal transfers. In particular, I show that the transfer to Janesville in period 2 is smaller than that suggested by the local multiplier and the migration semi-elasticity. This is due to a dynamic migration effect. One might have thought that transfers in the second period would have the same trade-off between the stimulus effect and the migration effect, but because people have more time to move, the migration effect is stronger and so the optimal transfer is smaller. That is not the full story because period 2 transfers not only affect where people live in period 2, but also period 1. If the government has made it clear that it will tax households that are in Janesville in period 2, households that have the opportunity to leave in period 1 will do so. Thus, the planner can encourage out-migration in period 1 without losing stimulus.

The final part of the paper uses a dynamic New Keynesian economic geography model to derive the practical implications for optimal fiscal transfers in response to different types of demand shocks. To do so, I move to a continuous time, parametric version of my theoretical model where wages are only partially rigid and there are finite trade costs in the traded sector. I calibrate the model using well-identified parameters from the literature, observed trade flows between states, observed migration flows between commuting zones, and economic activity at the commuting level.

I then consider what optimal fiscal transfers look like in the aftermath of an idiosyncratic local recession like that considered in the empirical analysis described above. Comparing the optimal policy to observed policy, fiscal transfers should be four times larger immediately after the shock to efficiently put households back to work. However, those transfers should then more quickly scale back. I find that the government should give less transfers to households than that suggested by redistributive motives in commuting zones 10 years after the shock to encourage out-migration. Observed policy gets only 35% of the welfare gains of optimal policy over no policy at all. Making unemployment insurance much more generous after a commuting zone-wide shock could get much of the welfare gains. Alternatively, the local government could engage in its own fiscal stimulus, borrowing money to jump start the economy, and paying it back over the period 5-20 years after the shock.

While there has been substantial research on the pain that the China trade shock has wrought, there has been much less work considering what policy should have done. Using my framework, I revisit how the national government could have used place-based policy to fight against the local recessions that resulted from competition with Chinese exporters. If the planner had anticipated how bad the China shock was going to be, the planner should have taxed people in commuting zones that were hit between 2000 and 2006 so as to encourage them to leave. The planner then gives generous transfers to commuting zones directly impacted by the shock all the way until the year 2024. The migration effect is less important in response to the China shock because it was so spatially correlated. Nearby regions were also hit by the China shock and so were less attractive to move to. Therefore, generous transfers for a long period of time can stimulate the economy without distorting migration decisions. Transfers to nearby regions are especially effective since they stimulate the commuting zones that were hit, while encouraging workers to leave relatively worse hit regions.

The rest of the paper is structured as follows. There is a short Related Literature section below where I mention a number of papers related to the current study. In section 2, I present descriptive facts about local recessions and the government policy response. I present the 2-period model of local recession in section 3, before characterizing the optimal policy and teasing out the implications in section 4. The dynamic new Keynesian economic geography model is in section 5. I show what the model implies for optimal policy in response to an idiosyncratic demand to a single commuting zone in section 6, and then in response to the China trade shock in section 7. I give some concluding remarks in section 8. All proofs of propositions are in the appendix.

Related Literature

This paper most directly contributes to the literature on placed-based policy. The study of optimal place-based policies is a large and diverse literature. Numerous empirical papers have explored the effect of place-based policies (see Neumark and Simpson (2015) and Ehrlich and Overman (2020) for reviews). And many theory papers have studied the reason that such policies could be welfare improving. Abdel-Rahman and Anas (2004), Wildasin (1980), Fajgelbaum and Gaubert (2020) and Kline and Moretti (2014) all study how optimal spatial policy could correct for agglomeration externalities. Other papers, such as Gaubert et al. (2021) and Donald et al. (2023), consider re-distributive reasons for place-based policies. Austin et al. (2018) shows that if the employment elasticity differs between regions, government policy should vary across the US. I contribute to this literature by considering what place-based policy can do in response to a completely different market failure: wage rigidity. I show that the implications for optimal policy are very different and the timing of the transfers play an important role.

My paper also contributes to a large empirical literature studying how regions respond to idiosyncratic shocks. Most closely related to my empirical contribution is Blanchard and Katz (1992), who use structural methods to see how states respond to economic shocks. Yagan (2019) shows that states more exposed to the great recession are affected long after the recession ends. Looking at commuting zones, as I do here, Autor et al. (2013) study regions that directly compete with Chinese industries as China starts exporting large numbers of goods. Topalova (2010) analyzes regions in India as tariff barriers came down, and Dix-Carneiro (2014) considers a similar episode in Brazil. Costinot et al. (2022) studies the effect of the collapse of trade between Finland and the USSR on worker outcomes and rationalizes some of the results with a model of wage rigidity. I contribute to this literature by showing how government policy responds to these shocks and finding what policy should look like in the aftermath to fight the local recession.

A growing dynamic trade and economic geography literature tries to quantify the welfare impacts of such trade shocks. Galle et al. (2017) and Caliendo et al. (2019) are two such neoclassical examples. Lyon and Waugh (2019) consider the welfare implications when households have imperfect savings tools. Rodríguez-Clare et al. (2020) incorporate wage rigidities, and Kim et al. (2023) shows that currency pegs play a key role in explaining the large impact of the China shock. My paper contributes to this literature by embedding a standard new Keynesian sticky wage model into an economic geography model and solving for the optimal place-based policy.

Finally, my paper also contributes to the Optimal Currency Area (OCA) literature. This literature has emphasized a number of important features of successful currency unions like factor mobility (Mundell, 1961), trade openness (Mundell, 1961), fiscal integration (Kenen, 1969), and financial integration (Mundell, 1973). My paper formalizes the results from Kenen (1969) when there is significant factor mobility as expressed by Mundell (1961).

The modeling approach in this paper builds on two more recent papers (Farhi and Werning, 2014, 2017), formalizing many of the arguments made by the older OCA literature. Farhi and Werning (2017) considers what optimal fiscal policy should look like in a currency unions when people are stuck in a location. Farhi and Werning (2014) shows that mobility in a currency union could either help or do nothing for macroeconomic stability of a region going through a recession. The model in this paper nests Farhi and Werning (2017) and shows that some of the results are overturned when there is significant factor mobility. While Farhi and Werning (2014) similarly allows for factor mobility in a currency union, my paper's question and focus are different. Farhi and Werning (2014) compares equilibrium migration to the migration a planner would enact if the planner could not transfer money between location but could control where people live. My paper takes as given that people can live where they want and then solves an optimal reallocation of funds exercise.

2 Descriptive Facts About Local Recessions and Policy

In this section, I show how wages and transfers from the government respond to changes in local unemployment at the commuting zone level. In the spirit of Blanchard and Katz (1992), I interpret an innovation in unemployment as the start of a local recession. I then trace out the impulse response functions using local projection methods.[4] I briefly describe the data I use in the text, further details are in Appendix A.

I use data on unemployment and labor force counts by county for 1990-2022 from the Local Area Unemployment Statistics (LAUS) managed by the US Bureau of Labor Statistics. I then aggregate to the commuting zone level following Tolbert and Sizer (1996) and Autor and Dorn (2013).

[4]These methods were pioneered by Jordà (2005) and have become a standard tool for macroeconomists looking to describe impulse response functions. See Jordà and Taylor (2024) for a review.

2.1 Wage Adjustment

I start by studying how wages in a commuting zone adjust to an innovation in unemployment relative to wages in the rest of the United States. I use data on individual wage earnings along with county of residence, demographic information, and weeks worked from the Annual Social and Economic Supplements (ASEC) of the Current Population Survey (CPS). I then project wage earnings of individuals in commuting zone n on an innovation in unemployment h periods earlier, controlling for the number of weeks worked.

My main regression specification is:

$$\log E^w_{i,t+h} = \delta^h \log \text{weeks}_{i,t+h} + \beta_h u_{n(i)t} + \gamma^h_{n(i)} + \gamma^h_t + \sum_{L=1}^{\overline{L}} \gamma^h_{uL} u_{n(i),t-L} + \Gamma^h X_{ith} + \varepsilon^w_{ith},$$

where $E^w_{i,t}$ is the wage earnings of individual i in year t, $\text{weeks}_{i,t}$ is the number of weeks that individual worked, $u_{n(i)t}$ is the unemployment in i's commuting zone in year t, γ^h_n and γ^h_t are commuting zone and year fixed effects respectively, and X_{ith} is a vector of individual level controls including education, race, sex, industry, age, and age^2. Controlling for lagged unemployment $u_{n(i),t-L}$ controls for the expected path of unemployment, so that β_h identifies the impact of an innovation in unemployment at time t on log wages h periods after. I use $\overline{L} = 2$, though including more (or less) lags does not materially affect the results.

I plot the estimates of β_h in Figure 1, normalizing the results to correspond to a 10 percentage point increase in unemployment. I find that weekly wage earnings do not move at all the year of the increase in unemployment. Instead, weekly wage earnings in the commuting zone slowly decrease relative to earnings in the rest of the US over the following 4 years, before leveling off and recovering. This is inconsistent with a neoclassical model of economic geography with no capital, where wages would drop immediately after the increase in unemployment. Then wages would recover to some extent as the shock that caused the decline subsides or workers leave to find better opportunities elsewhere. It is also inconsistent with Dix-Carneiro and Kovak (2017)'s model where wages fall long after a shock as capital slowly degrades for two reasons. First, there is no initial drop in wages. The wage earnings only become statistically significantly different from zero 2 years after the shock. Second, wages start to recover after 4 years whereas wages would continue to fall if capital were continually depreciating.

However, this is consistent with the well documented phenomenon of downward wage rigidity. Blanchard and Katz (1992) find that wages drop for 4 years in response to similar employment innovations at the state level. In the trade literature, Rodríguez-Clare et al. (2020) show that wage rigidity can account for the employment response to the China trade

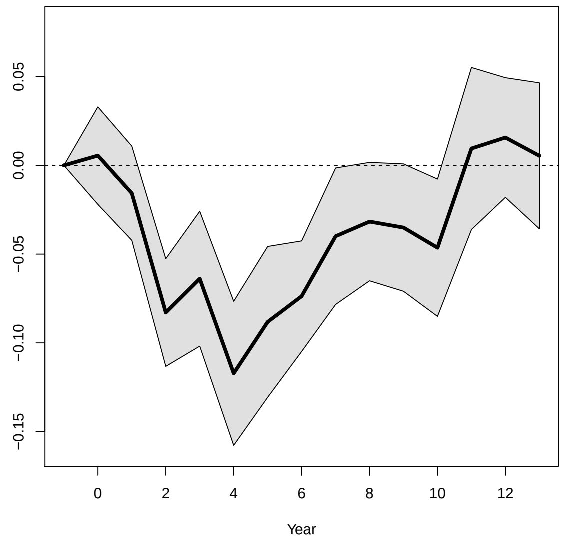


Figure 1: Log Wage Response.

Note: I plot the local Jorda projection of log wage earnings in a commuting zone on innovations in local unemployment controlling for the log number of weeks worked and detailed demographic controls described in the text. Results are normalized to correspond to a jump in unemployment of 10 percentage points. Bands indicate 95% confidence intervals clustering on commuting zone.

shock, and Costinot et al. (2022) find that wage rigidity can account for the wage dynamics in Finland after a collapse in trade with the Soviet Union. And in the macro literature, there is now significant micro evidence that wages are sticky downwards for both continuously employed workers (Grigsby et al., 2021) and new hires (Hazell and Taska, 2020).

2.2 Government Response

Next, I turn to how the government responds to commuting zone recessions. Using the same projection technique, I first analyze how much money the government sends to the region through various public assistance programs in response to an innovation in local unemployment. I then turn to payments in income tax to see how much less money the government collects in taxes from the region. Throughout, I will continue to normalize the results to correspond to a 10 percentage point jump in unemployment.

I use data on government transfers to each county from the Regional Economic Accounts (REA) managed by the Bureau of Economic Analysis (BEA). They report the aggregate payments to all households in a county for which no service is provided, what they call the personal current transfer receipts. This includes social security benefits, medical benefits, veterans' benefits, and unemployment benefits. It also includes some payments from busi-

(a) Public Assistance Programs (b) Log Income Retention Rate

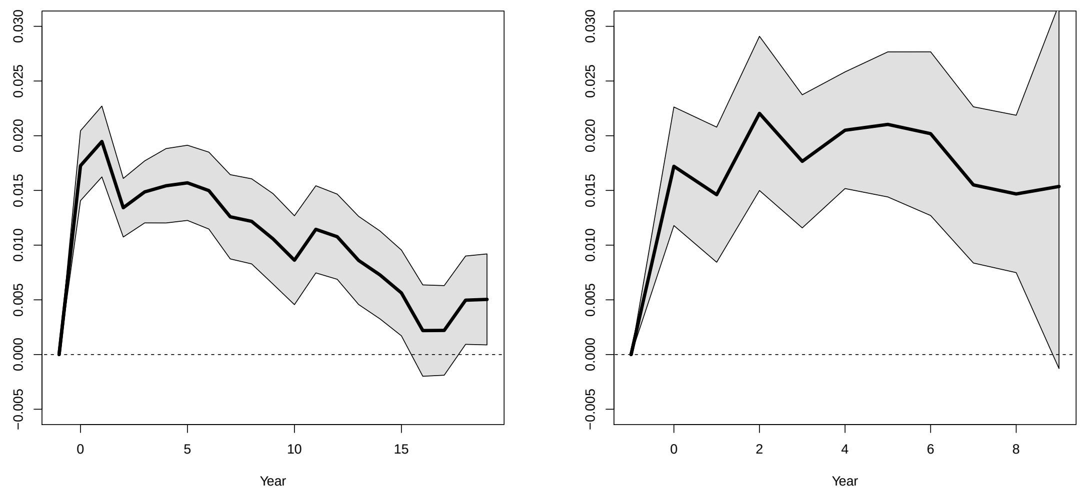


Figure 2: Government Transfer Impact on Log Income

Note: Panel a and b plot local Jorda projections of log public assistance programs and log income retention rates in a commuting zone on innovations in local unemployment, respectively. Results are normalized to correspond to a jump in unemployment of 10 percentage points. Bands indicate 95% confidence intervals clustering on commuting zone.

nesses for personal injury, though businesses only make up 1.7% of total current transfers in 2022.

