# The Role of Local Public Goods for Fiscal Policy in the Spatial Economy

Fabian Bald[1] Marcel Henkel[2]

[1]European University Viadrina

[2]University of Bern, CRED

EEA - ESEM Congress, Barcelona School of Economics

August 28 - September 1st 2023

# Place-based policies

- Widespread use of place-based policies
- **Efficiency motive:** Internalise externalities individuals impose on other (types of) workers (e.g. Fajgelbaum & Gaubert (2020))
- **Inequality motive:** Decrease spatial inequalities in consumption possibilities within or between worker groups (e.g. Gaubert et al. (2021))
- Often fiscal transfers are paid to local governments to help **finance locally-provided public goods** (e.g. education, infrastructure)

# Local public goods and fiscal policy

- Spatial policies can be **challenging to design:** May decrease spatial inequalities, but may simultaneously also create market distortions or inefficiencies
- Spatial differences in fiscal expenditures and public goods provision influence
  - **location choices** of workers or firms (Tiebout, 1956; Banzaf & Walsh, 2008)
  - local labour demand (Chodorow-Reich, 2019) or **labor force participation** via public good provision
- Add labor force participation channel to framework studied in literature on optimal design of spatial policies

# This Paper I

We provide new evidence on the local and general equilibrium effects of fiscal policies under **spatial mobility and (partially) elastic labor supply**

- **Novel Theoretical Framework**
  - **Spatial general equilibrium model with sorting** of heterogeneous workers across local labor markets and sectors (Fajgelbaum & Gaubert (2020); Rossi-Hansberg et al. (2022))
  - Extend framework to include **(partially) elastic local labour supply** that can be impacted by spatial policies
  - Embed model in **realistic public finance framework** (private and public goods, spatially varying taxes, fiscal redistribution system between local governments...)

# This Paper II

- **Optimal fiscal policy**
  - Contrast existing fiscal redistribution system with **socially-optimal fiscal policies** in the presence of elastic labour supply and different types of goods
  - Optimal fiscal policy instruments (taxes, transfers to workers/ local governments) feature **efficiency-equity trade-off:**

    $\rightarrow$ Force workers to internalise spatial externalities

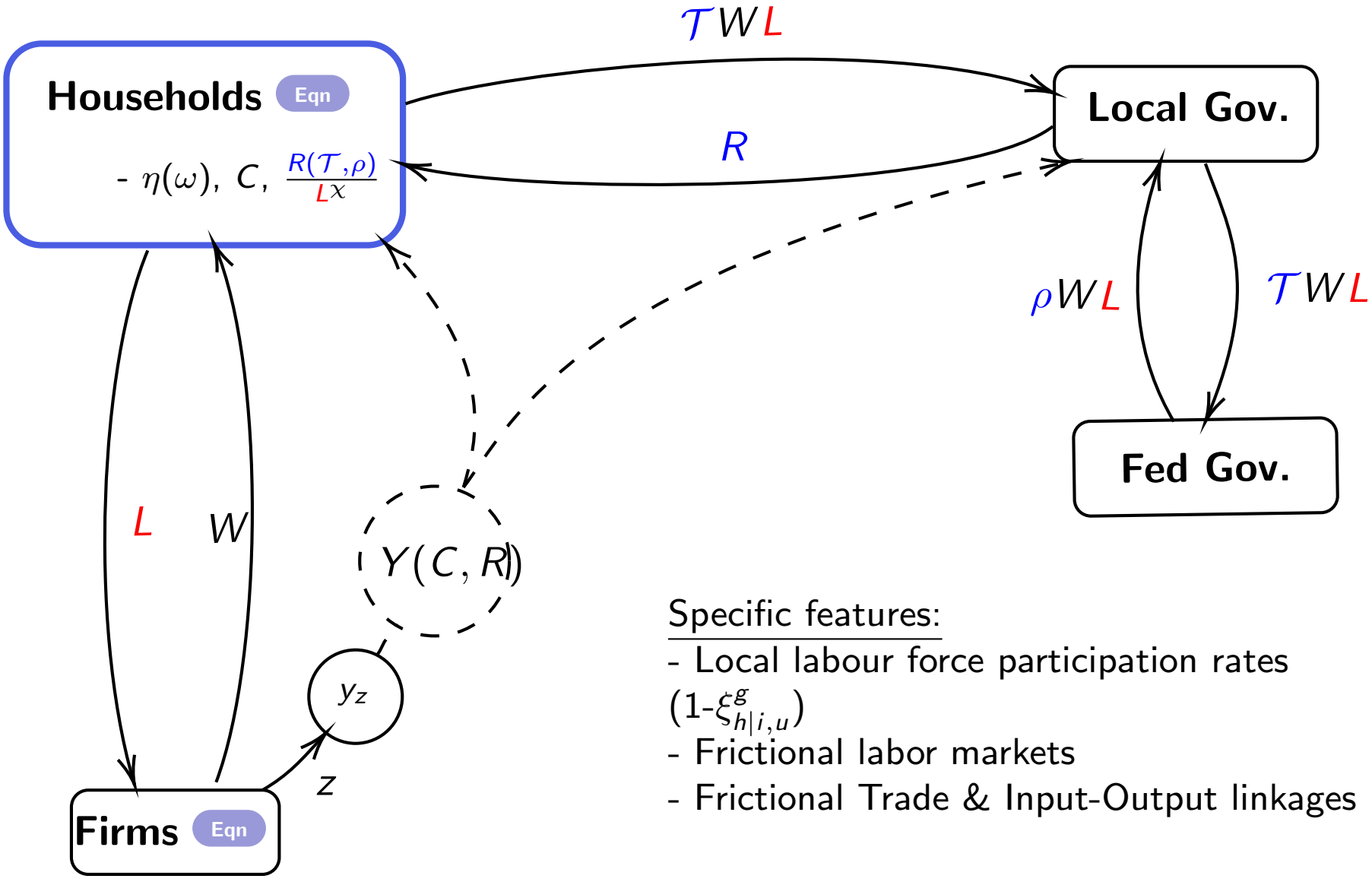
    $\rightarrow$ Reallocate funds into highly productive locations

- **Empirical Strategy**
  - **Application:** Quantify model using linked employer-employee data and novel data-set on fiscal transfers

    $\rightarrow$ Ignoring the labour force participation channel, we would **underestimate** the size of **optimal redistribution** as well as **GDP and welfare gains** from implementing optimal fiscal policies

# Model

# Model Outline




Specific features:

- Local labour force participation rates ($1\text{-}\xi^{g}_{h|i,u}$)
- Frictional labor markets
- Frictional Trade & Input-Output linkages

# Worker sorting and extensive labor supply

- In the first stage, workers choose regions and sectors to work in (incorporating future labor supply decision)
- Expected utility of worker ($\omega$) in region-sector pair $\{i, u\}$ depends on market and non-market income, prices, employment probabilities, structural parameters as well fundamental variables (amenities, preferences)
- Number of workers in region $i$ and sector $u$ that end up joining the labor force

$$L^g_{u|i,u} = 1 - \left[ \left( \frac{1}{\mathcal{B}^g_{s|i,u}} \right) \left( \frac{I^g_{u|i,u}}{I^g_{h|i,u}} \right)^{1-\alpha} \left( \left[ \frac{R_{u|i,u}}{L_i^{\chi}} \right]^{\rho^g_{h,R}} \right)^{\alpha} \right]^{-\epsilon^g} L^g_{i,u}$$

