County Population Size and the Employment Effects of Fiscal Policy

Sayantan Roy

Purdue University

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Abstract

Does $1 per capita in stimulus create the same number of jobs everywhere? I document an inverted-U relationship between local employment responses and county population size. Using county-level variation in American Recovery and Reinvestment Act (2009-12) spending, I find that local employment responses are largest in mid-sized counties (approximately 100,000 residents) and substantially smaller in both small counties (approximately 10,000 residents) and large counties (approximately 1 million residents). To understand these patterns, I develop a multi-region new Keynesian model with representative agents, search-and-matching labor market frictions and endogenous labor force participation, calibrated to reflect conditions during the zero lower bound. The model rationalizes the empirical findings through distinct mechanisms operating at different county sizes: small counties experience significant demand leakages due to their economic openness, while large counties face constrained job creation despite stimulus spending, as high prevailing vacancy posting costs limit firms' incentives to post new vacancies. These results demonstrate that the aggregate effectiveness of fiscal stimulus depends critically on its geographic distribution. Targeting mid-sized labor markets during the Great Recession may have improved the employment impact of a finite stimulus. Reallocating 35% of ARRA funds from large to mid-sized counties reduces the cost per job-year by about $1,050 (to $47,687) and adds roughly 103,000 job-years (+2.2%). A full reallocation reduces the cost per job-year by about $2,900 (to $45,851) and yields roughly 295,000 additional job-years (+6.3%).

1 Introduction

This paper asks a simple question: *Does $1 per capita in fiscal stimulus create the same number of jobs everywhere?* The answer matters for both positive and normative reasons. If the employment effect of a per-capita dollar varies systematically with local characteristics, then (i) the aggregate multiplier of a fixed national budget depends on its geographic distribution, and (ii) policy design during deep downturns—when monetary policy is constrained—can be improved by targeting the places where a dollar buys the most employment.

The Great Recession provides a natural setting to study this question. As the unemployment rate rose from 5.0% to 10.0% and the policy rate reached the zero lower bound, the United States implemented the American Recovery and Reinvestment Act (ARRA) in 2009, allocating spending across counties through numerous programs.

I use cross-county variation in per-capita ARRA spending during 2009–2012 to quantify how local employment responses vary with county population size. The measure I consider is the the cumulative change in employment to population ratio (EPOP) over 2007–2012. I find that a 1% increase in per-capita government spending is associated with a 0.014 percentage-point increase in cumulative EPOP (2007–2012). This average effect masks pronounced heterogeneity: the relationship between the local employment response and county population is inverted-U shaped—largest in mid-sized counties (roughly 100,000 residents) and substantially smaller in both very small (roughly 10,000) and very large (roughly 1 million) counties.

Why does population size matter? Population is a pre-treatment summary statistic that bundles key margins of transmission: openness to trade with the rest of the country and baseline prices and wage-setting. Smaller places are typically more open, so additional demand leaks out via imports from other regions, attenuating local multipliers. Cross-regional evidence on fiscal shocks underscores the role of such leakages for translating local to national effects (Dupor et al., 2023). Larger markets, by contrast, tend to have higher price levels and wage premia. Higher baseline vacancy-creation costs can compress job-creation incentives for a given spending impulse. In the model, search frictions are captured by a constant-returns matching function, so population size mainly matters through these openness and vacancy-cost channels rather than through an independent "thickness" effect. These mechanisms provide ex-ante reasons for non-monotonic, place-dependent employment responses to equal per-capita stimulus—an implication borne out in the data. These mechanisms provide ex-ante reasons for non-monotonic, place-dependent employment responses to equal per-capita stimulus—an implication borne out in the data. I develop a multi-region New Keynesian model with search-and-matching frictions and endogenous labor-force participation, calibrated to zero-lower-bound conditions, to interpret the cross-sectional employment responses. Anchored to standard NK–SAM targets, the model reproduces the average local semi-elasticity of employment with respect to stimulus (1.1), consistent with the reduced-form evidence. I use the cross-sectional moments to discipline mechanisms that vary with market size: small counties are highly open and exhibit sizable demand leakages, while large counties face muted vacancy creation because high posting costs dampen vacancy posting; mid-sized counties lie between these forces and convert dollars to jobs most efficiently.

To discipline the model with the cross-section and then study policy, I proceed in two steps. First, I calibrate three separate two-region economies in which region 1 is an individual county i (drawn from the large-, medium-, or small-county group) and region 2 is the rest of the United States. These county–versus–rest calibrations pin down size-specific parameters so that, in isolation, the model reproduces the employment semi-elasticity for each county type. Second, I construct a unified three-region model in which the basic units are no longer individual counties but three regional blocks aggregating all large, medium, and small counties, respectively. In this unified model, I study counterfactual reallocations, the share of funds shifted from large to mid-sized counties, and quantify the general-equilibrium feedbacks that govern aggregate gains. In this environment, reallocations toward mid-sized markets systematically raise job-years and lower the cost per job-year; for example, a 35% shift reduces the cost per job-year by about \$1,050 and adds roughly 103,000 job-years. A full reallocation reduces the cost per job-year by about \$2,900 (to \$45,851) and yields roughly 295,000 additional job-years (+6.3%).

My findings contribute along three dimensions. First, empirically, the paper documents that fiscal stimulus effects vary non-monotonically with county size, adding a new stratification to the regional multiplier literature that typically emphasizes a single average effect across space (e.g., Feyrer and Sacerdote, 2011; Wilson, 2012; Chodorow-Reich et al., 2012; Conley and Dupor, 2013; Leduc and Wilson, 2017; Dupor and Mehkari, 2016). Second, theoretically, the paper shows an inverted-U in employment responses across county sizes within a disciplined NK search-and-matching environment with participation. Third, for policy, the results imply that during the aggregate employment payoff of a given stimulus budget depends critically on where it is deployed. Translating local responses into aggregate effects requires a model because cross-regional regressions abstract from general-equilibrium feedbacks and spillovers (Nakamura and Steinsson, 2018; Chodorow-Reich, 2019). The structural analysis provides this bridge and clarifies when place-targeting amplifies the national employment impact of stimulus. Section 2 describes the data. Section 3 presents the empirical strategy and results, Section 4 describes the multi-region model; Section 5 discusses my calibration and the main quantitative experiments; Section 6 concludes.

2 Data

My empirical analysis uses county-level variation in government spending and employment ratios from the 48 contiguous U.S. states, excluding Hawaii and Alaska. Employment and population data come from the Local Area Unemployment Statistics (LAUS) and Census Bureau, respectively. Local income data is available from IRS Statistics of Income[1]. Local wage and sectoral composition data is based on Quarterly Census of Wages and Employment. The ARRA spending data come from the American Recovery and Reinvestment Act (ARRA).[2]

2.1 American Recovery and Reinvestment Act

The American Recovery and Reinvestment Act (ARRA), enacted in February 2009, allocated roughly equal funding across tax benefits, entitlements, and federal contracts and grants. This paper focuses on the $228 billion in contracts and grants spent over 2009-2012, which primarily funded transportation, infrastructure, energy, and education projects with substantial county-level variation. The federal government set up ”Recovery.gov” which tracked detailed ARRA award information including final recipient zip codes. Following Dupor et al. (2023) and Crucini and Vu (2021), spending on a particular location is assigned based on ultimate recipient locations. Figure 2.1 displays a county-level map of ARRA spending through 2012. Table 1 reports, at various percentiles, per-capita ARRA spending by county. I use this cross-sectional variation to test whether employment ratios across counties respond to fiscal stimulus.