Using τ^c_{nt} to denote personal current transfer receipts per capita, my main specification is:

$$\log \tau^c_{n,t+h} = \beta_h u_{nt} + \gamma^h_n + \gamma^h_{s(n)t} + \sum_{L=1}^{\overline{L}} \gamma^h_{uL} u_{n,t-L} + \gamma^h_O \log \mathrm{OldShare}_{n,t+h} + \varepsilon^c_{nth},$$

where $\mathrm{OldShare}_{nt}$ is the share of adults in the commuting zone over 65. Since retirement makes up a large component of the transfers, controlling for the share of people over 65 removes the mechanical increase in τ^c_{nt+h} that would occur as working age people leave the commuting zone to find work elsewhere and retired people stay. I plot the estimates of β_h normalized by the share of income that is personal current transfers to find the log first order impact of the transfer on total log income in the region in Figure 2a. I find that on impact, these transfers spike to increase total take home pay by almost 2%. The size of the transfers then slowly decrease over the next 15 years.

Finally, I turn to the other side of the government ledger. The Internal Revenue Service

(IRS) maintains the Statistics of Income (SOI), and starting in 2010, they record total income tax paid by each county along with total gross income. Thus, I can construct the income retention rate by commuting zone for the years 2010-2021 to see how income tax collection responds to local recessions. I plot the Jorda projection controlling for only one lag of unemployment so that I can get a longer time horizon in Figure 2b. I find that the income retention rate jumps by around 0.015 log points immediately after the shock and remains there for all years that I have data. This is driven primarily by the fact that the United States has a progressive income tax. After the unemployment shock, earnings in the region drop, so that people end up in a lower tax bracket. Therefore, they have to pay a smaller percentage of their income in taxes.

3 A Two Period Model of Local Recessions

Having shown that wages do not adjust in response to shocks, and the US government uses a number of policies to transfer money to regions in response, I now present a tractable 2-period model of regional recessions. Wages are perfectly rigid, workers are hand-to-mouth, and goods are either freely traded with no trade costs or non-traded. In this simplified setting, I can fully characterize the solution to a second best planner's problem choosing fiscal transfers to fight local recessions. I move to a continuous time model and relax the assumptions on fully rigid wages and no trade costs in the dynamic model introduced in section 5. In sections 6 and 7, I show how those forces play out in a quantitative dynamic model.

I model all fiscal transfers as explicitly place-based to illustrate the key mechanism in this section, however, as shown above, most transfers to regions in a recession are facially place-neutral. They only end up place-biased because what they target correlates with local recessions. I discuss how my results apply to those transfers in section 4.5 and in the quantitative sections.

3.1 Environment

Consider an economy with N regions indexed by $n, m \in \mathcal{N} = \{1, \ldots, N\}$ and two periods indexed by $t \in \{1, 2\}$. Throughout, I will use subscripts to index values and superscripts to index functions. I will then use subscripts on functions to denote partial derivatives.

Households. There is a continuum of households that I index by $i \in \mathcal{I}$. Denoting region at time t by $n_t(i)$, each household starts in a region $n_0(i)$. Then, at the beginning of period $t \in \{1, 2\}$, each household observes preference shocks for every region, $\boldsymbol{\varepsilon}_t(i) = (\varepsilon_{1t}(i), \ldots, \varepsilon_{Nt}(i)) \in \mathbb{R}^N$ which may depend on household i's location at time $t-1$. The utility that household i gets from living in region n at time 1 and region m at time 2 is given by

$$U_{nm}(i) = U_{n1} + \varepsilon_{n1}(i) + \beta \left(U_{m2} + \varepsilon_{m2}(i) \right),$$

where U_{nt} is the fundamental utility of region n, and $\beta \in [0, 1]$ is the discount rate. $\boldsymbol{\varepsilon}_t$ is distributed according to a continuous cumulative distribution function $G_n(\cdot)$.

Notice that I allow for households to differ in how much they like each of the regions. This could capture moving costs since the distribution of taste shocks is origin-specific or a taste for region-specific weather. It could also capture the fact that some households are very mobile while others would prefer to stay in their home location no matter how bad it gets.[5]

Then the population of region n at time t, ℓ_{nt}, is given by

$$\ell_{nt} = \bar{\ell} \int_{\mathcal{I}} \mathbb{1}_{n_t(i)=n} di,$$

where $\bar{\ell}$ is the total population of the country.

All of the households agree on the fundamental utility of a location. This fundamental utility in region n period t is determined by a nested set of functions

$$\begin{aligned} U_{nt} &= U^n(C_{nt}, H_{nt}), \\ C_{nt} &= C^n(C_{Tnt}, C_{NTnt}), \\ C_{Tnt} &= C^T(\{C_{Tmnt}\}), \end{aligned}$$

where C_{nt} is the sub-utility that a household in location n derives from consuming goods, H_{nt} is her per capita hours of labor supply, C_{Tnt} is the consumption of a freely traded aggregate, C_{NTnt} is the consumption of the non-traded good produced in location n, and C_{Tmnt} is the consumption of the traded good produced in location m. I assume that $U^n(C, H)$ is quasi-concave, strictly increasing in C, and decreasing in H. The consumption sub-utilities $C^n(C_{Tn}, C_{NTn})$ and $C^T(\{C_{Tmn}\})$ are both homogeneous of degree 1 and strictly quasi-concave.

[5]This general set up nests much of the economic geography literature that puts particular distributional restrictions on $\boldsymbol{\varepsilon}$. The assumption of additive shocks distributed according to a Gumbel distribution as used in Caliendo et al. (2019) is an explicit special case of the model. For the economic geography models that use multiplicative shocks distributed Fréchet as in Fajgelbaum and Gaubert (2020), one can simply define a new utility as log of the old utility. The set of Pareto optimal allocations will be the same in this transformed economy and it will fall under my assumptions. This setup also nests the Calvo friction to migration used by Peters (2022) as a limit case.

Firms. In both the freely traded and non-traded sector, a representative firm produces using technology linear in labor. That is,

$$Y_{snt} = A_{sn} H_{snt} \ell_{nt},$$

where Y_{snt} is the production of location n in sector $s \in \{T, NT\}$, A_{sn} is the productivity, and H_{snt} is the hours of labor demand per worker in sector s.

Market Clearing. For the labor market to clear in each location, total labor supply needs to equal the labor used by the freely traded sector and the non-traded sector,

$$H_{nt} \ell_{nt} = H_{Tnt} \ell_{nt} + H_{NTnt} \ell_{nt}, \text{ for all } n, t. \tag{1}$$

The market for the non-traded good needs to clear market-by-market,

$$Y_{NTnt} = C_{NTnt} \ell_{nt}, \text{ for all } n, t. \tag{2}$$

And demand for the freely traded good produced in location i needs to equal production,

$$Y_{Tnt} = \sum_m C_{Tmnt} \ell_{nt}, \text{ for all } n, t. \tag{3}$$

Wage Rigidity. Wages in each location W_n are sticky; they are therefore parameters of the model rather than equilibrium objects. The inefficiencies in the model arise because wages are either too high or too low given the realized demand for labor in the location embedded in the function $C^T(\cdot)$. When wages are too high, the quantity of labor demanded of households in a location will be below what the households would like to supply. Therefore, those households will be underemployed relative to the first best and policy can play some role in correcting that distortion.[6]

[6] I write the model here as one with wage rigidities that are exogenously set. I could also consider a more standard macro model with monopolistic firms that set prices of goods (or wages) before the realization of some state of the world, but cannot change them in the ex-post stage when the state of the word is realized. At this ex-post stage, prices (or wages) are fixed and the analysis is the same as I undertake here as long as local governments tax away all profits. I will do this in the quantitative section.

3.2 Decentralized equilibrium

Profit Maximization. Firms are competitive. They choose production to maximize profits taking as given wages and prices:

$$Y_{snt} \in \underset{Y'_s}{\operatorname{argmax}} \quad \left\{ \left(P_{snt} - \frac{W_n}{A_{sn}} \right) Y'_s \right\}, \text{ for all } s, n, t. \tag{4}$$

Thus, $P_{snt} = W_n/A_{sn}$ for all t. I drop the t index on prices from now on.

Utility Maximization. I start by taking as given utility in each location and characterize the household's dynamic optimization problem. I then return to characterize the intratemporal problem.

Households are free to live wherever they would like. Thus, they move to the location that provides them the most utility, however they do not know their utility shocks for period 2 when choosing their first location. Therefore, I characterize the household migration problem using backward induction. In period 2, household i observes her utility shocks $\boldsymbol{\varepsilon}_2$ and chooses

$$n_2(i) \in \underset{n'}{\operatorname{argmax}} \quad U_{n'2} + \varepsilon_{n'2}(i). \tag{5}$$

Denote by $\overline{U}_{n2} \equiv \mathbb{E}[\max_{n'} U_{n'2} + \varepsilon_{n'2} | n_1(i) = n]$ the expected utility in period 2 of a household who lives in location n at the end of period 1, before the idiosyncratic utility shocks $\boldsymbol{\varepsilon}_2$ are revealed. This is a function of the vector of fundamental utility levels in period 2. Then in period 1, the household chooses her location to maximize expected utility,

$$n_1(i) \in \underset{n'}{\operatorname{argmax}} \quad U_{n'1} + \beta \overline{U}_{n'2} + \varepsilon_{n'1}(i). \tag{6}$$

Conditional on living in location n at time t, households choose consumption to maximize utility subject to a single period budget constraint as they cannot save,

$$\sum_m P_{Tm} C_{Tmnt} + P_{NTn} C_{NTn} \leqslant W_n H_{nt} + T_{nt},$$

where P_{Tm} is the price of the freely traded good produced in location n, P_{NTn} is the price of the non-traded good produced in location n, W_n is the wage paid in location n, and T_{nt}

is the per capita transfer from the government to people in location n at time t. That is

$$
\begin{aligned}
\{C_{nt}, C_{NTnt}, C_{Tnt}, \{C_{Tmnt}\}\} \in \underset{C, C_{NT}, C_T, \{C_{Tm}\}}{\operatorname{argmax}} \Big\{ U^n(C, H_{nt}) \Big| \\
C &= C^n(C_T, C_{NT}), \\
C_T &= C^T(\{C_{Tm}\}) \\
\sum_m P_{Tm} C_{Tm} + P_{NTn} C_{NT} &\leqslant W_n H_{nt} + T_{nt} \Big\}.
\end{aligned}
\tag{7}
$$

The nested nature of the preferences allows for the problem to be broken down into subcomponents. First note that $C_T(\cdot)$ is homogeneous of degree 1 and identical across locations. Then, since there are no trade costs within the traded sector, there exists a common aggregate price of the traded good $P_T = \min\{\sum_m P_{Tm} C_{Tm} | C^T(\{C_{Tm}\} \geqslant 1\}$. In turn, the price of the consumption aggregate C_{nt} in each location n is $P_n = \min\{P_{NTn} C_{NT} + P_T C_T | U^n(C_{NT}, C_T) \geqslant 1\}$.

Importantly, households do not choose their hours H_{nt}. Instead, labor is completely demand determined in each location. This creates a wedge since the marginal rate of substitution between consumption and labor may not be equal to the relative price. With flexible wages, the household would choose consumption and labor supply so that $U^n_C / P_n = -U^n_H / W_n$. The labor wedge is a measure of how far this first order condition is from being satisfied. I will denote this wedge as follows:

$$
\tau_{nt} \equiv 1 + \frac{P_n}{W_n} \frac{U^n_H}{U^n_C}.
$$

If an economy is in a boom, then the household is working more than it would like. Therefore, $|U^n_H|$ will be high, leading to a negative labor wedge. On the other hand, the wedge will be positive if the region is going through a local recession.

Government Policy. The government serves two roles. First, it transfers money between regions. The budget constraint at period t for the national government is

$$
\sum_n \ell_{nt} T_{nt} = 0, \text{ for all } t. \tag{8}
$$

The second role the government plays is determining aggregate demand through monetary policy. In this simplified setup, I assume that the government can choose nominal GDP directly

$$E_t = \sum_n P_n C_{nt} \ell_{nt}, \text{ for all } t. \tag{9}$$

In a richer, dynamic model, the government would do this by setting the interest rate.

Definition 1. *Given nominal GDP in each period E_t and per capita transfers T_{nt}, an* equilibrium *is a set of location choices $n_t(i)$, utility levels $U_{nm}(i)$, U_{nt}, regional population ℓ_{nt}, prices for freely trade goods P_{Tn}, prices for non-traded goods P_{NTn}, consumption levels C_{Tmnt}, C_{NTnt}, labor supplies H_{nt}, and output Y_{NTnt}, Y_{Tnt}, such that:*

- *Households choose consumption and their location to maximize utility,* (5)*,* (6)*,* (7)*;*
- *Firms maximize profits taking prices as given,* (4)*;*
- *The government's budget constraints hold,* (8)*;*
- *The total value of consumption is equal to nominal GDP* (9)*; and*
- *Markets clear,* (1)*,* (2)*,* (3)*.*

3.3 The Planner's Problem

The planner chooses monetary policy E_t, place-based transfers T_{nt}, and associated expected utilities $U(i) \equiv \max_n U_{n1} + \varepsilon_{n1}(i) + \beta \overline{U}_{n2}$ to maximize social welfare. I assume that social welfare is a weighted sum of utility with weight $\lambda(i)$ on household i. Formally, the planner's problem (PP) is,

$$\max_{E_t, \{T_{nt}\}, \{U(i)\} \in \mathcal{E}} \int_{\mathcal{I}} \lambda(i) U(i) di, \tag{PP}$$

were $\mathcal{E}$ is the set of utility profiles attainable in a competitive equilibrium, as described in Definition 1.

4 Optimal Place-based Transfers

In this section, I derive the implications for optimal regional transfers in the aftermath of a recession. Before I do that, I characterize the economy of a region n at time t as a function of monetary policy, the population ℓ_{nt}, and the transfer from the government T_{nt}. This will provide some intuition for how national fiscal and monetary policy can affect regions in a recession, and also simplify the planner's problem. In setting this up, it will be easier to think of monetary policy as choosing the national spending on the traded sector, E_{Tt} where $E_{Tt} \equiv \sum_m P_T C_{Tmt} \ell_{mt}$, rather than total spending. I show these are equivalent, and provide all of the proofs for this section, in appendix B.

Throughout this section, I take the limit as $\beta \to 0$. This allows me to focus on the static implications for policy in the first period without worrying about the second period. Then, in the second period, I illustrate the dynamic implications of policy while ignoring feedback effects of the first period back on the second period.