# Social Planner Framework I

- We contrast the competitive equilibrium with the allocation of workers and goods chosen by a social planner
- Planner maximizes the (weighted) sum of expected utilities in all parts of the economy
- Planner chooses policy instruments (taxes, transfers) to influence
  - distribution of workers
  - size of labour force
  - consumption of private and public goods
  - allocation of production inputs

# Social Planner Framework I

## Proposition

*The competitive equilibrium is efficient if the planner's problem is globally concave and the following condition on private goods expenditure holds:*

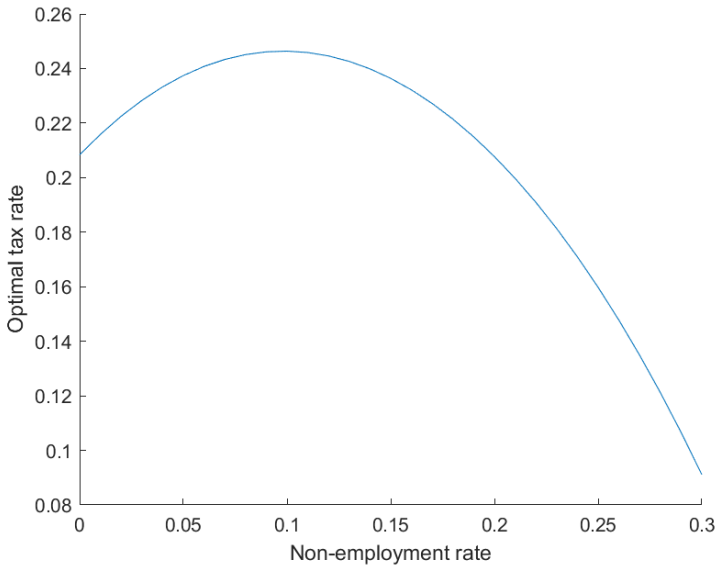
$$\underbrace{W^g_{i,u}}_{\text{opportunity cost}} + \underbrace{\sum_{u' \in M} P_{i,u'} \sum_{s \in h,u} \xi^g_{s|i,u} C^g_{s,u'|i,u}}_{\text{consumption cost}} =$$

$$\underbrace{\left(1 - \xi^g_{h|i,u}\right) w^g_{u|i,u}}_{\text{marginal product of labour}} + \underbrace{Ex^{Agg}_i}_{\text{productivity spillovers}}$$

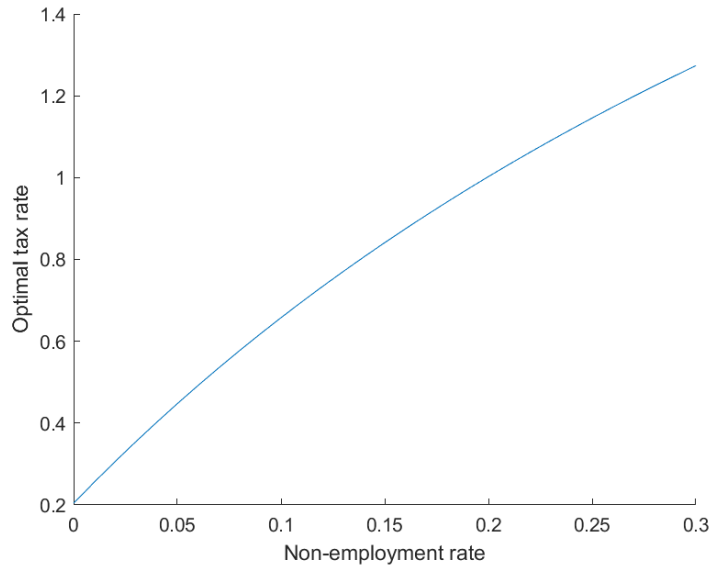
$$- \underbrace{Ex^{LF}_i}_{\substack{\text{spillovers on} \\ \text{local labour force}}} - \underbrace{Ex^{Pub}_i}_{\substack{\text{congestion spillovers on} \\ \text{public goods consumption}}}$$

# Optimal tax rates

## Workers in the labour force



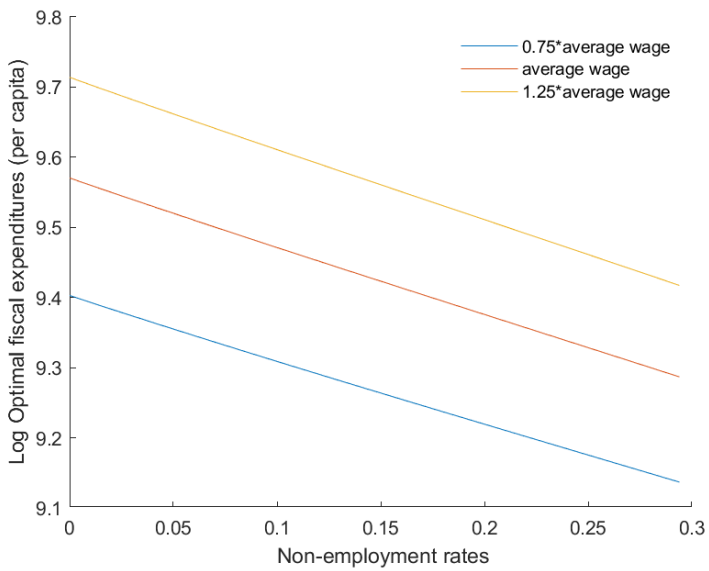

## Workers not in the labour force



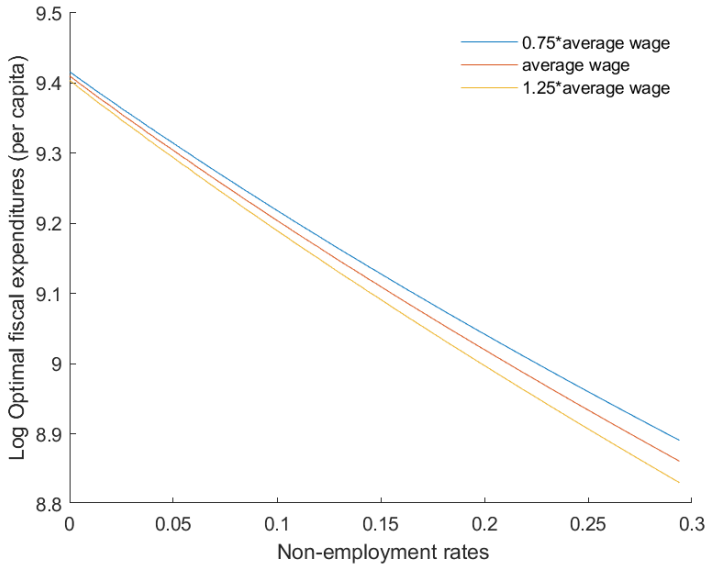

Taxes

# Optimal transfers

## Transfers to local governments




## Transfers to workers



# Optimal Fiscal Policy

- **Optimal tax rates:**
  - Follow reverse U-shape in local non-employment rates

    $\rightarrow$ Trade off behavioural responses with higher marginal utility of consumption
  - Benefits to non-employed workers decrease in local non-employment rates
- **Optimal fiscal transfers:** Planner allocates larger fiscal transfers to locations
  - with **large marginal product of labor** (high productivity / wage)
  - **large labour force participation**

    $\rightarrow$ Trade off high demand for public goods in locations of high participation with (relatively) smaller increase in labour force
  - high agglomeration benefits relative to congestion costs (**" internalising local externalities"**)
  - Transfers to workers also help internalising externalities and increase in labour force participation

