Spatial Policies and Heterogeneous Employment Responses

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Research Question

Central Question

How do place-based policies affect employment patterns differently across demographic groups and locations?

- **Standard view:** Spatial policies (e.g. fiscal transfers, local taxes) mainly affect *where* people work
- **This paper:** Spatial policies additionally affect *whether* people work
- **Key innovation:** Heterogeneous employment responses across gender and space – affected by local public investments and taxation

Motivation: The German Context

- **Spatial policies widespread across Germany:**
  - Fiscal transfers enable local public services (childcare, transport, education) in places with high demand – but little revenues
  - Variation in local taxation across regions
- **Policy debate on spatial redistribution:**
  - Public services affect work participation, especially for women
- **Key policy question:** Where should funds for public services be spent and how should they be financed?

Contribution to the Literature

Our Contribution

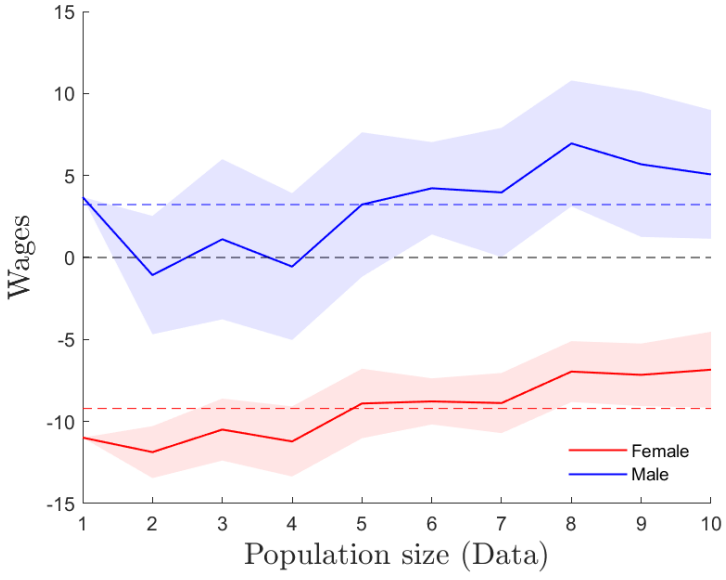
We extend quantitative spatial economics models by integrating labour force participation decisions with location choices

- **Existing quantitative spatial models:** Focus on *where* people work (mobility channel)
- **Our innovation:** Add *whether* people work (participation channel)
- **Key insight:** Identify novel (spatial) externalities
  $\rightarrow$ Optimal policy targets high-labour-elasticity areas, not necessarily only poor regions

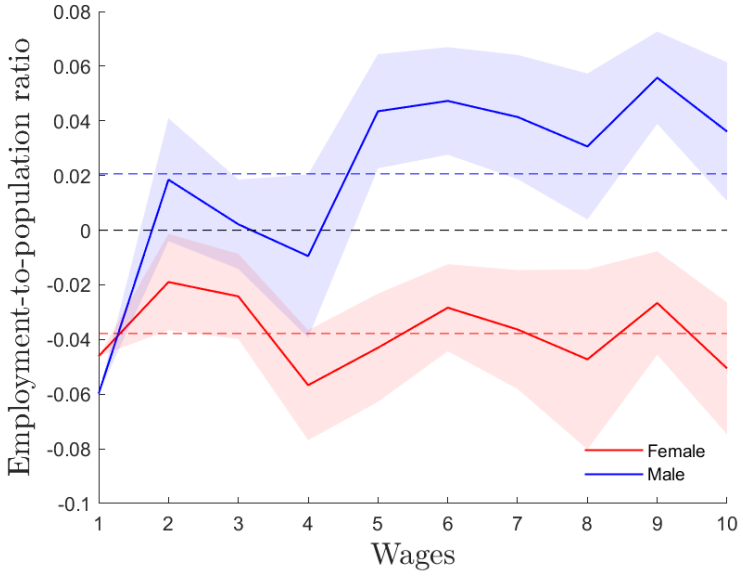
Quantitative impact: Models ignoring heterogeneous labour supply responses underestimate welfare gains from optimising spatial policy by 60%

Stylized Facts: Urban Premium vs. Gender Gaps

Urban Wage Premium



Labour Force Participation



Larger, high-wage cities show larger gender employment gaps despite higher productivity

Worker Preferences

- Individual ω of group g in location i, sector s gets utility from
  - individual amenity valuation $(a_i^g(\omega))$
  - consumption of market goods $(C_{s|i}^g)$
  - work disutility $((\Lambda_s^g)^{-1})$
  - benefits from home production $(b_{s|i}^g(\omega))$:

$$U_{s|i}^g(\omega) = a_i^g(\omega)\left(C_{s|i}^g\right)^{1-\alpha} \cdot (\Lambda_s^g)^{-1} \cdot b_{s|i}^g(\omega) \tag{1}$$

Home Production Technology

- **Workers allocates** one unit of **time to either market work or home production** (extensive labour supply margin)
- Utility from **home production depends** on individual ability, regional characteristics, and **local public goods** R_i**:**

$$b_{s|i}^{g}(\omega) = \begin{cases} \left(R_i / L_i^{\chi}\right)^{\alpha} & \text{if } s = m, \\ \exp\left[B_{h|i}^{g}\right] \left[\left(R_i / L_i^{\chi}\right)^{\alpha}\right]^{1-\rho^{g}} \varphi(\omega) & \text{if } s = h \end{cases} \tag{2}$$

Public goods provision decreases opportunity cost of market work $\rightarrow$ **Estimate degree of substitutability** ρ^{g} using quasi-random shocks to fiscal transfers

Local public finance

- After-tax income of workers: $I^g_{s|i} = (1 - t_{s|i}) w^g_i + x^g_{s|i}$
- Non-employed workers only receive fraction of after-tax income
- Federal government redistributes income tax revenues:

$$E_i = (t_{m|i} + \iota_i) \sum_{g \in G} (1 - \xi^g_{h|i}) w^g_i L^g_i . \tag{3}$$

- Final goods used for private consumption or to produce public goods

Labour Force Participation Decision

- **Key mechanism:** Workers compare utility in market and home market sector Model Details
- **Non-employment rate** depends on public policy and local conditions:

$$\xi^g_{h|i} = \Bigg[\underbrace{\left(\exp\left[B^g_{h|i}\right]\right)^{-1}}_{\text{Home Market Efficiency}} \underbrace{\left(\frac{I^g_{m|i}}{I^g_{h|i}}\right)^{1-\alpha} \left(\left[\frac{R_i}{L_i^{\chi}}\right]^{\rho^g}\right)^{\alpha}}_{\text{Spatial Policies}} \Bigg]^{-\epsilon^g}. \qquad (4)$$

- **Participation responses generate** agglomeration and congestion **spillovers**

  $\rightarrow$ Well-designed spatial policy to correct externalities

Efficiency in the economy

The efficient allocation of labour satisfies two conditions :

(1) **Spatial Sorting**:

$$\underbrace{W_i^g}_{\text{opportunity cost}} + \underbrace{P_i \sum_{s \in h,m} \xi_{s|i}^g C_{s|i}^g}_{\text{consumption cost}} = \underbrace{\left(1 - \xi_{h|i}^g\right) w_i^g}_{\text{marginal product of labour}} + \underbrace{Ex_i^{\text{NET}}}_{\text{net spatial externalities}}$$