[1] https://www.irs.gov/statistics/soi-tax-stats-county-data

[2] I thank Dr. Bill Dupor and Dr. Mario Crucini for making the ARRA data available

Table 1: Cross-sectional distribution of county-level government spending (per capita)

	Percentiles					
	10th	25th	50th	75th	90th	95th
Overall	$210	$315	$511	$888	$1,546	$2,301
Large Counties	$180	$266	$432	$853	$1,563	$2,525
Medium Counties	$291	$395	$568	$902	$1,450	$1,945
Small Counties	$396	$536	$733	$1,175	$1,678	$2,085

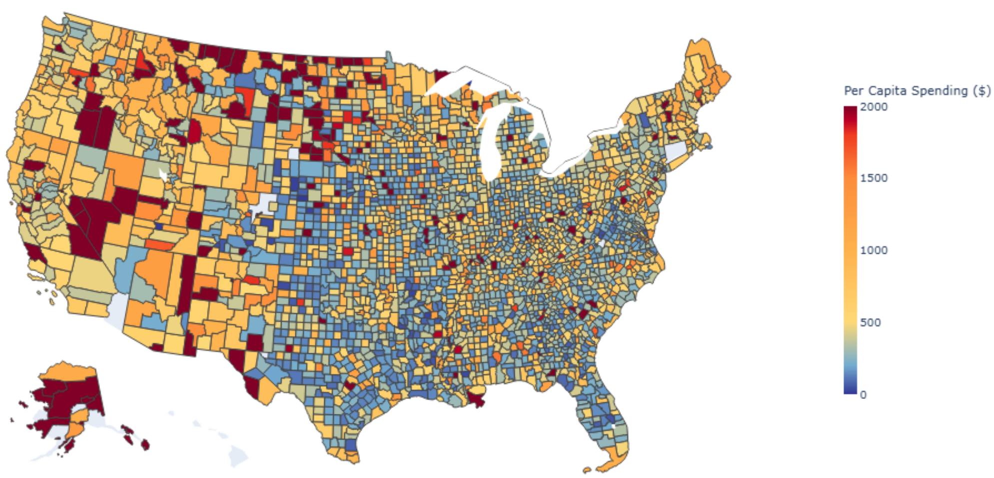

Figure 1: Per-capita ARRA Spending Across U.S. Counties 2009-12

3 Empirical Strategy

The analysis proceeds in two steps. First, I estimate the average local employment response to ARRA spending across U.S. counties. Second, I test the central hypothesis that this response varies systematically with market size by allowing the elasticity to differ across county population bins.

3.1 Measuring the Local Employment Response

I measure the employment impact of ARRA with the cumulative deviation of the employment–population ratio (EPOP) from its pre-recession baseline. For county j,

$$\mathrm{CumEPOP}_j \equiv \sum_{t=2007}^{2012} \Big(\mathrm{EPOP}_{j,t} - \mathrm{EPOP}_{j,2006} \Big). \tag{1}$$

The baseline specification relates $\mathrm{CumEPOP}_j$ to local ARRA intensity:

$$\mathrm{CumEPOP}_j = \alpha + \beta \, \log G_j + X_j' \Lambda + S_j + \varepsilon_j, \tag{2}$$

where $\log G_j$ is the log of real per-capita ARRA outlays over 2009–2012,[3] X_j is a vector of predetermined county characteristics, and S denotes state fixed effects. Regressions are weighted by the 2006 working population [4], and standard errors are clustered by state.

Endogeneity and instrument. Stimulus tends to arrive during downturns and may be targeted toward distressed areas, confounding OLS. Dupor et al. (2023) construct a narrative instrument using federal regulations and agency guidance to classify ARRA components whose allocation rules are orthogonal to contemporaneous local business conditions. The instrument is the county-level sum of these "non-targeted" components (2009–2012). I use this narrative instrument.

Controls. The vector X_j absorbs observable heterogeneity plausibly correlated with both spending and employment: (i) initial level and trend of local conditions—$\mathrm{EPOP}_{j,2006}$ and the pre-period change $\Delta\mathrm{EPOP}_{j,2000\text{–}2006}$; (ii) income and slack—2006 aggregate gross income per capita, the 2006 unemployment rate, and a recession-shock proxy $\Delta U_{j,2009\text{–}2007}$ (Yagan (2019)); (iii) demographics and human capital—shares aged 25–54 and 65+, and education shares (no high school, high school, some college); (iv) industrial structure—employment shares in goods and services. These controls capture demand capacity, supply composition, and sectoral exposure that affect both targeting and pass-through. The coefficient β is a semi-elasticity: a 1% increase in per-capita ARRA spending raises cumulative EPOP by $\beta/100$ percentage points.

[3] I aggregate project-level awards to the county, scale by the working age population

[4] population aged 16+

To test whether stimulus effects vary by market size, I allow slopes and controls to differ across population bins:

$$\text{CumEPOP}_j = \alpha + \sum_{g \in \{\text{Large, Medium, Small}\}} \mathbf{1}\{j \in g\} \left(\beta_g \log G_j + X_j' \Lambda_g \right) + S_s + \varepsilon_j, \qquad (3)$$

instrumenting $\log G_j$ with the narrative instrument interacted by group. I partition counties by their 2008 population shares: 144 large counties (4.7% of counties; 50% of the population), 1,044 medium counties (33.9%; 40%), and 1,891 small counties (61.4%; 10%), concentrating half the population in a small set of large counties.[5]

Table 2: Effect of ARRA Spending: Pooled vs Heterogeneous by County Size

	(1) Pooled Regression	(2) Group Specific Regression
Log(ARRA) Spending	1.43*	
	(0.81)	
Small Counties × Log(ARRA)		-0.40
		(1.65)
Medium Counties × Log(ARRA)		2.96***
		(0.67)
Large Counties × Log(ARRA)		0.85
		(0.83)
Controls	County Controls	Full Controls × Pop Groups
State Fixed Effects	Yes	Yes
Observations	3078	3078
First Stage F-stat	150.64	28.31

Standard errors in parentheses
Dependent variable: Cumulative change in employment-population ratio, 2007-2012.
Standard errors clustered at state level in parentheses.
All regressions weighted by 2006 working-age population.
IV: Log(ARRA) instrumented with IV proposed in Dupor et al. (2023)
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2 shows three facts. First, the all-county estimate is positive on average (1.42), but masks substantial heterogeneity. Second, the elasticities for large and small counties are economically

[5] Results are robust to alternative cutoffs.

modest and statistically indistinguishable from zero at conventional levels. Third—and central to this paper—medium counties exhibit a large and precisely estimated response ($\hat{\beta} = 2.96$), more than twice the national average, implying that a 1% increase in ARRA spending raised cumulative EPOP in medium counties by nearly 0.03 percentage points.

The inverted-U relationship poses an economic puzzle: why do medium counties respond most strongly to fiscal stimulus? I construct a multi-region model to isolate the competing mechanisms driving these differential responses.

4 Model

In this section I describe a multi-region, new Keynesian model of a monetary and a fiscal union with endogenous labor force participation, incomplete markets, and trade linkages.

4.1 Description of the economy

In each region there is a representative household of unit mass with a weight attached s_j such that $\sum_j s_j = 1$. The following sections drops the subscript j from the choice variables to reduce clutter. But it is to be understood that each allocation and parameter carries a region specific subscript. The economy has $N = 2$ regions: one (small) region interpreted to be a county and one large region interpreted to be the rest of the economy. Nakamura and Steinsson (2014), Dupor et al. (2023) both assume this geographical representation.

Each region has four agents. A representative household makes consumption, savings, and crucially, labor force participation decisions under search frictions. The heart of the model lies in the endogenous participation decision of households who choose how many members to send into the labor market versus keeping them engaged in home production. Wholesale Firms produce homogeneous output using labor from the households. These firms choose how many vacancies to post. Intermediate Firms transform wholesale output into differentiated varieties under calvo pricing Calvo (1983) constraints and sell to final good firms across locations. Final goods firms aggregate differentiated varieties across regions through a constant elasticity of substitution function and sell the final output to consumers.

A federal fiscal authority purchases local goods and and runs a union wide balanced budget . The monetary authority sets interest rates following a standard taylor rule constrained by the zero lower bound (ZLB).

4.2 The Household's Problem

The representative household acts as the central decision-making unit. Its core problem involves balancing the consumption of goods purchased in the market, C_t^M, with the production and enjoyment of goods produced at home, C_t^H.

To achieve this, the household must decide how to allocate its members across three distinct states: Employed (E_t), Unemployed (U_t), and Non-Participant (N_t). This is the crucial **endogenous participation decision**. This choice is fundamental because it simultaneously determines the household's market labor income and its capacity for home production. I follow the home production structure in Campolmi and Gnocchi (2016).

The household's dynamic optimization problem can be formally expressed using a recursive Bellman equation. The state of the household at the start of period t is described by its stock of already-employed members, E_{t-1}, and its holdings of nominal bonds, D_{t-1}. The household then chooses its current market consumption (C_t^M), new bond holdings (D_t), and its labor force allocation (L_t) to maximize its value function, $\mathcal{V}(E_{t-1}, D_{t-1})$.