# Application

# Quantification

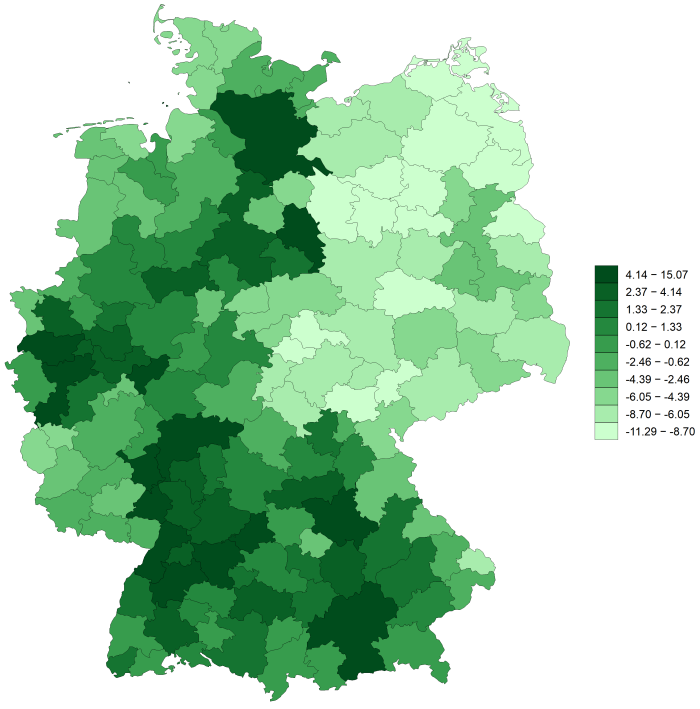
- Estimate/calibrate required model parameters for Germany to solve for initial spatial equilibrium in 2014 Parameters
- Use set of equations and parameters to uncover model-consistent prices, costs and initial distribution of amenities/productivity levels
- Counterfactual: Use the structure of the model to quantify importance of public policies for local labor supply decisions and the spatial distribution of economic activity and the aggregate economy

$\rightarrow$ We implement the optimal tax rates and transfers from the planner's problem and solve for new long-run general equilibrium

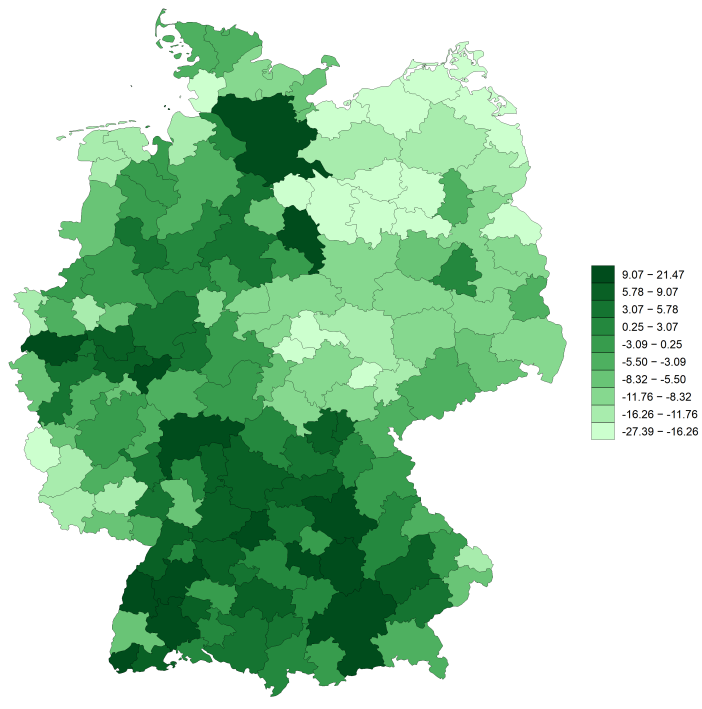
Census Shock

# Optimal fiscal policy

## Consumption shock

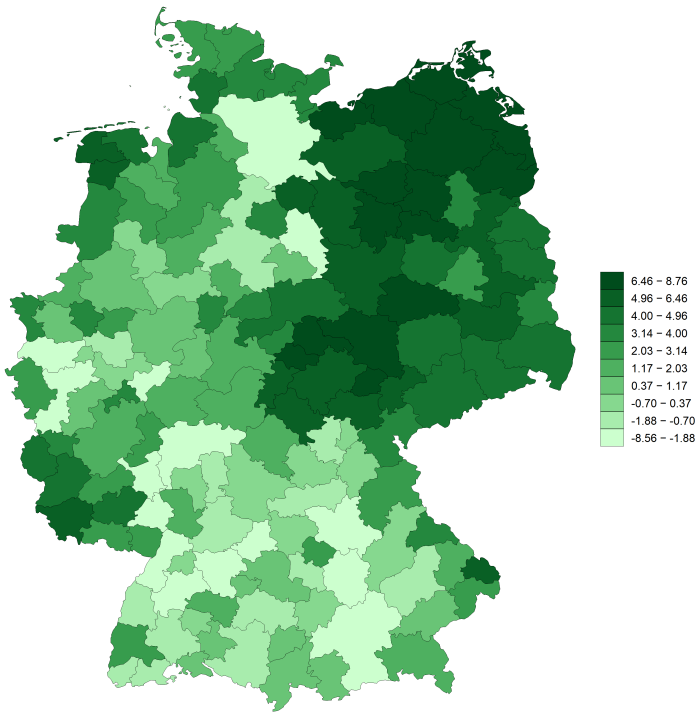



## Population change

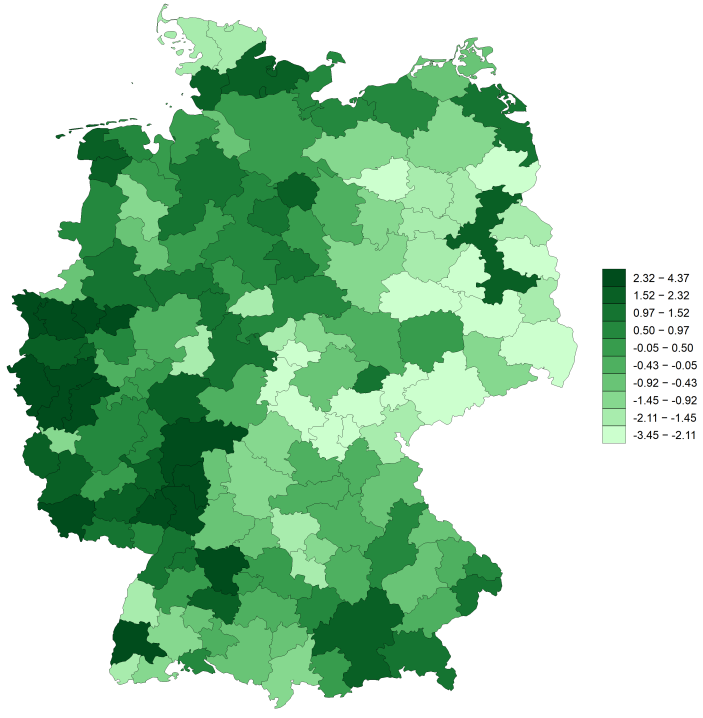


# Optimal fiscal policy

## Real wage change




## Change in labour force participation



# Aggregate effects

| | Overall | Recipient |
|---|---|---|
| Panel A: Population and Employment | | |
| Δ Population (Male; in %) | 0 | 5.02 |
| Δ Population (Female) | 0 | 4.11 |
| Δ Labour force (Male) | -0.36 | 4.85 |
| Δ Labour force (Female) | 2.99 | 8.11 |
| Panel B: Wages | | |
| Δ Average wage (Male; in % ) | 1.54 | -0.66 |
| Δ Average wage (Female; in % ) | -0.45 | -1.53 |
| Panel C: Aggregate measures | | |
| Δ Fiscal capacities (per capita; in %) | -1.26 | 2.40 |
| Δ Real GDP (in %) | 1.59 | 4.33 |
| Δ Welfare (in %) | 1.31 | 1.31 |