4.1 Characterizing the Local Economy

The derivation of the local equilibrium proceeds in two steps. I start by characterizing the consumption decision of households in each location. I then find what labor supply is consistent with those consumption choices and government policy.

Since prices are fixed and the consumption aggregator over the traded output of each location is homothetic, households spend a fixed proportion ϕ_m of their traded expenditures on the output of location m, i.e.

$$P_{Tm}C_{Tmnt} = \phi_m P_T C_{Tnt}.$$

Multiplying by the population in location n, ℓ_{nt}, and summing across all locations we get that total spending on the traded output of location m is a fixed share of traded output,

$$P_{Tm}Y_{mt} = \phi_m E_{Tt}.$$

Total labor earnings in location m, $W_j H_{mt}\ell_{mt}$, is then that spending on traded output plus spending on the non-traded good. Spending on the non-traded good is simply a fixed share of total income α_m, and total income is labor earnings $W_m H_{mt}\ell_{mt}$, plus the transfer from the government $T_{mt}\ell_{mt}$, i.e.

$$W_m H_{mt}\ell_{mt} = \phi_m E_{Tt} + \alpha_m \left(W_m H_{mt}\ell_{mt} + T_{mt}\ell_{mt}\right).$$

This defines hours worked as a function of monetary policy E_{Tt}, population ℓ_{mt}, and the transfer from the government T_{mt}. In what follows I define this function as,

$$H^m(E_T, \ell, T) \equiv \frac{1}{W_m}\left(\frac{\phi_m E_T}{1-\alpha_m}\frac{1}{\ell} + \frac{\alpha_m}{1-\alpha_m}T\right). \tag{10}$$

To complete the description of the local equilibrium, I also define an indirect utility function for households in location m only as a function of the transfer T_m and hours worked H_m. Substituting in that real consumption is total earnings $W_m H$ plus the transfer T divided by the price level P_m, I find that

$$V^m(T, H) \equiv U^m\left(\frac{W_m}{P_m}H + \frac{T}{P_m}, H\right). \tag{11}$$

Understanding the derivatives of these functions is crucial for building intuition.

Lemma 1. *The derivatives of the indirect utility function are*

$$\frac{\partial V^n}{\partial T} = \frac{U_C^n}{P_n}; \quad \frac{\partial V^n}{\partial H} = W_n \frac{U_C^n}{P_n}\tau_{nt}. \tag{12}$$

The derivatives of the hours worked function are

$$\frac{\partial H^n}{\partial T} = \frac{1}{W_n}\frac{\alpha_n}{1-\alpha_n}; \quad \frac{\partial H^n}{\partial \log E_T} = \frac{1}{W_n}\frac{\phi_n E_T}{1-\alpha_n}\frac{1}{\ell}; \quad \frac{\partial H^n}{\partial \log \ell} = -\frac{1}{W_n}\frac{\phi_n E_T}{1-\alpha_n}\frac{1}{\ell}. \tag{13}$$

I start by considering how E_T shapes the local equilibrium through equation (13). When the central government heats up the entire economy by increasing spending in the freely traded sector, the people in each location will work more in the freely traded sector. However, at the same time, they will get more money, and they will want to spend that money on traded and non-traded goods. This will increase demand for the local non-traded good, increasing the labor supplied to that sector leading to a feedback loop. The size of that feedback loop is summarized by the proportion of spending on the non-traded good, α_n. What this means for the utility of households in region n depends on whether the location is in a boom or bust. If it is in a bust ($\tau_{nt} > 0$), then the households there value the opportunity to work more and earn more money as shown in (12). On the other hand, if the labor market is already hot, household utility will decrease from having to work even harder.

In this model, migration ends up having a similar effect on utility as does an increase in the level of expenditures on freely traded goods as seen in equation (13). Suppose that more people move to location n. The demand for the traded output of the location remains the same, which means they cannot start producing more. Instead, every households needs to reduce the number of hours they are working so that the total number of hours worked at a location remains the same when including the extra workers. Then the feedback loop leads to reduced hours per household in the non-traded sector as well. The effect on utility then depends on the labor wedge of (12). If the area is in a recession, workers leaving will increase the utility of those left behind because those left behind can work and earn more.

Direct monetary transfers from the government behave very differently. In particular, they provide a direct utility benefit by increasing consumption of the traded goods (12) on top of the stimulus effect (13). Whether the increase in hours increases utility depends again on the state of the economy. If the economy is in a recession ($\tau_{nt} > 0$), then the social value of an extra dollar is higher than the marginal utility of income, $V_T^n + V_H^n H_T^n > \frac{U_C^n}{P_n}$, and there are positive externalities from spending more. If the economy is already booming then working more will hurt the residents and the total benefit from a transfer is smaller than the private internalized benefit.

4.2 The Simplified Planner's Problem

Having characterized the local equilibrium, I now restate the planner's problem in a simplified form. Taking as given starting location, the population of location n in period 1 is a function of the fundamental expected utility households can expect from living in each location m,

$$\ell_{n1} = \ell^{n1}\left(\{U_{m1} + \beta \overline{U}_{m2}\}\right) \text{ for all } n. \tag{14}$$

Conditional on being in location n at the end of period 1, the household's location in period 2 depends only on period 2 utility. Thus I define a function $\mu^{nm}\left(\{U_{k2}\}\right)$ as the share of households who move from location n to location m as a function of fundamental utility. Doing so, population in period 2 can be written as

$$\ell_{m2} = \sum_n \ell_{n1} \mu^{nm}\left(\{U_{k2}\}\right) \text{ for all } m. \tag{15}$$

Utility is given by the indirect utility functions derived in section 4.1,

$$U_{mt} = V^m\left(T_{mt}, H^m\left(E_{Tt}, \ell_{mt}, T_{mt}\right)\right) \text{ for all } m, t. \tag{16}$$

Then planner's problem (PP) is equivalent to the simplified problem (SPP),

$$\max_{E_{Tt},\{T_{nt}\},\{U_{nt}\},\{\ell_{nt}\}} \int_{\mathcal{I}} \lambda(i) \sum_n \mathbb{1}_{n \in \arg\max U_{n'1} + \varepsilon_{n'1}(i) + \beta \overline{U}_{n'2}} \left[U_{n1} + \varepsilon_{n1}(i) + \beta \overline{U}_{n2}\right] di, \tag{SPP}$$

subject to the free mobility constraints, (14), (15), the utility constraints, (16), and the budget balance constraints, (8).

4.3 Optimal Short-Run Transfers

The first order necessary conditions of (SPP) characterize the optimal policy. I start by summarizing how monetary policy adjusts in the background to ensure that the average labor wedge across locations is zero.

Lemma 2. *In any interior solution to* (SPP)*,*

$$\sum_n \frac{W_n H_{Tn1}}{1-\alpha_n} \ell_{n1} \frac{\tau_{n1}}{1+\frac{\alpha_n}{1-\alpha_n}\tau_{n1}} = 0.$$

By increasing the overall spending in the entire economy, the planner can stimulate all regions. Thus, the planner sets the average labor wedge to zero, properly weighting each region according to its economic importance. Before I show the relevant first order condition for place-based transfers, I introduce a variable β_{n1} to denote the social marginal utility of income in region n period 1. It is defined as

$$\beta_{n1} \equiv \frac{\overline{\lambda}_{n1} U_C^n}{P_n},$$

where $\overline{\lambda}_{nt} = \mathbb{E}[\lambda(i)|n_t(i) = n]$ is the average pareto weight on households in location n at time t. This measures how much social welfare increases if the income of the average household in location n increases slightly, holding all else fixed. The household's utility increase depends on the price index in the location P_n and her marginal utility of consumption U_C^n. What that means for social welfare then depends on the average weight the planner puts on those in the location, $\overline{\lambda}_{nt}$.

The first order condition for a transfer to location n implies the next lemma.

Lemma 3. *In any interior solution to to* (SPP)*, first period transfers must satisfy*

$$\underbrace{\sum_m \ell_{m1} T_{m1} \nu_{n1}^{m1}}_{\textit{fiscal externality}} = \ell_{n1}\Bigg[\underbrace{\frac{\beta_{nt}}{\lambda_1^G}}_{\textit{redistribution}} \underbrace{\left(1+\frac{\alpha_n}{1-\alpha_n}\tau_{n1}\right)}_{\textit{stimulus effect}} - 1\Bigg] - \underbrace{\sum_m \frac{W_m H_{Tm1}}{1-\alpha_m}\ell_{m1}\frac{\tau_{m1}}{1+\frac{\alpha_m}{1-\alpha_m}\tau_{m1}}\nu_{n1}^{m1}}_{\textit{migration effect}},$$

where $\nu_{n1}^{m1} \equiv \frac{\partial \log \ell^{m1}}{\partial U_{n1}}\left(\frac{\partial V^n}{\partial T_{n1}} + \frac{\partial V^n}{\partial H_{n1}}\frac{\partial H^{n1}}{\partial T_{n1}}\right)$ *is the migration semi-elasticity of population in location m to a transfer in location n holding fixed utility in locations other than n, and $\lambda_1^G > 0$ is the social value of the government having another dollar.*

Increasing the transfer to location n has four effects, each labeled in Lemma 3. The first effect is a fiscal externality. By increasing the transfer to location n, households move away from other locations and into location n. The extent to which the planner values this movement depends on how much people were being taxed in their old location versus their tax in their new location. If households were being taxed in their previous location m but gaining a transfer in their new location n, this will hurt the government's ability to raise money.

The next effect is a direct redistributive effect.[7] Ignoring any effect on labor demand, giving a transfer to households in location n increases utility. The amount that that improves social welfare depends on the social marginal utility of consumption divided by the value of an extra dollar to the government β_{n1}/λ_1^G.

The final two effects are the macroeconomic effects that are the focus of this paper. First, there is the stimulus effect. When the government increases transfers to a location n, utility increases over and above the direct utility benefit when n is in a recession (i.e. $\tau_{n1} > 0$) because total work hours demanded increases by a factor of $\frac{\alpha_n}{1-\alpha_n}$ as discussed in Lemma 1. Whether or not the government values that stimulus depends on the labor wedge τ_{n1}. Second, there is the migration effect. Providing a transfer to location n will increase the population in location n and decrease the population in every other location m. If the regions households leave are in a recession, the out migration improves social welfare, while if those regions are in a boom, that will be harmful as discussed in Lemma 1. The total migration effect of a transfer then depends on the distribution of recessions τ_{m1} and the matrix of migration semi-elasticities ν_{n1}^m.

Specializing these equations to the case of Janesville, where there is one small region in a recession within the large US, I find the following.

Proposition 1. *Suppose that there are two locations, j (Janesville) and u (Rest of the US), location j is arbitrarily small, $\ell_{jt} \to 0$, and there are no redistributive reasons for policy, $\beta_{nt} = 1$. Then in any interior solution to* (SPP)*, the optimal period 1 transfer to location j must satisfy*

$$T_{j1} = \frac{1}{\nu_{j1}^{j1}} \left(\frac{\alpha_j}{1-\alpha_j} - \frac{W_j H_{Tj1}}{1-\alpha_j} \frac{\partial \log \ell^{j1}}{\partial T_{j1}} \right) \tau_{j1},$$

where $\frac{\partial \log \ell^{j1}}{\partial T_{j1}} \equiv \frac{\partial \log \ell^{j1}}{\partial U_{j1}} \frac{\partial V^j}{\partial T}$ is the semi-elasticity of location 1 population to a transfer, holding fixed hours worked, and $\nu_{j1}^{j1} \equiv \frac{\partial \log \ell^{j1}}{\partial U_{j1}} \left(\frac{\partial V^j}{\partial T_{j1}} + \frac{\partial V^j}{\partial H_{j1}} \frac{\partial H^{j1}}{\partial T_{j1}} \right)$ is the semi-elasticity of location 1 population to a transfer, allowing hours to vary.[8]

Proposition 1 shows that the optimal transfer depends on four statistics: the labor wedge τ_{j1}, the local multiplier $\frac{\alpha_j}{1-\alpha_j}$, the micro migration semi-elasticity $\frac{\partial \log \ell^{j1}}{\partial T_{j1}}$ adjusted by the importance of the traded sector $\frac{W_j H_{Tj1}}{1-\alpha_j}$, and the macro migration semi-elasticity ν_{j1}^{j1}. I will take each of these in turn.

The first statistic is the labor wedge τ_{j1}. This determines if the region is in a recession

[7] This can also be thought of as an insurance effect from the perspective of a household before her utility draws are revealed. See Mongey and Waugh (2024).

[8] In the limit where households do not move across locations the planner will use transfers to set the labor wedge in Janesville to 0 since the planner has no redistributive reasons for policy. In Farhi and Werning (2017), the optimal stimulus transfers are weighed against the redistributive reasons for policy.

or not and so whether the planner wants to stimulate the economy or cool it down. In the following discussion, I assume that Janesville is in a recession, so that $\tau_{j1} > 0$.

The sign of the optimal transfer to Janesville then depends on the relative size of the local multiplier $\frac{\alpha_j}{1-\alpha_j}$ and the micro migration semi-elasticity with the traded sector adjustment $\frac{W_j H_{Tj1}}{1-\alpha_j}\frac{\partial \log \ell^{j1}}{\partial T_{j1}}$. In particular, the optimal transfer could actually be a tax on Janesville if households are sufficiently mobile. Why? Because a transfer to Janesville has a direct effect on both the demand and supply for total labor.

To demonstrate this, suppose that, starting from an equilibrium with no transfers, the national government gives a small transfer to Janesville, $dT_{j1} > 0$, paid for with a small tax on the rest of the US, $dT_{u1} = -\frac{\ell_{j1}}{\ell_{u1}} dT_{j1}$, and monetary policy sets the labor wedge in u to 0. Then the total effect on social welfare, when there are no redistributive reasons for policy ($\beta_{j1} = \beta_{u1} = 1$), is given by

$$\begin{aligned}
d\mathcal{W} &= \overline{\lambda}_{j1}\ell_{j1} dU_{j1} + \overline{\lambda}_{u1}\ell_{u1} dU_{u1} \\
&= \overline{\lambda}_{j1}\ell_{j1}\left(\frac{U_C^j}{P_j} dT_{j1} + W_j \frac{U_C^j}{P_j}\tau_{j1} dH_{j1}\right) + \overline{\lambda}_{u1}\ell_{u1}\frac{U_C^u}{P_u} dT_{u1} \\
&= \ell_{j1} dT_{j1} + \ell_{j1} W_j \tau_{j1} dH_{j1} - \ell_{u1}\frac{\ell_{j1}}{\ell_{u1}} dT_{j1} \\
&= \ell_{j1} W_j \tau_{j1} dH_{j1},
\end{aligned}$$

using the indirect utility function derivatives from Lemma 1. Therefore, since Janesville is in a recession, $\tau_{j1} > 0$, the transfer increases social welfare if and only if it increases per capita hours worked in Janesville, $dH_{j1} > 0$.