The Bellman equation is:

$$\mathcal{V}(E_{t-1}, D_{t-1}) = \max_{C_t^M, D_t, L_t} \left\{ U(C_t^M, C_t^H) + \mathbb{E}_t[\beta_{t+1}\mathcal{V}(E_t, D_t)] \right\}, \tag{4}$$

with the instantaneous utility function given by:

$$U(C_t^M, C_t^H) = Z_t \log C_t^M + \phi \frac{(C_t^H)^{1-\nu}}{1-\nu}. \tag{5}$$

The household's choices are governed by three sets of constraints that link its decisions to its economic outcomes. I begin with the labor market dynamics, as they are central to the model.

The household's primary decision is its choice of labor force participation, L_t. This choice, combined with the state of the economy, determines the allocation of all members. The stock of employed members evolves according to the law of motion:

$$E_t = \underbrace{(1-\rho)E_{t-1}}_{\text{Survivors}} + \underbrace{f_t S_t}_{\text{New Hires}} \,,$$

where f_t[6] is the job-finding rate and S_t is the number of members searching for a job. The pool of searchers consists of all members in the labor force (L_t) who were not already continuing in their job, meaning $S_t = L_t - (1-\rho)E_{t-1}$. Substituting this definition gives the consolidated law of motion:

$$E_t = (1-\rho)E_{t-1} + f_t\big(L_t - (1-\rho)E_{t-1}\big). \tag{6}$$

The number of unemployed members is then simply given by the identity $U_t = L_t - E_t$.

The household's labor market decisions directly determine its capacity for home production. The total effective hours available for producing home goods, C_t^H, comes from non-participants who contribute their full time unit and the unemployed who contribute a fraction $1-\Gamma$ of their time). Let H_t be defined as unit of time devoted to home production. Thus

$$\begin{aligned} H_t &= 1 * N_t + (1-\Gamma) * U_t \\ &= (1-L_t) + (1-\Gamma)(L_t - E_t) \\ &= 1 - (1-\Gamma)E_t - \Gamma L_t \end{aligned}$$

I define a simple home linear production function Campolmi and Gnocchi (2016):

$$\begin{aligned} C_t^H &= \left[A_t^h H_t\right] \\ &= \left[A_t^h \left(1 - (1-\Gamma)E_t - \Gamma L_t\right)\right]. \end{aligned} \tag{7}$$

Finally, the budget constraint ties the household's consumption and savings decisions to the income generated from its labor market activities and profit from the firms: Π_t. Total nominal spending must equal total nominal income. Using the identity $U_t = L_t - E_t$, we can write the budget constraint entirely in terms of the household's core choice and state variables. I further introduce quadratic bonds adjustment costs as is customary in open economy models to induce

[6] f_t is taken as given by the household and is derived from a matching function

stationarity.

$$P_t C_t^M + R_t^{-1} D_t + \frac{\phi_b}{2} P_t \left(\frac{D_t}{P_t} - \frac{D_{ss}}{P_{ss}} \right)^2 = D_{t-1} + W_t E_t + P_t b(L_t - E_t) - P_t \tau_t + \Pi_t. \quad (8)$$

This friction penalizes deviations from steady-state real bonds. b, τ_t, Π_t are respectively unemployment benefits, lump-sum taxes and profits.

The household's optimal participation decision balances the opportunity cost of market entry against its expected returns. The key equilibrium relationship determining labor force participation is

$$\Gamma \cdot \mathrm{MRS}_t \cdot \mathrm{MP}_t^H = b + f_t V_t^w \quad (9)$$

where V_t^w represents the employment surplus—the shadow value of an additional employed worker measured in units of market goods. The left-hand side captures the opportunity cost: each participating member forgoes Γ hours of home production valued at the marginal product of home time MP_t^H, converted to market-good units via the marginal rate of substitution MRS_t between market and home consumption. The right-hand side represents the expected benefit from participation: an immediate transfer b plus the probability f_t of employment times the employment surplus V_t^w.

4.3 Wholesale Firm

A representative **wholesale firm** in region j produces a homogeneous good $X_{j,t}$ using labour with a linear technology and sells it at the relative price $P_{j,t}^x / P_{j,t}$ to the local intermediate firms. Hiring is frictional: per-capita vacancies $V_{j,t}$ fill with probability $q_{j,t}$. Since the region's population (share) is $s_j \in (0,1]$ aggregate workers and vacancies are $s_j E_t$ and $s_j V_t$. The subscript j is dropped from E, V, κ.

Let $F(E_{t-1})$ denote the value of the wholesale firm at the start of period t, given the firm enters with the per-capita stock E_{t-1}.

$$F(E_{t-1}) = \max_{V_t, E_t} \left[\underbrace{s_j \left(P_t^x A_t - W_t \right) E_t}_{\text{agg revenue}-\text{agg wages}} - \underbrace{s_j P_t \kappa V_t}_{\text{agg vacancy cost}} + \mathbb{E}_t [Q_{t,t+1} F(E_t)] \right] \quad (10)$$

subject to the **per-capita** employment transition

$$E_t = (1-\rho)E_{t-1} + q_t V_t. \tag{11}$$

Here κ is the real cost per vacancy (in final-good units) and $Q_{t,t+1}$ is the household stochastic discount factor.

4.4 Employment and wages

Searchers and job vacancies V_t are matched according to a standard constant-returns-to-scale technology

$$M_t = \omega V_t^{1-\gamma} S_t^{\gamma}. \tag{6}$$

I define labor market tightness as $\theta_t \equiv V_t/S_t$. Hence, participation and vacancy posting decisions jointly determine the finding rate $f_t = \omega\theta_t^{1-\gamma}$, the filling rate $q_t = \omega\theta_t^{-\gamma}$. The wage is determined according to Nash bargaining so that $(1-\eta)V_t^w = \eta V_t^J$, where η is the workers's bargaining power and V_t^f is the firms's surplus of employing one additional member.

4.5 Final and Intermediate Firms

Here I describe the problems of the final goods firms and intermediate firms. I consider a representative final goods producer in a region j. This firm operates in a perfectly competitive market. This means it is a price-taker for both the final good it sells (at price P_j) and the intermediate inputs it buys (variety i from region k at price $p_k(i)$).

The firm combines a continuum of intermediate varieties $y_{jk}(i)$ from all possible source regions $k \in \{1,2\}$ to produce a final good Y_j. The production function is a Constant Elasticity of Substitution (CES) aggregator:

$$Y_j = \left[\sum_{k=1}^{N=2} \xi_{jk}^{\frac{1}{\varepsilon}} \left(\int_0^1 y_{jk}(i)^{\frac{\varepsilon-1}{\varepsilon}} di\right)\right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{12}$$

where $y_{jk}(i)$ is the quantity of variety i from region k used as an input in region j. $\xi_{jk} > 0$ is a weight parameter, interpreted as capturing taste/ home bias. I assume that $\sum_k \xi_{jk} = 1$. Home bias for region 1 is given by $\xi_{11} = \alpha$ so that $\xi_{12} = 1 - \alpha$. Following Dupor et al. (2023) if region 1 imports $1 - \alpha$, then region 2 imports $\xi_{21} = \frac{s_1}{s_2} \times (1 - \alpha)$, and home bias for region 2 is $\xi_{22} = 1 - \frac{s_1}{s_2}(1 - \alpha)$. The parameter $\varepsilon > 1$ is the elasticity of substitution between any two varieties. The optimal input demand, $y_{jk}(i)$ is

$$y_{jk}(i) = \xi_{jk} \left(\frac{p_k(i)}{P_j} \right)^{-\varepsilon} Y_j. \tag{13}$$

The final good firm makes zero profits (perfect competition), which allows us to write the price aggregate as

$$P_j = \left[\sum_k \xi_{jk} \int_0^1 p_k(i)^{1-\varepsilon} di \right]^{\frac{1}{1-\varepsilon}} \tag{14}$$

Intermediate good firms Each region has a continuum of intermediate firms. The total demand for the good produced by firm i in origin region k is given by

$$y_{k,t}(i) = \sum_{j=1}^{N} s_j \xi_{j,k} P_{k,t}(i)^{-\varepsilon} P_{j,t}^{\varepsilon} Y_{j,t}$$

where $p_{k,t}(i)$ is the price set by the firm, $P_{j,t}$ is the aggregate price index (CPI) in destination j, and $Y_{j,t}$ is per-capita demand in destination j. We can rewrite this by factoring out the firm's relative price. Let $P_{k,t}$ be the aggregate price index (CPI) in origin k.