# Conclusion

- Exploit **random shocks** to **fiscal redistribution system** to estimate **local employment effects** of fiscal policies
- Combine reduced-form estimates with **novel spatial GE model** to analyse place-based policies, incorporating public good provision and local multiplier effects under spatial mobility
- **Derive optimal taxes and transfers** that maximize societal welfare
  $\rightarrow$ Planner allocates **larger transfers** to (i) locations endowed with **high net externalities**, (ii) with **high productivity**, and (iii) **high labour force participation**
- Implementing the optimal fiscal policy increases aggregate GDP, labour force and welfare

  $\rightarrow$ Ignoring the extensive labour supply, we would **underestimate the optimal size of fiscal redistribution**

Empirical Evidence

# Additional material

# Model Setup

- Provide a comprehensive account of the effects of fiscal policies under spatial mobility and elastic labor supply
- Quantitative spatial general equilibrium model
  - Sorting of heterogeneous workers across local labor markets [Diamond, 2016; Fajgelbaum & Gaubert, 2020]
  - Local governments supplying local public goods [Fajgelbaum et al., 2019], and a fiscal transfer scheme reallocates resources across jurisdictions [Henkel et al., 2021; Fajgelbaum & Gaubert, 2020]
- We extend the framework by introducing ...
  1. Extensive labor supply decisions of heterogeneous worker groups that are shifted by local public goods provision
  2. Selection into occupational sectors based on comparative advantage or type-specific preferences [Hsieh et al., 2019; Burstein et al., 2020]

# Setup

- Endowments:
  - $J$ locations and $S$ sectors (one of which is the home market sector)
  - $G$ groups of workers of heterogeneous preferences
  - $L^g$: exogenous supply of group-$g$ workers
- Two goods/services
  - Intermediate goods in different sectors (traded + non-traded). Production uses labor, land and structures as well as materials
  - Final goods production uses intermediate goods
  - Final consumption good $C$
  - Local public good $R$
- Heterogeneous locations
  - Consumption amenities and market frictions: $\bar{A}_i^g$, $\mathcal{B}_{s|i,u}^g$
  - Productivity: $T_{i,u}^g = \bar{T}_{i,u}^g \left( \sum_{u \in M} \sum_{g \in G} L_{i,u}^g \right)^{\zeta^g}$ with $\zeta^g > 0$ ("agglomeration economies")
  - Exogenous land and structures: $h_{i,u}$

# Market and non-market compensation

- Workers receive wage income $w^g_{s|i,u}$, taxed at rate $\mathcal{T}^g_{s|i,u}$, as well as an additive transfer $\mathcal{S}^g_{s|i,u}$ from the general government:

$$I^g_{s|i,u} = \left(1 - \mathcal{T}^g_{s|i,u}\right) w^g_{s|i,u} + \mathcal{S}^g_{s|i,u},$$

- Non-convexities: workers in the home market receive non-employment compensation and profit less from public good expenditure:

$$w^g_{s|i,u} = \begin{cases} (1-\gamma) w^g_{u|i,u} & \text{if } s = h \\ w^g_{u|i,u} & \text{if } s = u \in M \end{cases} \qquad \frac{R_{s|i,u}}{L_i^\chi} = \begin{cases} \left(\frac{R_{u|i,u}}{L_i^\chi}\right)^{1-\rho^g_{h,R}} & \text{if } s = h \\ \frac{R_{u|i,u}}{L_i^\chi} & \text{if } s = u \in M, \end{cases}$$

with $\{\gamma, \rho^g_{h,R}\} \in [0,1]$

# Preferences

- Cobb-Douglas utility from the consumption of final goods produced by different sectors and local public goods and two idiosyncratic preference components $\{\eta^g_{s|i,u}(\omega), \Psi^g_{i,u}(\omega)\}$

$$V^g_{s|i,u}(\omega) = \eta^g_{s|i,u}(\omega) \left(\frac{R_{s|i,u}}{L_i^{\chi}}\right)^{\alpha} \left(\frac{I^g_{s|i,u}}{P_i}\right)^{1-\alpha} \Psi^g_{i,u}(\omega),$$

- Overall idiosyncratic preference component:

$$\eta^g_{s|i,u}(\omega) = \begin{cases} \bar{A}^g_i \exp\left[\bar{B}^g_{h|i,u}\right] \varphi(\omega) & \text{if } s = h \\ \bar{A}^g_i \exp\left[-\mu^g_{u|i,u}\right] & \text{if } s = u \in M. \end{cases} \quad (1)$$

- Fréchet distributed (shape parameter $\theta^g > 1$; scale parameter 1) idiosyncratic preferences $\Psi^g_{i,u}(\omega)$ for living and working in region-sector pair $\{i, u\}$

Back

# Worker sorting and extensive labor supply I

- Timing:

  (1) Workers decide on place to live and work (incorporating expected wages and home market preferences)

  (2) Afterwards, workers decide whether to supply labor (given random preference shock $\varphi(\omega)$

- Workers join labor force if attainable utility is higher
  $\Rightarrow$ Unique region-sector-specific cut-off $\tilde{\varphi}^g_{s|i,u}$

$$\tilde{\varphi}^g_{s|i,u} = \left(\frac{1}{\mathcal{B}^g_{s|i,u}}\right)\left(\frac{I^g_{u|i,u}}{I^g_{h|i,u}}\right)^{1-\alpha}\left(\left[\frac{R_{u|i,u}}{L_i^{\chi}}\right]^{\rho^g_{h,R}}\right)^{\alpha}.$$

  with

$$\mathcal{B}^g_{s|i,u} \equiv \exp\left[\bar{B}^g_{h|i,u} + \mu^g_{u|i,u}\right]$$

- Idiosyncratic preferences $\varphi$ are drawn from group-specific Pareto distribution:

$$G^g(\varphi) = 1 - \varphi^{-\epsilon^g}$$

# Market clearing

- Local governments own the land and structures in all regions and rent it out at local rates
- Local rents enter a national portfolio to finance non-employed compensation in all regions.
- All workers receive a constant share of the remaining portfolio of rent incomes
- Local governments use local taxes and fiscal transfers to purchase final goods as input for local public good provision at local prices
- Market clearing on goods market as well as input factor clearing (labor, land and structures and materials) needed for identification of preference and demand shifters

Final goods producers

# Worker sorting and extensive labor supply III

- Preferences for regions/sectors are drawn from Fréchet distribution
- Average utility of workers of type $g$ is

$$\mathcal{V}^g = \Gamma\left(\frac{\theta^g - 1}{\theta^g}\right)\left(\sum_{u\in M}\sum_{i\in J}\left[\bar{V}^g_{i,u}\right]^{\theta^g}\right)^{\frac{1}{\theta^g}}$$

- Number of workers of type $g$ choosing region $i$ and market sector $s$:

$$L^g_{i,u} = \frac{\left(\bar{V}^g_{i,u}\right)^{\theta^g}}{\sum_{u\in M}\sum_{i\in J}\left(\bar{V}^g_{i,u}\right)^{\theta^g}} L^g,$$