(2) **Sectoral Allocation**:

$$\underbrace{w_i^g}_{\text{Market productivity}} = \underbrace{\tilde{W}_{m|i}^g}_{\text{social value in home market}}$$

Social Planner Set-Up

Spatial Externalities

- **Workers'** location and participation **choices** influence other workers via **spatial externalities**:

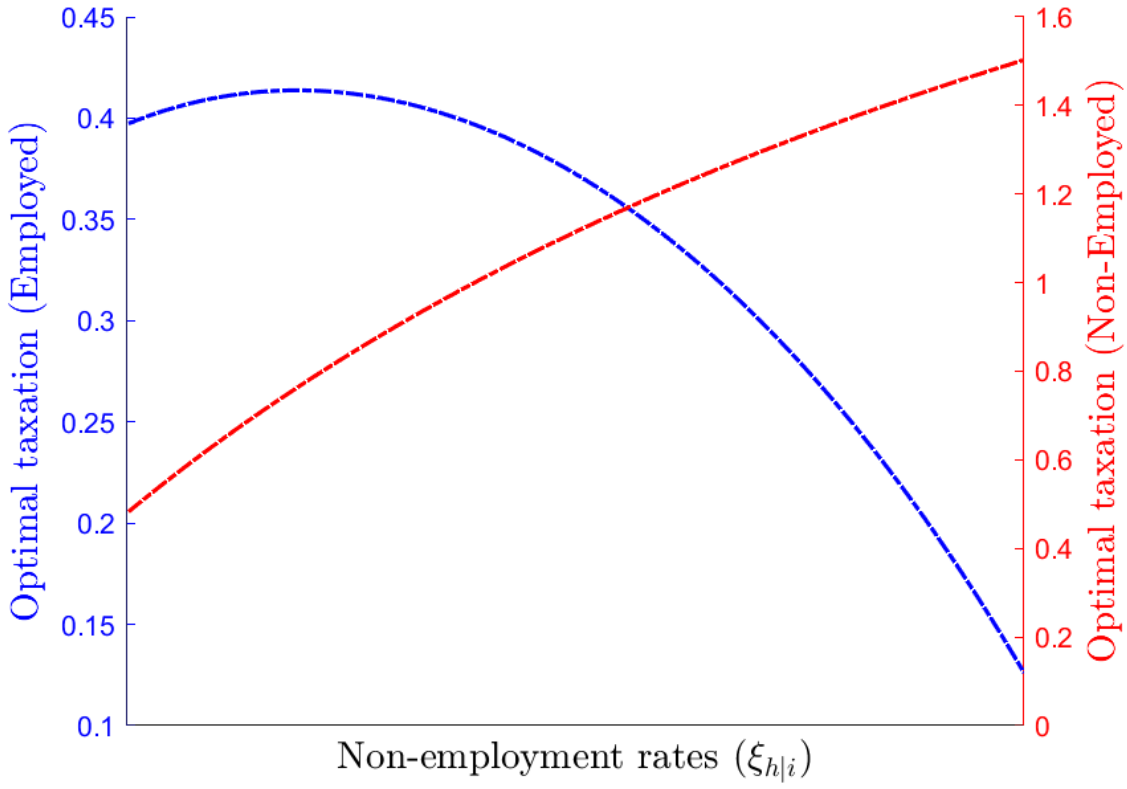
$$\mathrm{Ex}_i^{\mathrm{NET}} \equiv \underbrace{\mathrm{Ex}_i^{\mathrm{AGG}}}_{\text{productivity spillovers}} + \underbrace{\mathrm{Ex}_i^{\mathrm{CON}}}_{\text{congestion spillovers}} + \underbrace{\mathrm{Ex}_i^{\mathrm{LFP}}}_{\text{labour supply fiscal externality}}$$

- An additional worker who joins the labour force in region i
  - increases **productivity** (and local fiscal budgets)
  - increases **congestion** of public goods and endogenous amenities
  - Influences **participation choices** of other workers:
    - $\rightarrow$ Congestion lowers quality of public goods
    - $\rightarrow$ Opportunity cost of home market work decreases
    - $\rightarrow$ Heterogeneous labour supply responses across places!

Simple Examples - Optimal tax policy

- When **LFP choices are absent** in the economy ($\xi_{h|i} = 0$), the planner implements a **uniform tax rate** across regions
- **With LFP choices:** The planner now **accounts for spatially-varying labour supply externalities:**
  - **Optimal tax rates for employed workers follow a U-shape relationship** with non-employment rates
  - Tax rates higher in places with inelastic labour supply (high LFP)
  - Tax cuts in places with highly elastic (and productive) workers ('selection effect')

Optimal taxation



Simple Examples - Optimal redistribution

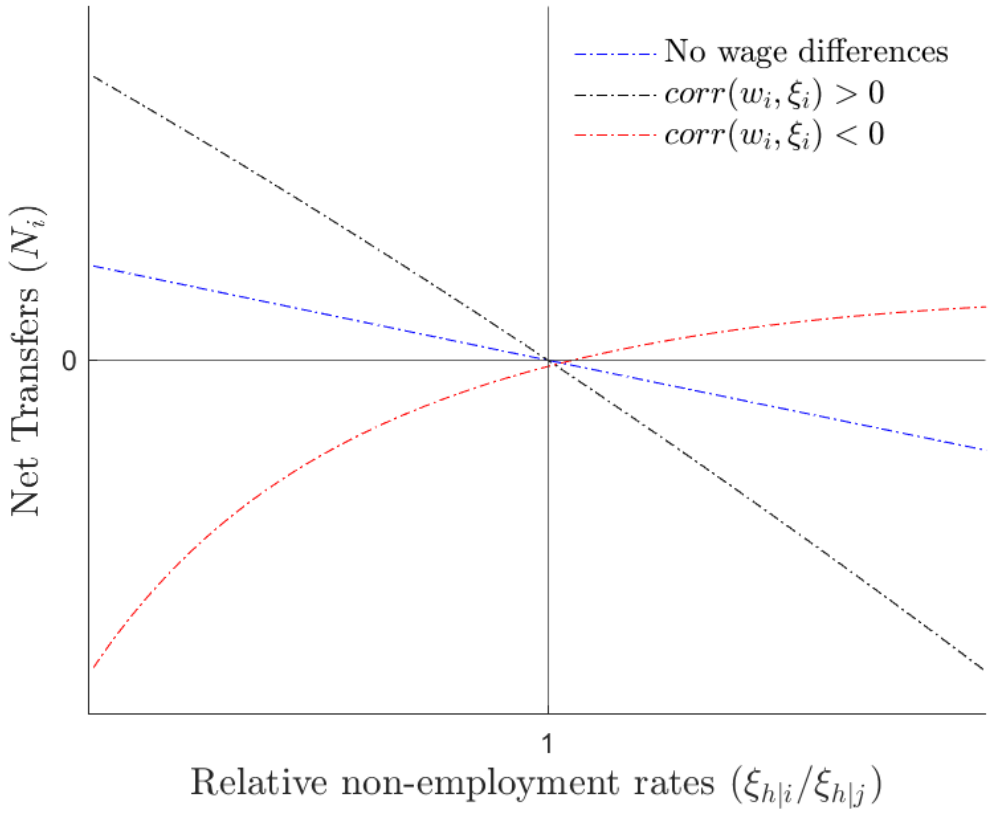
- When **LFP choices are absent** in the economy ($\xi_{h|i} = 0$), the planner trades off (i) agglomeration benefits and (ii) congestion costs as well as (iii) spatial differences in marginal consumption utility