$$y_{k,t}(i) = \left(\frac{P_{k,t}(i)}{P_{k,t}} \right)^{-\varepsilon} \sum_{j=1}^{N} s_j \xi_{j,k} \left(\frac{P_{k,t}}{P_{j,t}} \right)^{-\varepsilon} Y_{j,t}^{D} \tag{15}$$

I define the demand shifter common to all all firms in region k:

$$D_{k,t} = \sum_{j=1}^{N} s_j \xi_{j,k} \left(\frac{P_{j,t}}{P_{k,t}} \right)^{\varepsilon} Y_{j,t} \tag{16}$$

$$= \sum_{j=1}^{N} s_j \xi_{j,k} \mathcal{Q}_{j,k,t}^{\varepsilon} Y_{j,t} \tag{17}$$

where $\mathcal{Q}_{j,k,t} \equiv P_{j,t}/P_{k,t}$ is the bilateral real exchange rate between destination j and origin k. The demand for firm i's good can now be written compactly as:

$$y_{k,t}(i) = \left(\frac{P_{k,t}(i)}{P_{k,t}}\right)^{-\varepsilon} D_{k,t} \tag{18}$$

The intermediate good is produced from wholesale output using a linear production function.

$$y_{k,t}(i) = X_{k,t}(i)$$

The total cost function is:

$$\begin{aligned} C(y_{k,t}(i)) &= P_t^x \cdot X_t(i) \\ &= P_{k,t}^x y_{k,t}(i) \end{aligned} \tag{19}$$

Due to monopolistic competition the intermediate firms have price-setting power. However they are unable to set prices every period. They can only do so with a fixed probability $1-\delta$. A firm that gets to reset its price at time t chooses a new price $P^*_{k,t}(i)$ to maximize the present discounted value of expected future profits, conditional on this price not being reset again. The firms are ultimately owned by the household and therefore discounts future profits by the household stochastic discount factor $Q_{t,t+1}$

$$\max_{P^*_{k,t}(i)} \quad E_t \sum_{h=0}^{\infty} (\delta_k)^h Q^k_{t,t+h} \left[\underbrace{P^*_{k,t}(i) \cdot y_{k,t+h}(i)}_{\text{Revenue}} - \underbrace{C(y_{k,t+h}(i))}_{\text{Cost}}\right]$$

where $y_{k,t+h}(i)$ is the demand at time $t+h$ for a firm that set its price to $P^*_{k,t}(i)$ at time t. This leads to the optimal pricing equations:

$$\left(\frac{P^*_{k,t}}{P_{k,t}}\right) = \left[\left(\frac{\varepsilon}{\varepsilon-1}\right)\frac{K_{k,t}}{F_{k,t}}\right]$$

$$K_{k,t} = D_{k,t}\,\mathrm{RMC}_{k,t} + \delta\,\mathbb{E}_t\big[Q^k_{t,t+1}\,\pi^{1+\varepsilon}_{k,t+1}\,K_{k,t+1}\big], \qquad F_{k,t} = D_{k,t} + \delta\,\mathbb{E}_t\big[Q^k_{t,t+1}\,\pi^{\varepsilon}_{k,t+1}\,F_{k,t+1}\big]$$

$$\mathrm{RMC}_{k,t} = \frac{P^x_{k,t}}{P_{k,t}}, \qquad \text{and} \quad y_{k,t}(i) = \left(\frac{P_{k,t}(i)}{P_{k,t}}\right)^{-\varepsilon} D_{k,t}.$$

4.6 Real GDP

Let the aggregate real revenue in origin region k, be denoted by $\bar{\mathcal{R}}_{k,t}$.

Real revenue is simply nominal revenue $\mathcal{R}_{k,t}$ deflated by the origin's price index $P_{k,t}$.

$$\bar{\mathcal{R}}_{k,t} \equiv \frac{\mathcal{R}_{k,t}}{P_{k,t}} = \int_0^1 \frac{p_{k,t}(i)}{P_{k,t}} y_{k,t}(i)\, di \tag{20}$$

Hence, per-capita GDP $\mathcal{Y}_{k,t}$ is simply $\frac{\bar{\mathcal{R}}_{k,t}}{s_k}$

4.7 Monetary authority

The regions are part of a monetary union. Monetary policy follows a Taylor rule based on population-weighted average inflation across regions:

$$\ln R_t = -\ln \beta + \phi_\pi \ln \left(\sum_{j=1}^{N} s_j \frac{\pi_{j,t}}{\pi_{j,\text{ss}}} \right) + \phi_y \ln \left(\sum_{j=1}^{N} s_j \frac{\mathcal{Y}_{j,t}}{\mathcal{Y}_{j,\text{ss}}} \right), \quad \phi_\pi > 1, \phi_y > 0, \tag{21}$$

Since during the recession, the monetary policy was constrained by the lower bound, I will consider the interest rate policy of the form $\bar{R}_t = max(1, R_t)$. This case captures the effect of government spending in an environment where the monetary authority is unresponsive to inflation and spending pressures.

4.8 Government

Fiscal policy operates under a balanced budget constraint in each period, where total nominal outlays consist of government purchases $\sum_{k=1}^{N} s_k P_{k,t} G_{k,t}$ and unemployment benefits $\sum_{k=1}^{N} s_k P_{k,t} b_k U_{k,t}$, with s_k denoting population weights. The fiscal burden is distributed according to population shares: each region j pays a tax bill equal to s_j times the union-wide per-capita fiscal cost $\sum_k s_k P_{k,t} G_{k,t} + \sum_k s_k P_{k,t} b_k U_{k,t}$. This arrangement implies that each household faces the same per-capita tax regardless of location, creating cross-regional fiscal transfers when local economic conditions differ.

4.9 Equilibrium

Given exogenous sequences $\{(G_{i,t}, Z_{i,t}, A_{i,t}, A^h_{i,t}, \beta_{i,t})_{i=1(1)2}\}_{t\geq 0}$, together with initial conditions $x_{-1} \equiv \{E_{i,-1}, d_{i,-1}\}_{i=1(1)2}$ and $\mathcal{Q}_{-1}$. An equilibrium is sequences of *allocations*

$$X \equiv \{(C^M_{i,t}, C^H_{i,t}, L_{i,t}, E_{i,t}, V_{i,t}, \theta_{i,t}, f_{i,t}, q_{i,t}, d_{i,t})_{i=1(1)2}\}_{t\geq 0}$$

and *prices and policies*

$$P \equiv \{(w_{i,t}, \pi_{i,t}, p_{i,t})_{i=1(1)2},\ R_t,\ \mathcal{Q}_t,\ (\tau_{i,t})_{i=1(1)2}\}_{t\geq 0}$$

such that for all $t \geq 0$ and $i = 1(1)2$: solve the household problem, the problems of all three types of firms and clears the inter-regional goods market.

5 Quantitative Analysis

Symmetric two–region baseline. I begin with a symmetric two–region benchmark in which preferences, technologies, pricing, and labor-market parameters are identical across regions. Before introducing size heterogeneity (large, medium, small), I ask whether a calibration based on standard values can reproduce the *average* employment elasticity in Table 2. The procedure is to fix conventional parameters, calibrate a small set of parameters to match steady-state targets, and then study local employment responses to temporary government-spending shocks at the zero lower bound (ZLB).

Primitives. Quarterly parameters follow standard values: discount factor $\beta = 0.99$ (annual real rate $\approx 4\%$); elasticity of substitution $\varepsilon = 6$ (Christiano et al., 2011); Calvo parameter $\delta = 0.85$ (15% reset probability) (McKay et al., 2016); separation rate $\rho = 0.12$ (Shimer, 2005). I set bargaining power $\eta = 0.5$ and matching elasticity $\gamma = 0.5$ to satisfy the Hosios condition (Hosios, 1990). These values are consistent with the range reported in Petrongolo and Pissarides (2001). The participation block uses $\nu = 5$ and $\Gamma = 0.44$ (Campolmi and Gnocchi, 2016). Trade shares imply home bias $\xi_{11} = 0.59$ (Dupor et al., 2023). $A_i = A^h_i = Z_i = 1$ are simply steady-state normalizations set.