# Intermediate goods producers

- Firms in each region-occupation pair are able to produce many varieties of intermediate goods at differing productivities
- Productive inputs are the human capital of all groups, land and structures as well as materials
- The different labor types are imperfectly substitutable inputs to the production function

# Final goods producers

- Intermediate goods are combined into a local CES bundle (final good)
- Local final goods goods are used as materials for the production of intermediate varieties as well as for final consumption and public good provision
- Final goods producers purchase varieties of intermediate goods from the location in which the acquisition cost is the least
- The share of expenditures in pair $\{i, s\}$ that accrues to occupation-$s$-goods from region $j$ is

$$\pi_{ij,u} = \frac{X_{ij,u}}{X_{i,u}} = \frac{\left(\lambda_{j,u}\tau_{ij,u}\right)^{-\nu_u}}{\sum_{n\in J}\left(\lambda_{n,u}\tau_{in,u}\right)^{-\nu_u}}$$

Production II | Market clearing | Back

# Parameters

| Parameter | Description | Approach | Source |
|---|---|---|---|
| | **Production** | | |
| $\zeta^g = \{0.018; 0.032\}$ | Productivity spillovers | Set | Ahlfeldt et al. (2020) |
| $\sigma^g = 2.5$ | Elast. of substitution btw males and females | Set | Olivetti and Petrongolo (2014) |
| $\sigma = 5$ | Elast. of substitution of varieties | Set | Head and Mayer (2014) |
| $\nu_s = 10$ | Trade elasticity | Set | Head and Mayer (2014) |
| $\tau_{ij,s} = \{1, ..., 1.03\}$ | Trade cost | Est. | Trade flows from Schubert et al. (2014) |
| $1 - \kappa_i = \{0.08, ..., 0.95\}$ | Labour share in production | Cal. | Wage income/ Value added |
| $\delta_{i,s} = \{0.15, ..., 1\}$ | Share of value added | Cal. | Value added / Gross output |
| $\delta_{i,su} = \{0, ..., 0.54\}$ | Share of material inputs | Cal. | Input-Output Tables |
| $\beta_s = \beta_s^R = \{0.001, ..., 0.53\}$ | Expenditure share | Fit. | Equation (42) |
| | **Preferences** | | |
| $\chi = \{0; 1\}$ | Rivalry in public goods cons. | Set | Fajgelbaum et al. (2019); Henkel et al. (2021) |
| $\alpha = 0.24$ | Cobb-Douglas preferences weight on public good | Set | Fajgelbaum et al. (2019); Henkel et al. (2021) |
| $\theta^g = 5$ | Fréchet shape parameter | Set | Ahlfeldt et al. (2023) |
| $\epsilon^g = 1.63$ | Pareto shape parameter | Cal. | Mean $(1-\alpha)\epsilon^g \frac{\xi^g_{h\|i,u}}{1-\xi^g_{h\|i,u}}$ fit to match micro-elasticities of extensive labour supply |
| | **Extensive Labour Supply** | | |
| $1 - \rho^g_{h,R} = \{0.886; 0.854\}$ | Non-employed public goods cons./Employed public goods cons. | Est. | Section B.2.2 |
| | **Government** | | |
| $\mathcal{T}_i = \{0.22, ..., 0.45\}$ | Regional tax rate | Cal. | Tax revenues |
| $\rho_i = \{-0.15, ..., 0.23\}$ | Transfer rate | Cal. | Transfer payments |

Quantification

# Fiscal transfers in Germany and the 2011 Census Shock

- Use quasi-experimental shocks to fiscal transfers to estimate labour supply elasticity of public expenditure
- Larger local population is associated with larger net transfers
- Official population counts are carried out very irregularly, such that they are approximated via extrapolations ("Bevölkerungsfortschreibung") in the meantime
- After a nationwide Census, population counts and in turn fiscal transfers are "corrected" immediately 2011 Census Shock
- Induces unexpected, but permanent spatial variation in fiscal capacities that is exogenous to economic and fiscal conditions (Helm & Stuhler, 2021)

# Reduced-form Effects

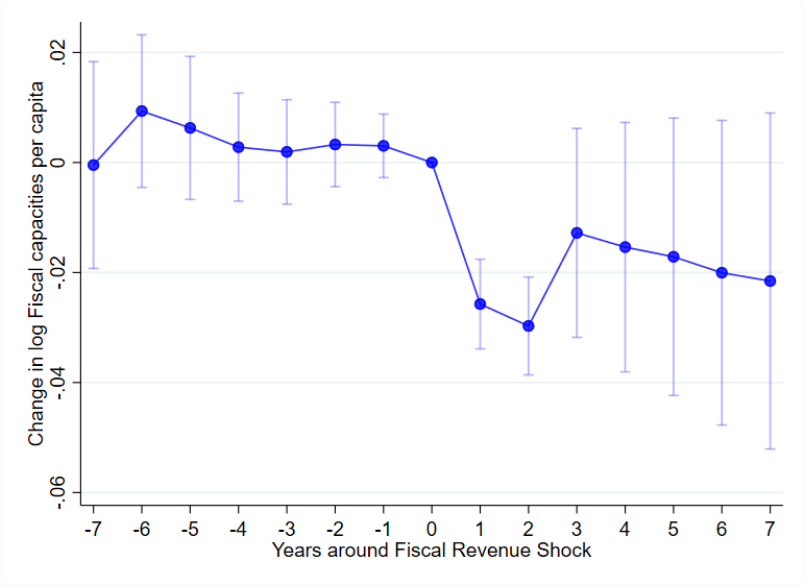
- **Main Concern**: Census Shock correlated with local economic trends that simultaneously predict local public finance and employment dynamics
- **Binary Treatment**: $D_{i,t} = 1$ for locations with a large negative Census shock (one SD below the mean)
- **Treatment Effects Strategy**: Let $\Delta Y^s_{i,t}(d) = Y^s_{i,t}(d) - Y_{i,t1}$ denote the potential change in (log) outcome from time $t-1$ to time $t+s$ (Serrato and Wingender, 2016)
- **Causal Effect**: of a change in treatment in $t$ on outcome $s$ periods thereafter for treated counties (ATET) is

$$\beta^s = \mathbb{E}\left[\Delta Y^s_{i,t}(1) - \Delta Y^s_{i,t}(0) | D_{i,t} = 1, D_{i,t} = 0\right]$$

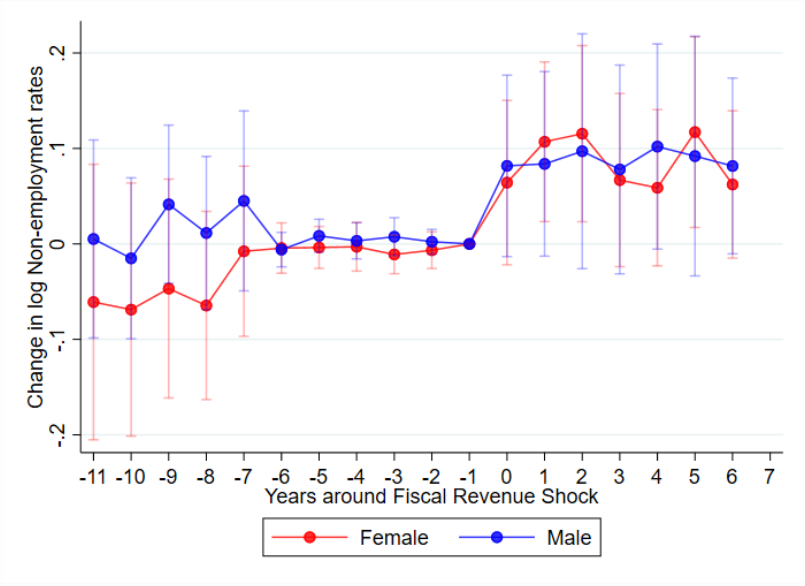
- **Assumption**: Selection on observables
$\Delta Y^s_{i,t}(d) \perp D_{i,t} | Y^{t+1}_{i,t-1}, Y^{t+1}_{i,t-4}, \mathbb{I}\{District\}_{i,t}, \mathbb{I}\{Year\}_{i,t} \quad \forall s \geq 2$