- Additional **trade-off due to novel externality:**
  - Labour supply externality more likely to act as congestion force in places with high wages or large home market sector

    $\rightarrow$ Fiscal transfers flow to places with low wages or small home market sector

- **Correlation** $(w_i, \xi_{h|i})$ **determines direction and size of redistribution**

Optimal spatial redistribution



Social Planner

Application to German labour markets

- Quantify the spatial GE model to German labour markets in 2014

  $\rightarrow$ Then implement optimised spatial policy

- Use quasi-experimental evidence from Census shocks to estimate main structural parameters Reduced-Form Estimates

- Rich labour market and public finance data to fit average wages, LFP, taxes, transfers, employment, trade structure etc

- Optimised policy implies less redistribution into low-wage places and smaller tax rates in high-LFP areas

Quantification Application

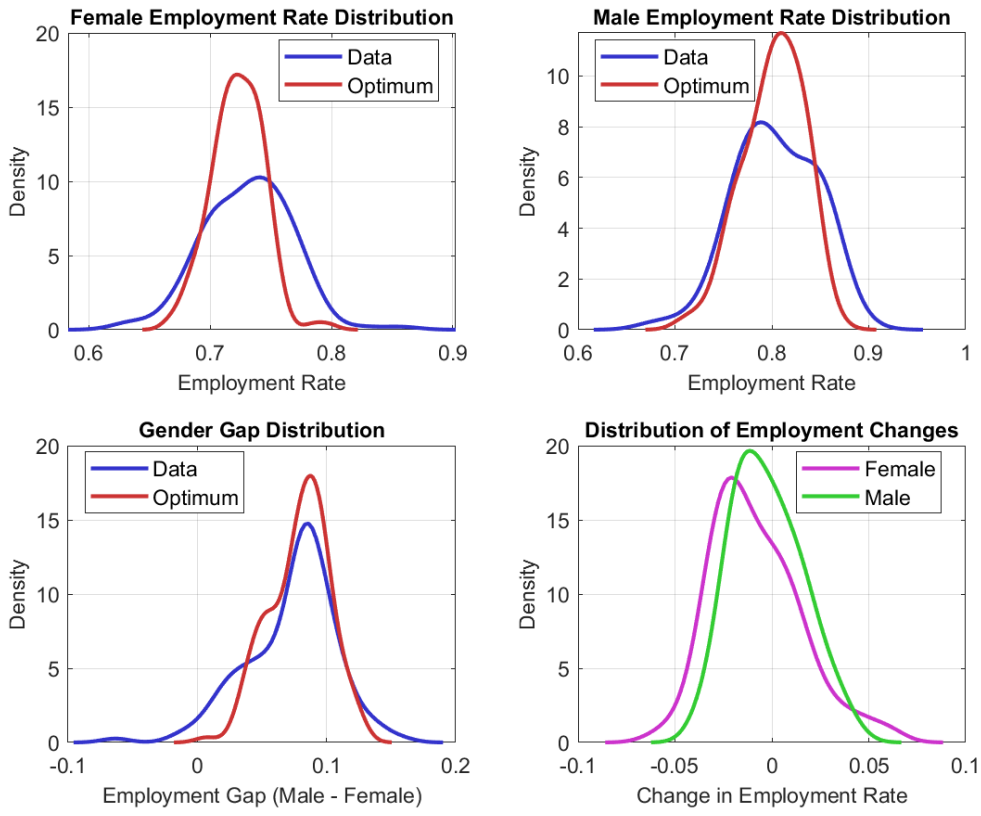
Aggregate Effects of Optimal Policy

Table: Optimal Policies: Aggregate Effects

Change in	**LFP**	**No LFP**
Labour Force	402,394	-
Fiscal capacities (per capita)	6.56	3.86
Nominal GDP	2.82	-0.09
Real GDP	2.18	-0.62
Welfare	2.74	0.39

Accounting for heterogeneous employment responses substantially increases welfare gains from spatial policy optimization

Local Effects: Distribution of LFP Changes



Key patterns:

- Reduced regional variation in female LFP
- Narrowing of gender gaps across regions
- Some areas see particularly large female LFP increases

Additional Results Policy Implications

Conclusion

Main Contributions

1. **Theoretical:** Integrated spatial-participation framework with heterogeneous responses
2. **Empirical:** Identification of gender-specific policy effects using Census shock
3. **Policy:** Optimal spatial policies differs substantially from current practice

Key insight: Accounting for heterogeneous employment responses and highlighting novel externality significantly alters optimal place-based policy design

Backup: Literature

- **Optimal spatial policies in quantitative models**

  Donald et al. (2024), Fajgelbaum & Gaubert (2020, 2025), Henkel et al. (2021), Kline & Moretti (2014), Rossi-Hansberg et al. (2025)

  $\rightarrow$ Evaluate how place-based policies impact both the spatial allocation and local employment decisions

- **Spatial general equilibrium models and (frictional) unemployment**

  Bilal (2023), Jung et al. (2023), Kline & Moretti (2013), Kuhn et al. (2021)

  $\rightarrow$ Focus on spatial externalities and participation responses to fiscal policy

  $\rightarrow$ Show how LFP margins can be represented as the long-run equilibrium in search-and-matching models with frictional labour markets (Kline & Moretti (2013))

Literature

- **Causes for gender differences in labour force participation**

  flexible work arrangements (Goldin, 2014), care responsibilities (Kleven et al. 2019), commuting constraints (Le Barbanchon et al. (2021)

  $\rightarrow$ Impact of spatial policy on female LFP by shifting funds to places with high demand but little capacity to fund them

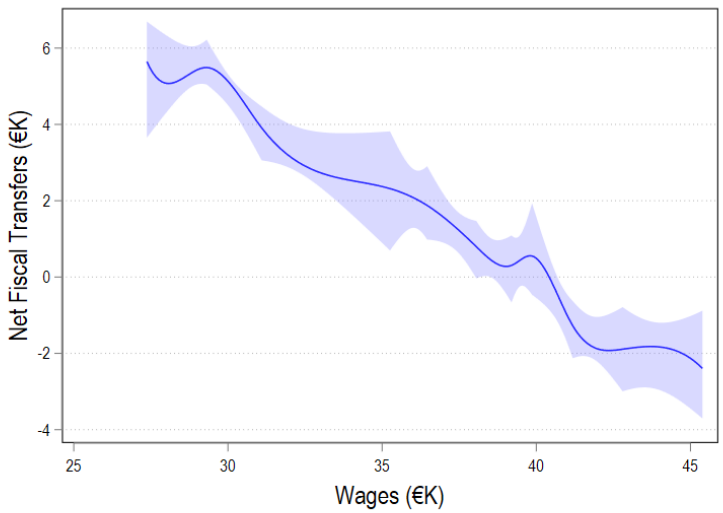
- **Aggregate impact of labour market frictions**