I graph the equilibrium in Figure 3a in order to illustrate the comparative static. For notational convenience, I omit the dependence on monetary policy E_{Tt} and variables in the rest of the United States u since Janesville is infinitesimal and so has no effect on those aggregates. The top panel plots hours demanded and the optimal number of hours the households would like to supply, holding fixed the transfer from the government and total population. Distinct from the usual supply and demand framework, wages are rigid at W_j and so do not clear the market. $W_j \tau_{j1}$ then measures how far off households in location j are from their ideal labor supply.

To complete the description of equilibrium, I endogenize ℓ_{j1} in the bottom panel of Figure 3a. I plot the population supply curve in red. This curve shows how many households would like to live in location j as a function of the hours worked per capita. It is increasing for most H_{j1} because the region is in a recession and fundamental utility increases in hours. I also plot the hours demanded curve as a function of population. Where they cross determines

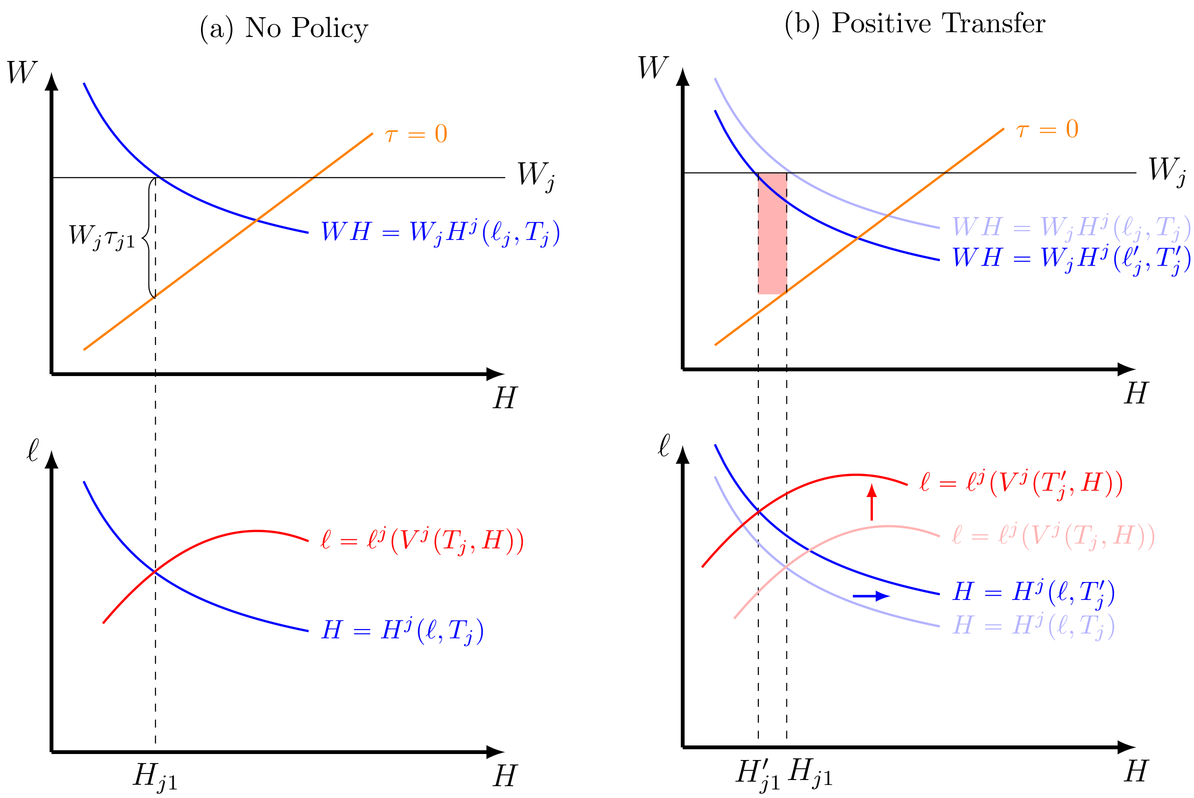


Figure 3: Illustration of Stimulus and Migration Effect of a Transfer

Notes: The top panel of (a) plots the per capita hours of work demanded and the first best level of hours supplied in Janesville holding fixed population with no government transfer. Population is endogenously determined by the population supply and the hours demanded curves in the bottom panel which both take as given the transfer. (b) plots the comparative static with respect to a small increase in the transfer to Janesville. The top panel shades the welfare loss due to the decrease in hours worked per capita.

the equilibrium population and hours.

I plot how the equilibrium changes when the national government gives a small transfer to Janesville in Figure 3b. The stimulus effect leads to the hours demanded curve in the bottom panel shifting to the right by $\frac{1}{W_j}\frac{\alpha_j}{1-\alpha}$ as shown in Lemma 1. That is, for a given population, if those households have extra income, there will be more demand for their labor because there is home bias in consumption. If this were the only direct effect of a transfer, then the transfer might affect total population, but the inflow of population would only come from a shift along the population supply curve and could not decrease hours demanded.

However, that is not the case here because transfers directly increase utility independent of the stimulus effect. Therefore, the population supply curve also shifts up by $\frac{\partial \log \ell^j}{\partial U_{j1}}\frac{\partial V^j}{\partial T_j}$. It is this shift that determines whether or not the migration effect can dominate the stimulus effect, which is why the migration semi-elasticity that matters for the migration effect is this micro semi-elasticity, holding fixed hours worked, rather than the macro semi-elasticity which would take into account moves along the supply curve.

The curve that shifts up the most dominates. That is, if the hours demanded curve shifts up more, then hours worked will increase and welfare will improve from a transfer. If the population supply curve shifts more, then hours will decrease since too many people move in. I note that the slope of the hours demanded curve is $-\frac{W_j}{\frac{W_j H_{Tj1}}{1-\alpha_j}}$ so that a shift to the right of $\frac{1}{W_j}\frac{\alpha_j}{1-\alpha}$ corresponds to a shift up of $\frac{1}{\frac{W_j H_{Tj1}}{1-\alpha_j}}\frac{\alpha_j}{1-\alpha}$. Thus, the stimulus effect dominates, and the optimal policy features transfer to Janesville, if and only if

$$\frac{\alpha_j}{1-\alpha_j} > \frac{W_j H_{Tj1}}{1-\alpha_j}\frac{\partial \log \ell^j}{\partial U_{j1}}\frac{\partial V^j}{\partial T_j}.$$

Not drawn is the fiscal externality that comes from increasing or decreasing a transfer to Janesville. The ultimate size of the transfer balances the direct stimulus and migration effects on the labor wedge against that force. Therefore, the formula is divided by the migration semi-elasticity ν_{j1}^{j1}. Importantly, this elasticity takes into account the effect on hours worked of a transfer since that determines the total utility effect of the transfer, and therefore the total increase in the population. That is why it is a macro migration semi-elasticity that matters for the fiscal externality rather than the micro migration semi-elasticity of the migration effect.

In practice, many labor demand shocks do not hit only one small region. Instead, they hit whole industries, as is the case with the China trade shock. In that case, the migration effect of a transfer can have more complicated effects. If giving a transfer to a region in a recession causes households to leave a region that is in a worse recession, the migration effect will be a net positive. The next proposition makes precise how the spatial distribution of shocks interacts with migration patterns to shape optimal spatial policy.

Proposition 2. *Suppose that there are two large locations, s (southern US) in a boom and n (northern US) in a recession, and one small location, j (Janesville). Then, if there are no redistributive reasons for transfers $\beta_{nt} = \beta_{st} = \beta_{jt} = 1$, in any interior solution to* (SPP),

$$T_{j1} > \frac{1}{\nu_{j1}^{j1}}\left(\left(\frac{1}{\lambda_1^G} - 1\right) + \frac{1}{\lambda_1^G}\frac{\alpha_j}{1-\alpha_j} - \frac{W_j H_{Tj1}}{1-\alpha_j}\frac{\partial \log \ell^{j1}}{\partial T_{j1}}\right)\tau_{j1},$$

if and only if migrants to j disproportionately come from n, i.e. $|\nu_{j1}^{n1}| > |\nu_{j1}^{s1}|$.

Proposition 2 says that if migrants to location j disproportionately come from the northern part of the US, which is in a recession, the national government should give more money to location j than that suggested by the local multiplier and migration semi-elasticity, taking into account the social marginal value of a government dollar λ_1^G. Importantly, the formula in Proposition 2 looks slightly different than that in 1 because in Proposition 1, the social value of another government dollar is 1. When there are two locations, and one is in a recession, that is no longer the case, because the value of another dollar is not simply the marginal value of consumption (which we have assumed is 1 because there are no redistributive reasons for transfers). That extra dollar can now also be used to stimulate the north relative to the south, so that $\lambda_1^G > 1$.

Above and beyond that difference, the transfer to Janesville is larger than that suggested by the local trade-off if and only if migrants to Janesville disproportionately come from the north. To see why that is, suppose that migrants to Janesville came proportionately from the north and the south, i.e., $\nu_{j1}^{n1} = \nu_{j1}^{s1}$. In that case, increasing the transfer to Janesville will have the effects on Janesville discussed in Proposition 1, but it will also have an impact on the fiscal externality and the migration effect in the north and the south. In particular, households will leave the south and the north proportionately to their population. However, the average labor wedge and the average transfer across the two locations are zero due to monetary policy and budget balance, respectively. Therefore, the net effect on the fiscal externality and the net migration effect are both zero.

By contrast, if migrants to Janesville disproportionately come from the north, increasing the transfer to Janesville will have a net migration effect and an effect on the fiscal externality that depends on the social value of having slightly fewer households in the north relative to the south. Importantly, the fact that the planner has the optimal transfer on the north and south already tells us something about the combined fiscal externality and migration effect. The combined fiscal externality and migration effect that come from migration into the north in response to the transfer are balanced against the stimulus effect of the transfer. However, because the north is in a recession, the stimulus effect must be positive, and therefore the combined fiscal externality and migration effect must be negative. Thus, the planner values encouraging households to disproportionately leave the north by giving extra money to those in Janesville.

This implies that the nature of the demand shock matters for the optimal policy. If the shock is very correlated, then regions that are in recessions will be near other regions in recessions. Therefore, a transfer to one of those regions will not have a large net migration effect since all migrants in response to the transfer will come from other areas also in a recession. The China trade shock might call for more aggressive transfers from the national government than an idiosyncratic shock like the closure of the Janesville Assembly Plant. I will return to this quantitatively in sections 6 and 7.

4.4 Optimal Long-Run Transfers

Having shown that fiscal transfers to a region in the immediate aftermath of a factory closure have competing stimulus and migration effects, I next turn to the effects of a transfer in the long run. One might think that the same basic trade-off between the migration effect and the stimulus effect apply in the second period as it did in period 1. The only difference is that people have more time to move so that the migration effect will likely be stronger. But that intuition turns out to be incomplete, as I now discuss.

I start by stating the first order necessary condition for a transfer to location n in period 2. I define the social marginal utility of income in region n period 2,

$$\beta_{n2} \equiv \frac{\beta \overline{\lambda}_{n2} U_C^n}{P_n}.$$

Lemma 4. *In any interior solution to* (SPP)*, second period transfers must satisfy*

$$\sum_t \frac{\lambda_t^G}{\lambda_2^G} \sum_m \ell_{mt} T_{mt} \nu_{n2}^{mt} = \ell_{n2} \left[\frac{\beta_{n2}}{\lambda_2^G} \left(1 + \frac{\alpha_n}{1-\alpha_n} \tau_{n2} \right) - 1 \right] - \sum_t \frac{\lambda_t^G}{\lambda_2^G} \sum_m \frac{W_m H_{Tmt}}{1-\alpha_m} \ell_{mt} \frac{\tau_{mt}}{1 + \frac{\alpha_m}{1-\alpha_m} \tau_{mt}} \nu_{n2}^{mt},$$

where λ_2^G is the social value value of the government having another dollar in period 2, and ν_{n2}^{mt} is the elasticity of population in location m at time t to a transfer to location i at time 2.

Lemma 4 shows the same four effects of a transfer from the period 1 first order condition shown in Lemma 3: fiscal externality, redistribution, stimulus, and migration. The redistribution and stimulus effects remain the same as before. Transferring an extra dollar to households in location n improves social welfare by β_{n2} directly through consumption. The planner weights that use of the money against the marginal value of a dollar in period 2, λ_2^G. Similarly, the transfer leads to a stimulus of $\frac{\alpha_n}{1-\alpha_n}$. The only difference is that real consumption and the labor wedge might be different in period 2 as compared to period 1.

Both the fiscal externality and the migration effect now have dynamic components. That is because a promise to tax certain locations in period 2 will affect where households decide to live at time 1. Therefore, the planner has to take into account how that movement in the first period will affect the fiscal externality and recessions in the first period. Under the limit $\beta \to 0$, this effect is infinitesimal. However, λ_2^G is also infinitesimal, so the effect still shapes the optimal policy.

In the next proposition, I consider what this implies for optimal policy in Janesville in period 2.

Proposition 3. *Suppose that there are two locations, j (Janesville) and u (Rest of the US), location j is arbitrarily small, $\ell_{jt} \to 0$, there are no redistributive reasons for policy, $\beta_{nt} = 1$, and j is in a recession, $\tau_{jt} > 0$. Then in any interior solution to* (SPP)*, the optimal period 2 transfer to location j satisfies*

$$T_{j2} < \frac{1}{\nu_{j2}^{j2}} \left(\frac{\alpha_j}{1-\alpha_j} - \frac{W_j N_{Tj2}}{1-\alpha_j} \frac{\partial \log \ell^{j2}}{\partial T_{j2}} \right) \tau_{j2},$$

when the share of workers in location j in period 1 who stay in location j in period 2 is greater than zero.