Table 3: Fixed parameters and steady–state targets (symmetric baseline)

Category	**Symbol (value)**	**Source / rationale**
Discount factor	$\beta = 0.99$	Annual real rate $\approx 4\%$
Elasticity of substitution	$\varepsilon = 6$	Christiano et al. (2011)
Calvo stickiness	$\delta = 0.85$	McKay et al. (2016)
Separation rate	$\rho = 0.12$	Shimer (2005)
Bargaining power	$\eta = 0.5$	Petrongolo and Pissarides (2001)
Matching elasticity	$\gamma = 0.5$	Hosios: $\gamma = \eta$ (Hosios, 1990)
Participation block	$\nu = 5,\ \Gamma = 0.44$	Campolmi and Gnocchi (2016)
Trade shares (home bias)	$\xi_{11} = 0.59$	Dupor et al. (2023)
Targets for calibration		
Employment rate	$E_{ss} = 0.6159$	LAUS (county aggregate)
Participation rate	$L_{ss} = 0.6516$	LAUS (county aggregate)
Job–filling rate	$q_{ss} = 0.90$	Andolfatto (1996)
Vacancy cost / wage	$v_{\text{cost}} = 0.045$	Campolmi and Gnocchi (2016)

Calibrated parameters and targets. For each region, I calibrate

$$\Xi \equiv (\omega,\ \kappa,\ b,\ \phi),$$

where ω is matching efficiency, κ vacancy posting cost, b unemployment benefit, and ϕ the utility weight on home production. These are disciplined by four targets: employment E_{ss} and participation L_{ss} (LAUS), job-filling rate $q_{ss} = 0.90$ (Andolfatto, 1996), and the vacancy-cost-to-wage ratio $v_{\text{cost}} = 0.045$ (Campolmi and Gnocchi, 2016). By symmetry, calibrated values are identical across regions.

Experiment and mapping to data. Empirical inputs are in nominal dollars. To feed them into the model, I first convert each county's ARRA series in terms of the *% of the average quarterly wage* and then express that share in model units by scaling with the model's steady-state wage. Concretely, let $G^{\$}_{it}$ denote per-capita ARRA dollars for county i in quarter t and let $W^{\$}_{i2006}$ be the nominal wage in 2006 the data for the same county. The spending share is

$$s_{it} \;=\; \frac{G^{\$}_{it}}{W^{\$}_{i2006}},$$

Table 4: Elasticity of cumulative employment with respect to log cumulative ARRA spending

	Elasticity $\hat{\beta}$
Data (cross-section, 2006–2012)	1.4
Model (symmetric baseline)	1.1

The model's per-capita spending paths are then set as $G_{1t} = s_{it} W_{ss}$ for Region 1 (county i) and $G_{2t} = s_{US,t} W_{ss}$ for Region 2, where W_{ss} is the model's steady-state wage. These paths are active over $t = 8, \ldots, 21$ (2009Q3–2012Q4) and zero otherwise. Both regions face a common recessionary demand path; the union policy rate is constrained by the ZLB, and transitions are solved with the piecewise-linear method of Guerrieri and Iacoviello (2015).

Model response of employment $\{E_{i,t}\}$ is annualized, expressed as deviations from steady state, and cumulated over the empirical window to construct the pp-sum outcome ΔE_i. Let $\sum_t G_{1t}$ be cumulative ARRA for county i. The model simulated data is subjected to the same specification as in the data.

$$\Delta E_i \ = \ \alpha \ + \ \beta^{\text{model}} \log \sum_t G_{it} + \ \varepsilon_i,$$

The coefficient β^{model} is the model-implied elasticity. The symmetric baseline delivers a model-implied elasticity $\beta^{\text{model}} = 1.1$ that is strikingly close to the empirical estimate of 1.4 from the pooled cross section. This agreement is noteworthy because it arises *without* targeting local multipliers, or ad hoc adjustment of deep parameters: the calibration uses standard quarterly values and matches only steady-state labor-market moments. The model's propagation—operating through price rigidities, search frictions, and the participation margin—generates a local elasticity that is quantitatively in line with the data.

Heterogeneous analysis. Because the literature does not provide size-specific primitives, I use the model to trace how the local employment elasticity varies with three interpretable parameters for the treated region: bargaining power η_1 (with $\gamma_1 = \eta_1$ to satisfy Hosios), home bias ξ_{11} (so $\xi_{12} = 1 - \xi_{11}$), and the vacancy–cost target $v_{\text{cost},1}$. All remaining primitives are held at the symmetric baseline. For each calibration $(\eta_1, \xi_{11}, v_{\text{cost},1})$, I solve the two–region model, feed ARRA spending as wage–bill shares scaled by the steady–state wage, simulate the ZLB transition, and compute the same cross–sectional elasticity β as in the data. This delivers a smooth mapping $\beta = \beta(\eta_1, \xi_{11}, v_{\text{cost},1})$ that I use to read off size-specific implications under a *monotone* discipline (parameters weakly ordered from small to large counties). The goal is interpretability rather than point identification.

What the surfaces imply. Figure 2 shows three informative slices. Two gradients are strong across all panels: β increases with home bias ($\partial\beta/\partial\xi_{11} > 0$) and decreases with the vacancy–cost target ($\partial\beta/\partial v_{\text{cost},1} < 0$); a milder negative slope appears in bargaining power ($\partial\beta/\partial\eta_1 < 0$). Panel (a) fixes ξ_{11} and shows that higher $v_{\text{cost},1}$ and higher η_1 dampen β. Panel (b) fixes $v_{\text{cost},1}$ and shows that higher ξ_{11} (stronger internal absorption) raises β while higher η_1 lowers it. Panel (c) fixes η_1 and again exhibits $\partial\beta/\partial\xi_{11} > 0$ and $\partial\beta/\partial v_{\text{cost},1} < 0$. Read together, the surfaces imply: (i) absorption (high ξ_{11}) and cheap vacancy creation (low $v_{\text{cost},1}$) push β up; (ii) stronger worker bargaining (η_1) tempers the response.

These slopes rationalize the monotone profiles by size. To keep β_s modest in *small* counties, ξ_{11} must be *low*—otherwise the upward slope in ξ_{11} (panels b,c) would over-amplify a given spending pulse. With ξ_{11} restrained, β_s stays near target without extreme choices for $v_{\text{cost},1}$ or η_1. At the other end, *large* counties are economically integrated, so ξ_{11} is naturally *high*, which would raise β; matching their muted elasticity therefore requires *higher* $v_{\text{cost},1}$ (panel a's strong negative slope in $v_{\text{cost},1}$) and *higher* η_1 (the milder negative slope in η_1) to offset absorption. The *medium* group attains the peak elasticity precisely where panels (b) and (c) display a ridge: ξ_{11} *high* to internalize spending, $v_{\text{cost},1}$ *low* so vacancies expand, and η_1 not too high so bargaining does not choke the response. Economically, thinner places need *leakages* (low ξ_{11}); thick markets feature stronger bargaining and costlier hiring (high η_1, high $v_{\text{cost},1}$); and the largest multiplier appears where absorption is strong but posting frictions are light. Though direct evidence is lacking as to the appropriate values of the posting costs, there is some evidence in the literature (Azar et al., 2020) that suggests monopsony power is stronger in smaller labor markets. Thus we might expect lower values of η for smaller counties.

Openness is the dominant force—retaining stimulus locally (high ξ_{11}) raises multipliers—while participation/bargaining and vacancy costs scale how easily employment can expand. Imposing monotonicity by size selects low ξ_{11} for small counties, high ξ_{11} for large counties counterbalanced by higher $v_{\text{cost},1}$ and η_1, and a medium-group peak where ξ_{11} is high and $v_{\text{cost},1}$ low with moderate η_1.