  Albanesi & Olivetti (2016), Hsieh et al. (2019)

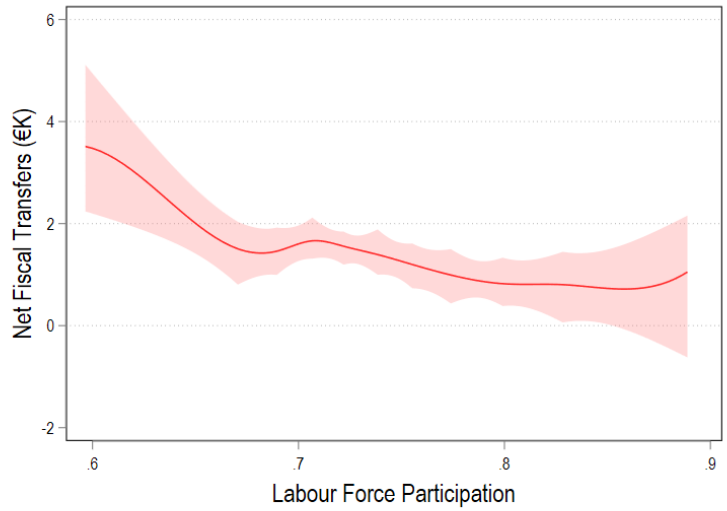
  $\rightarrow$ Focus on how spatial policy can mitigate their heterogeneous impact

Current Spatial Policy Pattern

Net Transfers and Wages



Net Transfers and LFP



Current pattern: Redistribution from high-wage to low-wage areas, but what about employment potential?

Backup: Model Details

- Firms differ in their productive efficiency z_i:

$$y_i(z_i) = z_i h_i^{\kappa_i} l_i^{1-\kappa_i}, \tag{5}$$

- Draws come from a Fréchet distribution with parameter ν and we allow for agglomeration economies with elasticity ζ^g

- Labour input combines different worker types with elasticity of substitution $\sigma^g > 1$:

$$l_i = \left[\sum_{g \in G} \left(Z_i^g (1 - \xi_{h|i}^g) L_i^g \right)^{\frac{\sigma^g - 1}{\sigma^g}} \right]^{\frac{\sigma^g}{\sigma^g - 1}}. \tag{6}$$

Production II

- Unit input cost:

$$\lambda_i(z_i) = \frac{D_i}{z_i}\left(r_i^{\kappa_i}\left[\sum_{g\in G}\left(\frac{Z_i^g}{w_i^g}\right)^{\sigma^g-1}\right]^{\frac{1-\kappa_i}{1-\sigma^g}}\right), \tag{7}$$

- Trade costs are of the iceberg type, such that we get trade shares:

$$\pi_{ij} = \frac{X_{ij}}{X_i} = \frac{(\lambda_j\tau_{ij})^{-\nu}}{\sum_{n\in J}(\lambda_n\tau_{in})^{-\nu}} \tag{8}$$

and price levels:

$$P_i = \Gamma\left(\frac{\nu+1-\sigma}{\nu}\right)^{\frac{1}{1-\sigma}}\left[\sum_{j\in J}(\lambda_j\tau_{ij})^{-\nu}\right]^{-\frac{1}{\nu}}, \tag{9}$$

Definition of General Equilibrium

- Workers **choose locations** to maximize expected utility from real wages, amenities, employment prospects
- Workers **optimize** location and **employment choices** given regional wages, amenities, and public services
- **Firms maximize profits** given production costs and trade opportunities
- Local governments maintain **balanced budgets** while providing public services
- All goods and factor **markets clear** in each region

Labour Force Participation

Backup: Social Planner Problem

- *Normative approach:* We contrast the competitive equilibrium with social planners' allocation

  $\rightarrow$ Which **spatial policies** would **increase the overall welfare** in the economy in the presence of spatial externalities and frictions?

- Planner maximizes the weighted sum of expected utilities:

$$\mathcal{W} = \sum_{g \in G} \mu^g \mathcal{U} \left[\Gamma \left(\frac{\theta - 1}{\theta} \right) \left(\sum_{i \in J} \left[\bar{V}_i^g \right]^\theta \right)^{\frac{1}{\theta}} L^g \right] \tag{10}$$

- Optimal policy instruments (taxes, transfers, subsidies) influence
  - worker distribution across locations
  - size of local labour force
  - Consumption possibilities (private + public)
  - allocation of production inputs

Net fiscal transfers

Corollary

Net fiscal transfers i are given by:

$$N_i = \Theta_{i,1} \underbrace{\left(\sum_{j \in J} w_j L_j / L - w_i \right)}_{\text{relative market compensation}} + \Theta_{i,2} \underbrace{\left(\sum_{j \in J} \xi_{h|j} w_j L_j / L - \xi_{h|i} w_i \right)}_{\text{relative non-market compensation}} \quad (11)$$

$$- \Theta_{i,3} \underbrace{\left(\sum_{j \in J} \Upsilon_j L_j / L - \Upsilon_i \right)}_{\text{relative non-employment rates}} + \underbrace{\gamma \sum_{j \in J} \xi_{h|j} w_j L_j / L}_{\text{average non-market compensation}}$$

$$+ \frac{1}{(1-\alpha)L} \underbrace{\left[(1 - \Upsilon_i/\alpha) \sum_{j \in J} \alpha \left((1 - \xi_{h|j}) w_j L_j + r_j h_j \right) - (1 - \Upsilon_i) \sum_{j \in J} \tilde{E}_j \right]}_{\text{extended "Samuelson rule"}}$$

Social Planner

Simple Examples - Case I: Without Non-employment

- Without frictions: **redistribution flows from high-wage to low-wage areas** following the relative market compensation term and Samuelson's rule for public goods

- **Trade-off:** Higher **marginal utility of consumption** of workers in low-wage location, but also **efficiency costs** of redistribution

  $\rightarrow$ Workers would
  - relocate to low-productivity regions
  - which decreases overall tax revenues ("fiscal externality")
  - and decreases overall productivity ("agglomeration economies")

- The planner redistributes to below-average-income locations as long as $(\alpha + \zeta)\theta < 1$: holds under realistic parametrisation

Backup: Quantification

- Quantify model for German commuting zones in 2014
- Consider several market sectors (tradables + non-tradables), input-output linkages (Caliendo et al. (2018)) and several worker groups
- Core labour market data from Federal Employment Agency, BSSR
- Individual wages and employment histories from IAB, Nuremberg
- Create novel panel dataset for tax and transfer rates between German counties/ labour market areas
- House prices from Ahlfeldt et al (2020) and prices of non-tradables from Weinand & Auer (2020)
- Bilateral trade flows by region and sectors (Institute of Transport Research of the German Aerospace Centre)
- Gross output and value added from EU Klems/ Eurostat / WIOD