Comparing Proposition 3 to Proposition 1 reveals that in period 2, the optimal transfer to a region in a recession is always lower than that implied by the simple static trade-off between the stimulus effect and the migration effect.

A transfer in the second period has the same stimulus, migration, and fiscal externality effects on period 2 as first period transfers did in period 1. However, giving a transfer to people in Janesville in period 2 also increases the expected utility of living in Janesville in period 1 if people who live in Janesville in period 1 are likely to live there in period 2 (due to moving costs). Therefore, if the planner promises to give a transfer to people who are in Janesville in period 2, people who would have left in period 1 because they had a job opportunity somewhere else will be less likely to leave. So the period 2 transfer will increase population in period 1 Janesville, impacting the first period fiscal externality and migration effect.

What is the net effect on social welfare? To answer that, we need to know the signs and relative strength of those two forces. The key is to note that period 1 transfers already reveal something about their combined effect. Period 1 transfers optimally trade off those exact forces that come from an increase in population against the positive stimulus effect of giving a little extra money to people in location 1. Therefore, the net effect of increasing population in period 1 Janesville must be negative, and a transfer in period 2 makes that worse. Therefore, transfers in period 2 should be smaller than what would be suggested by the static trade-off since taxes in period 2 allow the planner to encourage out migration without decreasing stimulus in the first period.

The actual size of the transfer in period 2 could be larger or smaller than that in period 1. For most models, the migration semi-elasticity in period 2 will be larger than the semi-elasticity in period 1, suggesting the transfer should be lower. However the labor wedge in period 2, τ_{j2} will often be closer to 0 than the labor wedge in period 1 τ_{j1}, shrinking the transfer towards 0. I will demonstrate how this plays out quantitatively in sections 6 and 7.

4.5 Extensions and Robustness

The model so far has been stylized in order to shed light on the key forces shaping optimal fiscal policy in the most transparent way possible. Here I consider how the results change when I include other real world features.

Downward Wage Rigidity and Costly Price Adjustments. This model features perfect wage rigidity, but empirical evidence suggests that wages are more rigid going downwards. In appendix C.1, I consider a variant of this model with 2 locations, downward wage rigidity, and costly upward price adjustments. In that case, I derive a new version of Proposition 1 in the appendix. The relative sign of the transfer still depends on the local multiplier and the migration semi-elasticity.

Place-biased Policy. In appendix C.2, I consider an extension of the model with multiple types and transfers that can be partially targeted towards those types and locations. I show that starting from an equilibrium with no taxes, whether or not a place-biased transfer helps with macroeconomic stability still depends on the same sufficient conditions: the local multiplier and the migration semi-elasticity. Importantly, the stimulus effect depends on the observed place-biased nature of the transfer while the migration effect is determined by how place-biased the transfer is within a type.

One way to think of this extension is having to do with automatic stabilizers. The extension then solves for the conditions under which making a particular place-biased program more generous helps macroeconomic stability. Consider the income tax. The income tax will have stimulus effects if income decreases in a recession. But also, because the tax rate is progressive, higher paying jobs are less attractive. Therefore, households have less incentive to take a higher paying job in a region with higher demand. Similarly, unemployment benefits will stimulate the region, but it will reduce the incentive to find a job. Assuming that it is easier to find a job in a low unemployment area, this reduces the attractiveness of other regions not in a recession.

Another interpretation of this extension is as transfers that can be targeted based on starting location. The type is then starting location. In that case, this extension says that the planner would target money towards types who tend to be in recessionary regions, that is, those who were there before. However, the migration effect still operates within the group, so that the planner might want to offer households more money to go somewhere else if the migration semi-elasticity is high enough.

Households Affect Demand. In appendix C.3, I consider an extension of the model to have multiple household types who can affect demand for a particular region. These could represent entrepreneurs, for example. When they move into a region, they open up new businesses that export new products to the rest of the country. I find an adjusted version of Proposition 1. The migration effect then also has an effect on demand that depends on the covariance between the household type's effect on demand and their migration semi-elasticity to the transfer. In practice, this covariance is likely small since entrepreneurs likely move to areas with good economic conditions, regardless of the government transfers, though this force could suggest other place-based policies to fight local recessions.

Wage Stickiness Only in Traded Goods. While Autor et al. (2013) found that earnings decreased significantly, they found no evidence that wages decreased in the manufacturing sector. Instead, all of the wage movement was in services. In appendix C.4, I consider an extension of the model where labor is imperfectly substitutable across the traded and non-traded sector, and wages are not sticky in the non-traded sector. In that case, there is no stimulus effect of a transfer because there is no wedge on the non-traded labor. Instead, there is only a migration effect, so I show that in an adjusted version of Proposition 1, the optimal transfer to Janesville is always negative.

Monetary Policy. I also consider the implications for monetary policy in Appendix B.1. I show that in the baseline model, there is a contractionary bias to monetary policy. By under-heating the economy, the regions in a recession become less attractive since unemployment is higher. Conversely, regions that are booming become more attractive because they are not working too much. Thus, households are encouraged to move out of recessionary regions into regions doing well.[9]

5 Dynamic New Keynesian Economic Geography Model

The two period model with freely traded and non-traded goods in section 3 reveals the key forces in a transparent manner, but it is too stylized to bring to the data to quantify how large place-based transfers should be. On the trade side, I have abstracted from any geographic considerations that may create non-zero trade costs on traded goods. On the macro side, I have abstracted from any wage adjustment by assuming completely rigid wages.

[9]This force is closely related to the contractionary bias in times of industrial reallocation of Guerrieri et al. (2021) when wages are perfectly sticky and workers can reallocate across sectors.

In this section, I present a continuous time model of New Keynesian economic geography with parametric assumptions that will allow me to map to the data in a transparent way. While the parametrization limits the model compared to that in section 3, it also allows me to include finite trade costs and slowly adjusting wages so that I can match key moments in the real world. I then discuss how I use the model by approximating the solution and calibrating it to the 722 commuting zones in the contiguous United States. The quantitative implications are presented in sections 6 and 7.

5.1 Environment

There are N regions indexed by $n, m \in \mathcal{N} = \{1, \ldots, N\}$, one non-traded sector and one traded sector, and continuous time indexed by $t \in [0, \infty)$.

In every period, households consume a consumption aggregate and elastically supply labor to the local industries. The opportunity to migrate subject to moving costs arrives at an exogenous Poisson rate. The consumption aggregate is a Cobb-Douglas aggregation of sectoral goods that themselves are Armington aggregates of different varieties produced in each of the locations. Varieties are traded subject to iceberg trade costs.

In each location, there is a continuum of competitive firms that hire labor from unions and produce differentiated goods. Unions get a chance to change their posted wages at some Poisson rate. When given the chance, they unilaterally set their wage to maximize the utility of the households in the location.

Households. There is a continuum of households that I index by $i \in \mathcal{I}$. I will start by describing the dynamic welfare taking as given flow utility before returning to describe the flow utility.

I denote the location of agent i at time t by $n(i, t)$. Then each household starts in some location $n(i, 0)$ and it gets the opportunity to move at a Poisson rate $\delta_\ell > 0$. At that point, the household observes additive utility shocks of moving to every location m, $\varepsilon_m(i, t)$. The utility shocks are distributed Gumbel with shape parameter ν. The household can then move subject to an additive migration cost of moving to a location m, $\tau_{\ell nm}$.

Denoting the set of all times where household i moves from location n to m by $\mathcal{M}_{nm}(i) \subset [0, \infty)$. Then realized utility of household i is

$$\int_0^\infty e^{-\rho t} \left[U_{n(i,t)}(t) + \sum_{n,m} \delta_{t \in \mathcal{M}_{nm}(i)} [-\tau_{\ell nm} + \varepsilon_m(i, t)] \right] dt,$$

where $U_n(t)$ is the flow utility of living in location n, $\rho > 0$ is household's discount rate, and

$\delta_{t \in \mathcal{M}_{nm}(i)}$ is the dirac delta function.

The immediate flow utility of a household in location n at time t of type γ, $U_n(t)$ is a function of consumption and labor supply,

$$U_n(t) = \frac{C_n(t)^{1-\theta}}{1-\theta} - \frac{H_n(t)^{1+\eta}}{1+\eta},$$

where $C_n(t)$ is the consumption aggregate, θ is the elasticity of intertemporal substitution, $H_n(t)$ is hours supplied, and η is the Frisch labor elasticity. The consumption aggregate is a cobb-douglas aggregation of consumption of the traded good and the non-traded good,

$$C_n(t) = C_{NTn}(t)^{\alpha} C_{Tn}(t)^{1-\alpha},$$

where $C_{sn}(t)$ is consumption of the sector s good and $\alpha \in (0,1)$ is the share of spending on non-traded goods. The traded good is an aggregation of the varieties produced in each location,

$$C_{Tn}(t) = \left(\sum_{m \in \mathcal{N}} \phi_m^{\frac{1}{\sigma}} C_{Tmn}(t)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}},$$

where ϕ_m is the consumption weight on the variety produced by location m, which I normalize so that $\sum_m \phi_m = 1$, $C_{Tmn}(t)$ is consumption of the traded good produced in location m by the consumer in n, and σ is the elasticity of substitution between varieties produced by the locations.

Firms. In each location n, there is a continuum of intermediate producers $\omega \in [0,1]$ who produce an intermediate using labor. Firm ω produces

$$Y_n(\omega, t) = H_n(\omega, t) \ell_n(t),$$

where $Y_n(\omega, t)$ is production and $H_n(\omega, t)$ is the amount of per capita labor supplied to intermediate ω.

A final producer then combines those intermediates according to a CES aggregator

$$Y_n(t) = A_n \left[\int_0^1 Y_n(\omega, t)^{\frac{\epsilon-1}{\epsilon}} d\omega \right]^{\frac{\epsilon}{\epsilon-1}},$$

where $Y_n(t)$ is the aggregate production of location n and $\epsilon > 1$ is the elasticity of substitution across intermediates. This final good can then be consumed as a non-traded or traded good.

Market Clearing. For the labor market to clear, labor supplied equals the sum of labor demand by each intermediate producer,

$$H_n(t) = \int_0^1 H_n(\omega, t) d\omega, \text{ for all } n, t. \tag{17}$$

Aggregate production of location n is consumed as a traded good and non-traded good. The non-traded good is only consumed by the local households. Trade is subject to iceberg trade costs. Therefore, goods market clearing requires production in location n is equal to consumption of non-traded goods in the location plus consumption of its produce as a traded good across all locations,

$$Y_n(t) = C_{NTn}(t)\ell_n(t) + \sum_m \tau_{nm} C_{Tnm}(t)\ell_m(t), \text{ for all } n, t, \tag{18}$$

where $\tau_{nm} \geqslant 1$ is the iceberg trade costs of delivering a good from location n to location m.

5.2 Decentralized equilibrium

5.2.1 Utility Maximization

I start by characterizing the household's migration decision taking as given flow utility in location n at time t, $U_n(t)$. I then turn to the consumption decision. Just as before, workers do not choose labor, and instead supply the labor demanded.

Migration Decision. The Bellman equation for a household in location n is

$$\rho v_n(t) - \dot{v}_n(t) = U_n(t) + \delta_\ell \left(V_n(t) - v_n(t)\right), \tag{19}$$

where $v_n(t)$ is the expected lifetime utility of a household in location n at time t and $V_n(t)$ is the expected utility if that households gets the opportunity to move. Because the utility shocks are distributed Gumbel,

$$V_n(t) = \frac{1}{\nu} \log\left(\sum_m \exp(\nu(v_m(t) - \tau_{\ell nm}))\right). \tag{20}$$

This implies that a $\exp\left(\nu(v_m(t) - \tau_{\ell nm} - V_n(t)\right)$ share of households in location n who have the chance to move will move to location m. The population in location m changes according to

$$\dot{\ell}_m(t) = \delta_\ell \left[\sum_n \exp\left(\nu(v_m(t) - \tau_{\ell nm} - V_n(t)\right) \ell_n(t) - \ell_m(t) \right]. \tag{21}$$

Intratemporal Consumption Decision. Given expenditures $E_n(t)$, households in location n at time t choose consumption to maximize utility taking prices as given. In particular,

$$\begin{aligned} \{C_{NTn}(t), C_{Tn}(t), \{C_{Tmn}(t)\}\} \in \underset{C_{NT}, C_T\{C_{Tm}\}}{\operatorname{argmax}} \Bigg\{ (C_{NT})^{\alpha} (C_T)^{1-\alpha} \Bigg| \\ C_T = \left(\sum_m \phi_m^{\frac{1}{\sigma}} (C_{Tm})^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \\ \sum_m p_{Tmn}(t) C_{Tm} + p_{NTn} C_{NT} \leqslant E_n(t) \Bigg\}. \end{aligned} \tag{22}$$

This problem is standard so the characterization is left for the appendix D. I denote by $P_n(t)$ the prefect price index so that $E_n(t) = P_n(t)C_n(t)$.

Households are hand-to-mouth so they spend all of their income in each period. Income comes from two different sources: labor earnings and government transfers. That is,

$$E_n(t) = \left(\int_0^1 W_n(\omega, t) H_n(\omega, t) d\omega \right) + T_n(t), \tag{23}$$

where $W_n(\omega, t)$ is the wage offered by intermediate producer ω in location n and $T_n(t)$ is the transfer to households in location n.

5.2.2 Production

Profit Maximization. A competitive, representative firm for each intermediate ω in location n maximizes profits taking prices and wages set by the union as given using a linear technology. Therefore, the price of the intermediate is simply the wage $p_n(\omega, t) = W_n(\omega, t)$.

The final producer is competitive and so maximizes profits taking as given the price of the final good $p_n(t)$ and intermediates $W_n(\omega, t)$. Therefore, the usual CES algebra yields

$$\begin{aligned} Y_n(t), \{Y_n(\omega, t)\} \in \underset{Y, Y(\omega)}{\operatorname{argmax}} \Bigg\{ p_n(t) Y - \int_0^1 W_n(\omega, t) Y(\omega) d\omega \Bigg| \\ Y = A_n \left[\int_0^1 Y(\omega)^{\frac{\epsilon-1}{\epsilon}} d\omega \right]^{\frac{\epsilon}{\epsilon-1}} \Bigg\}. \end{aligned} \tag{24}$$

Trade is also competitive so that $p_{Tnm}(t) = \tau_{nm} p_n(t)$ and $p_{NTn}(t) = p_n(t)$.