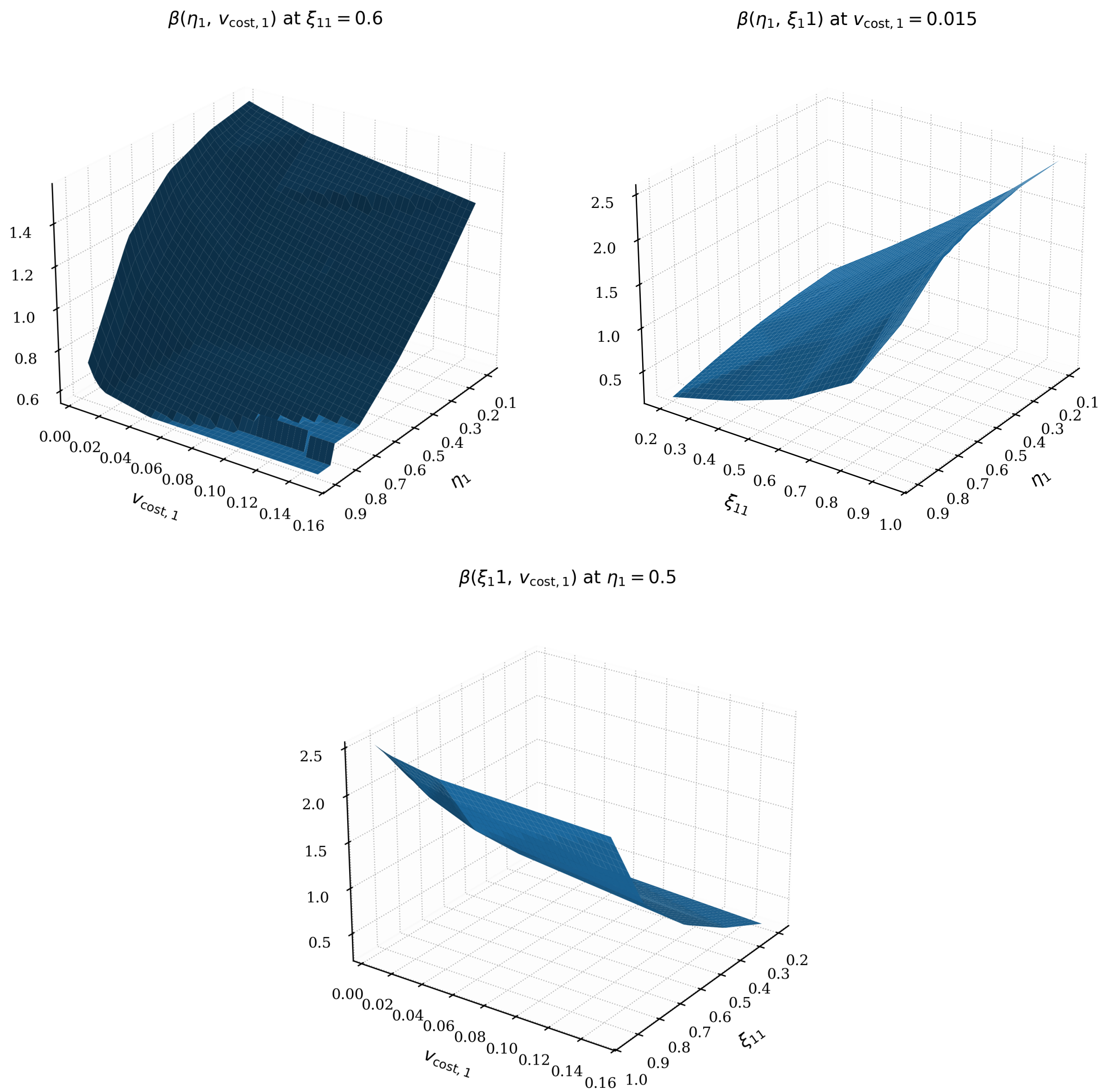

Figure 2: Model-implied elasticity $\beta(\eta_1, \xi_{11}, v_{\text{cost},1})$. Panel (a): $(\eta_1, v_{\text{cost},1})$ at fixed ξ_{11}. Panel (b): (η_1, ξ_{11}) at fixed $v_{\text{cost},1}$. Panel (c): $(\xi_{11}, v_{\text{cost},1})$ at fixed η_1.

5.1 Heterogeneous regions: large, medium, and small

Labor market indicators differ systematically across counties. Figure 3 shows labor–force participation and employment by size, while Table 5 reports averages from 1990–2006: large counties display consistently higher participation and employment–to–population ratios than small

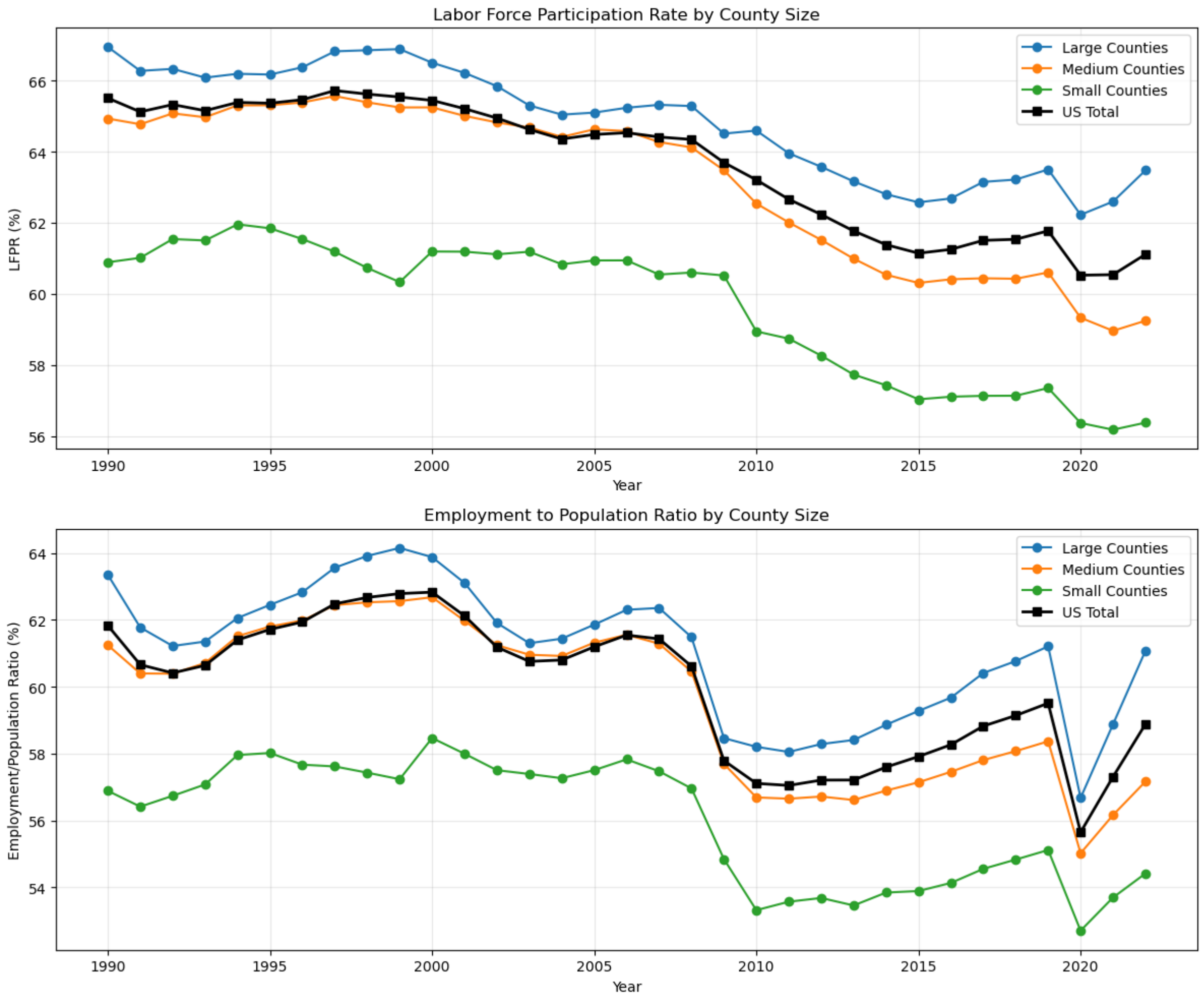

Figure 3: Labor–force participation and employment by county size

Table 5: Mean employment ratios by county type, 1990–2006

County type	**Labor–force participation**	**Employment–to–population**
Large counties	66.12%	62.50%
Medium counties	65.02%	61.54%
Small counties	61.17%	57.47%
U.S. total	**65.16%**	**61.59%**

counties, with medium counties in between.