Structural Parameter Estimates

Key Parameter Estimates

- **Female elasticity:** 0.013 (employment response to fiscal transfers)
- **Male elasticity:** 0.009 (44% smaller than female response)
- **Public goods preference:** $\alpha = 0.24$
- **LFP elasticities:** $\varepsilon^F = 0.465$, $\varepsilon^M = 0.310$

Interpretation: Women respond more strongly to place-based policies and taxation, consistent with greater barriers to employment (childcare, transport)

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)
$\nu_s = 5$	Trade elasticity	Set	Head and Mayer (2014)
$\tau_{ij,u} = \{1, ..., 1.03\}$	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
$\delta_{i,u} = \{0.15, ..., 1\}$	Share of value added	Cal.	Value added / Gross output
$\delta_{i,uu'} = \{0, ..., 0.54\}$	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)
$\theta^g = 2$	Fréchet shape parameter	Set	Fajgelbaum et al. (2019)
$\epsilon^g = \{1.58, 1.56\}$	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 $\{0.31; 0.465\}$
	Extensive Labour Supply		
$\rho_h^g = \{0.01; 0.014\}$	Non-employed public goods cons./Employed public goods cons.	Est.	Section B.2.2
	Government		
$t_i = \{0.22, ..., 0.45\}$	Regional tax rate	Cal.	Tax revenues
$\rho_i = \{-0.15, ..., 0.23\}$	Transfer rate	Cal.	Transfer payments

Quantification Application

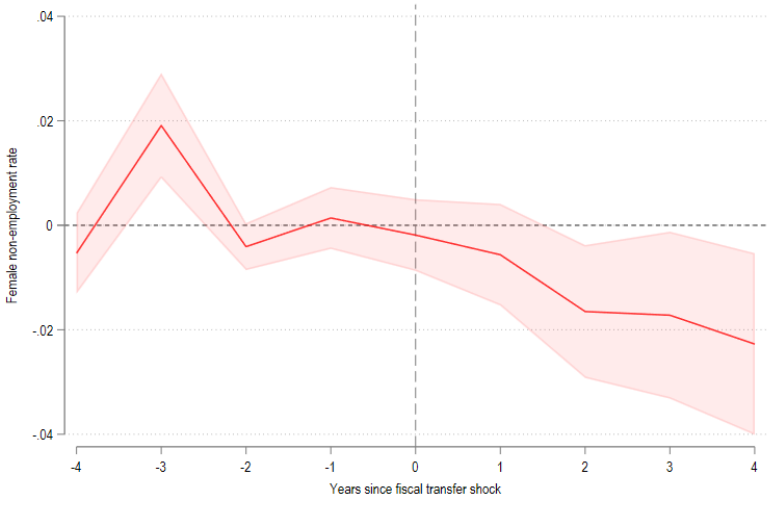
Identification Challenge

- **Problem:** Fiscal transfers likely correlated with unobserved local conditions
- **Solution:** Exploit 2011 German Census shock
  - Census revealed systematic deviations from registry population projections
  - Population revisions: -7.65% to +3.43% across regions
  - Transfers depend mechanically on population counts
  - Revisions unrelated to economic conditions
- **Exogenous variation** in fiscal capacity $\rightarrow$ identify causal effects

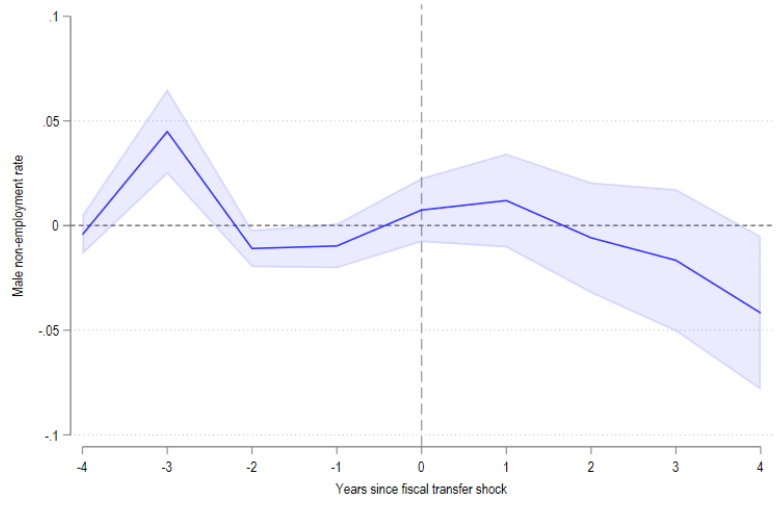
Estimation Strategy

- **Difference-in-differences** comparing regions with above/below mean census revisions
- **Augmented Inverse Probability Weighting (AIPW)** to address selection:
  - Treated regions systematically different in pre-treatment characteristics
  - AIPW combines outcome regression and treatment models
  - Robust to misspecification of either model
- **Controls:** State-specific trends, pre-treatment dynamics, lags of non-employment rates

Reduced-Form Results: Gender-Specific Responses



Female Non-Employment



Male Non-Employment

Key finding: Fiscal transfers reduce non-employment, with stronger effects for women

DID estimates

	ATT
Panel A. Public Finance	
Fiscal transfers per capita	167.34**
	(84.80)
Panel B. Non-employment rate	
– Female	-0.013**
	(0.006)
– Male	-0.009
	(0.013)
Observations	4,400
Controls	Yes
State × Year FE	Yes
Pre-treatment dynamics	Yes

Treatment Heterogeneity

Key insights:

- Regions with highest transfer increase observe significant drops in (female) employment
- Public service provision mediates the employment response
- Strongest effects in regions with limited childcare access
- Gender-specific mechanisms clearly visible
- Infrastructure constraints amplify policy effects