Labor Unions. For each intermediate ω in location n, there is a union that can unilaterally set the wage it demands. Wages are sticky, and the union only gets the chance to change the wage demanded at a poisson rate δ_w.

Given wages, the union supplies the labor necessary to meet demand for intermediate ω. I assume that there is efficient rationing. When a union gets the chance to change its wage, it sets the wage to maximize utility of the average household in its location. As is standard in this literature, I assume the local government has a wage subsidy κ to undo the monopoly distortion, funded by a tax on the residents. That is, the unions who can change their wage at time t choose a new wage $\tilde{W}_n(t)$ that solves

$$\tilde{W}_n(t) \in \underset{W'}{\operatorname{argmax}} \int_t^{\infty} e^{-(\rho+\delta_w)(t'-t)} \left[\kappa \frac{C_n(t')^{-\theta}}{P_n(t')} (W')^{1-\epsilon} - H_n(t')^{\eta} (W')^{-\epsilon} \right] A_n^{\epsilon-1} P_n(t')^{\epsilon} Y_n(t') dt'. \tag{25}$$

Appendix D describes further details.

5.2.3 Government

The government sets aggregate spending $E(t)$, such that

$$E(t) = \sum_n E_n(t) \ell_n(t), \text{ for all } t, \tag{26}$$

and also chooses the place specific transfers between locations. The government budget constraint then must hold in each period,

$$\sum_n \ell_n(t) T_n(t) = 0, \text{ for all } t. \tag{27}$$

Definition 2. *Given monetary policy $E(t)$ and per capita transfers $T_n(t)$, an* equilibrium *is a set of location choices $n^*(\xi, t)$, utility levels $U_n(t)$, regional population $\ell_n(t)$, prices $P_n(t)$, wages $W_n(\omega, t)$, consumption levels $C_{Tmn}(t)$, $C_{NT}(t)$, labor supplies $H_n(t), H_n(\omega, t)$, and output $Y_n(t)$, such that:*

- *Households choose consumption and their location to maximize utility* (19), (20), (21), (22), (23);
- *Firms maximize profits taking prices as given,* (24);
- *Unions set wages to maximize expected utility of the local households,* (25);
- *The government's budget constraints hold,* (27);
- *Total spending is equal to nominal GDP* (26); *and*
- *Markets clear* (17), (18).

5.3 The Planner's Problem

The government chooses monetary policy $E(t)$, place-based transfers $T_n(t)$ and associated flow utilities

$$U(i,t) \equiv U_{n*(i,t)} + \sum_{n,m} \delta_{t \in \mathcal{M}_{nm}(i)}[-\tau_{\ell nm} + \varepsilon_m(i,t)],$$

to maximize social welfare. Following Dávila and Schaab (2022), I allow the government to have a time varying pareto weight $\lambda(i,t)$ on households. That is, the planner could care about the consumption of a household more at some time t than another time t'. I will adjust these time varying Pareto weights to justify no government policy in the steady state. However, in contrast to section 4, I will include redistributive reasons for policy. Formally, the planner faces the problem

$$\max_{E(t),\{T_n(t)\},\{U(i,t)\}\in\mathcal{E}} \int_{\mathcal{I}} \int_0^\infty e^{-\rho t} \lambda(i,t) U(i,t) dt di, \tag{28}$$

where $\mathcal{E}$ is the set of utility profiles attainable in equilibrium, as described in Definition 2.

5.4 Calibration and Computation

5.4.1 Linear-quadratic Approximation

This is a non-linear model with state variables utility $v_n(t)$, population $\ell_n(t)$, along with wages $W_n(\omega,t)$ for each intermediate. Solving the optimal planner's problem with the 722 commuting zones of the United States would be infeasible. Therefore, I follow the macro literature in doing a log-quadratic approximation to the social welfare function and a log-linear approximation to all of the constraints around a no-inflation, no-fiscal transfer steady state, where Pareto weights $\lambda(i,t)$ are such that it is optimal before any shocks. Details of how I derive the loss function including distortions in migration, trade, inflation, and output along with the final linearized constraints are in appendix E. I use $\hat{x}$ to denote log deviations from that steady state, and I consider idiosyncratic demand shocks to the traded output of specific regions ϕ_m.

The final linearized model features four state variables for each commuting zone: population $\hat{\ell}_n(t)$, utility $\hat{v}_n(t)$, wage $\hat{w}_n(t)$, and inflation $\hat{\pi}_n(t)$, for a total of 2,888. I give details on how I solve the equilibrium and optimal policy for time varying shocks without using an infeasible shooting algorithm in appendix G.

Table 1: Calibration Summary

Parameter	Value	Description	Source
Panel A. Stimulus effects			
Parameter	Value	Description	Source
$\frac{\alpha}{1-\alpha}$	1.6	Local multiplier	Moretti (2010)
σ	4.5	Trade EoS	Caliendo and Parro (2015)
τ_{nm}		Trade costs	CFS state trade flows
Panel B. Migration effects			
Parameter	Value	Description	Source
$\frac{\nu}{\rho+\delta_\ell}$	2.9	long-run migration elasticity	Hornbeck and Moretti (2024)
δ_ℓ	0.157	Migration calvo friction	ACS migration flows
$\tau_{\ell nm}$		Migration costs	
Panel C. Other Parameters			
Parameter	Value	Description	Source
ρ	0.06	Patience	Farhi and Werning (2017)
ϵ	11	Intermediate EoS	Farhi and Werning (2017)
η	2	Frisch labor supply elasticity	Peterman (2016)
δ_w	0.3	Wage calvo friction	Figure 1a
θ	1	Intertemporal EoS	log preferences
A_n		Productivity	CBP labor earnings

5.4.2 Calibration

In this section, I provide an overview of how I calibrate the model to match the United States in 2000. Additional details can be found Appendix F. I interpret a local labor market in the model as a commuting zone (CZ), as developed by Tolbert and Sizer (1996). My analysis will focus on the 722 commuting zones of the contiguous United States, as in Autor et al. (2013). I discuss the key parameters for the stimulus effect and migration effect in detail before turning to the more standard parameters from the macro literature. A summary of how I calibrate the parameters is in Table 1.

Stimulus Effects. As I show in Appendix H, for a small open region, the stimulus effect of a transfer depends on the local multiplier $\frac{\alpha}{1-\alpha}$ when wages are perfectly rigid. While it does not estimate the local multiplier in response to a government transfer, Moretti (2010) measures the next best thing: how many jobs in the non-traded sectors are created in response to the creation of a new manufacturing job, 1.6. I set α to rationalize what he finds.

With a finite number of regions, the stimulus effect also depends on trade flows between commuting zones. I set the elasticity of substitution across varieties produced by different commuting zones to be 4.5, which is what Caliendo and Parro (2015) estimate when pooling all traded sectors. I do not have data on trade across commuting zones in the United States, so I infer those costs by looking at trade across states. In particular, I assume the iceberg trade costs between two distinct commuting zones n and m are

$$\log \tau_{nm} = \delta_D \log \text{distance}_{nm} + \delta_H,$$

where distance_{nm} is the bilateral distance between the population centroids of CZs n and m. I then guess δ_D and δ_H and find the implied productivity of each commuting zone to match observed employment and earnings. I can then back out the implied expenditure flows between states. I search over δ_D and δ_H to minimize the square distance between the implied share of state's earnings spent on another state and the observed shares from the 2002 Commodity Flow Survey.[10]

Migration Effects. As I show in Appendix H, the migration effect depends on the long-run migration elasticity $\frac{\nu}{\rho+\delta_\ell}$ and the speed of transition δ_ℓ when wages are perfectly rigid. I set ν to match the average long-run migration elasticity of Metropolitan Statistical Area (MSA) population to earnings found in Hornbeck and Moretti (2024), 2.9.[11] This is not ideal as it is the elasticity in response to earnings rather than a transfer, but under the envelope theorem, the elasticities are the same at the point $T_n = 0$, which determines the sign of the transfer.

The speed of transition is then jointly determined by δ_ℓ and the matrix of migration costs $\tau_{\ell nm}$. I calibrate these parameters using migration reported in the American Community Survey (ACS). In particular, I construct yearly CZ-to-CZ commuting flows from where people report being in the previous year and their current location. This matrix has many zeros so I assume that migration costs have the gravity structure

$$\tau_{\ell nm} = \delta_{\ell D} \log \text{distance}_{nm} + \delta_{\ell H}.$$

I then jointly calibrate $\delta_{\ell D}$, $\delta_{\ell H}$ and δ_ℓ to match the elasticity of migration to distance and the share of workers who do not move in any given year. I find that $\delta_\ell = 0.1575$ which is double the value of 0.07 that Peters (2022) finds in Germany in the post-war years. I also

[10] This procedure is very similar to that used in Allen and Arkolakis (2014) but using great arc distance rather than using the observed transportation network, and stopping at the CZ level rather than going down to counties.

[11] As opposed to CZs, MSAs do not cover all of the United States, leaving off rural areas. However, they are similar-sized: some CZs fully encompass an MSA and some MSAs encompass a CZ. Bryan and Morten (2019) find a value of 2.7 for the US and 3.2 in Indonesia, and Hsieh and Moretti (2019) find a value of 3.3. Other papers studying the effect of the China trade shock like Artuç et al. (2010), Caliendo et al. (2019), and Rodríguez-Clare et al. (2020) consider the elasticity across sectors and/or states.

find that, conditional on getting the opportunity to leave, a household will almost always leave. This is consistent with the evidence of Yagan (2019) and Monras (2018) that while population of a region responds to economic shocks, the likelihood of an individual household leaving does not.

Wage Rigidity. The wage rigidity that matters for my mechanism is the relative wage across commuting zones. There is reason to believe that that relative wage rigidity is higher than absolute wages since many firms set national wages (Hazell et al., 2022). Therefore, I set wage rigidity $\delta_w = 0.3$ to match the fact that, for an average commuting zone, the half-life for wage adjustment is just above two years in Figure 1. These are very sticky wages and I will consider how robust the results are to this parameter.

Other Parameters. For patience, ρ, I take the standard value of the literature used by Farhi and Werning (2017). The elasticity of substitution across intermediates ϵ determines the loss from inflation. I similarly set this according to the literature. I take a value of 2 for the Frisch labor supply elasticity η to be closer to the macro estimates of Peterman (2016). And finally, I set $\theta = 1$ implying log preferences.

6 Optimal Policy After an Idiosyncratic Shock

In section 5, I presented a New Keynesian economic geography model and calibrated it to the continental US. In this section, I use this model to compute the optimal policy in the average commuting zone after an idiosyncratic demand shock for its traded output. This will allow me to demonstrate how the migration and stimulus effect from Proposition 1 and Proposition 3 interact. I can also assess how effective imperfect policies like unemployment insurance and income tax can be when place-based policy is not feasible. I then show how the optimal changes when there is an aggregate shock like the China trade shock in section 7.

6.1 Impulse Response with no Policy

I consider a commuting zone with the average amount of home bias in consumption and in migration. Larger locations will have stronger stimulus effects and weaker migration effects on average while smaller locations will have weaker stimulus effects and stronger migration effects. I then simulate a local recession by considering a drop in demand for traded output that matches the first year drop in employment of the local projections in section 2, and assuming that every other location in the United States is unaffected. The model is log linear, so all results can be scaled up or down to consider a different sized recession.

I plot the impulse response functions in Figure 4 when the central government implements a smoothed-out version of the observed policies in Figure 2 in black. Details of how I construct the observed policy are in Appendix F. I compare that to what would have happened in the absence of policy (blue dotted line), and the optimal policy (magenta dashed line) which I will discuss more below. Every variable is in log differences from its steady state value except for fiscal transfers which are relative to the size of original income.

Figure 4b plots the fiscal transfers to the region. These transfers start around 3.5% of original income, but they slowly fade out over the next 20 years. I assume that the retention rate remains at 1.5% of pre-shock income so that the government continues to provide payments long after the recession has receded.

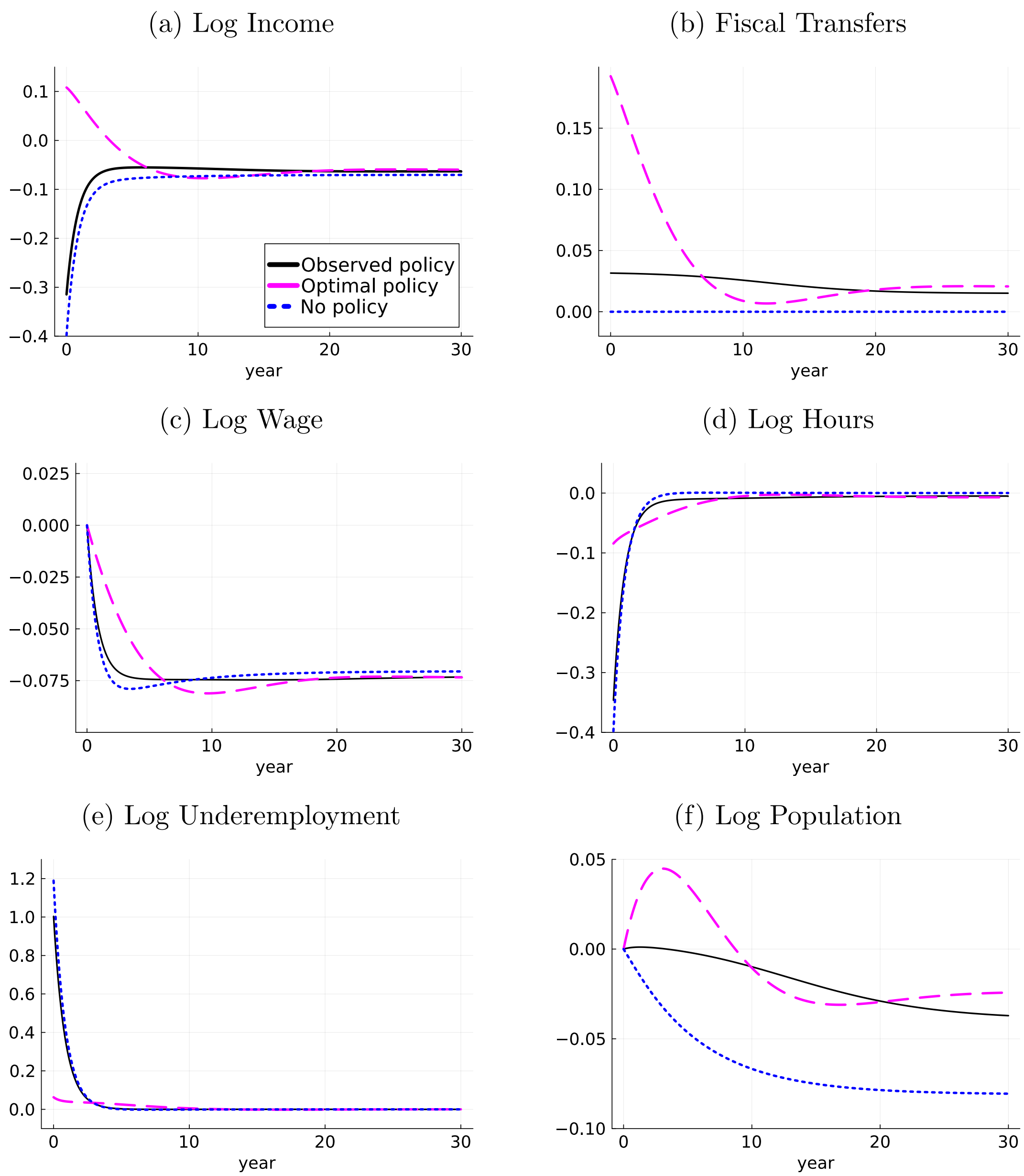
I plot the time path of log wages in Figure 4c. Consistent with the patterns observed in 1a, wages fall for the first 4 years following the shock. Only after that do wages recover slightly as people leave the commuting zone for employment somewhere else. Without the observed policy, the wages would have fallen still further since there is no increased local demand from the policy. Wages would then have recovered more as more people left the region.