# Event Studies

## Transfers to local governments

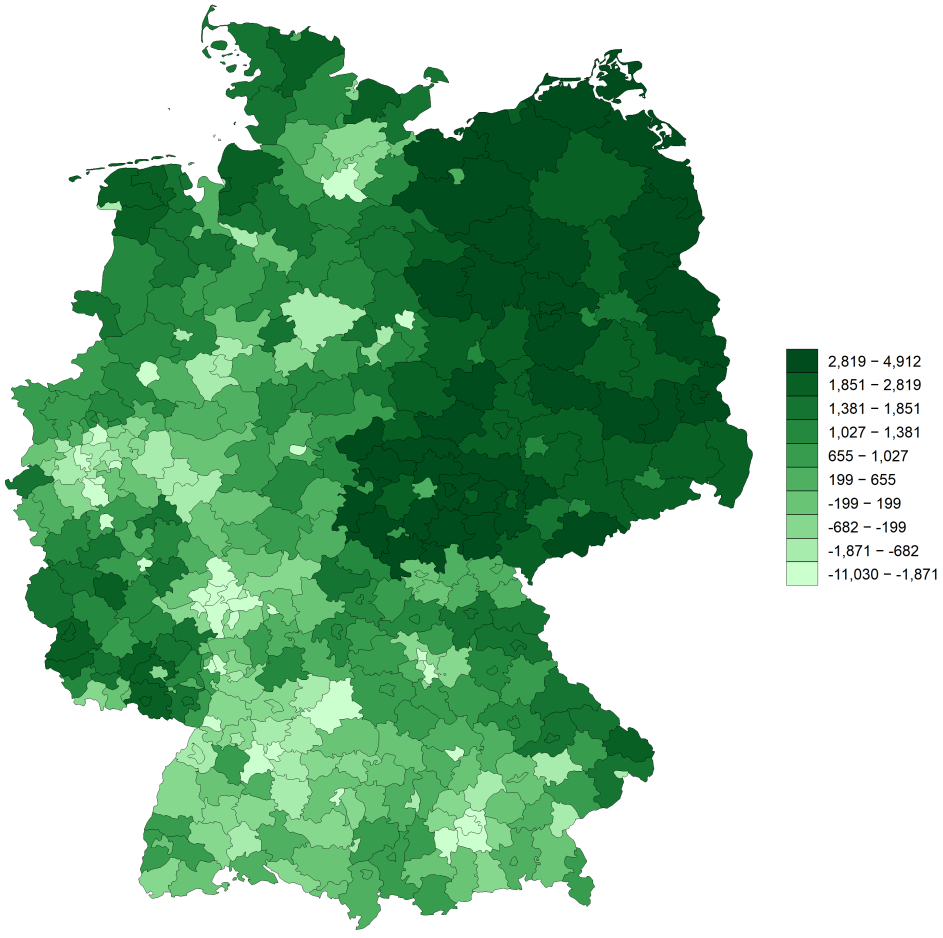



## Transfers to workers




Quantification

# Fiscal transfers



# Census shock and Fiscal Transfers

- Definition of Census shock (May, 2011):

$$\Delta \ln \text{Census}_{i,2011} \equiv (\ln L_{i,\text{Census}} - \ln L_{i,2010}) * 100$$

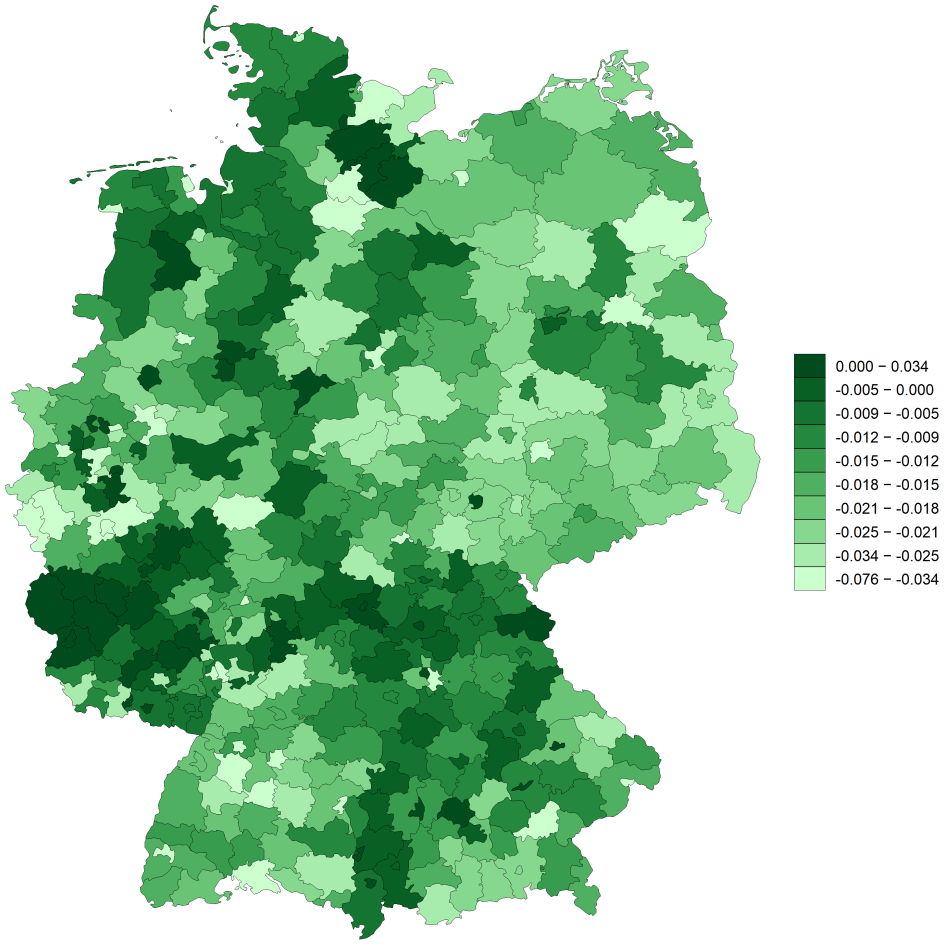
- Event study of Census shock on changes in fiscal transfers:

$$\Delta \text{Transferpc}_{i,t} = c_t + c_{j,t} + \sum_{s=T+k} \beta_s \Delta \ln \text{Census}_{i,2011} \times 1[t = s] + u_{i,t}$$