Treatment Heterogeneity: Public Services Matter

Table: Gender-Specific Impacts of Fiscal Transfers on Employment

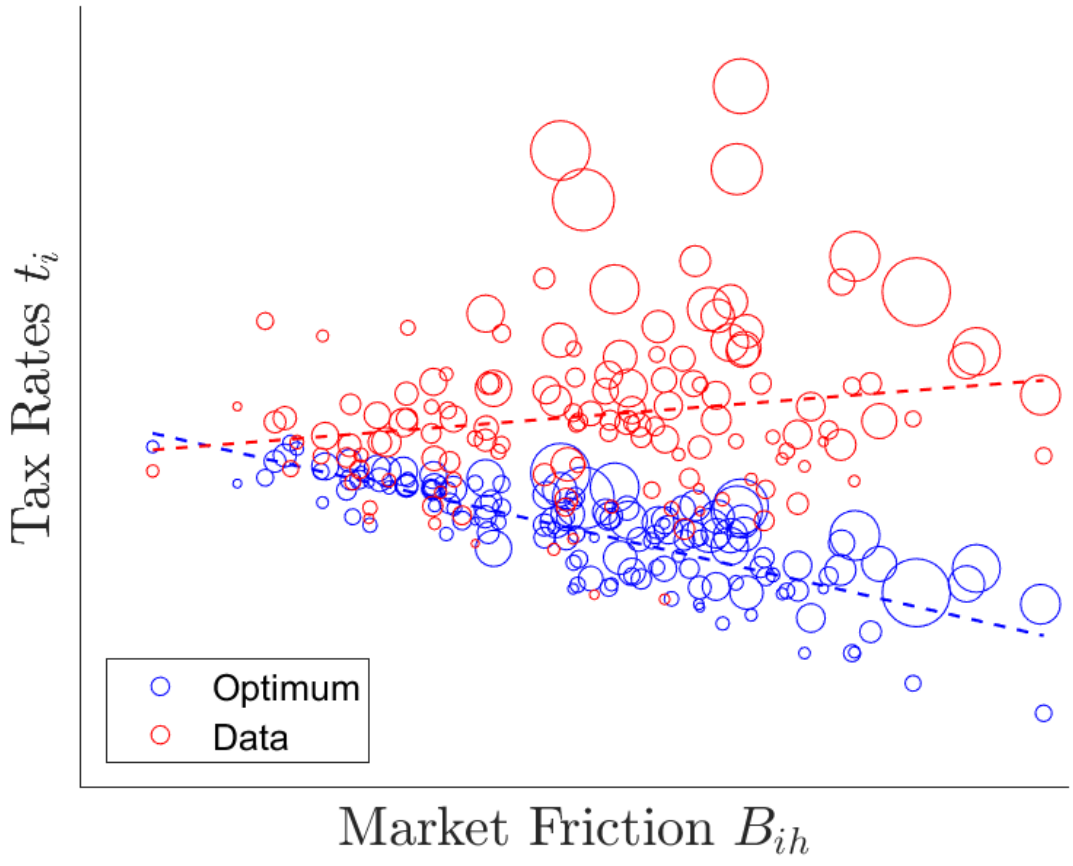
	Childcare Access		Transport Access	
	Low	High	Low	High
	(1)	(2)	(3)	(4)
Female Non-employment rate	-0.019**	-0.004	-0.006*	0.005
	(0.009)	(0.010)	(0.007)	(0.111)
Male Non-employment rate	-0.019*	0.008	0.002	0.003
	(0.011)	(0.034)	(0.014)	(0.148)
Observations	2,280	1,998	2,464	1,936
Controls	Yes	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes	Yes
Pre-treatment characteristics	Yes	Yes	Yes	Yes

Reduced-Form Estimates

Backup: Application

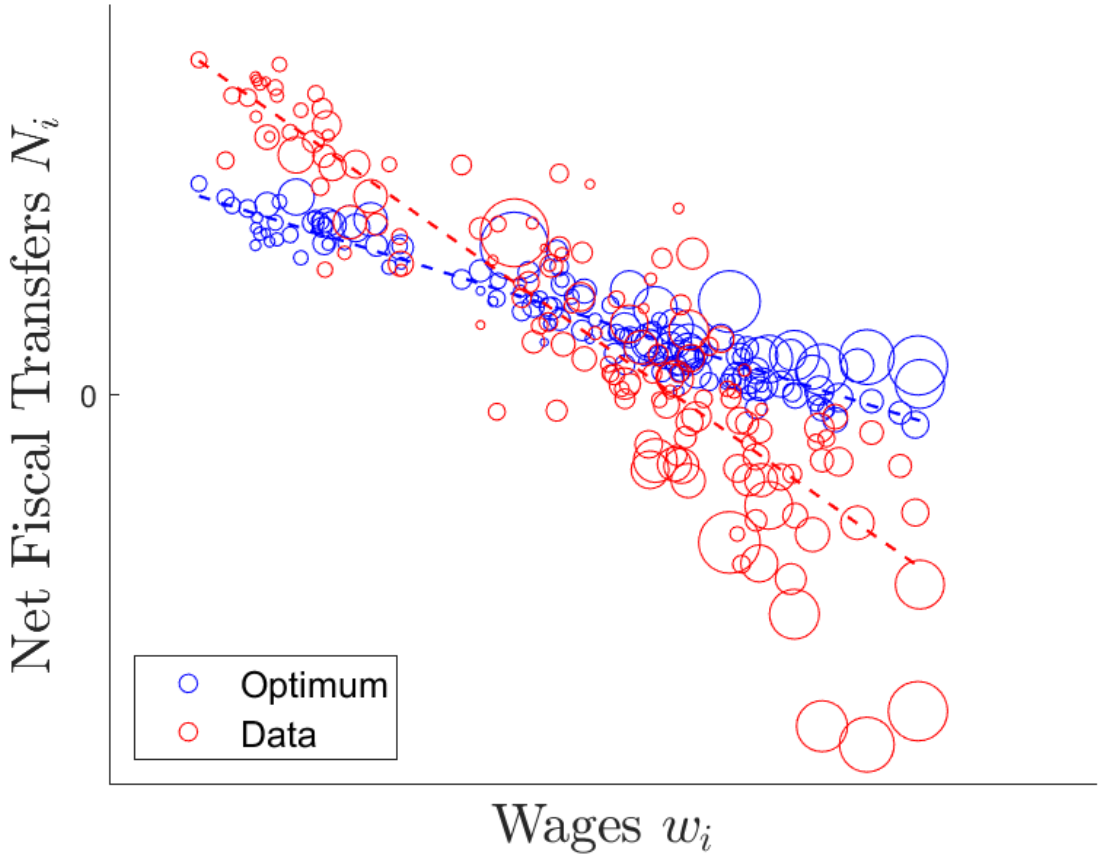
- Concern: Counterfactual outcomes depend on initial fiscal policies (given fundamentals and structural parameters)
- Start from German economy and fiscal redistribution system in 2014. Then
  - **Counterfactual I:** Randomly draw $N = 10,000$ sets of fiscal policies (taxes, subsidies, transfers) and solve for new equilibrium vector of all endogenous variables and fiscal policies
  - **Counterfactual II (optimal spatial policy):** use N spatial equilibria as starting point, implement gradient of optimal fiscal policies and solve for new spatial general equilibria
  - *Optimal* fiscal policy maximises welfare changes relative to German economy in 2014