While wages did not fall on the impact of the shock, earnings did. I plot the log per capita income in Figure 4a. Immediately on impact, earnings drop by more than 30%, completely driven by a decline in hours. As wages decline, demand for the traded output recovers, and log hours increase back toward their steady state value in 4d. Income recovers to around 5% less than its original amount 5 years after the shock. In the absence of policy, income would have dropped further.

There is no unemployment in this model, but there is a labor wedge. To give an idea of what that might mean for unemployment in response to a demand shock, I plot the log difference between how much the representative worker would like to work relative to how much he does work in Figure 4e. The impulse response suggests that the gap jumps by an entire log point. Unemployment then slowly drops over the next 5 years. In the absence of policy this looks very similar, though the jump is larger.

Finally, population also slowly adjusts to the new economic situation. Households are very slow to move in this model because they rarely get the opportunity. But when they do, they often decide to live somewhere else. In the meantime, very few people outside of the region want to move in. Thus, the population slowly drops more than 4% in the 30 years following the demand shock as shown in Figure 4f. By contrast, in the absence of policy, population would drop much quicker and further.

Figure 4: Impulse Response



Note: This figure shows the impulse response in an average commuting zone to a demand shock when under various policies. This is calculated by feeding a demand shock for the average CZ's tradable output into the model described in Section 5 assuming the rest of the country remains unchanged. All values are in log differences from the steady state except transfers which is relative to original income.

6.2 Optimal Policy Response

I plot how the national government should respond and what that impies for local economic variables in a magenta dashed line on the same Figure 4. Figure 4b plots the time path of the optimal transfers relative to earnings in the steady state. There are three distinct stages to the optimal transfer that roughly correspond to each of the three roles transfers can play: stimulus, migration, and finally, redistribution.

Stage one lasts for about six and a half years. In this time period, the stimulus effects of the transfer dominate. Immediately after the demand shock, there is a large amount of unemployment, but people do not have time to move in response to government policy, so the government can get free stimulus by giving people a check immediately upon being laid off. Thus, optimal transfers jump to around 20% of the original commuting zone income. In fact, the transfers are so large, one can see in Figure 4a that total income of the region actually increases. That is because, immediately after the shock migration cannot respond. Therefore, transfers only have two effects: redistribution and stimulus. Redistribution would suggest that the planner should exactly make up for the lost income so that the marginal utility of consumption remains the same. However, at that level of spending, the household is still working less than he would like, so the planner would like to give extra money for the added stimulus. Because of that, log underemployment in Figure 4e peaks at around 6% log points of initial labor supply rather than more than 100% increase seen with observed policy. Optimal transfers then taper in size as the migration effect of the transfer becomes more important.

In stage two, the migration effect of the transfer dominates, consistent with Proposition 3. This lasts from year 7 to around year 20 and features transfers that are lower than the long run redistributive transfers. After the demand shock, the planner commits to an entire time path of fiscal transfers. The planner promises very generous transfers in the immediate aftermath of the shock, but he also includes a promise to tax people who stay in the commuting zone in the medium run (around 10 years after the shock). Because of that promise, workers who get the opportunity to move to a different location (because of a new job opportunity, etc.) take it. Thus, the planner can have her cake and eat it to. She can get the immediate stimulus with the front loaded transfers while still encouraging workers to find work elsewhere through the promise of less generous transfers in the medium run. Therefore, the bump in population in Figure 4f is relatively small, even though the transfers immediately after the demand shock are quite large.

The third stage is the long run, more than 20 years after the shock. At this point, wages have completely adjusted and population has started to stabilize. There is no longer any reason for policy to affect macroeconomic stabilization. This transfer optimally trades off redistribution to people who are now poorer because of the shock against misallocation that comes from worker migration response as explored in Gaubert et al. (2021).

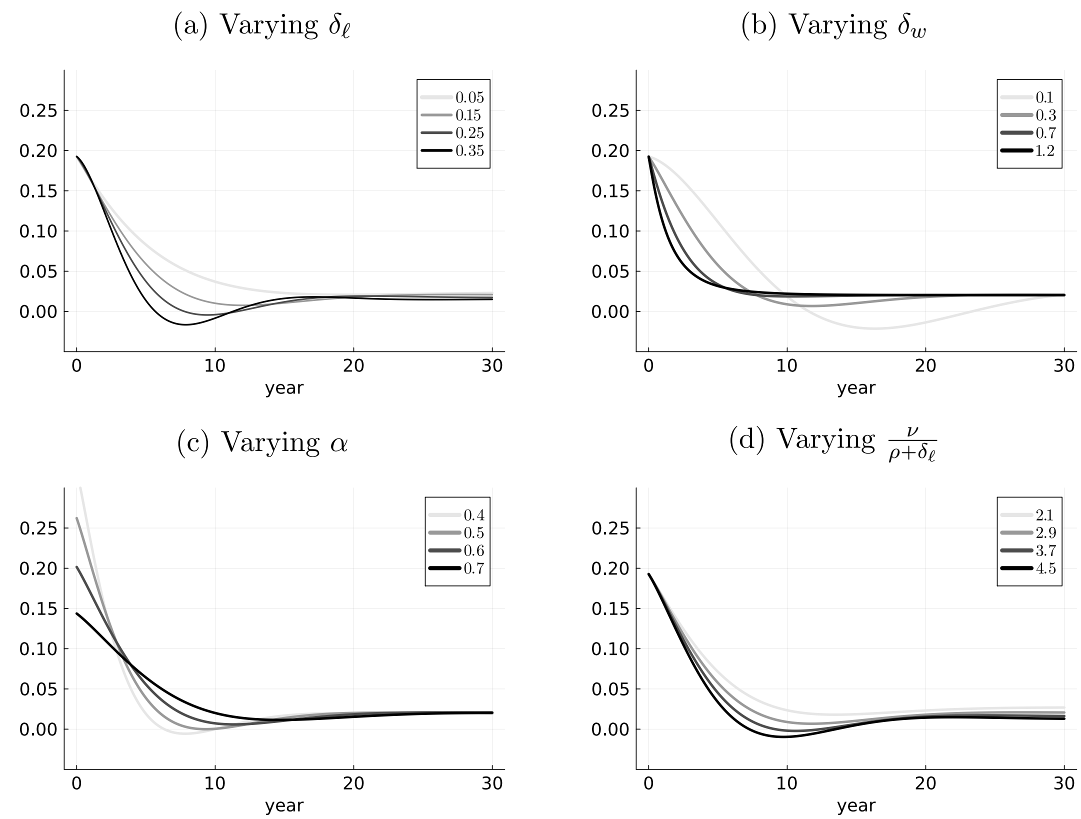
The observed policy falls short in two main ways. First of all, it is not nearly generous enough immediately after the demand shock, so that unemployment rises inefficiently high. It then also does not fade away quickly enough, encouraging workers to remain in the area for too long. In particular, transfers driven by the retirement and disability programs seem to hurt macroeconomic stability. However the observed poilcy does a decent job at matching the long run optimal insurance. In the end, the observed policy achieves 35.4% of the welfare gains offered by the fully optimal policy.

Robustness. Next I assess how sensitive the optimal policy is to different parameters. In particular, I plot the time path of optimal transfers in response to a demand shock while varying key parameters determining the relative strength of the migration and stimulus effect in Figure 5. In Figure 5a, I vary the speed of migration δ_ℓ, holding fixed the long run migration elasticity. Figure 5b varies the degree of wage rigidity. Figure 5c shows how the policy changes with the local multiplier, and Figure 5d shows how sensitive the policy is to the long run migration elasticity.

I start by discussing how the speed of population change affects the optimal policy in 5a. When population adjusts very slowly (i.e. δ_ℓ is close to 0), the optimal transfer never falls below the long run insurance level. That is because the planner cannot affect population on the time scale necessary to affect the recession. People might be very mobile in the long run, but if they will only move out 10 years after a policy change, there is no macroeconomic benefit because wages will have already adjusted by that point. When people are very quick to move, as suggested by the impulse response in Figure 1b, the migration effect becomes more important because people's migration decision is very responsive to planned taxes. Therefore, when $\delta_\ell = 0.35$, the optimal transfer becomes negative not even 7 years after the demand shock. It then rises back to the same level of long run insurance transfers.

Next I vary the speed with which wages adjust in 5b. Similar to δ_ℓ, varying δ_w plays a large role in how important the migration effect is. The main difference is that while increasing δ_ℓ speeds up the movement of households so they can respond while the recession is happening, decreasing δ_w slows down the wages so that the recession is still happening while population slowly adjusts. Thus, as wages become perfectly rigid (i.e δ_w becomes very small), the optimal transfer becomes negative for a large number of years following the demand shock. As wages adjust more quickly, migration cannot react in time so that the transfers never drop below their long run insurance levels. However, the basic structure of generous transfers that quickly fade out remains robust.

Figure 5: Optimal Policy Robustness

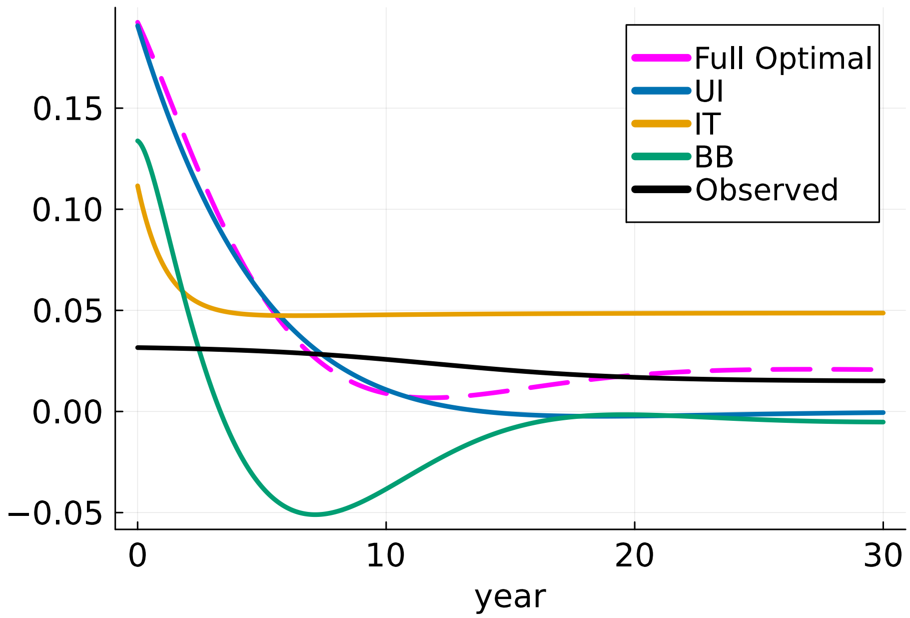


Note: This figure shows how the optimal policy changes with various parameters.

Varying the home bias in consumption α has very different impacts on the optimal transfers as seen in 5c. Increasing α makes stimulus payments much more effective. Therefore, as $\alpha \to 1$, the stimulus effect always dominates the migration effect so that there is no large dip in the optimal transfer around year 10. However, when transfers are very effective at stimulating the local economy, the government does not need to transfer as much money to a region in a recession to stimulate it. Therefore, at time 0, the optimal transfer is actually decreasing in the degree of home bias.

Finally, I show how the optimal transfer changes with the long run migration elasticity in Figure 5d. Increasing that elasticity changes the insurance effect because it increases the misallocation caused by giving a small transfer to the region. Therefore, the optimal long run transfer decreases in the migration elasticity. This comparative static also changes the migration effect. When households' location choices are more responsive to transfers, the government will want to tax a recessionary city more to encourage people to get out. Thus, the optimal transfer becomes negative around year 10 if the long run migration elasticity is 3.7.

Figure 6: Imperfect Policies



Note: This figure plots optimal policy against various imperfect policy instruments

6.3 Alternate Policy Instruments

While the United States might never have access to fully optimal place-based taxes, it could make adjustments to its current programs of automatic stablizers so that they do a better job of ensuring macroeconomic stability for cities going through recessions. In this section, I assess how well these automatic stabilizers could work to fight local recessions when we account for the stimulus and migration effects of policy. In particular, I will consider 3 types of policies: unemployment insurance, income tax, and local budget balance. I model unemployment insurance as a transfer to the region that must be proportional to the labor wedge. With the income tax, the transfer must be proportional to lost income. Local budget balance is different. I assess how effective policy can be when it is constrained to have a present discounted value of 0, taking as given the taxes and transfers currently offered by the national government. I optimize over the possible policies within each class and assess how well they can compare to the full optimal policy in response to the idiosyncratic demand shock to a commuting zone.