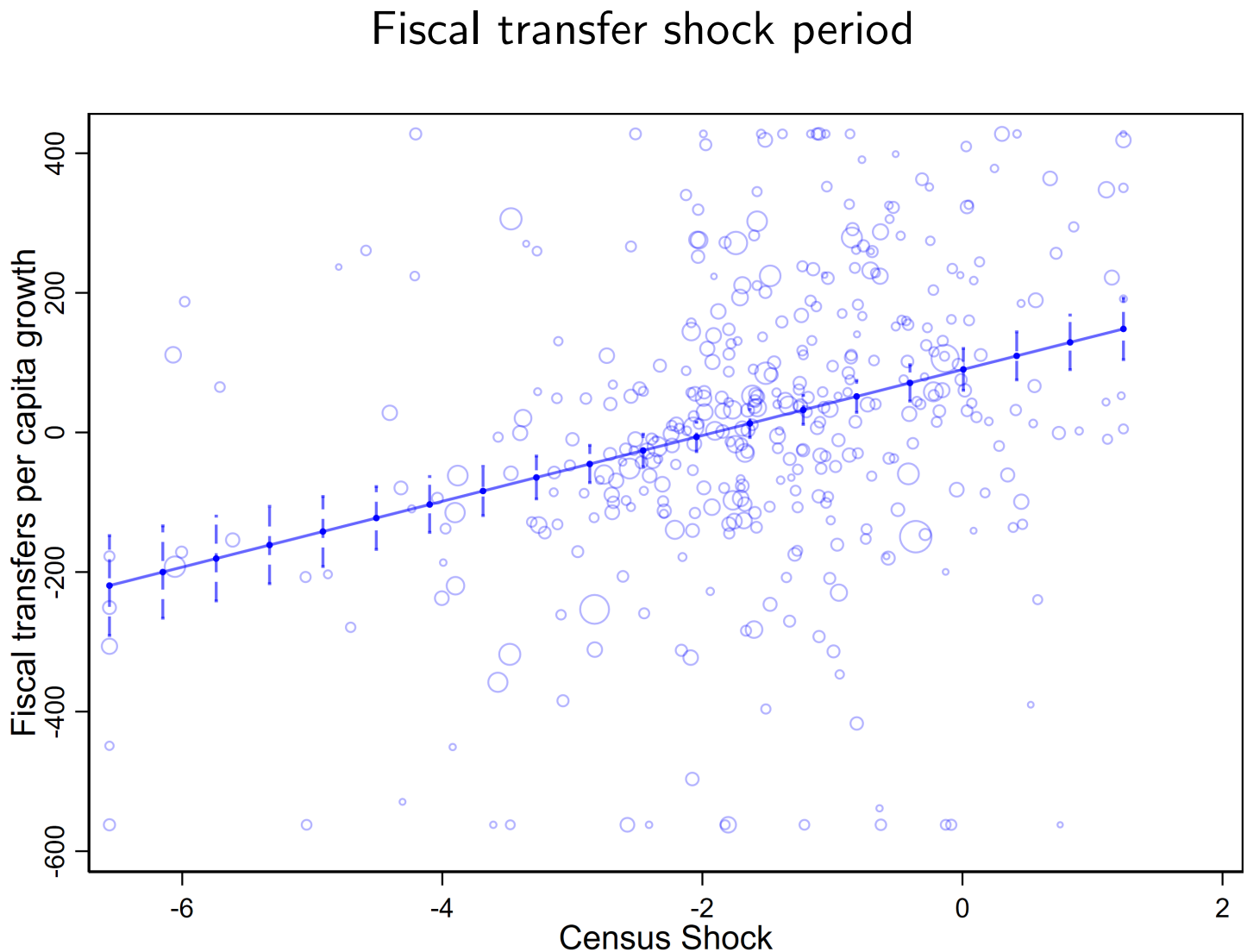
- No statistically significant impact in pre-periods