Wage differentials also matter. Figure 4 plots relative wages, while Table 6 shows systematic

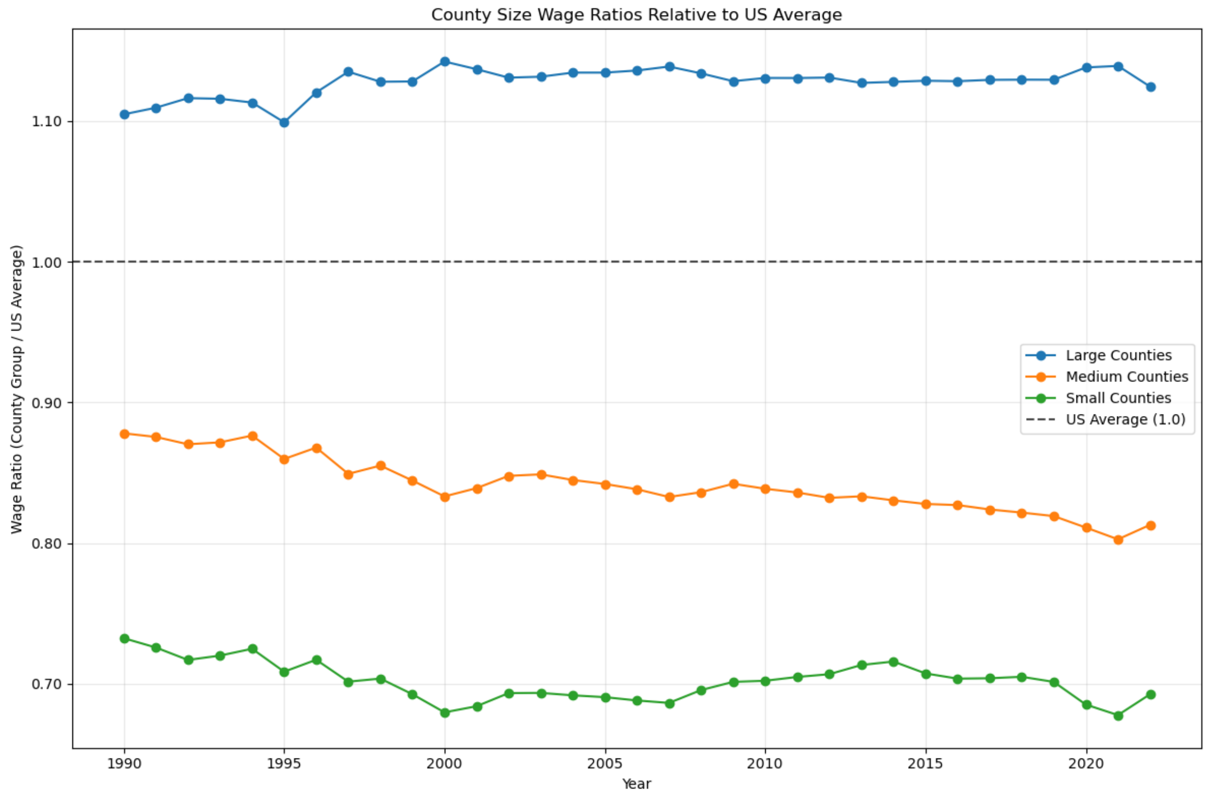

Figure 4: Nominal wages relative to the rest of the U.S. by county size

Table 6: Wage ratios by county type, 1990–2006

County type	Mean	Min	Max
Large counties	1.125	1.099	1.142
Medium counties	0.856	0.833	0.878
Small counties	0.704	0.680	0.733

premiums in large counties and discounts in small ones. These map directly into productivity parameters.

Calibration by size: targets and disciplined margins. I retain the common quarterly primitives from the symmetric baseline $(\beta, \varepsilon, \delta, \rho, \nu, \Gamma)$, and I discipline size differences with observables. Productivity (A) matches wage ratios; employment and participation targets (E, L) match the 1990–2006 means; region size s matches population shares; and I fix the steady-state job–filling target $q_{ss} = 0.90$ and participation curvature $\Gamma = 0.44$ for comparability across sizes. The monetary environment and the aggregate recession path remain common to all regions.

The three *local* margins that govern absorption and hiring respond strongly in the heterogeneous analysis and are therefore allowed to vary by size under a monotone discipline: (i) home bias ξ_{11} (effective openness/leakage), (ii) the vacancy–cost target $v_{\text{cost},1}$, and (iii) bargaining power η_1 with $\gamma_1 = \eta_1$ (Hosios). Consistent with the results in Section 5, small counties are calibrated with *low* home bias (high openness), medium counties with *high* absorption but the *same low* vacancy-posting cost as small counties, and large counties with *high* absorption combined with a *higher* posting cost and stronger worker bargaining power. Thus vacancy costs are weakly increasing in size (low for small and medium, high for large), while home bias and bargaining power both rise from small to large. Concretely, the profiles used in the runs are reported in Table 7.

Fit to size–specific elasticities. Feeding county–size–specific ARRA paths (as wage–bill shares scaled by the steady–state wage) and simulating the ZLB transition yields the model-implied cross–sectional elasticities:

$$\beta_\ell = 0.58, \qquad \beta_m = 2.14, \qquad \beta_s = 1.07.$$

These numbers line up closely with the empirical targets.

Mapping mechanisms to size. Openness varies with size: large counties are relatively closed, while small counties are highly open. High openness leads to spending leakage, limiting small counties' multipliers despite lower vacancy costs. At the other end, large counties retain spending but face higher posting costs, compressing surpluses and weakening vacancy creation. Medium counties combine sufficiently high home bias with moderate costs and responsive participation margins, generating stronger employment effects. , implying lower effective worker bargaining.

The result is an *inverted U* in local fiscal multipliers. Figure 5 shows that medium counties deliver the largest employment response, while both large counties and small counties exhibit weaker effects.

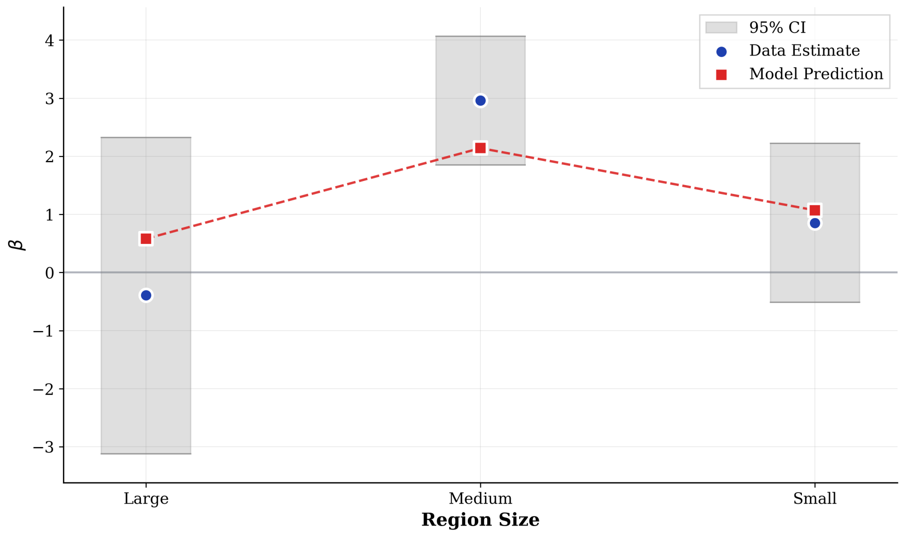

Figure 5: Employment multiplier by county size. Medium counties deliver the largest response, producing an inverted U across the size distribution.

Overall, the symmetric baseline matches the order of magnitude of the average elasticity (Table 4), while the heterogeneous calibration traces out systematic variation by size. Openness governs leakage, cost and surplus parameters shape vacancy creation, and participation elasticity scales the pass–through. Medium counties combine these forces most favorably, yielding the peak of the inverted U. Designing place-aware stimulus can raise aggregate bang-per-buck: targeting marginal dollars toward medium counties—where openness is high enough to limit leakage and costs are not prohibitive—yields the largest employment gains.

5.2 Three regions and counterfactual reallocation

The two–region framework pins down the *average* elasticity and its size gradient, but it cannot speak to *composition*: how aggregate outcomes change when the same national dollars are distributed differently across places. To study allocation in general equilibrium, I group counties into three blocks—*large* (Region 1), *medium* (Region 2), and *small* (Region 3)—and trace the aggregate jobs envelope as funds are reallocated across them.