I plot the time path of transfers for the best policy within each class in Figure 6. The fully optimal policy and the observed policy are both reprinted for easy comparison. The optimal unemployment insurance does a very good job of matching the general shape of the fully optimal policy. It allows for extremely generous transfers on impact that decay over the next ten years as wages adjust. Compared to the fully optimal policy, it only fails to recover and offer the efficient long run insurance. Yet, despite that, it still manages to achieve 94.7% of the welfare gains of the fully optimal transfer. This unemployment insurance policy is much more generous than any reasonable unemployment insurance system. It suggests that each unemployed person should get a transfer equivalent to 5 times their original income. While that does not make sense as an individual transfer, it does suggest that the central government could transfer money to commuting zones that have high unemployment rate shocks. It also suggests that the federal government should consider making the special benefits authorized for periods of high unemployment more generous.

The income tax has a small bump in transfers on impact, but it then falls close to its long run level after 5 years. This high long run transfer implies that it continues to distort migration too much, both in the medium run and long run. The income tax only manages to get 65.6% of the welfare gains of the fully optimal policy even while it makes up 50% of the lost income in the commuting zone.

Turning to the budget balanced policy, I find that a local government can fight a local recession by borrowing to fund a large stimulus program after the demand shock. The stimulus is not enough to increase income on impact, but it does put many of the households back to work. The local government then pays for that policy with taxes in the medium and long run. By taxing heavily around year 8, the local government can encourage people to leave and find good employment somewhere else at the same time it funds its stimulus payments. The government then settles in with a moderate long run tax to make up the rest of the shortfall. With this policy, and no change in the central government's tax and transfer program, a local government can get 74.7% of the welfare gains from the fully optimal policy, much better than the 35.4% implied by the current policies.

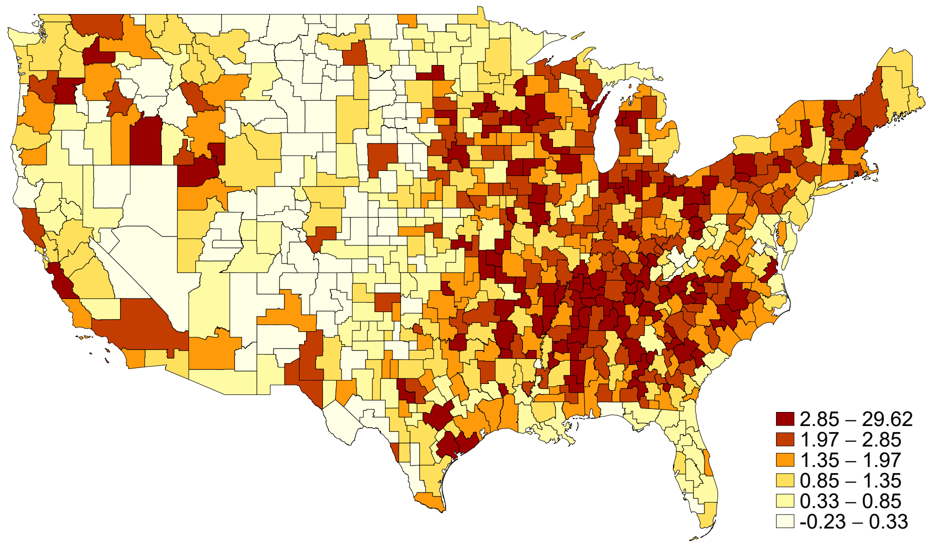
7 Optimal Policy After the China Trade Shock

In section 6, I analyzed how place-based policy should react to an idiosyncratic demand shock to a single region. In this section, I consider what the regional recessions caused by the China trade shock imply for optimal place-based transfers. With the full model and a spatially correlated shock, I can assess how the migration and stimulus effect change as suggested by Proposition 2.

7.1 The Trade Shock

I model the trade shock as a uniformly increasing demand shock for traded production of the regions starting in the year 2000 and ending at the beginning of year 2007. I further

Figure 7: China shock spatial incidence.



Note: This figure plots the incidence of the China Trade shock across the 722 commuting zones of the contiguous United States. The shock is constructed using the increase in Chinese exports in 4 digit industries to other advanced countries from 2000 to 2007. The impact on each commuting zone is determined by share of commuting zone employment in the sector in year 2000.

assume that starting the year 2000, the planner fully anticipates the size of the entire trade shock. I follow Adao et al. (2019) in constructing the China Trade shock to each commuting zone. In particular, the decrease in demand for commuting zone n's traded output is

$$\hat{\phi}_n = -\sum_s \ell_{n,s} \Delta M_{China,s},$$

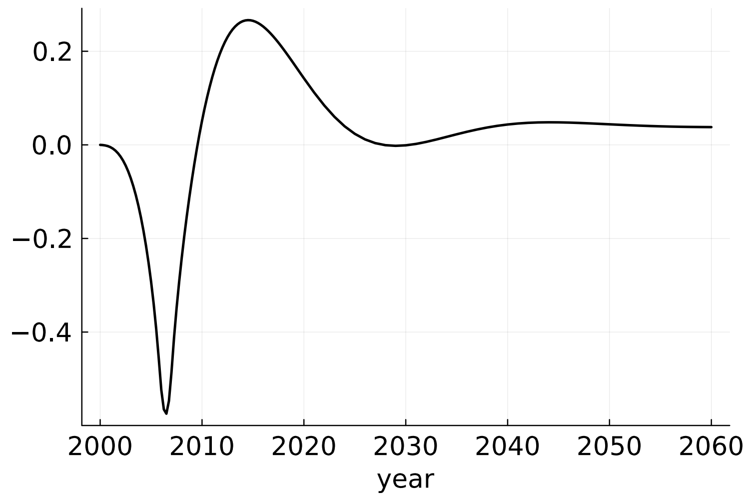
where $\Delta M_{China,s}$ is the change in imports for the years 2000 to 2007 from China in the 4-digit SIC sector s for a set of high-income countries divided by the US initial employment in sector s, and $\ell_{n,s}$ is commuting zone n's employment share in sector s in the year 2000. I plot the distribution of shocks in Figure 7.

7.2 Average Optimal Policy

I start by plotting the impulse response function for the average commuting zone hit by the China trade shock. In particular, I weigh commuting zone n by its earnings, population, and the size of the shock, i.e. $E_n \ell_n \hat{\phi}_n$, and take the average value of the transfer. I plot the results in Figure 8.

The time path of the transfers is significantly different from that found in Section 6 because starting in the year 2000, the planner expects future shocks. Therefore, the planner

Figure 8: Weighted Optimal Policy to China Trade Shock



Note: This figure plots the transfers to commuting zones hit by the China trade shock, weighted by labor earnings and the size of the shock.

actually wants to encourage people to move out of the commuting zones before the worst of the China trade shock. In 2000, the planner promises zero taxes because transfers announced right away have no impact on anyone's choice to move. However, by promising to tax workers in the future, with the largest taxes in 2006, the planner gets some households to leave the region. This completely depends on the planner foreseeing the China shock. If the planner did not know how bad the shock would be, the optimal transfer would be positive in the year 2000, and then continue to grow as the shock became increasingly worse.

After 2006, the optimal transfer to regions hit by the China shock starts to increase, becoming positive before the year 2010. At that point, the stimulus effect of a transfer dominates, and the planner starts transferring lots of money to the regions in a recession. The stimulus effect continues to dominate the subsequent migration effect after the shock until 2024, a full 17 years after the China trade shock fully stopped. This is much longer than the 7 to 10 years found in Section 6 in response to an idiosyncratic shock. And it suggests that perhaps the take up in disability insurance that Autor et al. (2013) noted after the shock actually could have helped with the macroeconomic stability. After the China shock, many people did not have other places to go, so long run transfers from the federal government could provide stimulus without distorting migration decisions much.

After 2024, the migration effect again dominates. The optimal transfers drop below their long run redistribution levels so that workers are encouraged to find jobs elsewhere..

7.3 The Geography of Optimal Policy

The average policy hides a significant amount of spatial heterogeneity. I plot some of that heterogeneity in Figure 9.

In the year 2002, Figure 9a, transfers are on average taxing the regions hit by the China trade shock. This is seen most clearly in the Northwest where there are a lot of taxes centered on the commuting zones in Eastern Washington, soon to be most affected. However, the positive transfers are often targeted at commuting zones near the areas with a shock. For example, the planner gives generous transfers to northern Minnesota, Louisiana, Eastern California, and Nevada. These are regions that workers about to be affected by the China shock would move to before the shock hits. By 2006, Figure 9b, the transfers are far more concentrated in regions far away from the China shock, and there are taxes on most areas near the shock. The only exception to this is the Northwest where the planner has already started providing stimulus to regions in Eastern Washington.

By 2017, transfers are targeted toward all commuting zones directly affected by the China shock. But the government also gives transfers to commuting zones near those directly affected. Those transfers nearby serve three purposes. First, the China shock indirectly hurts those regions since a decline in income of nearby regions reduces spending on the unaffected region because of trade costs. Therefore, those regions also experience a recession. Adao et al. (2019) document evidence consistent with this. Second, since there are trade costs, giving money to commuting zones near regions in a recession will lead to some stimulus for the commuting zone in the recession. Finally, those transfers encourage people who live in nearby commuting zones to move to the region that is not as badly affected. This is exactly Proposition 2. The stimulus transfers become less generous by 2024.

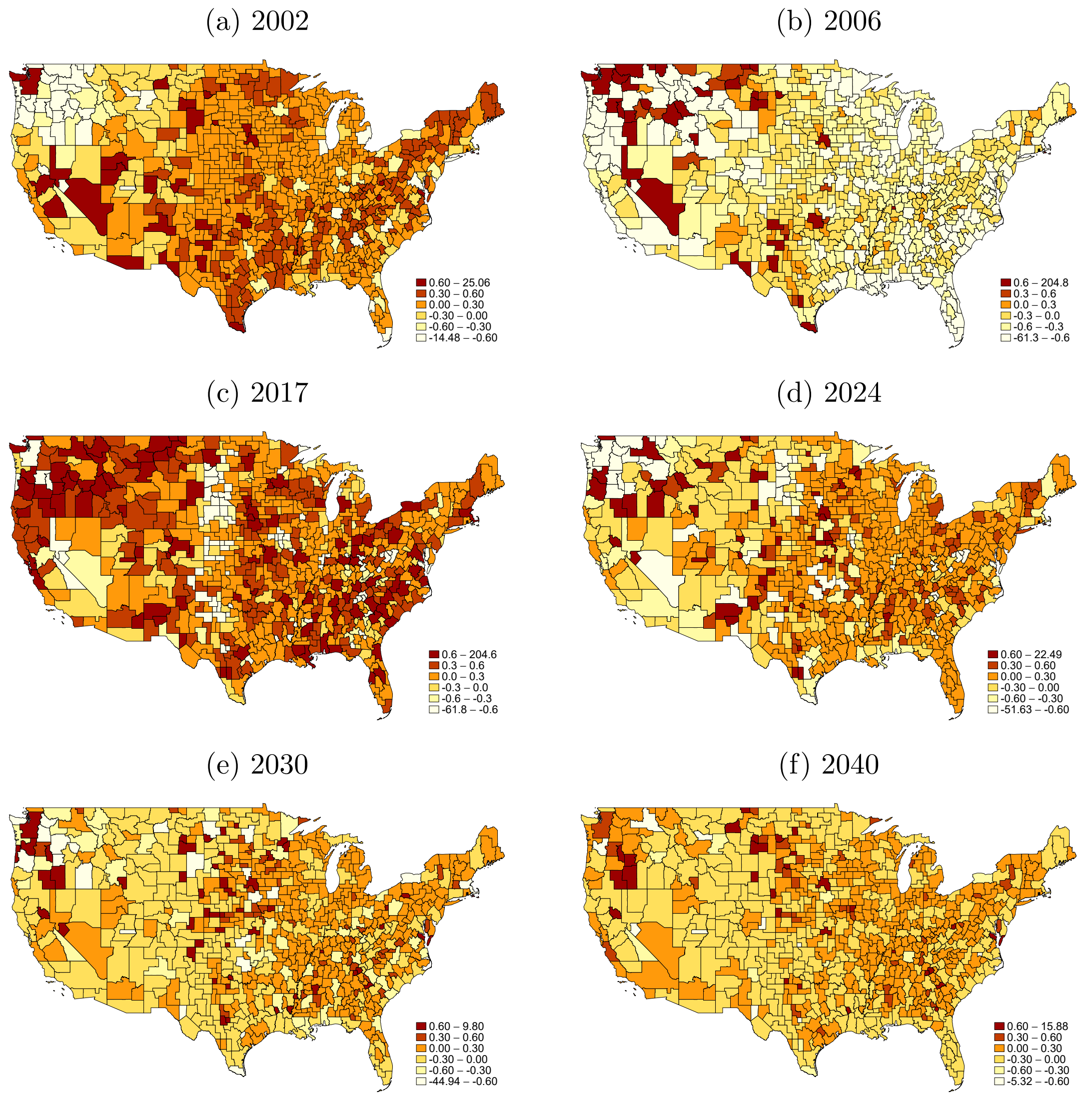
In 2030, the planner then follows through on her plan to reduce transfers to regions that had bad recessions during the China shock. The taxes then settle in at their long run insurance levels around the year 2040.

8 Concluding Remarks

Regions are subject to idiosyncratic shocks. Changes in trade policies can lead to large shifts in demand. Economic structural change can make the product one location produces less enticing. And idiosyncratic shocks to individual firms can end up greatly hurting a town. Central governments cannot use monetary policy to fight the resulting local recessions, but it can use other policies.

In this paper, I focused on one key market failure that shapes how regions respond to

Figure 9: Optimal Transfers.



Note: This figure shows the impulse response in an average commuting zone to a demand shock when under various policies. This is calculated by feeding a demand shock for the average CZ's tradable output into the model described in Section 5 assuming the rest of the country remains unchanged. All values are in log differences from the steady state except transfers which is relative to original income.

these shocks: wage rigidity. In such a case, I have shown that fiscal policy can be used to fight the resulting local recession. The resulting optimal transfers should be aggressive, but short lived. For idiosyncratic shocks, more generous unemployment insurance could provide the necessary stimulus without distorting location choice greatly. More aggregate shocks likely call for a more coordinated response.

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