Optimal Taxation Policy - Application



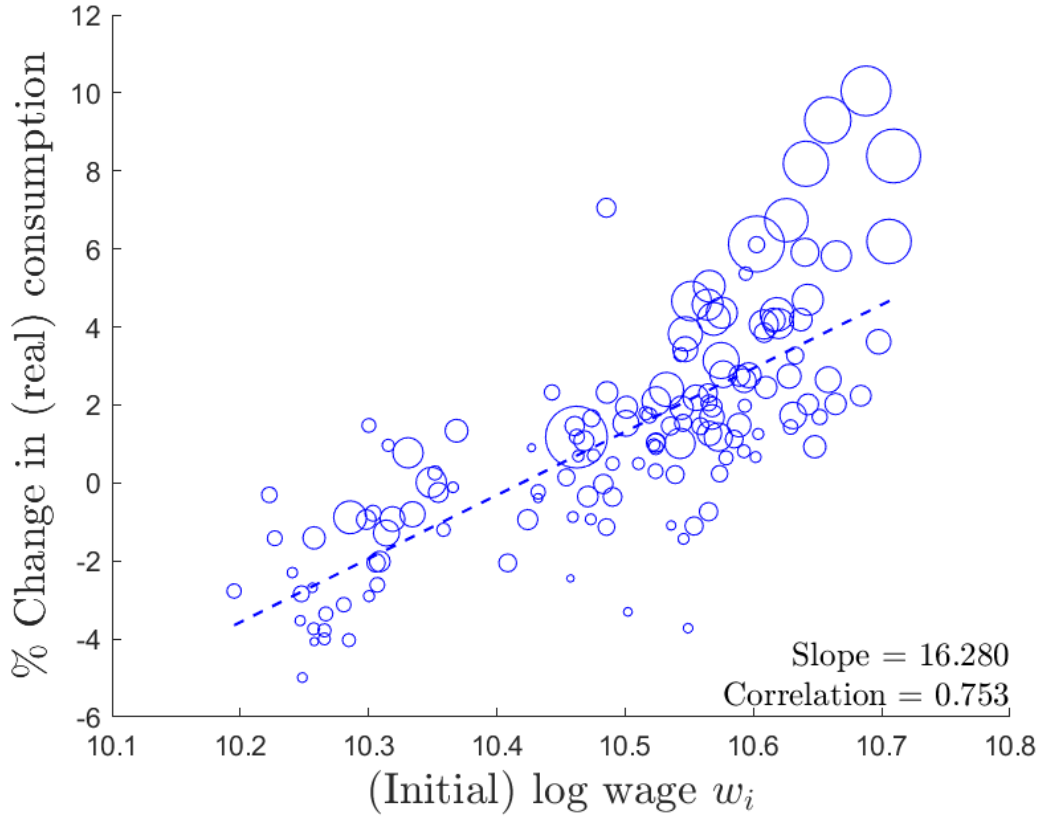
Pattern: Lower tax rates in places with small LFP to encourage labour force participation of productive individuals

Optimal Redistribution Policy

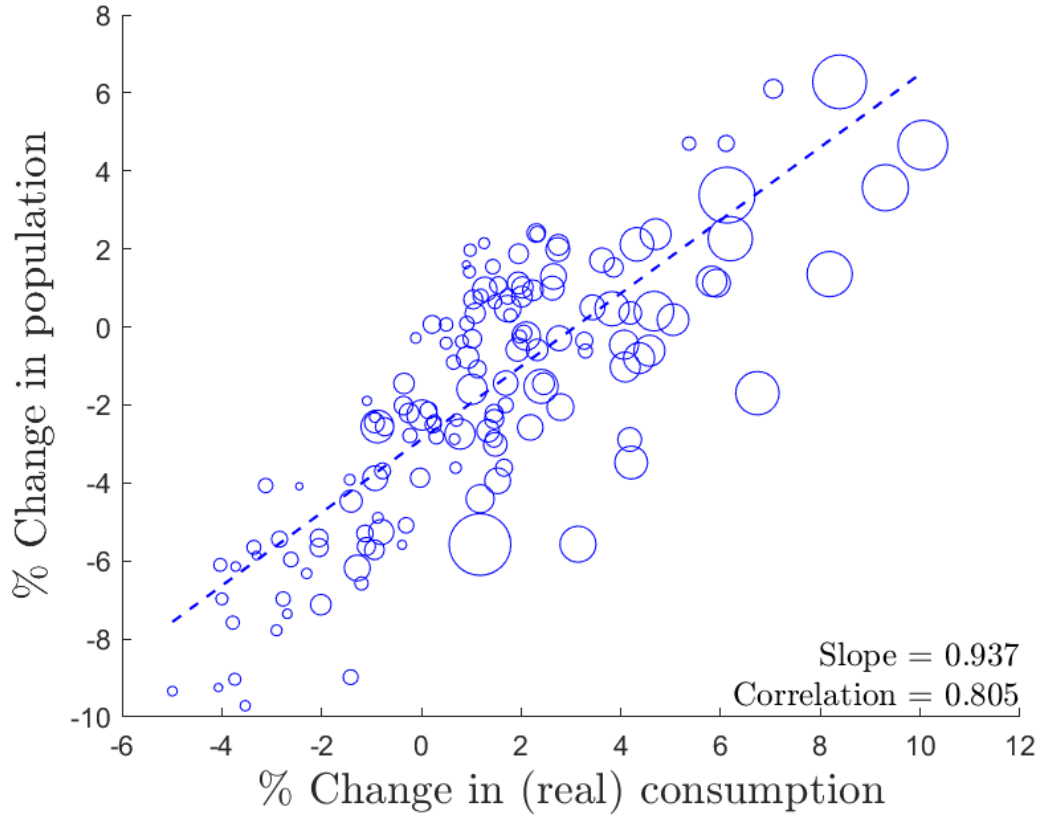


Key insight: Redistribution targeted to areas with high labour supply elasticities, not just low wages