Correlation | Event Study - Yearly | Event Study - Cumulative

# Census Shock

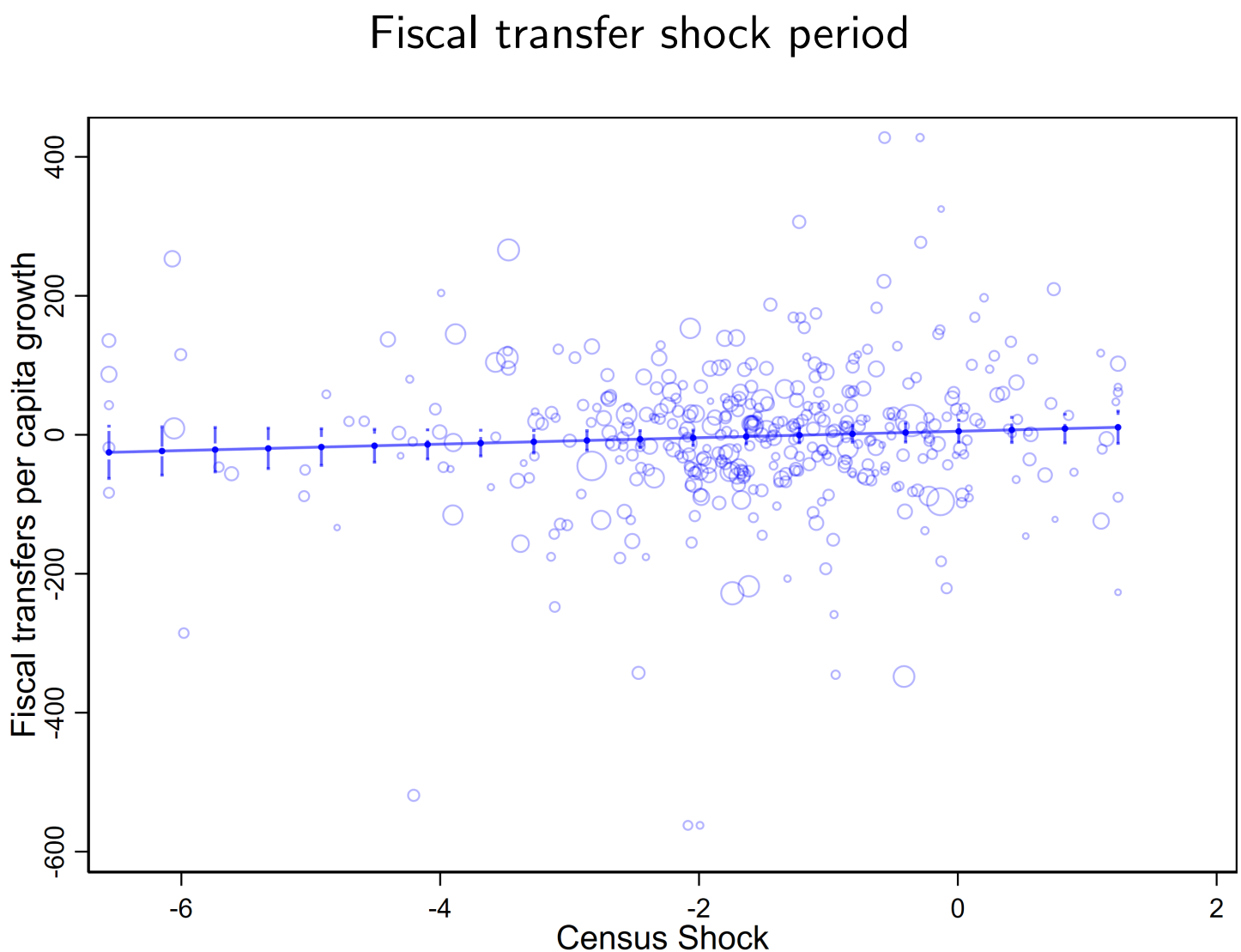


# Fiscal transfers and Census shock



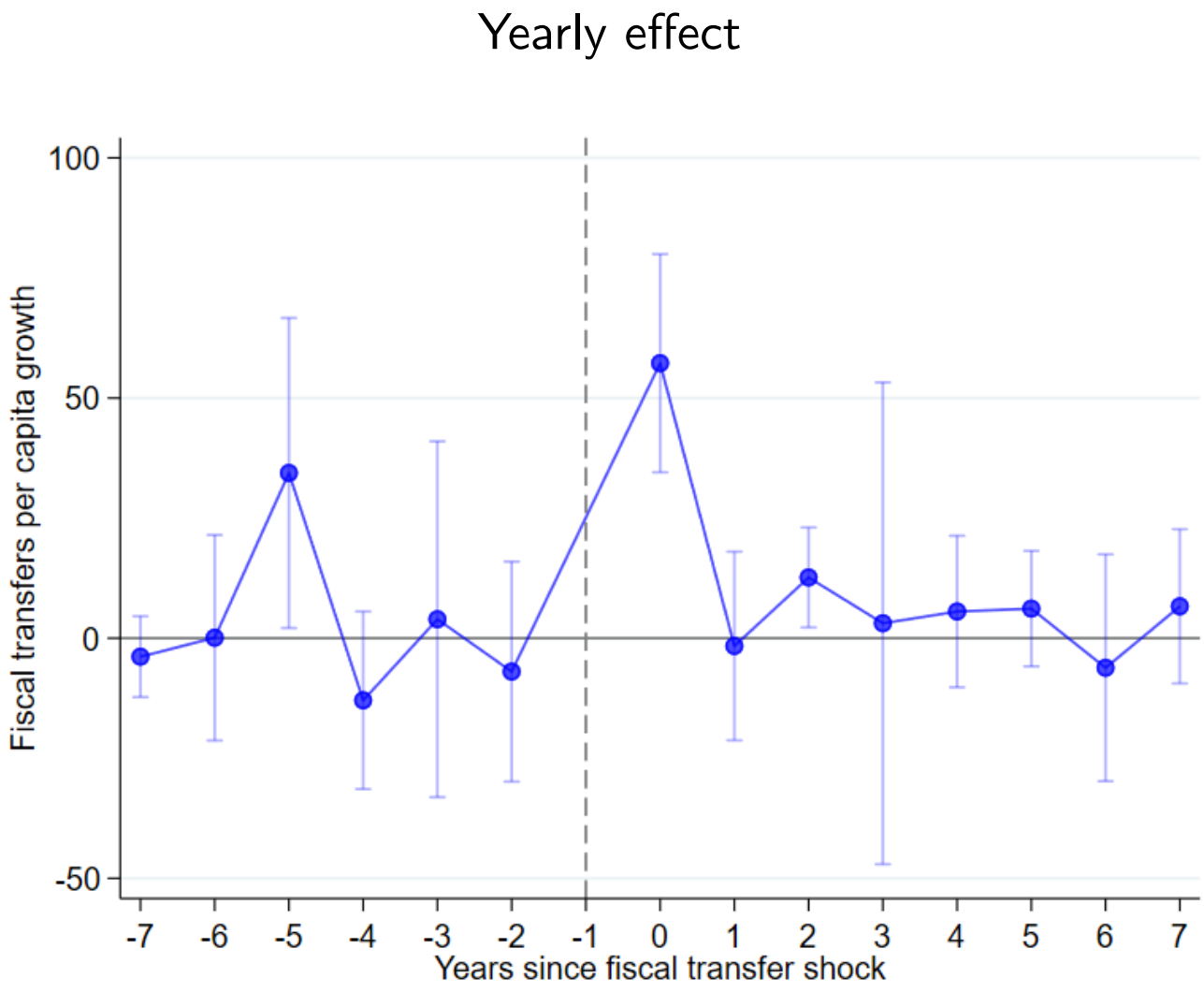

Source: Beta = 57.15; t-stat = 5.02; R-squared = 0.0610.

# Fiscal transfers and Census shock II



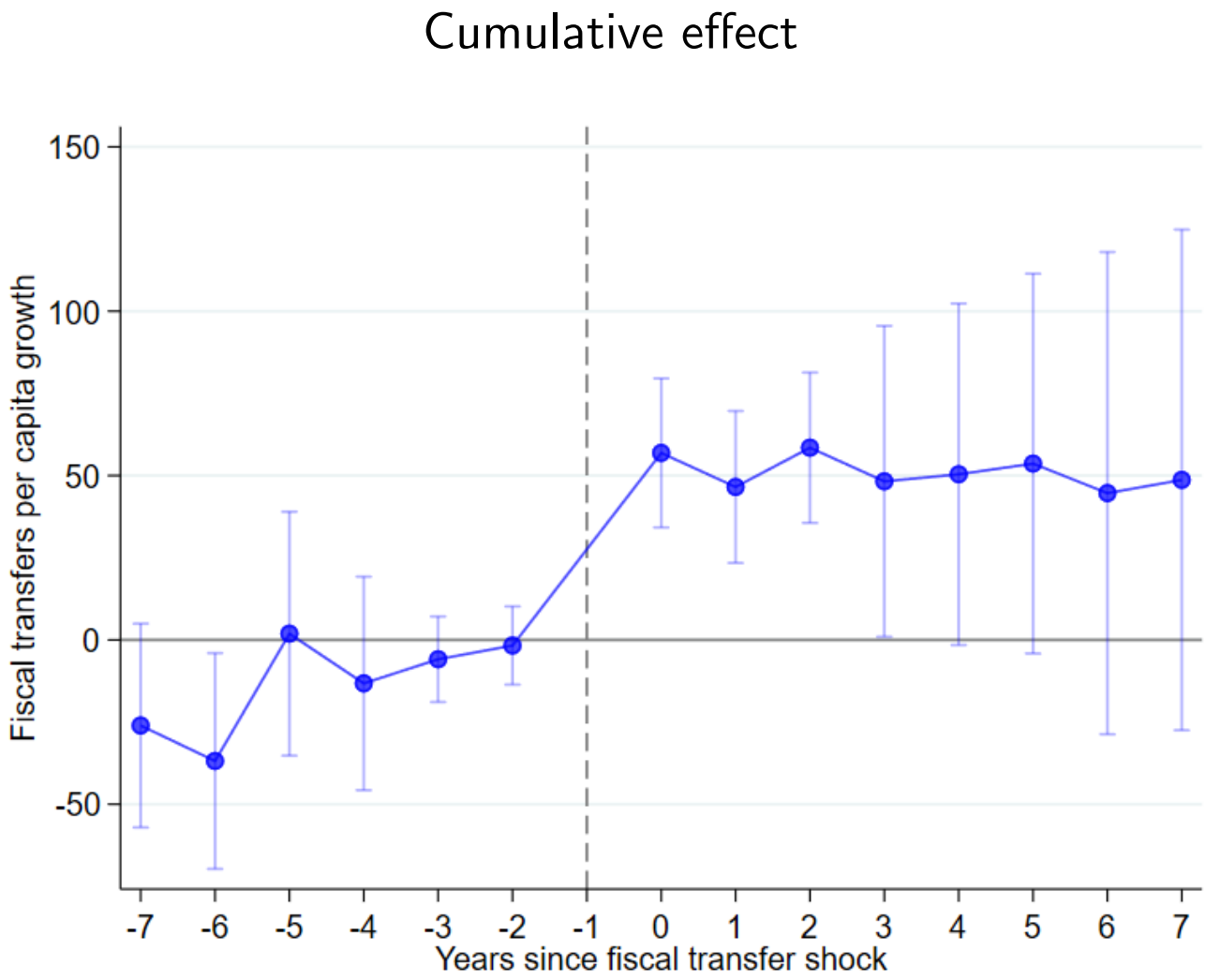

Source: Beta = 7.43; t-stat = 1.42; R-squared = 0.0062.

# Fiscal transfer growth and Census shock




Back

# Cumulative fiscal transfer growth and Census shock




Back