Environment. Preferences and nominal rigidities are common across regions ($\beta = 0.99,\ \varepsilon = 6,\ \delta_r = 0.85$). Each region is calibrated to match its pre-ARRA participation and employment

Table 7: Region–size parameters and targets

Parameters	**Large**	**Medium**	**Small**	**Rest of U.S.**
Common parameters				
β, ε, δ		0.99, 6.0, 0.85		
Production				
A (productivity)	1.125	0.86	0.70	1.00
s (region size)	0.013	0.0017	0.00045	–
Labor market				
E (employment rate)	62.50%	61.54%	57.00%	61.59%
L (labor force)	66.00%	65.01%	61.00%	65.16%
ρ (separation)		0.12		
η (bargaining)	0.8	0.30	0.30	0.50
γ (matching)	0.8	0.30	0.30	0.50
Γ (participation curvature)		0.44		
Household				
A_h (home production)	1.125	0.86	0.70	1.00
Z (preference shifter)		1.00		
Trade				
ξ_{11} (home bias)	0.7	0.65	0.35	–
ξ_{12} (imports)	0.3	0.35	0.65	–
Targets				
$v_{\text{cost}}^{\text{target}}$	0.10	0.010	0.010	0.045
q^{target} (job–filling rate)		0.90		

(L_r, E_r), population share s_r, and relative wages via productivity normalizations (A_r, A_r^h). Population shares are $(s_1, s_2, s_3) = (0.50, 0.40, 0.10)$, so the "large" and "medium" blocks are continental and the "small" block is comparable to a small European country. Trade is Armington with destination rows summing to one, and ξ_{jk} denotes the weight on goods sourced from origin k in destination j. In the two–region exercises of Section 5, the home–bias terms reported in Table 7 ($\xi_{11} = 0.70, 0.65, 0.35$ for large, medium, and small) are calibrated for a "county vs. rest of U.S." environment. When I move to the three–region framework used for the policy experiments, I re–specify the Armington matrix for a different object: three large regional blocks (large, medium, small counties) that together *exhaust* the U.S. and must collectively reproduce an empirically plausible aggregate home bias.

To do this, I choose regional home–bias parameters

$$\xi_{11} = 0.89, \qquad \xi_{22} = 0.89, \qquad \xi_{33} = 0.69,$$

so that (i) large and medium regions are relatively closed, (ii) the small–county block is more open, and (iii) the population–weighted average of ξ_{rr} lines up with U.S. home–bias estimates.[7] Off–diagonal entries are then chosen so that each destination row sums to one. All other parameters in the three–region model follow their size–specific values in Table 7. The counterfactual reallocations in Table 8 are therefore based on this three–region Armington structure, not on the two–region ξ values.

Spending and common shocks. ARRA enters as wage-bill shares by size. For region r and quarter $t \in \{2009\text{Q}3, \ldots, 2012\text{Q}4\}$,

$$G_{r,t} = \text{share}_{r,t} \times W_r^{\text{ss}},$$

with W_r^{ss} the steady-state wage per capita. All regions face the same recessionary demand path and a union policy rate at the ZLB; transitions are solved piecewise-linearly. This keeps the nominal content of the data while putting spending in model units.

Reallocation experiment. Let $\tau \in [0, 1]$ be the fraction of the 2009Q3–2012Q4 spending shifted from Region 1 (large) to Region 2 (medium), holding fixed the national total and the within-window time profile; Region 3 (small) remains on its observed path. For each τ I rescale the three regional paths by $(W_1^{\text{ss}}, W_2^{\text{ss}}, W_3^{\text{ss}})$, simulate the ZLB transition, and record employment effects.

Measurement. Two statistics summarize outcomes. First, *job-years* aggregate employment gains over 2008–2012:

$$\text{JobYears}_r(\tau) = \sum_{y=2008}^{2012} \left(\overline{\Delta E_{r,y}(\tau)}\ \text{pp}\right) \times \frac{\text{pop16}_{r,2006}}{100}, \qquad \text{JobYears}_{\text{US}}(\tau) = \sum_{r=1}^{3} \text{JobYears}_r(\tau).$$

[7]For comparison, Nakamura and Steinsson (2014) report home–bias values around 0.69 for regions of roughly one–tenth the union, which is close to the role played here by the small–county block.

Table 8: Reallocating ARRA across size groups: aggregate jobs and efficiency by τ

τ (%)	Jobs per year	Δ vs. τ=0	Job–years (total)	Δ vs. τ=0	Efficiency (job–years/$1M)	Cost per job–year ($)
0	935,607	0	4,678,034	0	20.52	48,738
5	938,553	2,946	4,692,763	14,729	20.58	48,585
10	941,498	5,892	4,707,492	29,459	20.65	48,433
15	944,444	8,838	4,722,221	44,188	20.71	48,282
20	947,390	11,783	4,736,951	58,917	20.78	48,132
25	950,336	14,729	4,751,680	73,646	20.84	47,983
30	953,282	17,675	4,766,409	88,376	20.91	47,835
35	956,228	20,621	4,781,138	103,105	20.97	47,687
40	959,174	23,567	4,795,868	117,834	21.03	47,541
45	962,119	26,513	4,810,597	132,563	21.10	47,395
50	965,065	29,459	4,825,326	147,293	21.16	47,251
55	968,011	32,404	4,840,055	162,022	21.23	47,107
60	970,957	35,350	4,854,785	176,751	21.29	46,964
65	973,903	38,296	4,869,514	191,480	21.36	46,822
70	976,849	41,242	4,884,243	206,210	21.42	46,681
75	979,795	44,188	4,898,973	220,939	21.49	46,540
80	982,740	47,134	4,913,702	235,668	21.55	46,401
85	985,686	50,079	4,928,431	250,397	21.62	46,262
90	988,632	53,025	4,943,160	265,127	21.68	46,124
95	991,578	55,971	4,957,890	279,856	21.75	45,987
100	994,524	58,917	4,972,619	294,585	21.81	45,851

Average jobs per year equals $\text{JobYears}_{\text{US}}(\tau)/5$. Second, with G_{total} the total spending over the window,

$$\text{Efficiency}(\tau) = \frac{\text{JobYears}_{\text{US}}(\lambda)}{S/10^6}, \qquad \text{Cost per job–year}(\tau) = \frac{S}{\text{JobYears}_{\text{US}}(\tau)}.$$

The object of interest is therefore an *allocation frontier* $\tau \mapsto \{\text{jobs per year}, \text{cost/job–year}\}$.

Results. Table 8 reports the frontier. It is *monotone* over the admissible range: shifting dollars from region 1 to region 2 steadily raises national job-years and lowers the cost per job-year. For example, reallocating 35% reduces the cost per job-year by about $1,050 (to $47,687) and adds roughly 103,000 job-years ($+2.2\%$). A full reallocation lowers the cost per job-year by about $2,900 (to $45,851) and yields roughly 295,000 additional job-years ($+6.3\%$).

Relative to region 1, region 2 in this calibration expands vacancies at cost and still retain enough spending locally that openness does not wash out the effect. Hence the frontier rises monotonically as dollars move from Region 1 to Region 2.

6 Conclusion

I examined whether fiscal stimulus had any impact on the employment ratios following the 2008 crisis by analyzing county-level variation in American Recovery and Reinvestment Act spending between 2009-2012. Using a narrative instrumental variables approach as in Dupor et al. (2023), I find that a 1% increase in government spending raised the cumulative employment-population ratio by 0.029 percentage points in medium-sized counties. Very large and small counties display minimal effects. In a two-region framework I recover an *inverted U* in local employment multipliers across county size. The symmetric baseline matches the average elasticity, while size heterogeneity—through openness, vacancy costs, bargaining—produces stronger responses in medium counties and weaker ones at the tails. Openness governs leakage, determining how much stimulus remains local. Cost and surplus parameters shape vacancy creation and wage setting. Medium counties sit at the intersection of these forces, combining sufficient home bias with moderate costs and responsive margins.

Policy follows directly. When the objective is jobs per dollar, place-aware allocations that tilt marginal funds toward medium counties can increase total employment gains without increasing aggregate outlays. Reallocating 35% from large to mid-sized counties reduces the cost per job-year by about \$1,050 (to \$47,687) and adds roughly 103,000 job-years (+2.2%). A full reallocation reduces the cost per job-year by about \$2,900 (to \$45,851) and yields roughly 295,000 additional job-years (+6.3%). Small counties may still warrant for equity or access, but the jobs-per-dollar frontier is highest in the middle of the size distribution. Overall, the results highlight a simple lesson: *place matters*.

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