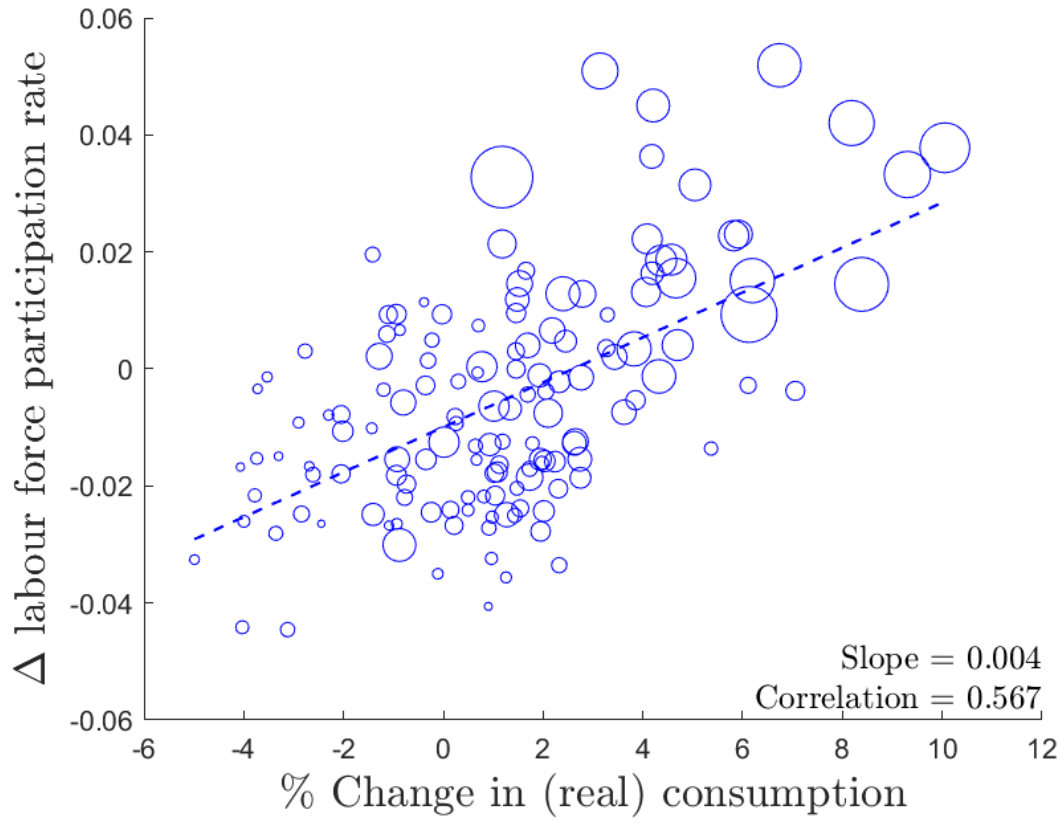
Local Effects I



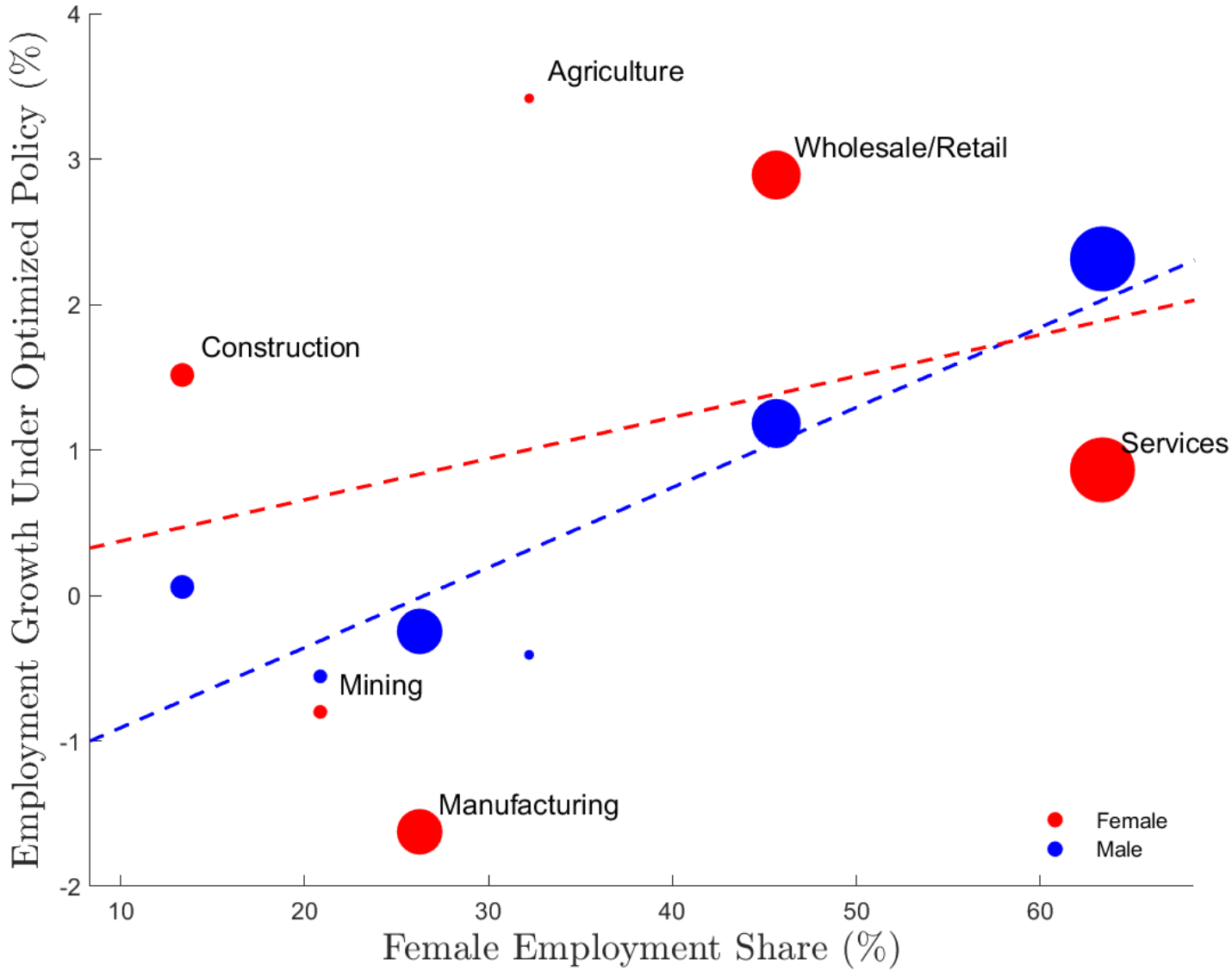
Local Effects II



Local Effects III



Occupational Selection



Sensitivity

- Results **hold across calibrations for main parameters** $\{\theta, \eta, \zeta\}$
- **Results are most sensitive to labour supply** elasticities:

  $\rightarrow$ Gender employment gaps could be fully closed by optimised policy iff they were twice the size of males'

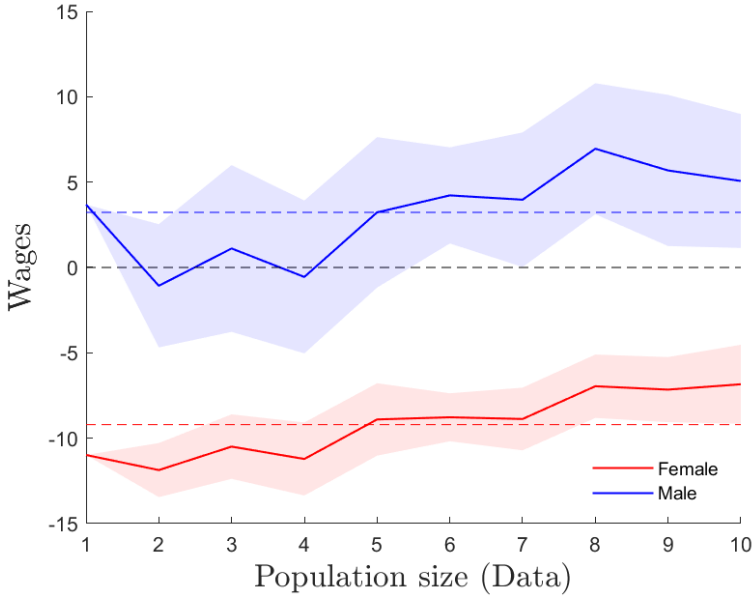
  $\rightarrow$ Larger welfare and output gains with larger average (female) labour supply elasticities

- Optimized spatial policy **reduces occupational segregation** by gender:

  $\rightarrow$ Facilitates female entry into previously male-dominated fields (e.g. Agriculture, Wholesale/ Retail) while encouraging male employment in service sectors.

Urban Premia and Gaps in Optimum

Urban Wage Premium



Labour force participation by population percentile

Application

Policy Implications

- **Rethink spatial policy design:**
  - Current: Redistribute to low-wage areas
  - Optimal: Target both low-wage and high labour supply elasticity areas
    $\rightarrow$ Direction of redistribution depends on their correlation
- **Gender-specific considerations crucial:**
  - Public goods provision (e.g. investments in childcare, infrastructure) in urban areas with high gender gaps
- **Aggregate benefits substantial:**
  - Mobilize underutilized labour
  - Higher tax revenues from increased participation
  - Welfare improvements through better matching

Robustness and Future Work

Robustness:

- Results stable across parameter ranges
- Alternative specifications consistent
- No pre-trends in identification

Future Work:

- Dynamic adjustment costs
- Endogenous infrastructure
- Family migration decisions

Broader relevance: Particularly important for ageing economies with tightening labour markets and untapped labour force potential